A WEB BASED MODEL FOR MANAGEMENT OF RESEARCH INFORMATION IN KENYA

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation itself.

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Approval

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ABSTRACT

For Kenya to become a knowledge-led economy, there must be better coordination of Kenya's multiple institutions dealing with research and development, and that Kenya must adopt a better dissemination strategy. The current method of managing research information does not adequately address research sharing, duplication of research and dissemination.

The study aimed at investigated how research information is managed in Kenya and sought to identify information requirements for management of the research, identify any limitations of the current system and propose a model for management of national research.

The study reviewed research management activities being undertaken by some selected countries developed and developing in Africa and across the world and found that most countries have already employed or are putting into place, measures to consolidate research information for knowledge sharing and elimination of duplication of research effort.

The study found that there is a lot of research going on in Kenya. However, research information is scattered across the various institutions performing research. The research revealed there is willingness by institutions to share their research information but Poor infrastructure, none enforcement of regulations on research and lack of a central location to collect this information are major limiting factors to the access and sharing of research information.

A model was proposed that can be implemented for suitably managing research information nationally. The model was proposed as a central database on a web-based platform after an analysis of the current research activities in Kenya and a review of existing models used by other countries/organizations.

The Research concluded that the National Council for Science and Technology (NCST) is nationally mandated to coordinate all research operations in Kenya. It is therefore, suitably placed to host the Centralized Database and since the model proposed has a very wide range of stakeholders for research information; its implementation requires NCST to vigorously create awareness of the roles it plays in coordination of research in Kenya and let stakeholders buy into the benefits likely to accrue due to shared central research resources.

Regulations and procedures for any conduct of research done in Kenya should be enforced with penalties or sanctions being imposed on those that default.

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List of Acronyms and Abbreviations

ACTS	-	African Centre for Technology Studies
COSTECH		Commission for Science and Technology
CRF	-	Coffee Research Foundation
CSO	-	Common services Organization
EA	-	East Africa
EAC	-	East African Community
ESF	-	European Science Foundation
GOK	-	Government of Kenya
HEFCE	-	Higher Education Funding Council For England
ICIPE	-	International Centre of Insect Physiology and Ecology
ICRAF	-	International Centre for Research in Agroforestry
IGAD	-	Intergovernmental Authority on Development
ILRI	-	International Livestock Research Institute
ITDG	-	Intermediate Technology Development Group (Now Practical Action)
IUCEA		Inter University Council of East Africa
JISC	-	Joint Information Systems Committee
KARI	-	Kenya Agricultural Research Institute
KEFRI	-	Kenya Forestry Research Institute
KEMFRI	-	Kenya Marine and Fisheries Research Institute
KEMRI	-	Kenya Medical Research Institute
KIPS	-	Kenya Information Preservation Society
KNAS	-	Kenya National Academy of Sciences
LAC		Library and Archives Canada
MOHEST	-	Ministry of Higher Education Science and Technology
MOPND	-	Ministry of Planning and National Development
MOST	-	Ministry of Science and Technology
NCST	-	National Council for Science and Technology
NRF		National Foundation

RSC	-	Research and Social Council
RTD	-	Research Technology Development
TRF	-	Tea Research Foundation
UNCST		Uganda National Council for Science and Technology
UK	-	United Kingdom

Definition of Significant Terms

Client-server system- A computing system composed of two logical parts: a server, which provides information or services, and a client, which requests them.

Information Silos- Rrefers to Information systems incapable of exchanging information with other related systems or with other systems

Model - Refers to anything used in any way to represent anything else. Models are used to help us know and understand the subject matter they represent.

Repository - Refers to a storage where data is kept and maintained in an organized way such as computer storage.

Research - The systematic processes of inquiry in order to discover, interpret or revise facts, events, behaviors, or theories, or to make practical applications with the help of such facts, laws or theories. The word "Research" is derived from the Middle French and has the literal meaning is "*to investigate thoroughly"*

Research and Development (R&D) - Refers to the processes and activities for generation of knowledge and information and their application to the improvement of human welfare.

Web-based systems - Client-server systems developed specifically to run within the Web environment. The 'client' is an internet browser and is responsible only for displaying the user interface; none of the application runs on the client side and none of the processing is done there either.

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DEDICATION

For my wife and children, who offered me unconditional love and support throughout the course of this work.

CHAPER 1: INTRODUCTION

1.1 BACKGROUND

According to the Kenya Vision 2030, Kenya intends to become a knowledge-led economy where the creation, adaptation and use of knowledge will be among the most critical factors for rapid economic growth (GOK, 2007, p. 11). The vision further recognizes that rapid progress can be made by building capacities to create, access and use knowledge. It also recognizes the role played by research and development (R&D) in accelerating economic development in all the newly industrializing countries of the world.

Research and development (R&D) has been applied in Kenya since pre-independence, where the colonial government developed a research infrastructure to serve the colonial economy (MOST, 2007). After independence, these activities were continued under the East African Community until 1977 when the community broke up and Kenya enacted the Science and Technology Act (Cap 250) in 1977. The Act signified government's resolution to have S&T play a central role in the development of the Kenyan economy (Wandiga, Awuor, Wanyama, & Abuodha, 2004).

The Act also established the National Council for Science and technology (NCST) to authorize the establishment of research institutions. Other initiatives included the creation of the Ministry of Research, Science and Technology in 1987 with a mandate to upgrade Kenya's technological skills and mobilize resources for science and technology (MOST, 2007).

Research activities are currently spread across Governmental institutions, International institutions, private institutions and universities, which carry out these activities independently and according to their priorities. In an effort to improve coordination of science, technology and innovation the Ministry of Science and Technology was established in December, 2005 with a mandate that included Authorization, coordination and inventory of research. It was given a new expanded mandate in April, 2008 to include university education, continuing education and science, technology and innovation through Presidential Circular No. 1 of May 2008 (MOHEST, 2008).

The NCST has remained a core function in all these Government initiatives and has the mandate to provide machinery for making available to the Government advice on all matters relating to the scientific and technological activities, and for coordination of research and experimental development.

There is a variety of institutions that can conduct research. Malo (2003) points that institutions engaged in active research and technology development are Universities (public and private); specialised (sector-based) government or donor sponsored institutions (like KEMRI, KARI, KEMFRI, KEFRI, CRF, TRF, etc.); International research and technology development institutes (ICRAF, ITDG, ICIPE, ILRI, etc.); Individual companies (especially private commercial companies) that have research units that engage in research by employees or external consultants; Individuals, and professional bodies like the Kenya National Academy of Sciences (KNAS) as well as regional bodies like ACTS, IGAD, EAC and other professional and academic networks.

He further notes that the overall research system in Kenya is made up of structures and sub-systems which perform various functions with the MOHEST charged with the overall responsibility of managing science and technology in Kenya by formulating the national policy on Science and technology while NCST undertakes advisory and coordination functions and that at sector level, management of the respective research function lies with specific parent Ministries.

1.2 Research Authorization and Inventory

Research authorization is one core function of the Ministry of Higher Education Science and Technology and is performed through the National Council for Science and Technology (NCST) a Semi Autonomous Governmental Agency of the Ministry.

The research clearance and authorization process was instituted in Kenya in 1966 and requires that all research work in the country be conducted only on issuance of a Research Permit from the NCST (NCST, 2009). This process therefore provides a single source for capturing all research documentation as the process requires the researcher to obtain a form from the NCST which is filled by the applicant and returned together with the research proposal. Validation and subsequent approval ensues and if successful, the applicant gets the necessary authorization in the form of a permit. On completion of the research work, the researcher is required to submit copies of the report to the Council in hard copies. These then accumulate into the National research inventory.

Table 1.1 below shows the returns on authorization that is processed through the council as provided on the Research Returns Registry. About a thousand (**1000**) researchers are approved through the NCST annually. The records from these research proposals and final reports has been

increasing over the years even as not all research information is captured through the NCST.

The NCST however, is the National organ that is mandated to authorize research, collect and disseminate it to relevant stakeholders. This makes it to be the only organ centrally and legally placed to collect and disseminate research findings and other related research documents at the national level. This will further provide a single location for research sharing and reporting for national decision-making on research being done in Kenya and will alleviate duplication of effort for researchers, among others.

Table 1.1: Annual Research Returns (2004-2010 selected years)

Year	Research Return
2005	600
2006	747
2007	844
2008	826
2009	1145
Jan-2010- Sept, 2010	909

1.3 Research Institutions

As categorized by Malo (2003) research institutions in Kenya fall under various Ministries. Such institutions may have been established through Acts of parliament which mandates them to conduct research in their respective areas. The research they perform is thereby conducted without the involvement of the NCST and the results are recorded elsewhere leading to unavailability and duplication of research effort. Kamunge (2007) notes that the legal framework for Research, Science, Technology and Innovation (RSTI) lacks adequate mechanism for storage and dissemination. Gacuhi (1998) in his report to the EAC secretariat also observed that there was unavailability of information vital for scientists, planners and other users for socio-economic development and identified poor linkages between the institutions as leading to duplication of activities; and fragmentation of effort. He further observed that most institutions had information but poorly sorted.

The need to address research Management in order to reduce duplication and improve on research information availability cannot be over emphasized. The world over, most countries developed and developing have made or are making efforts to address issues relating to research

information management to consolidate information scattered across various institutions and to provide a central point for all round access to this information. Among African countries, South Africa uses a number of National Databases to consolidate and manage research information. These are databases which contribute to knowledge generation and facilitate access to ensure the utilization of research results. These include Specific databases like *Current and Completed Research Projects Database* , *Forthcoming Conferences Database*', etc hosted by the National Research Foundation (NRF), the Research Information Management Project (RIMS) which is a web-based national system that can be used throughout South Africa to support research in any public university and other research institution. It is the product of a collaborative effort between a number of South African research institutions, comprising of both Higher Educational Institutions and various Science Councils the main aim of which is to provide an integrated view of R&D investments in South Africa, (NRF, 2010)

In Tanzania COSTECH (an organization similar to the NCST in Kenya) is in the process of developing a National Research registry database to consolidate Tanzania's research related information for ease of access and decision making (Bennett & EAC, 2000).

The Electronic Theses Online Service (EThOs) Project managed by the British Library in the UK. A Digitization and Electronic centralization of research theses from many, geographical sources to one central, British Library-based database i.e. a "one stop shop", (EThos, 2008).

The Library and Archives Canada (LAC) hosts an online database, 'Theses Canada Portal' that provides a central access point for theses and dissertations within Canada and throughout the world (LAC, 2004).

In Australia, the National Library in has worked with partners including the higher education sector to develop solutions to support long term access to research information. Projects such as the Australian Research Repositories online to the world (ARROW) have been undertaken (Cathro, 2006)

To address the challenges of disaggregated information that is profound in Kenya like in the rest of the world, the NCST, a national organ mandated to collect and disseminate research information needs to be equipped with a modern information system for harnessing and disseminating scientific information. This study aims at coming up with a suitable model for managing the research information.

1.4 Statement of the Problem

According to the directory of research organizations (MOPND, 2003), there are about 125 research institutions Kenya. These institutions conduct research but the proposals and reports on their research do not reach the NCST which is the national organ mandated to collect and disseminate research information in Kenya. These reports are kept by the individual institutions and only their members get to know of this availability of information. This leaves gaps for duplication of effort while making it difficult to obtain literature on past research. For proper coordination of this information, an information system that can be accessible to all the research stakeholders will be of importance. This will further provide a single source of information for research sharing and reporting for national research decision making and will alleviates duplication of effort on research activities.

NCST, with a mandate to coordinate national research is appropriate as a central point of collecting all the information on research but lacks an information system that can adequately address the information requirements.

The problem therefore is that there is lack of a model for NCST to implement for management of research information.

1.5 Research Objectives

The aim of the study is to investigate the current methods used by the NCST and research institutions to collect, store and disseminate research and come up with a suitable model to be implemented for management of research operations in Kenya through a web based interface. In line with this, the following specific objectives will be addressed:

1. To investigate the current research management methods applied in Kenya
2. Identify Information requirements for management of the research
3. Identify any limitations of the current system.
4. Propose a model for management of national research.

1.6 Research Questions

The study aims to answer the following questions.

1. How is research managed currently in Kenya?
2. What information do research institutions require for research management?
3. What are the limitations to the current method of research management?
4. What model can NCST adopt for managing Research Operations?

1.7 Significance of the Study

The study will provide information on the challenges facing the NCST in the process of managing research activities. It will also give information on the limitations that research institutions face towards sharing their research results with the NCST and other research users.

1.8 Outcome of the Study

The findings from this study will be used to develop a model for a system whose implementation by the NCST will ensure that information on research undertaken in Kenya is readily available to other researchers, industry, academic institutions, the Government and the global public.

The benefits of having this model will be improvement in coordination and elimination of duplication by providing one central point for information on research, enabling sharing and efficiency in research data manipulation including faster reporting and dissemination.

1.9 Scope and Limitations

This study will be limited to the activities employed to manage research done in Kenya by the NCST on one hand and Universities(Public and Private), Public and international Research Institutions on the other. The study will be confined to findings on how research information is captured, stored and disseminated. It will not consider the Application and Authorization process nor will it consider funding for research nor inventory of researchers and or any specific research areas.

CHAPTER 2: LITERATURE REVIEW

This chapter reviews literature on research activities in Kenya. It will cover research activities and their management since pre-independence and the policy directions impacting on research since then. It will also look at the initiatives being employed by institutions in Kenya. Models for research management from other Countries and Organizations will be explored.

2.1 Review of Research activities in Kenya.

According to wordiq.com (2010), research is an active, diligent and systematic process of inquiry in order to discover, interpret or revise facts, events, behaviors, or theories, or to make practical applications with the help of such facts, laws or theories and the word "Research" is derived from the Middle French and has the literal meaning is "*to investigate thoroughly"*

Shuttleworth (2008) defines research as *"*performing a methodical study in order to prove a hypothesis or answer a specific question"

According to the National Council of Science and Technology (NCST, 2009) research is any creative systematic activity undertaken to increase the stock of scientific and technical knowledge and to devise new applications. It comprises of creative work undertaken in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications and services. Research enables us to discover, interpret and develop methods and systems for the advancement of human knowledge on a wide variety of fields.

A study conducted by the East African community Secretariat in 2000, traced activities on research back to the 1920s when the first research institute (Department of Tsetse Research) was established in east African territory (Bennett & EAC, 2000) in Tanganyika. The study revealed that during these periods (1920s), research took place without the need for legitimization or accountability to higher regional authority or co-ordination. However, in 1929, The Hilton Young Commission (Bennett & EAC, 2000) recommended a central authority for the three East African Countries to coordinate matters of research among other issues.

The East African High commission was established in 1948, encompassing Kenya, Uganda and Tanganyika. It was responsible for joint research in the regions. According to the study, this commission saw the establishment of regional research institutes in East Africa and setup two councils: EA Agricultural and Fisheries Research Council and EA Council for medical Research to administer the work of research organizations (Bennett & EAC, 2000). This commission was

replaced with the Common services Organization (CSO) in 1962, with policy formulation assigned to four ministerial committees, one of which was the Social and Research Services committee.

In 1967, the "Treaty for East African Co-operation" was signed which established the East African Community. The treaty provided for the establishment of five councils, one of which was the Research and Social Council (RSC) to assist in the coordination of research and social matters.

The East African Community came to an end in 1977 and Kenya retained control of research facilities within its territory. The RSC was the predecessor to the National Council for Science and Technology (NCST) in Kenya. Similar organizations were created by the other East African member states with similar roles of research co-ordination like the NCST. In Tanzania, the Commission for Science and Technology (COSTECH) was enacted in 1986, and in Uganda, the Uganda National Council for Science and Technology (UNCST) in 1990 (Bennett &EAC, 2000)

2.2 Co-ordination and Management of Research Activities

In Kenya Gacuhi (1998) notes that co-ordination of research activities at the national level is the responsibility of two bodies: The National Council for Science and Technology (NCST) and the Ministry in charge of research (currently: - Ministry of Higher education Science and Technology).

At the sector level, line ministries are responsible for coordination according to their specific mandates.

Creation of the NCST was necessitated by a need to have these research activities under coordinated through on organ of the Government. According to Martin (1977) by 1971 activities on science and technology were growing and becoming complex. The need to have a mechanism through which scientific activities could be coordinated and promoted resulted in the enactment of the Science and Technology Act (Cap 250) in 1977. The Act established the National Council for Science and Technology (NCST) to serve as advisory to the government on matters of science and technology (Wandiga et al., 2004).

By 2003, Kenya had 125 research institutions involved in research and development as listed in the first edition of the directory of research organizations (MOPND, 2003).

The Kenya Vision 2030 (GOK, 2007) has identified four elements that allow effective exploitation of knowledge:

(a) An economic and institutional regime that provides incentives for the efficient use of the existing knowledge, the creation of new knowledge, and the flourishing of entrepreneurship;

(b) An educated and skilled population, that can create share and use knowledge well;

(c) A dynamic information and communication infrastructure that can facilitate processing, communication, dissemination; and finally

(d) An effective innovation system (that is: a network of research centers, universities, think tanks, private enterprises and community groups) that can tap into the growing stock of global knowledge, assimilate and adapt it to local needs, while creating new knowledge and technologies as appropriate.

The Vision further notes that, to become a knowledge-led economy , there must be better coordination of Kenya's multiple institutions dealing with research and development, and that Kenya must adopt a better dissemination strategy.

The web based model will provide a means for bringing together research information for convenient dissemination and sharing.

2.3 Research Dissemination.

Gacuhi (1998) observed that whereas the Government has done well in providing physical infrastructures and information networks which are vital for Science and Technology, the need for libraries and modern information systems for harnessing and disseminating scientific information has not been fully addressed. This has lead to unavailability of information vital for scientists, planners and users for socio-economic development. He further observed that most institutions have information but poorly sorted. He saw poor linkages between institutions of higher learning and business, business and government Ministries, private firms and research institutions, research institutions and universities e.t.c. as leading to duplication of activities; fragmentation of effort; lack of coordination between institutions and among stake holders and poor utilization of effort.

Gacuhi proposed that a meaningful dissemination mechanism will involve the establishment, operation and maintenance of an effective information service to facilitate more intensive use of research findings by all those who need it; encourage greatest possible use of scientific knowledge; raise the level of information exchange among others.

2.4 Management of Research Information in Kenya

The NCST is the National organ that is mandated to authorize research, collect and disseminate it to relevant stakeholders. The makes it suitable to be the central location to collect and disseminate research findings other related research documents. However, currently, most institutions keep their own institutional documents on research.

Most Universities in Kenya now have a link to an internal electronic Library with a controlled access and only available to their registered users or through their internal network. This does not suitably address the duplication of effort in research activities across the various research institutions. Neither does it address information availability for national decision-making, access and sharing.

Other research institutions have similar independent repositories holding sector specific research information such as Agricultural specific information from the Kenya Agricultural Institute (KARI), Kenya Agricultural information Network (KAINET), among others.

The Kenya Information Preservation Society- KIPS (Thomas, 2008) undertook the task of bringing together records held by universities and research institutions which reflect post-graduate research that has been completed on all aspects of Kenya. They have a database entitled "***The union list of theses and dissertations held by universities and research institutions in Kenya"*** *which stores* details of theses and dissertations reflecting research undertaken in Kenya. However, KIPS does not hold the documents listed on their site, and users who need to access the material contact the relevant institution. Duplication of effort can fairly be addressed by such an effort but not access to and sharing of information

The NCST with a national mandate to authorize, store and disseminate research findings is in a position to receive and disseminate such findings thereby addressing information availability, sharing and reducing duplication of effort while benefiting all stake holders.

2.5 Co-ordination of research activities in the East African Member States

In each of the East African member states, there is a government body responsible for the co-ordination of research activities. In Kenya these activities are coordinated by the NCST, whereas in Tanzania coordination is through the COSTECH and in Uganda, the UNCST.(Bennett &EAC, 2000). According to Mugoya (1998) in his report to the East African Community, these Science Councils are the bodies empowered by their respective governments to clear and register research in the region. This makes them better placed to consolidate research information in their respective countries.

Bennett & EAC, 2000) observes that, there is a need for the creation of a body for research coordination in the East African region. Mugoya (1998) draws special attention to the role of a revitalized Inter-University Council for East Africa (IUCEA) and notes that to have a central research coordinating body for the three EAC member states would only take a small collaborative effort by the respective councils in the area of research.

The IUCEA is a regional inter-governmental organization established in 1980 by the three East African Partner States with the aim of facilitating contact between the universities of East Africa, (IUCEA, 2010). It is mandated to co-ordinate collaboration among institutions of Higher Education in terms of teaching, research and outreach services (Chacha, 2009).

At the regional level such an organization could be suitably placed to coordinate sharing of research, but this should be done in collaboration with the respective Science Councils, as noted by Bennett & EAC (2000).

2.6 Trends in Management of Research Information

There are challenges in providing access to research information. In Kenya, these challenges include resources such as infrastructure, Technology, the appropriate skills to link the various institutions etc. Such challenges can be overcome by employing approaches that have been implemented and seen suitable as in the developed countries. Different developed and developing countries have established a variety of effective mechanisms to mitigate these challenges and promote access, and use of digital scholarly information. Models such as collaborative Web sites are increasingly becoming useful tools for managing research. Use

In most countries, developed or underdeveloped, management of research information has been carried out by individual institutions. This has lead to efforts by those countries towards consolidating this information into a single database which, however, raises interoperability problems where systems are not compatible.

In South Africa the Research Information Management Project (RIMS) which is a web-based national system is used throughout South Africa to support and intergrate research in South Africa, (NRF, 2010)

In Tanzania COSTECH (an organization similar to the NCST in Kenya) is developing a National Research registry database to consolidate Tanzania's research related information for ease of access and decision making (Bennett & EAC, 2000).

The Electronic Theses Online Service (EThOs) Project managed by the British Library in the UK. A Digitization and Electronic centralization of research theses from many, geographical

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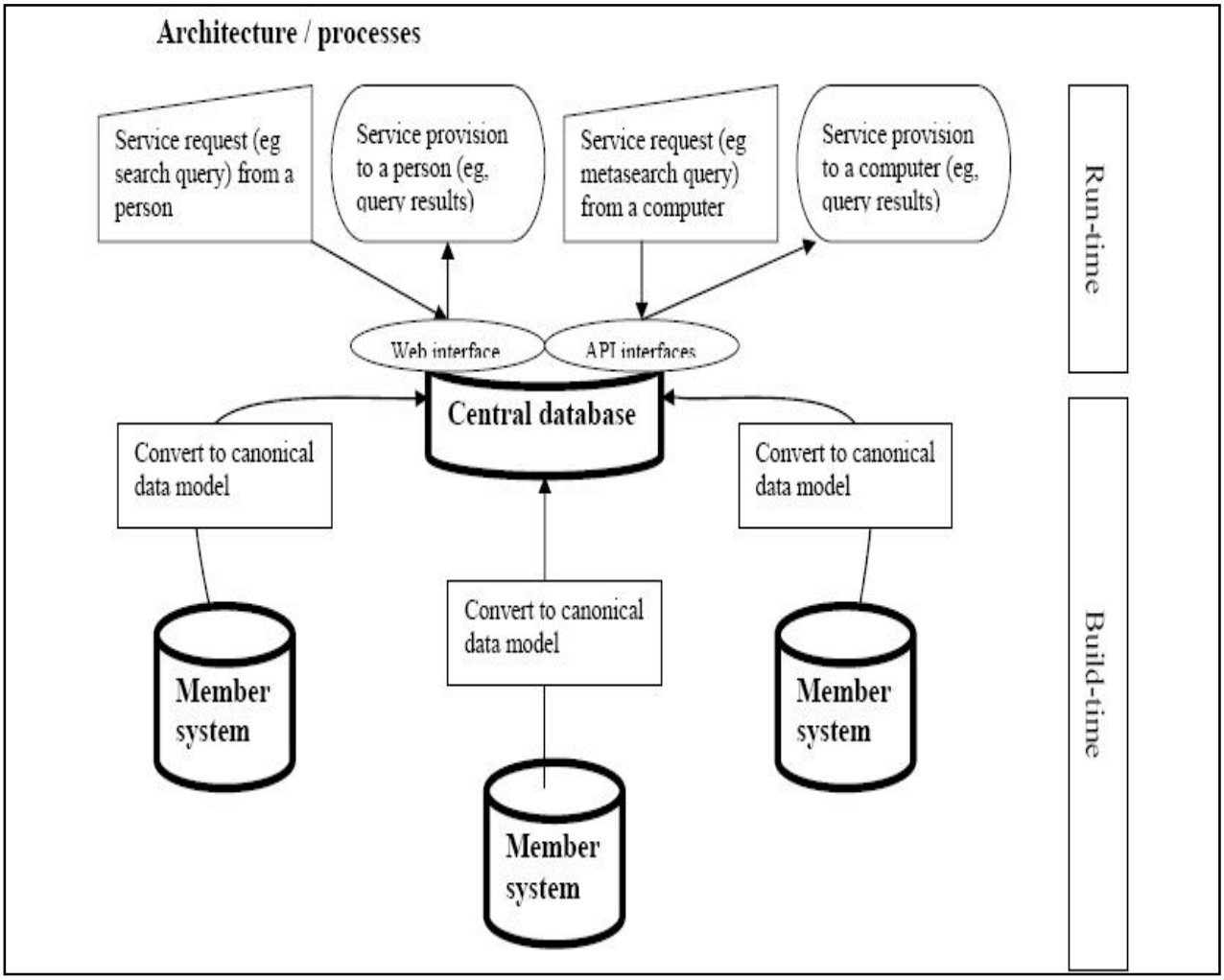
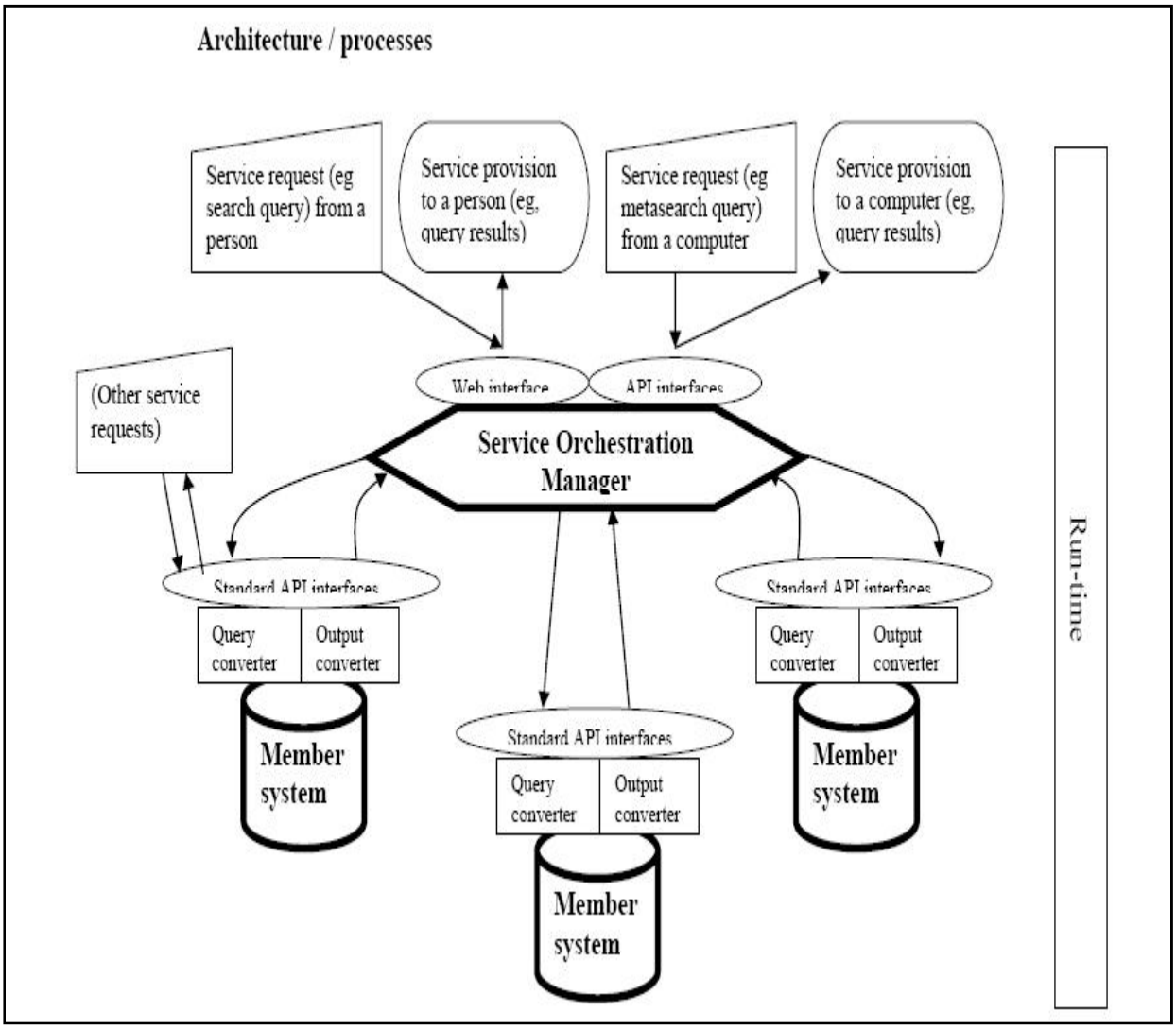
According to HEFCE (2011) in the UK, JISC, HEFCE, the Research Councils and others are funding a range of work to help manage information about research, covering institutional infrastructure (joining up institutional systems), national infrastructure (building services and interoperability to share research information), as well as providing guidance, support and opportunities to share experiences and work together.

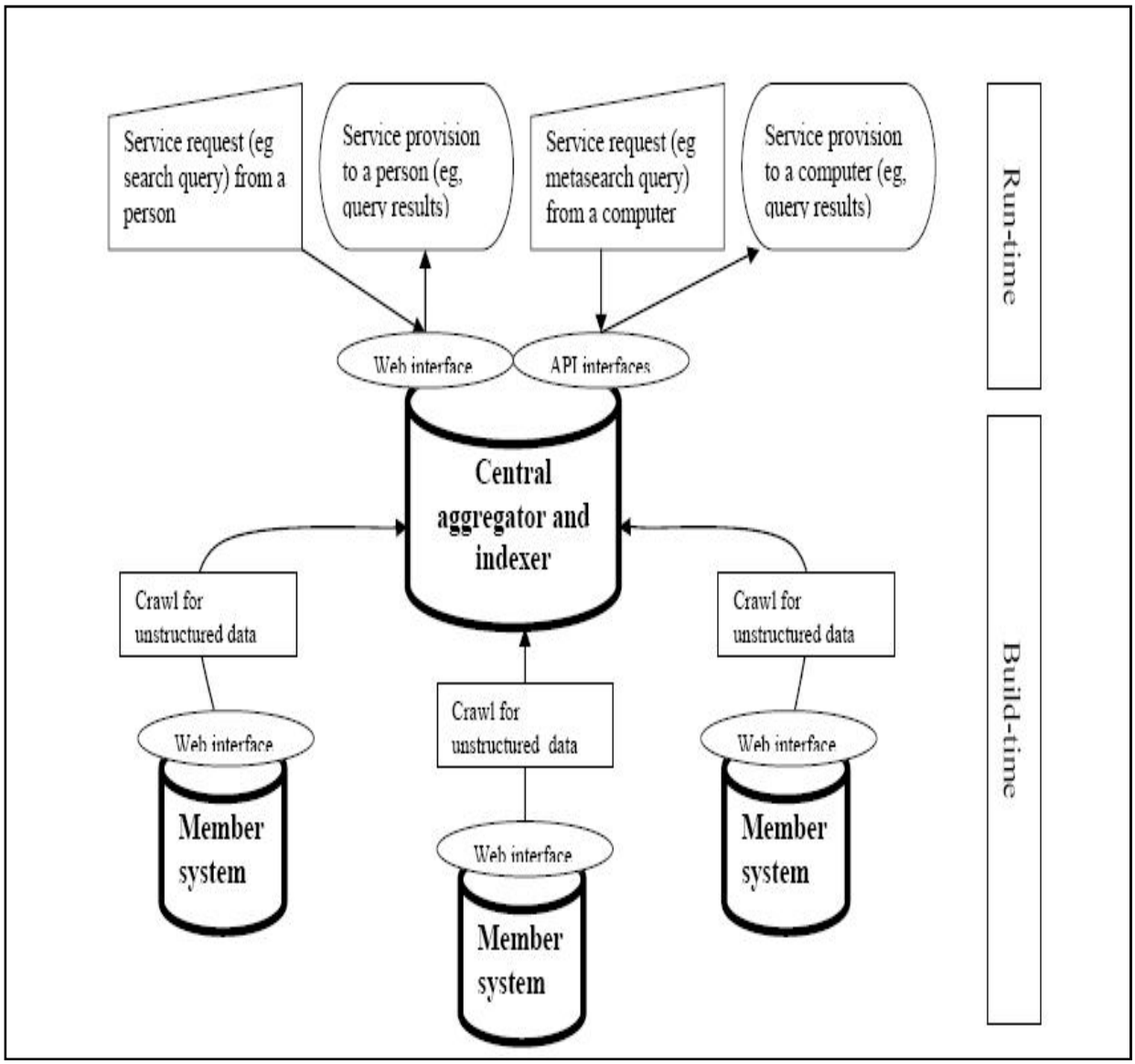
According to Ponniah (2003) organizations primarily adopt one of two approaches. If the entire database is kept in one centralized location, this type of database is a centralized database. On the other hand, if fragments of the database are physically placed at various locations, this type of database is a distributed database. Each type these databases has its own benefits and shortcomings. Ponniah further points out that whether an enterprise adopts a centralized or a distributed approach depends on the organizational setup and the information requirements.

In acentral database, all data is held at a single site and data access from remote sites is through communication links. Such a database would be easier to administer but data availability would be uncertain due to single point of failure and would depend on the capacity and reliability of the communication links. In the distributed database, Ponniah notes that computer processing is also distributed, with processing done locally at each location. A fragment of the data can be placed at each site based on the usage. Each fragment of data at every location may be managed with the same type of database management system in which case, it will be a distributed homogenous database. Where data fragments at different locations run with different DBMSs, it will be a distributed heterogeneous database systems. Such a heterogeneous arrangement provides extra flexibility but is difficult to coordinate and administer.

The European Science Foundation (ESF) provides a common platform for its Member Organizations in order to serve the needs of the European research community in a global context. In a report on "*Joint Research Information System*" ESF (2008) identified three basic


Architecture / processes
Service request (eg search query) from a person
Service provision to a person (eg, query results)
Service request (eg metasearch query) from a computer
Service provision to a computer (eg, query results)
Run-time
Web interface
API interfaces
Central database
Convert to canonical data model
Convert to canonical data model
Convert to canonical data model
Member system
Member system
Member system
Build-time


Architecture / processes
Service request (eg search query) from a person
Service provision to a person (eg, query results)
Service request (eg metasearch query) from a computer
Service provision to a computer (eg, query results)
(Other service requests)
Web interface
API interfaces
Service Orchestration Manager
Standard API interfaces
Query converter
Output converter
Member system
Standard API interfaces
Query converter
Output converter
Member system
Standard API interfaces
Query converter
Output converter
Member system
Run-time


Service request (eg search query) from a person
Service provision to a person (eg, query results)
Service request (eg metasearch query) from a computer
Service provision to a computer (eg, query results)
Run-time
Web interface
API interfaces
Central aggregator and indexer
Build-time
Crawl for unstructured data
Crawl for unstructured data
Crawl for unstructured data
Web interface
Web interface
Web interface
Member system
Member system
Member system

2.6.4: Model Comparison

In comparing the models ESF (2008) noted that the Web Crawling model requires little development effort as each information system would just expose what it holds for the Google (or Search Engine) robot to find it. It however has the disadvantage that the data retrieved is unstructured and would not have much added value.

The central model can offer a wide range of services but requires considerable effort in the maintenance and update of central database from the member databases and moving data across organizations might have legal implications or other.

In the distributed model, services are offered on current data and datasets are not moved. This model however requires considerable effort in maintaining a number of requests and response converters due to disparities that would arise in member systems. This model would require using common formats for a single shared "language" to which queries and responses need to translate.

CHAPTER 3: RESEARCH METHODOLOGY

This chapter will describe the procedures that will use in the study. The following sections will comprise this chapter: Research design, Target population, Sample and Sampling procedures, research instruments, Instrument validity, data collection procedures, model design.

3.1 Research Design

According to Kothari (2004) a research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. It is the conceptual structure within which research is conducted and constitutes the blueprint for the collection, measurement and analysis of data.

This study was conducted using descriptive methods to gather and evaluate information on the current methods of research management. These methods were suited to the study because information on the current research information management status was being sought. The methods have been used to carry out investigations through observation, interviews and questionnaire applications, documents reviews, etc as ways of obtaining information on the current states of affairs.

3.2 Target Population

According to Kothari (2004) all the items under consideration in any field of inquiry constitute a 'universe' or 'population'. It is also defined as a well-defined collection of individuals or objects known to have similar characteristics and all individuals or objects within a certain population will usually have some common characteristics.

For this study, the target population constituted the NCST and research institutions in Nairobi and its environs and was confined to the Universities (public and private); Public Research Organizations, and International research organizations.

3.3 Sampling Procedures

Kothari (2004) defines a complete enumeration of all the items in the 'population' as a census inquiry and can be presumed that in such an inquiry when all the items are covered no element of chance is left and highest accuracy is obtained. This type of inquiry involves a great deal of time, money and energy. Hence, a few items were selected from the population in this study.

The population in the study was not a homogeneous group even as Kothari (2004), and Patton (2002) affirm that stratified sampling can be used when the population can be divided into

several subpopulations that are individually more homogeneous. This increases confidence in making generalizations to specific subgroups. Samples were drawn from the population by stratifying the population into Public Universities, Private Universities, Public research organizations, and international research Organizations. The samples within the four subpopulations were then randomly drawn using judgment sampling.

Kothari (2004) points that, in judgment sampling, the judgment of researchers is used for selecting items which are considered as representative of the population. Items of the sample can be selected deliberately, and the choice concerning the items remains supreme. In this type of sampling, the inquiry purposively chooses particular units of the population to constitute a sample on the premise that the small mass that is so selected out of a huge one will be typical or representative of the whole. In this study, judgment was used in selecting the individual samples within the subpopulations based on their location or nearness to Nairobi which is home to most research organizations and could easily be accessed.

3.4 Research Instruments

Questionnaires, interviews, and document reviews were used in this study. A questionnaire consists of a number of questions sent to an individual or group of individuals with the objective of obtaining data on some problem under investigation. The questions are printed or typed in a definite order on a form or set of forms. It is also defined as a systematic compilation of questions that are administered to a sample of a population of which information is desired (Kothari, 2004). McMillan and Schumacher (2001) define a questionnaire as a set of statements that assesses attitudes, opinions, beliefs and biographical information.

For this study, questionnaires to be administered to Research Institutions and the NCST were designed. Document reviews and interviews were conducted only to the NCST. Questionnaires were used because of their economy, permit use of standardized questions and have uniform procedure.

3.5 Instrument Validity

Validity indicates the degree to which an instrument measures what it is supposed to measure. Validity can also be thought of as utility. In other words, validity is the extent to which differences found with a measuring instrument reflect true differences among those being tested (Kothari, 2004). Mugenda and Mugenda (1999) define validity as the accuracy and meaningfulness of inferences which are based on research results. Validity was ensured through

Colleagues' evaluation of the test items and the expert judgment of the supervisor Professor Vitalis Onyango-Otieno and Dr. Ismail Ateya were sought to ensure that the instrument was representative of the study area. A pilot run of the instrument was done to a selected number of the sample to identify items in the instruments that were likely to elicit irrelevance or be left blank (Kathuri and Pals, 1993). Those selected for piloting were not included in the final run.

3.6 Data Collection Procedures

A letter stating the purpose of the questionnaires to the research institutions was drafted and an introductory letter was obtained from Strathmore University. Sampled institutions were visited to enable face to face meetings with the personnel involved in managing research. This provided an opportunity for clarification and interviewing where it became necessary.

3.7 Data Analysis Procedures.

Data was coded in Ms Excel to arrive at frequencies and percentages. These were then used to plot charts.

3.8 Model Design.

In order to come up with a model for NCST to use in managing research operations, existing models for managing research were reviewed against the Kenyan scenario and an appropriate model was proposed. The model was sketched using Rrflow modeling software. Software ideas modeler and MagicDraw UML 9.0 were used to produce a use case of the system

CHAPTER 4: PRESENTATION OF RESEARCH FINDINGS

This chapter presents the results obtained from the investigations done from the NCST which were then compared with the findings from the questionnaires administered to research organizations. Investigations done at the NCST involved documents reviews, clarifications interviews on the documentations, and a questionnaire administration. Clarification interviews were conducted to obtain more detailed information on the controls on documents held which was not possible with the questionnaire. Documents were reviewed to reveal how information on research is received and stored.

4.1 Choice of Sampled Organization

The sample consisted of 46 (out of 125) research organizations comprising the NCST (which is the national organ mandate to coordinate research activities), 7 Public and 18 Private Universities, 11 Public research institutions and 9 International research institutions around Nairobi. Nairobi was purposively selected as it is home to a large number of the research organizations and also its accessibility to the researchers.

The sample of the 45 research institutions was randomly selected from four subpopulations of public universities, private universities, public research institutions and international research institutions. According to Kothari (2004), under stratified sampling the population is divided into several sub-populations that are individually more homogeneous than the total population; then we select items from each stratum to constitute a sample. Responses were obtained from the NCST and 25 research institutions (making 56%). 20 Institutions (making 44%) did not return the questionnaires.

Stratifying the population into the various subpopulations ensured that each type of research institution relevant to the research was included in the sample. The analysis of the findings was based on the whole targeted sample, and not the subpopulations, and was compared to the NCST's responses. This is because the NCST is the organ that should be collecting information from all the research institutions. **Table 4.1** below shows the types of Institutions that responded and their frequencies.

Table 4.1 : Research institution that responded and their type

	Frequency	Percentage
Public University	4	16%
Private University	9	36%
Public Research Institution	8	32%
International Research Institution	4	16%
Total	**25**	**100**

4.2. Research Management.

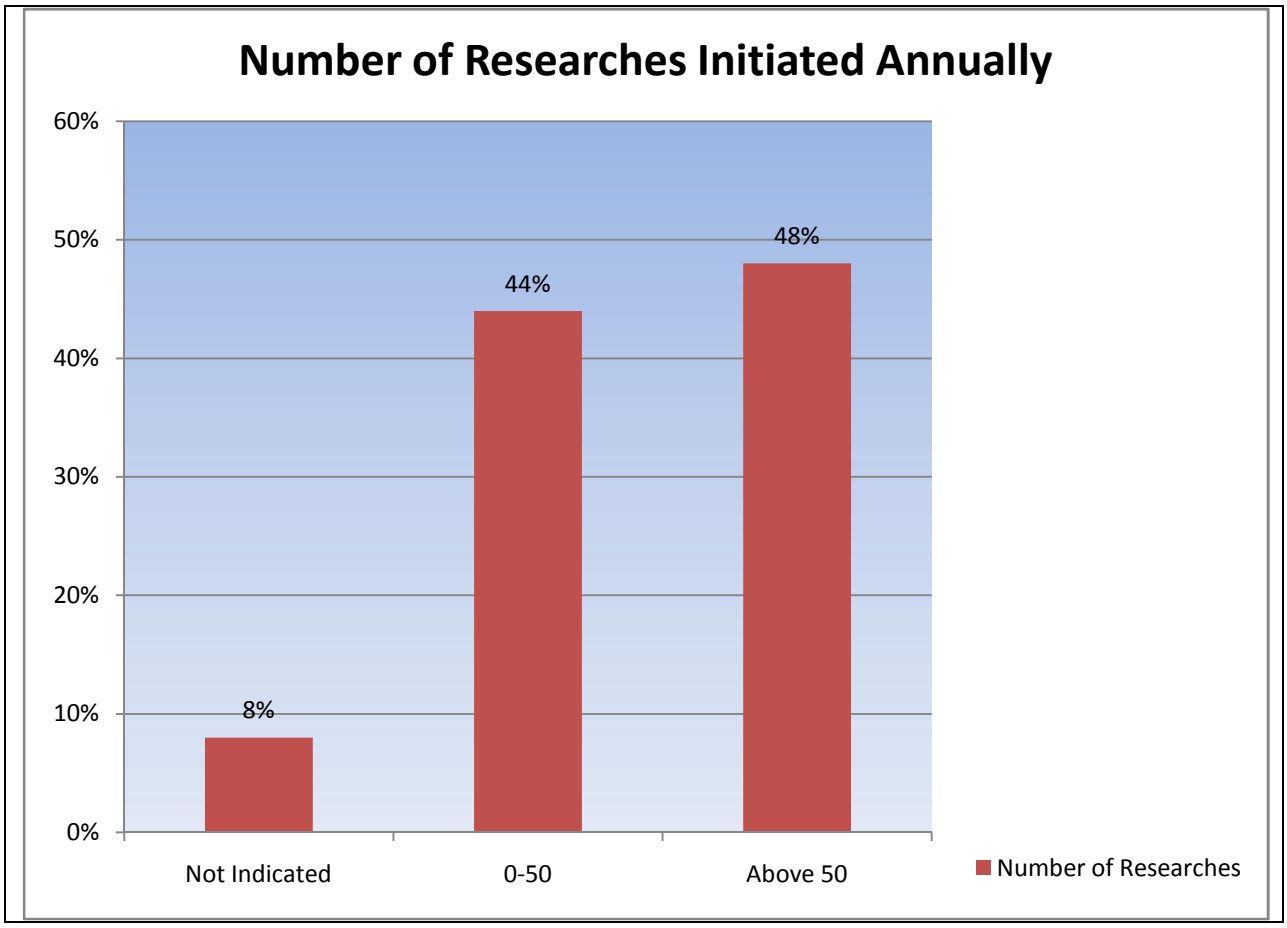
4.2.1 The number of researches initiated annually.

The question how many researches are initiated annually was to establish if there are more researches done in Kenya than is made available to the NCST. The research found that approximately 1300 proposals from various research institutions are approved by the NCST annually whereas 48% of the respondents from research institutions indicated they initiate above 50 researches annually, while 44% indicated figures between 0 50 researches annually. **Table 4.2** below summarizes the results in frequencies and percentages.

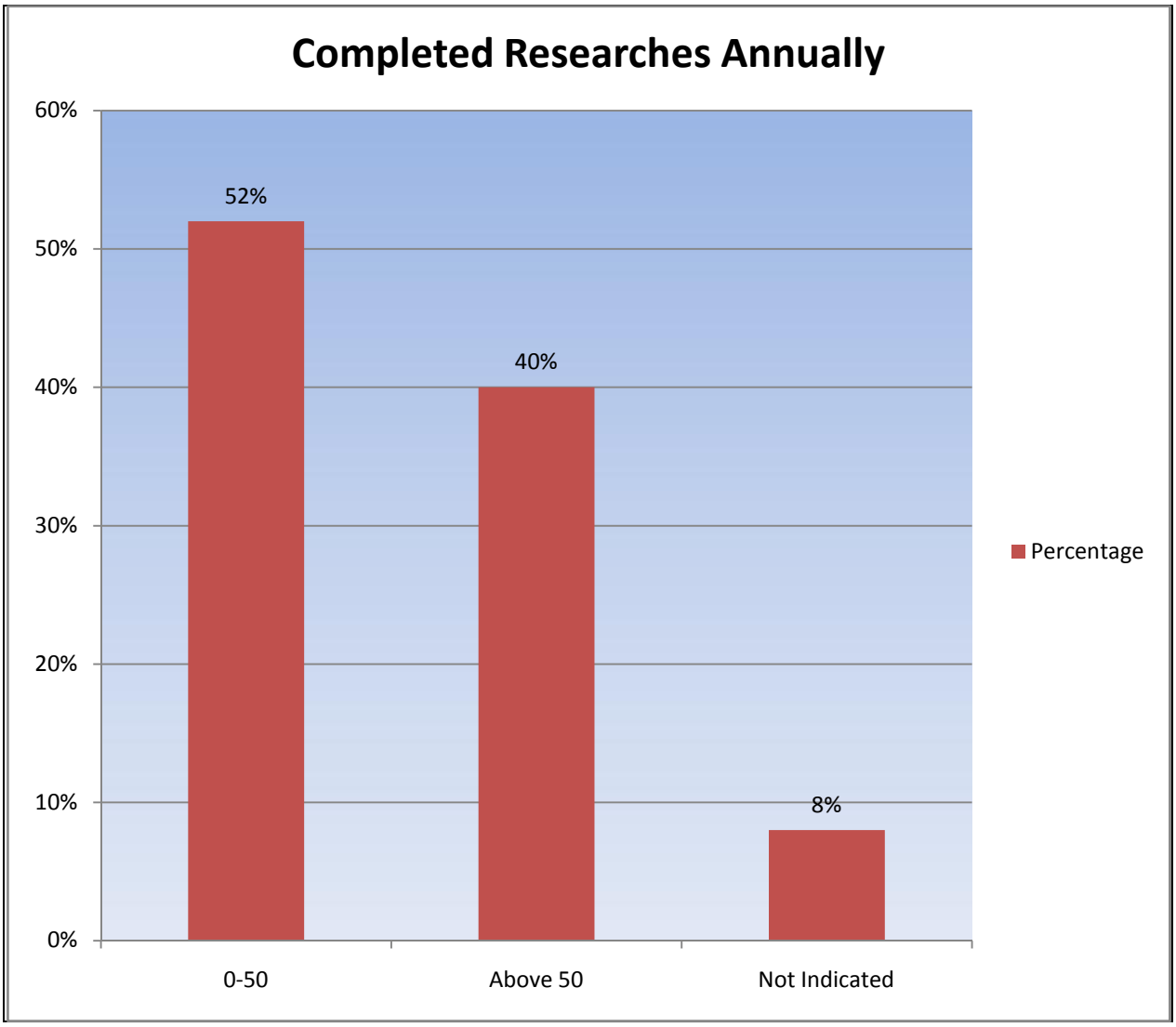
Table 4.2 : Researches initiated annually

	Frequency	Percentage
0-50	11	44
Above 50	12	48
Not Indicated	2	8

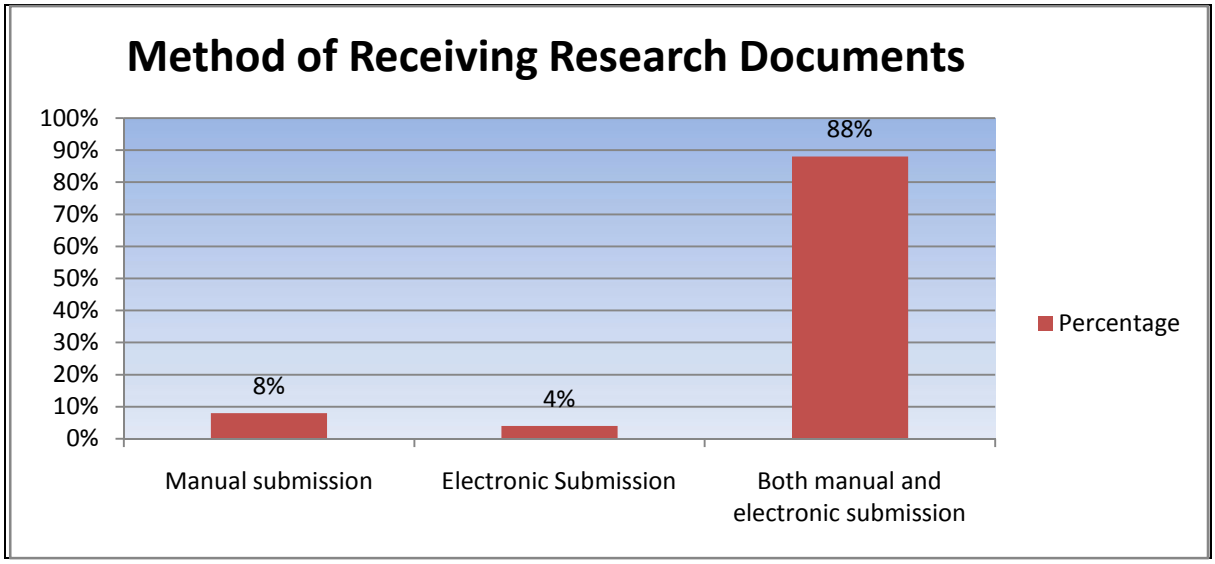
Graphical representation of the above results is shown on **Figure 4.1** below:


Number of Researches Initiated Annually
60%
50%
40%
30%
20%
10%
0%
8%
44%
48%
Not Indicated
0-50
Above 50
Number of Researches

	Frequency	Percentage
0-50	13	52
Above 50	10	40
Not Indicated	2	8



	Frequency	Percentage
Manual submission	2	8%
Electronic Submission	1	4%
Both manual and electronic submission	22	88%



The above results show that manual documents still dominate as a method of submitting research documents with the trend moving towards electronic submission.

4.2.4 Specific Documents for receiving Research information.

The researcher sought to establish if it would possible obtain information on researches done in the past by the organization and the information that is captured on them. This would also provide a guide to the type of information that organizations capture about research. Results from the questionnaire and Document reviews shows that the NCST has specific documents that record research information as shown on **Figure 4.4** and **Figure 4.5**.

Figure 4.4 shows a register for recording proposals and final research reports. Both of these are received in hard copies and entered into a manual register. There are 8 registers used representing 8 research areas (Environmental, Industrial, Physical and nuclear, Social, Medical, information and Biological).

Serial No.	Date	Name/Researcher Details	Source of Funds	Title of Research
No	Date	Name	Source of Finance	Subject
36409	20/6/06	Simon P. Nduru Gitumu	Self KU	Obstacles to Effective Teaching of Fine Art in Secondary Schools June 06 to June 07.
36410	20/6/06	Lyamura Margaret Kahunji	Action Aid Kenya	Opportunities [illegible] Adequate Housing [illegible]: A Case Study of Nyika and Olenkulu Locations, [illegible] Division, [illegible] District
36411	21/6/06	Peter M. Kamau	[illegible]	Challenges of Financing of Small and Medium Enterprises in the Hotel Sector in Kenya. June 06 to Aug 06
36412	21/6/06	John Olang Sana	Self	Development Versus Rights: A Case Study of Magadi Soda Company and Maasai of [illegible] June to July 06
36413	21/6/06	Benson Kibuka ~~Kamau~~ Kuria	Self	The Impact of Free Primary Education on Selected Factors in Central Division, [illegible] District June 06 to Aug 06
36414	22/6/06	Ndirangu Peter Githui	Self	Burnout Among Secondary School Teachers June 06 to July 06
36415	23/6/06	Marian Odoyo Odilla	Self	Management of Educational Change with Reference to Free Primary Education in Kenya: The Case of Kakamega and [illegible] Districts July 06 to Dec 06
36416	23/6/06	Hulda Kemunto Oruko	Self	Factors Influencing Growth of the [illegible] - Manufacturing [illegible] Enterprises of [illegible] in Northern Kenya June to Dec 06

Serial No	Research Title	Researcher Details	Research Institution	Date
15	Non-traditional sources of funding secondary school education in Kibwezi Division	Gerald Kioko Muia	KU	2006
16	Headteacher's and teachers' opinions on the hiring of staff by boards of governors: A survey of Ol Joro Orok division	Samuel N Njathi	KU	2006
17	A study of the factors that contribute to unrest in secondary schools in Kirinyaga District	Laurence Kinyua	KU	2006
18	The influence of guidance and counseling programme on academic career and personal competences among secondary school students in Koibatek District Kenya	Kabutlel J Kibii	Egerton	2006
19	Teachers' perception on the role of quality assurance and standard officers on quality of education: A case study of Nairobi Sec. School	Adikinyi W Judith		2006
20	Instructional supervisory practices applied in private primary schools in Central Province, Kirinyaga District	Gatuma, Patrick Gachahi	KU	2006
21	Influence of single and dual parenthood on self-esteem, discipline and interpersonal relationships among secondary school students within Nakuru Municipality, Kenya	Kimani James Mwaura	Egerton	2006
22	Factors hindering the teaching of orientation and mobility to visually impaired students in Thika primary school for the visually impaired.	Nasimiyu L Milimu	KU	2006
23	Factors influencing high drop out rates in public secondary schools in Murang'a District	Gatutha J Wathoblo	UON	2006
24	Factors influencing demand for Bachelor of Education (Arts) external degree programme in the college of education and external studies	David Otigo Otieno	UON	2006
25	Roles of Guidance and counseling in discipline maintenance in public secondary schools in Nembure division of Embu District	Kariithi Ann	KU	2006
26	The extend of the Heads of department involvement in administration of public secondary schools in Ruiru Division, Thika District	Wanjohi R Wambui	KU	2006
27	Assessment of performance appraisal in facilitating secondary school teacher professional development in Thika Municipality	Mwangi M Wambui	KU	2006
28	A survey of levels of satisfaction of clients to the Teachers Service Commission secretariat	Lekipaika Maasai	UON	2006
29	Gender enrolment and performance trends in Technical and vocational education and training in National polytechnics and it's implications for Human Resource Development in Kenya	Were Agnater Omusulah	KU	2006
30	Attitudes of teachers and female students towards mathematics in relation to the	Mary C Kemunto	CUEA	2006

All the institutions responded that they have Specific documents to record research information as shown on **Table 4.5** below; information captured on the documents included researcher, research, and institution details.

Table 4.5: Research Organizations have Specific Documents to record research information.

	Frequency	**Percentage**
Yes	25	100%
No	0	0%

4.2.5 Method for storing research information.

The research sought to establish the methods used by institutions to store their research information. This gave indications to the accessibility of the information to users of the information. The NCST responded that the information is stored in hard copy files and users are given authorization to access the physical storage. Responses from research institutions are shown in **Table 4.6** below. These are further presented graphically as shown on **Figure 4.6** below.

Table 4.6: Method of Storing Research information

	Frequency	**Percentage**
Manual (on paper) files	5	20%
Manual (on paper) files and Electronic files (Word, Excel etc)	5	20%
Manual (on paper) files and Electronic database	3	12%
Manual (on paper) files and Electronic files (Word, Excel etc) and Electronic database	10	40%
Electronic files (Word, Excel etc) and Electronic database	1	4%
Electronic database	1	4%

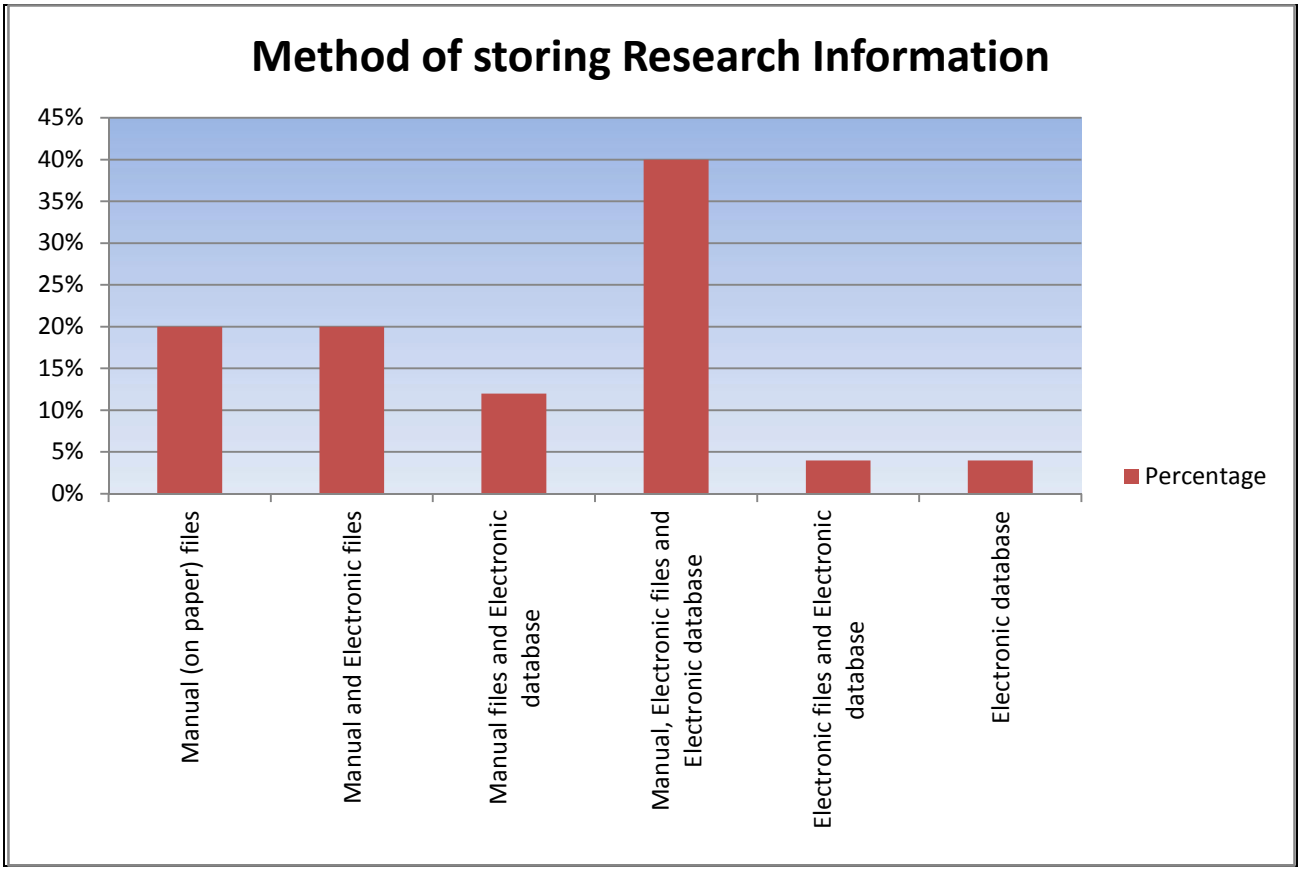

Method of storing Research Information
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Manual (on paper) files
Manual and Electronic files
Manual files and Electronic database
Manual, Electronic files and Electronic database
Electronic files and Electronic database
Electronic database
Percentage

Table 4.7: Access to research information.

	Frequency	Percentage
Free access for everyone	7	28%
Authorization - intended people, only Students Members, Passwords	18	72%

Figure 4.7 below gives the graphical representation of the results

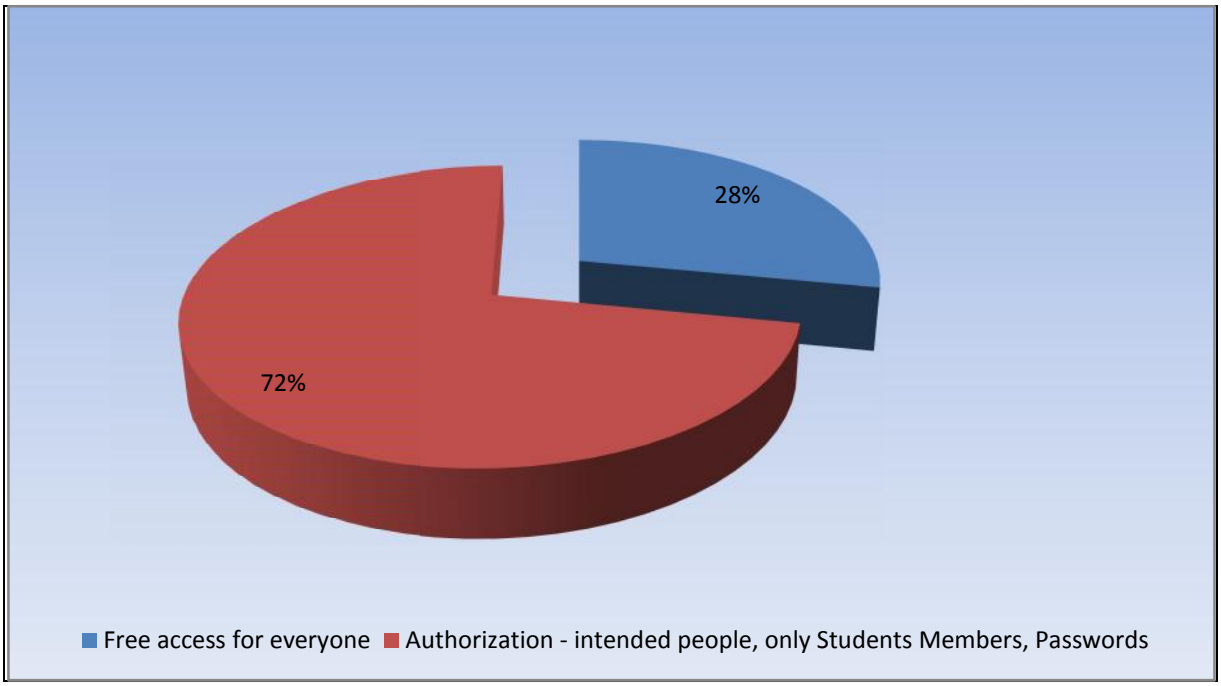


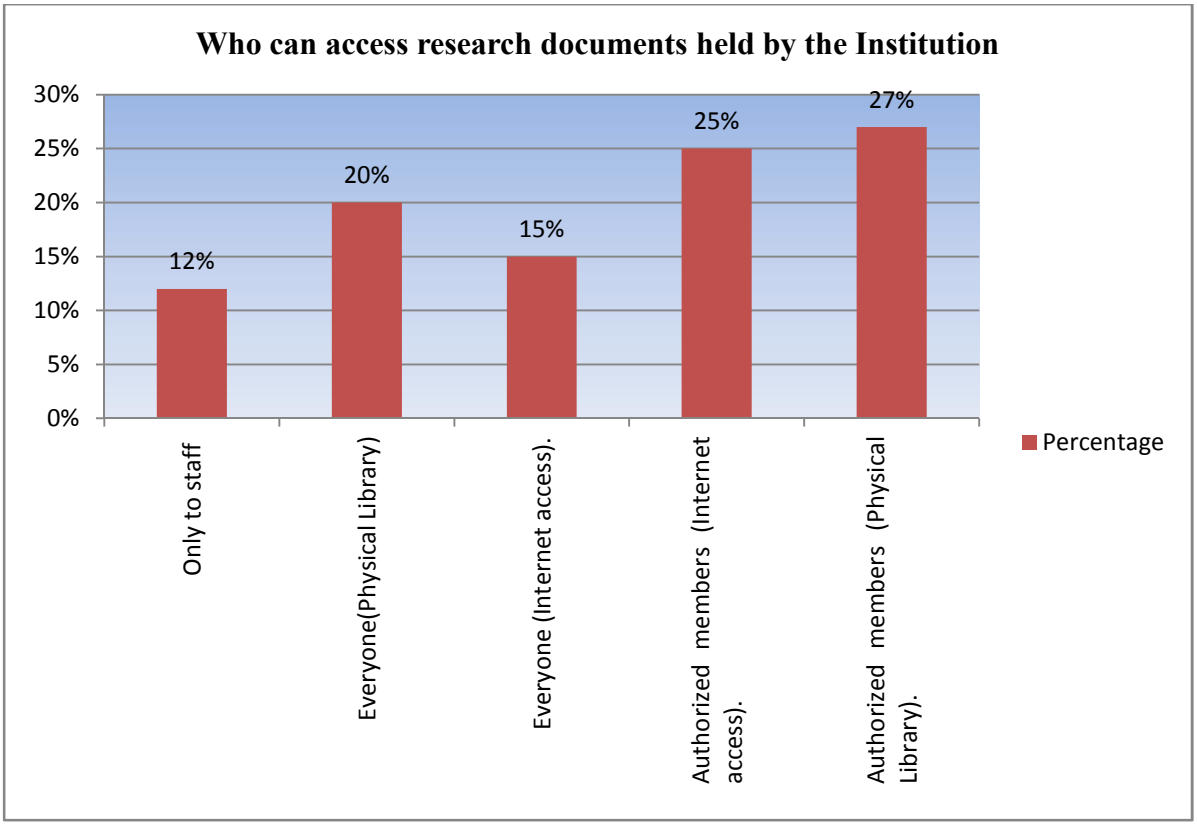
Figure 4.7: Access to research information held by research institutions

The results show that 72% of the respondents confirmed that access is controlled through authorization while 28% responded that access was free.

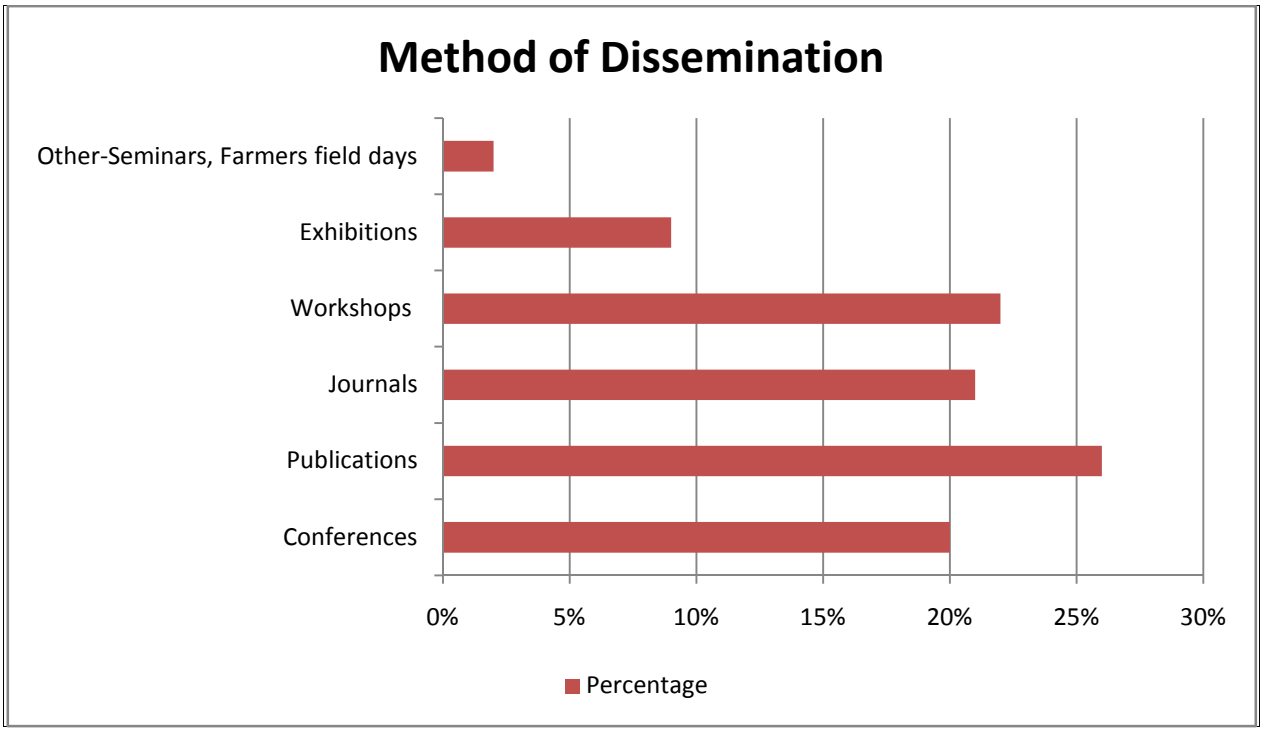
Table 4.8 below gives the results showing who can gain access to this information as held by the research institutions.

Table 4.8: Who can access research documents held by the Institution?

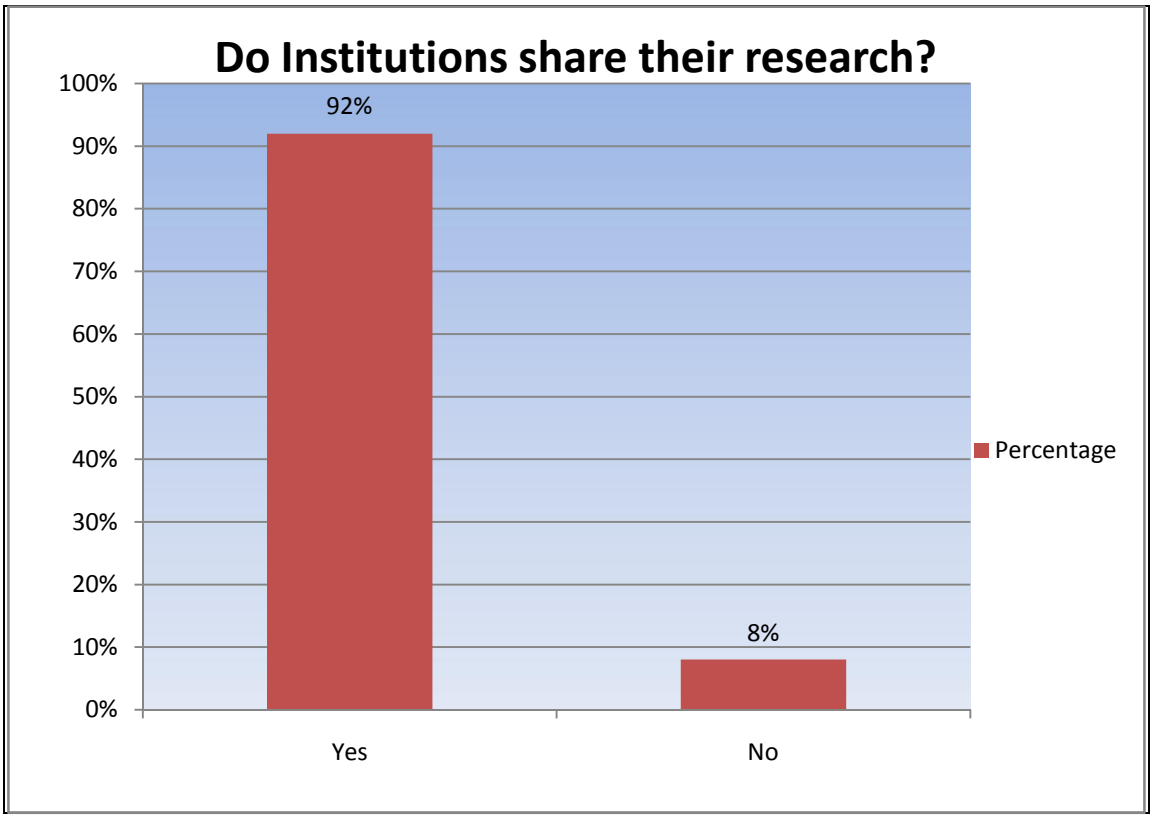
	Frequency	Percentage
Only to staff	7	12%
Everyone(Physical Library)	12	20%
Everyone (Internet access).	9	15%
Authorized members (Internet access).	15	25%
Authorized members (Physical Library).	16	27%


Who can access research documents held by the Institution
30%
25%
20%
15%
10%
5%
0%
12%
20%
15%
25%
27%
Only to staff
Everyone(Physical Library)
Everyone (Internet access).
Authorized members (Internet access).
Authorized members (Physical Library).
Percentage

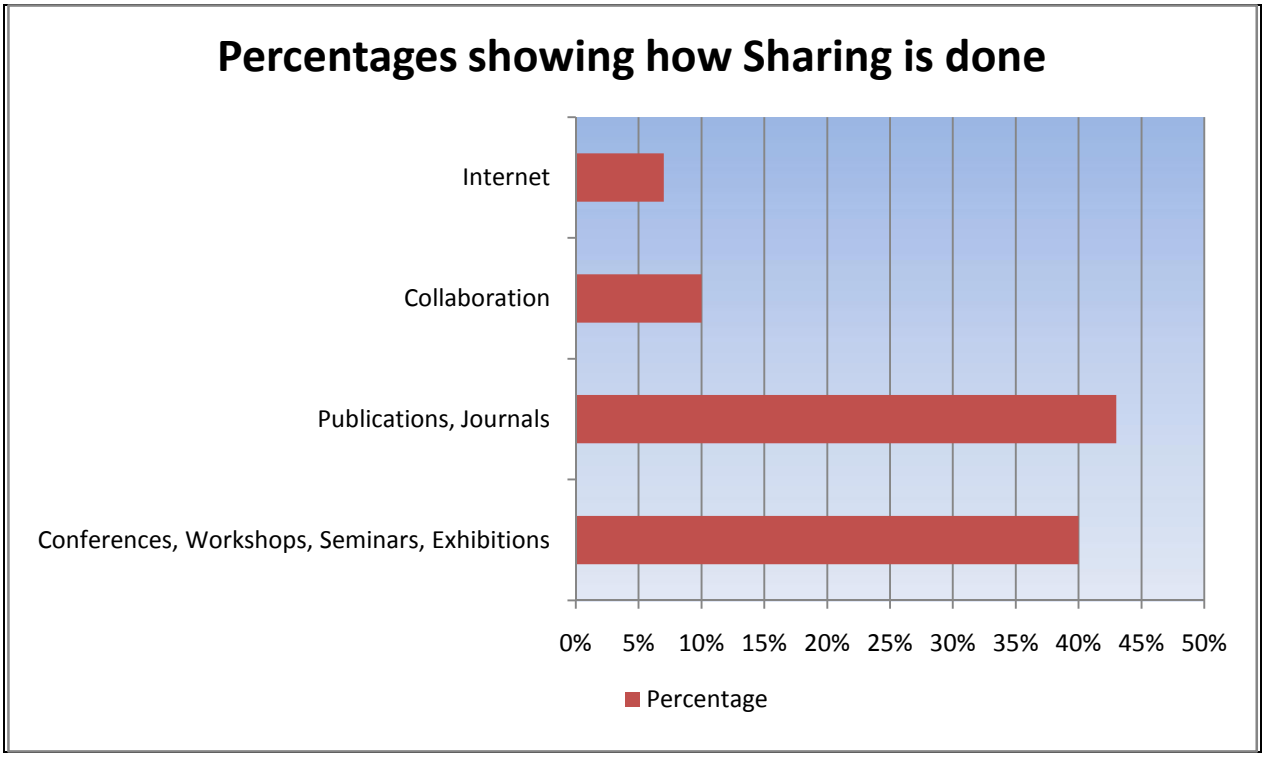
	Frequency	Percentage
Conferences	18	20%
Publications	23	26%
Journals.	19	21%
Workshops	20	22%
Exhibitions	8	9%
Other-Seminars, Farmers field days	2	2%
Total	**90**	**100%**



Does the Institution share research information it holds with other Institutions?	Frequency	Percentage
Yes	23	92%
No	2	8%
Total	**25**	**100%**



	Frequency	Percentage
Conferences, Workshops, Seminars, Exhibitions	12	40%
Publications, Journals	13	43%
Collaboration	3	10%
Internet	2	7%
Total	**30**	**100%**



4.3 Barriers that hinder sharing research

The research sought to establish if there any limitations faced by research institutions and the NCST towards sharing research information they hold. According to the NCST poor infrastructure, institutional silos and that regulations are not enforced are major barriers to sharing information. **Table 4.12** below gives the frequencies and percentages of responses by research organizations on barriers to sharing of research information. **Figure 4.12** gives the graphical representation of the results.

Table 4.12: Barriers that hinder sharing research

	Frequency	Percentage
Poor Infrastructure	14	25%
Institutional information Silos	9	16%
No regulations to enforce sharing.	12	21%
No central point for research information collection.	18	32%
Intellectual property rights, cost	3	5%
Total	**56**	**100%**

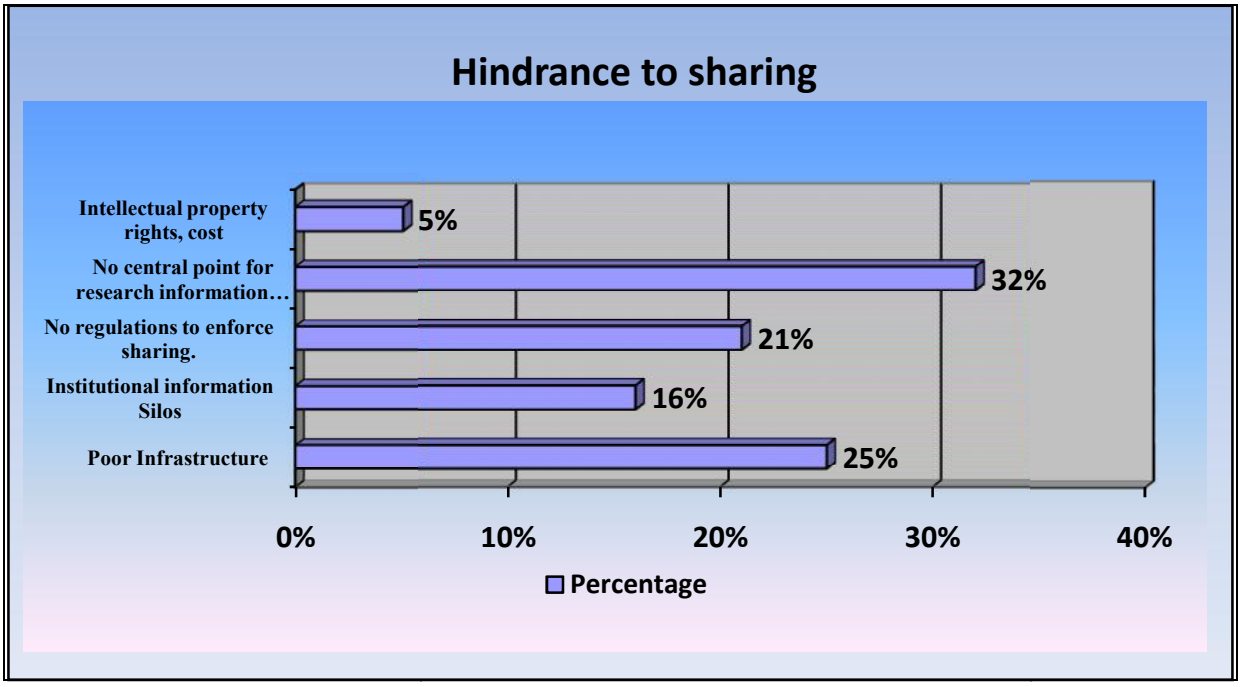
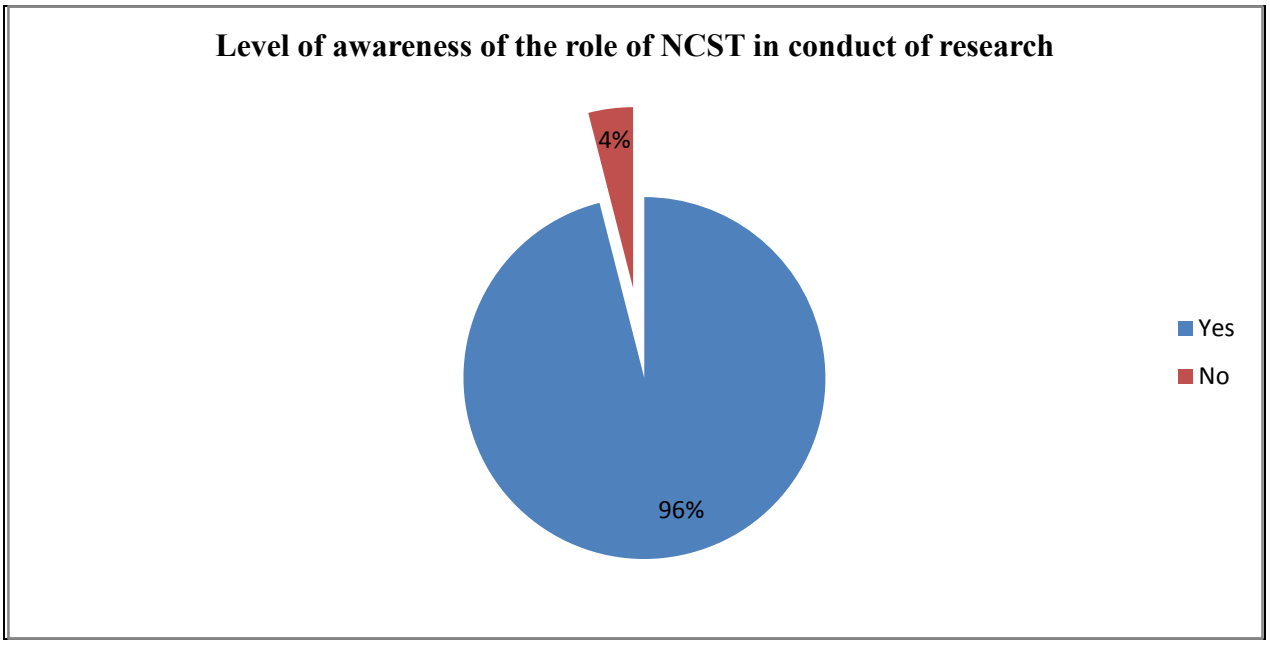


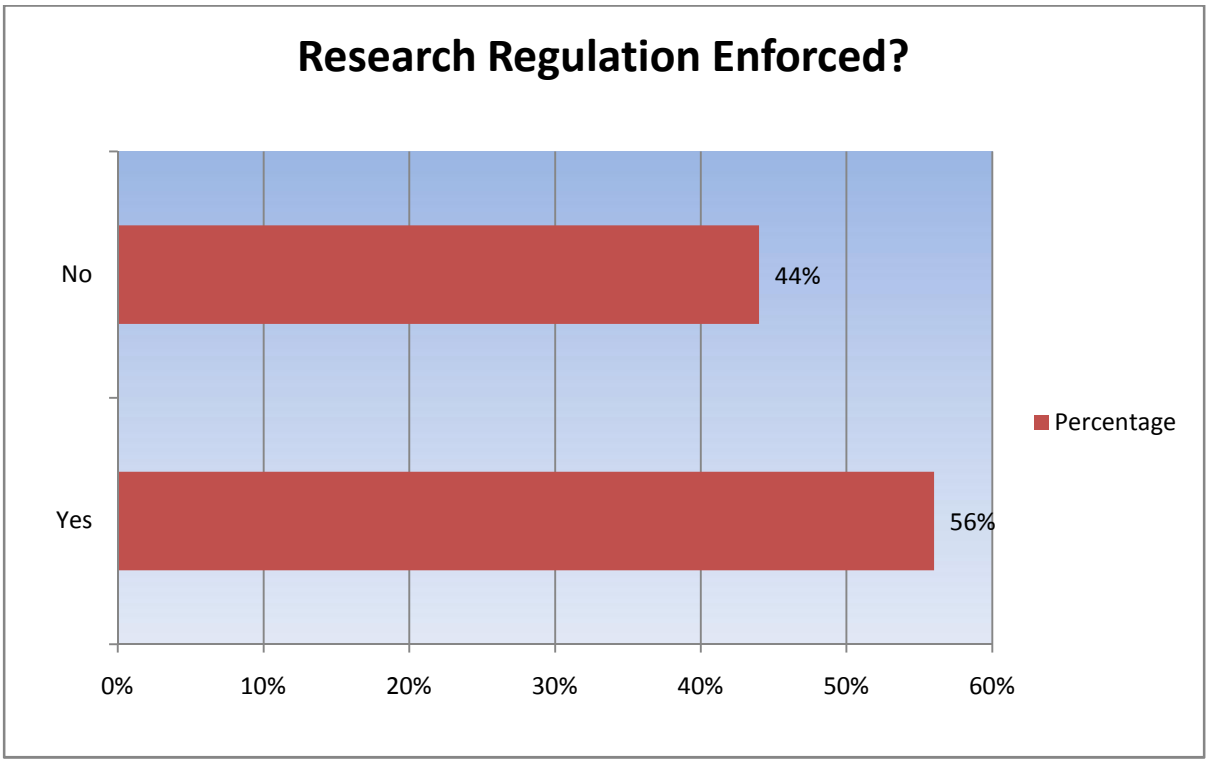
Figure 4.12: Hindrances to research sharing

Research Institutions indicated that there is lack of a central point for collecting research information and that there is poor infrastructure, regulations are not enforced and some

	Frequency	Percentage
Yes	24	96%
No	1	4%
Total	25	100%



	Frequency	Percentage
Yes	14	56%
No	11	44%
Total	**25**	**100%**



imposed on defaulters of the regulations

4.4.3 Research authorization from NCST

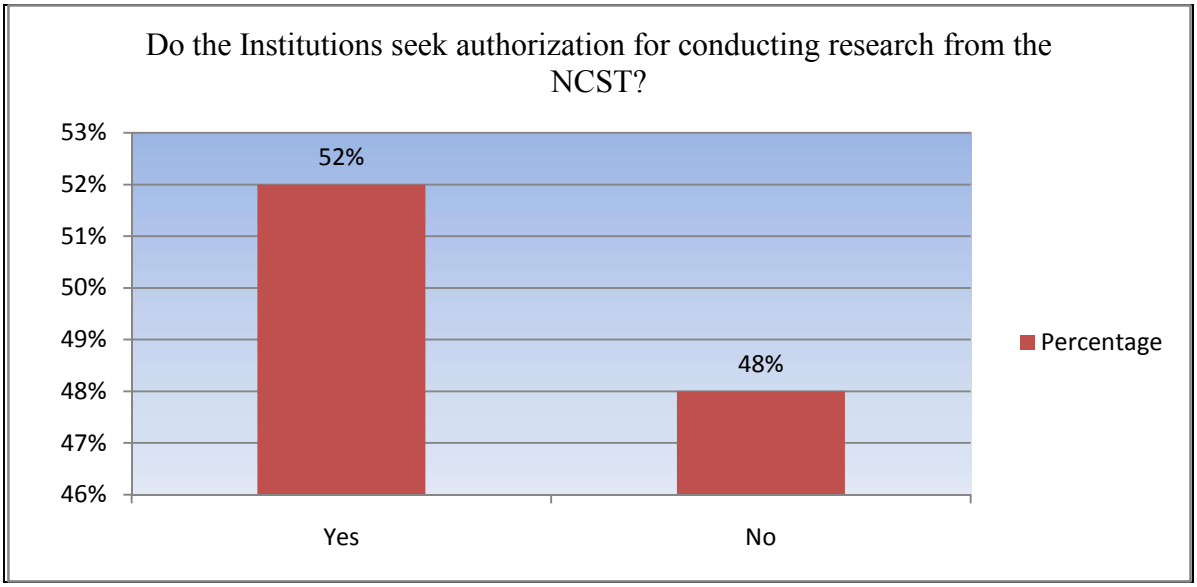
Research authorization is one way to ensure that the NCST is aware of what researches will be conducted. This also initiates the process of getting research documents from the research institutions and even other researchers.

According to the response by NCST only public research institutions are exempted from seeking authorization. According to the research rules and regulations, only employees of public research institutions/ Ministries, etc who are required to do research as part of their work are exempted from research authorization by the NCST. Everyone intending to perform research in Kenya must seek authorization in order to do so. The regulations in Kenya apply to anyone doing research, student or otherwise (NCST, 2009).

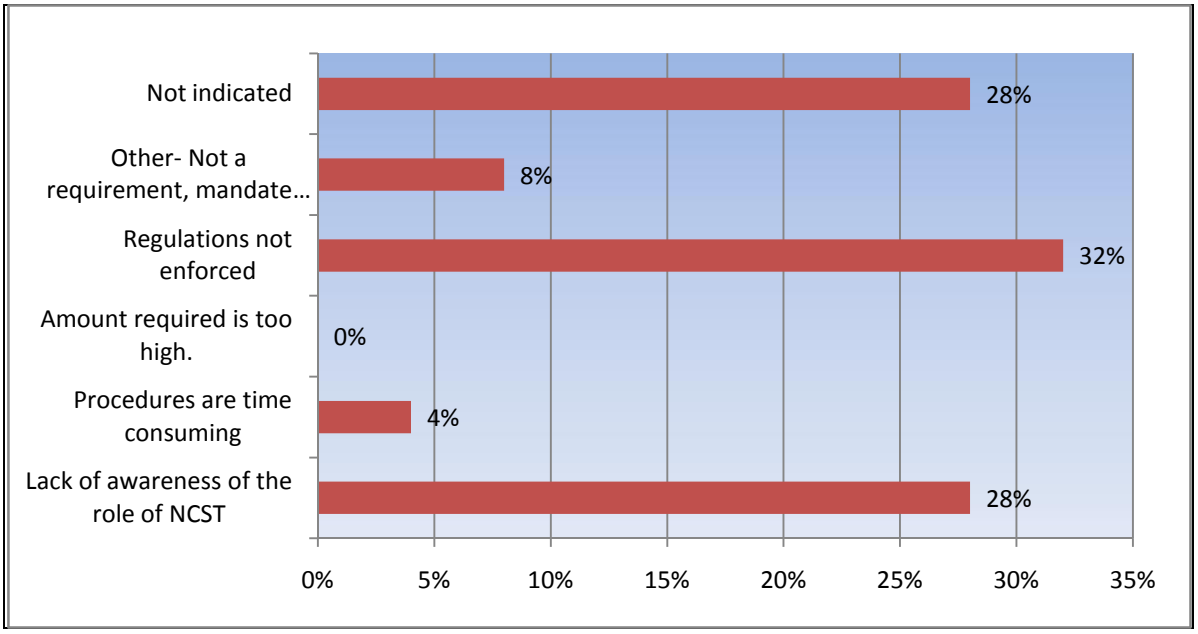
Half of the respondents from research institutions confirmed they seek authorization from the NCST for their research as shown on **Table 4.15** and the graphic representation on **Figure 4.15** below.

Table 4.15: Do Institutions seek authorization for conducting their research, from the NCST?

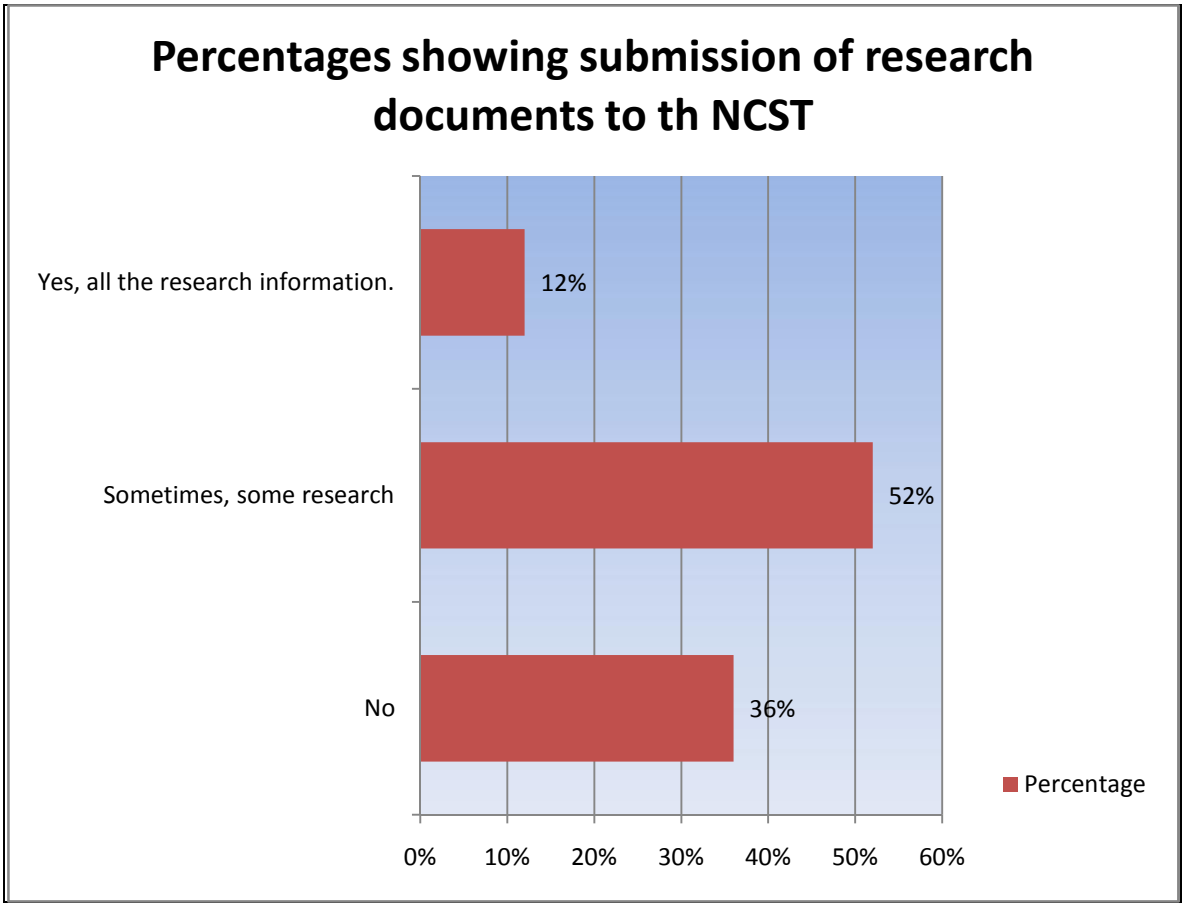
Response	**Frequency**	**Percentage**
Yes	13	52%
No	12	48%
Total	**25**	**100%**



	Frequency	Percentage
Lack of awareness of the role of NCST	7	28%
Procedures are time consuming	1	4%
Amount required is too high.	0	0
Regulations not enforced.	8	32%
Other- Not a requirement, mandate allows research	2	8%
Not indicated	7	28%
Total	25	100%

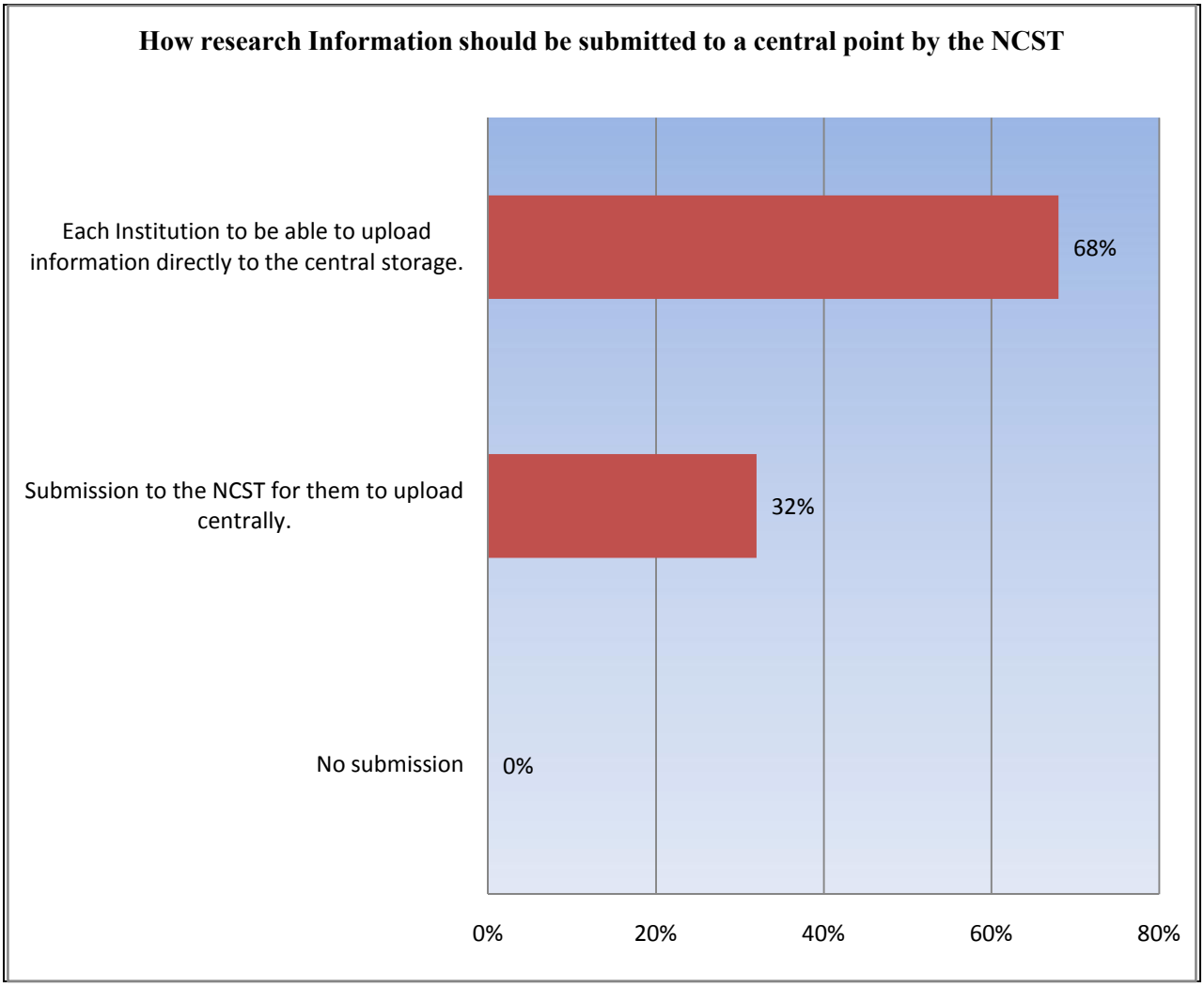


	Frequency	Percentage
No	9	36%
Sometimes, some research	13	52%
Yes, all the research information	3	12%
Total	**25**	**100%**



	Frequency	Percentage

No submission	0	0
Submission to the NCST for them to upload centrally.	8	32%
Each Institution to be able to upload information directly to the central storage.	17	68%
Other (Specify)	0	0
Total	**25**	**100%**



The results support that; institutions would mostly like to access and upload information by themselves. Only a few support submissions to the NCST for upload. None of the institutions sampled was in favor of not submitting their researches at all.

This proves a willingness of institutions to share research and to use a common or central location for sending their research information.

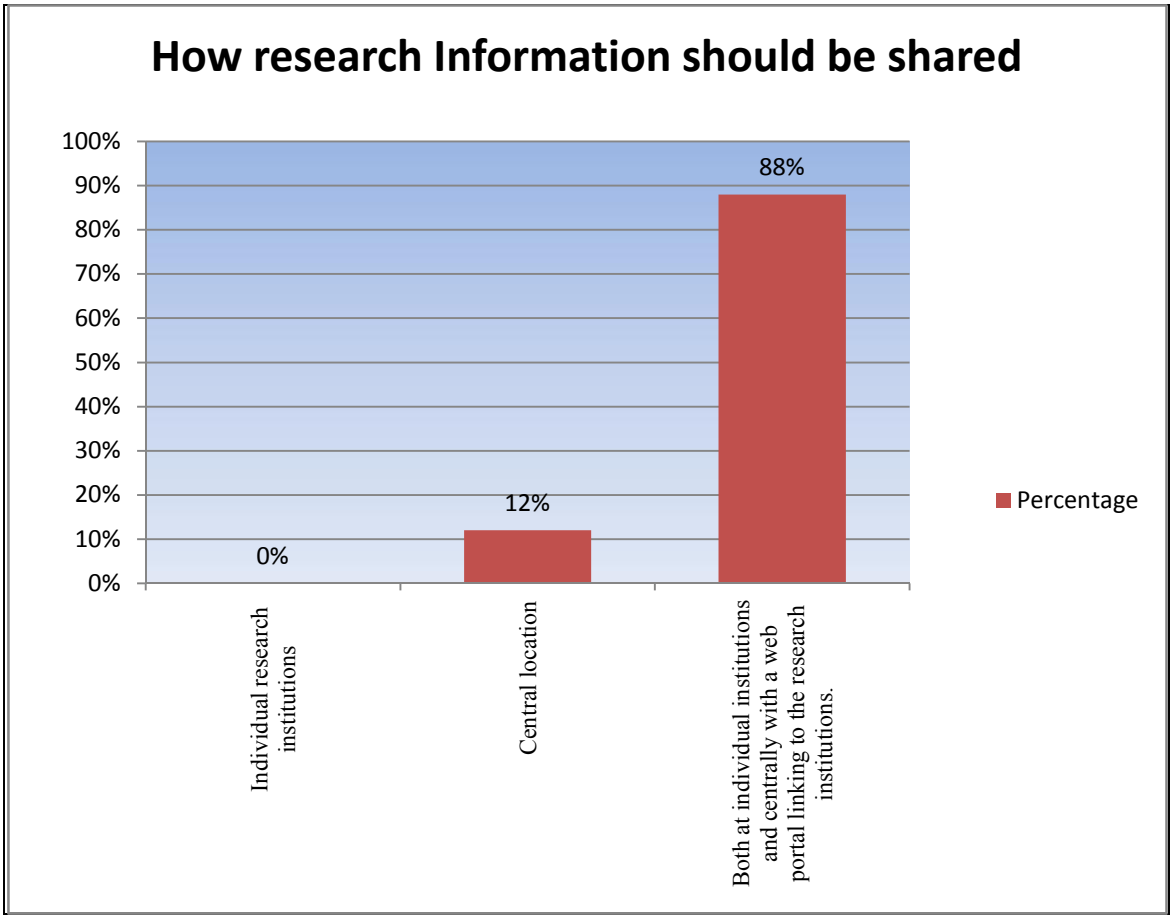
4.6 How Information can be shared nationally

The research sought views from respondents towards a method of sharing research. The response from the NCST indicated that research should be stored both at a central location and also at individual research institutions

Table 4.19 below shows responses in percentages and frequencies while the **Figure 4.19** below presents the results in a graph.

Table 4.19: Where research information should be stored

	Frequency	Percentage
Individual research institutions	0	0%
Central location	3	12%
Both at individual institutions and centrally with a web portal linking to the research institutions.	23	88%
Total	**26**	**100%**


How research Information should be shared
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
88%
12%
0%
Individual research institutions
Central location
Both at individual institutions and centrally with a web portal linking to the research institutions.
Percentage

CHAPTER 5: DISCUSSION OF RESULTS

The study findings show that there are more research documents held by institutions than are made available annually through the NCST. The research has found that poor infrastructure, the lack of a central point for collecting information and lack of enforcement of research regulations are the major obstacles that limit the sharing of research information, given that the research also revealed that research institutions are willing to share their findings.

The study reviewed three basic models that can be applied to manage research information. These models are the central database model, the distributed database model, and the web crawler database model. In comparing these models it was found that the Web Crawling model requires little development effort as each information system would just expose what it holds for the Google (or other) robot to find it but has the disadvantage that the data retrieved is unstructured and would not have much added value.

In the distributed model, services are offered on current data and datasets are not moved. This model however requires considerable effort in maintaining a number of requests and response converters due to disparities that would arise in member database systems. This model would require using common formats for a single shared "language" to which queries and responses need to translate. This raises interoperability concerns where member systems already exist and different across organizations.

The central model can offer a wide range of services but requires considerable effort in the maintenance and update of central database from the member databases and moving data across organizations might have legal implications or other. In addition, infrastructure is one of the major limitations identified by the research findings; hence having direct communication between member's systems is favorable but will be limited by the infrastructure linking the institutions.

Based on the findings from the study; of the three models reviewed, the central database model is still has more services and potential for being adapted for the NCST. The proposed model in this study was therefore be based on the concept of the central database model

5.1 Web Based System

According to Winsolutions(2009), Web-based systems are characterized as having been developed specifically to run within the Web environment where the 'client' is an internet browser and is responsible only for displaying the user interface and none of the applications or

any processing runs on the client side unlike Web-enabled systems which are Client/Server based systems that require client-side software to be downloaded.

Wood (2007) also suggests that web-based Systems allow all system functionality including management and development functionality to be run from the browser and there no client side application code. Therefore there are no issues with maintaining client side software as the application runs entirely on the server. System performance is dependent only on the servers available and is therefore more manageable

A Web-Based Central database which is accessible through the internet for institutions to access and upload their information will be an appropriate mechanism for the NCST to implement in managing research information. **Figure 5.1** below presents a model adapted from the central database model for management of research information in Kenya.

5.1: The Proposed Model

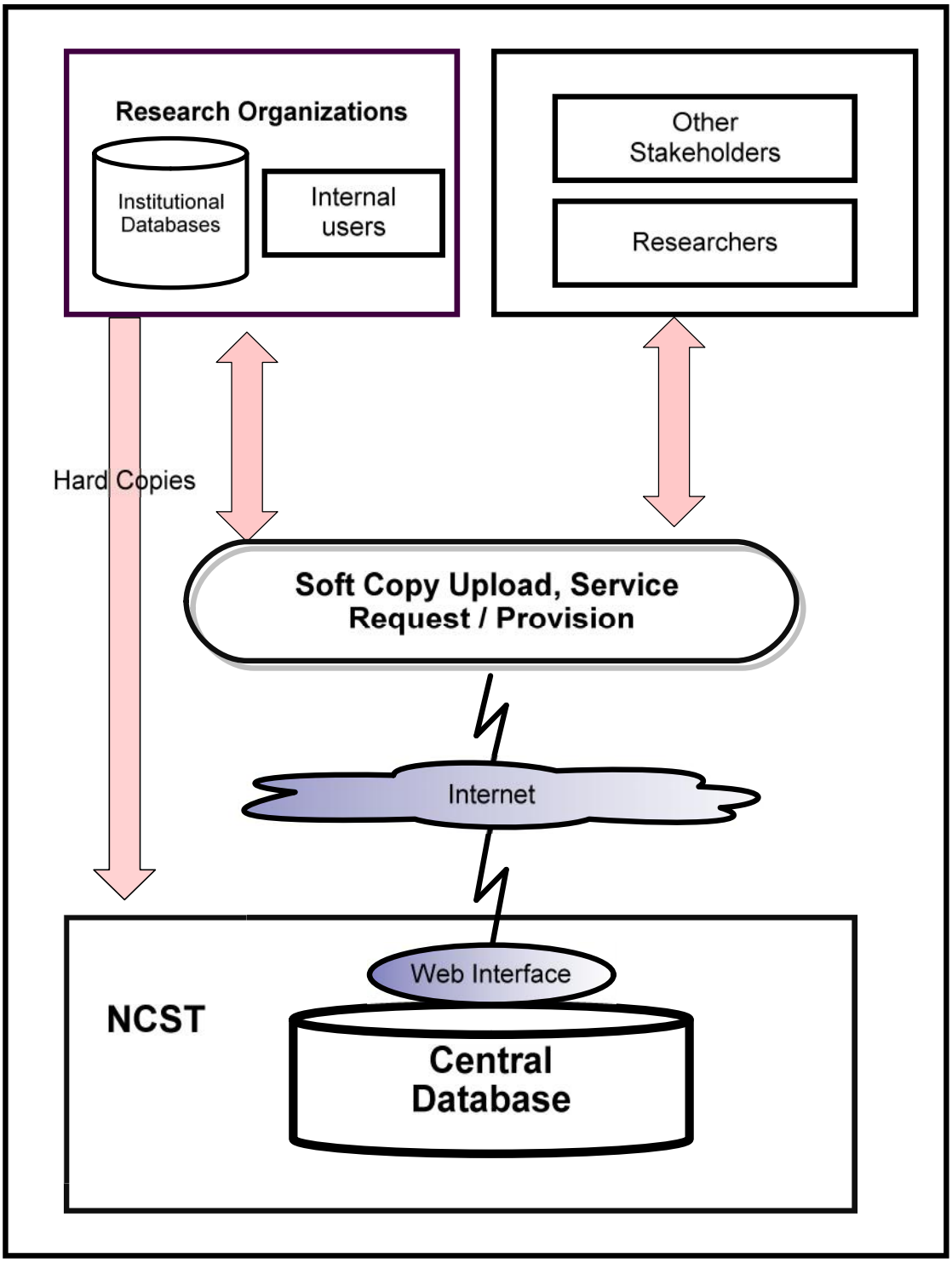


Figure 5.1: The Proposed Model

5.2 Suitability of the proposed model.

The research has identified poor infrastructure, Lack of a central place for sharing, and lack of enforcement on research regulations to be the major contributors to information sharing.

According to wood (2007, October) Web-based systems provide the ability to easily extend the system to other users, who may require access. Access to the system is simplified, especially for remote or geographically separated users. Remote users only require an Internet connection in order to use the system

A central database which is accessible through the internet for institutions to access and upload their information will therefore be a suitable alternative to the current methods of sharing which the research revealed as mainly done through Publications and Journals, Conferences, Workshops, Seminars, Exhibitions and Collaborations (**Table 4.10).** These methods of sharing are only occasional in their nature and may not address a real time requirement by researchers and other stakeholders. Further, these methods cannot adequately address duplication of research effort.

Having a web-based central database ensures there are no issues with maintaining client side software as the application runs entirely on the server. Access to the system is convenient even for remote or geographically separated institutions and users, requiring only an Internet connection in order to use the system (Wood, 2007, October).

This alleviates infrastructure problems and also addresses duplication of research effort while making dissemination and sharing real time.

A Central Database however provides a single point of failure which would introduce unavailability of information if it goes down, Ponniah (2003) and Muller (1999). Replication of the Database through the use of multiple sites will solve such an outcome. Further, research institutions will continue to hold their institution specific information and only provide copies of the same at the central location.

5.3 System Modeling

The system will have both manual and electronic components. The manual component is the existing physical storage. The web-based system will have the electronically available documents and a list of the documents that are available only as hard copies.

5.3.1: Sample Database Table Structures.

Table Name: User**, Structure:** User (U-ID, Username, Password, access-level.)

Table Name: ResearchDocument, **Structure:** ResearchDocument(**Document-ID**, **Author-ID**, Title, **Research-Area**, **Institution**, **DocumentType**, **Status**).

Table Name: Research-Area, **Structure:** Research-Area(**Researcharea-ID**, ResearchArea-Description).

Table Name: Institution, **Structure:** Institution(**Institution-ID**, InstitutionName , InstitutionAddress, InstitutionType).

Table Name: Status, **Structure:** Status(**Status-ID**, Description)

Table Name: Document-Type, **Structure:** Document-Type (**DType-ID**, Description).

Table Name: InstitutionType**, Structure:** InstitutionType (**InstitutionTypeID**, Description)

Table Name: Author, **Structure:** (**AuthorID**, Fname, Lname, **Research-Area**)

5.3.2 Description using UML use cases

The Unified Modeling Language (UML) is a standard language for writing software blueprints. The UML may be used to visualize, specify, construct, and document the artifacts of software intensive System (Fowler, 2000), According to Muller (1999) a use cases for a system describes at a high level what the system should do .A use case diagram is a context diagram that shows the top-level relationships between actors and use cases. An actor is a role of object or objects outside of a system that interacts directly with it as part of a coherent work unit (a use case). An Actor element characterizes the role played by an outside object; one physical object may play several roles and therefore be modeled by several actors(Muller, 1999).

ACTORS

The actors which are participating in the case are 5 namely

- **Database Administrator:**

  Manages the Database; Registers users and ensures authorized users access areas according to authorization levels.

- **Data Entry Clerk:**

  Receives Documents; Prepares electronic Catalogue; Uploads Documents to the Databse.

- **Resource Centre Staff:**

  Receives Documents; Verifies Documents, Prepares Catalogues (Physical and electronic Catalogues); Scans Documents; Verifies users of Physical Catalogue; Provides Physical Catalogue. Submits Documents for data Entry. Could includes the Librarian and Data Entry Clerk.

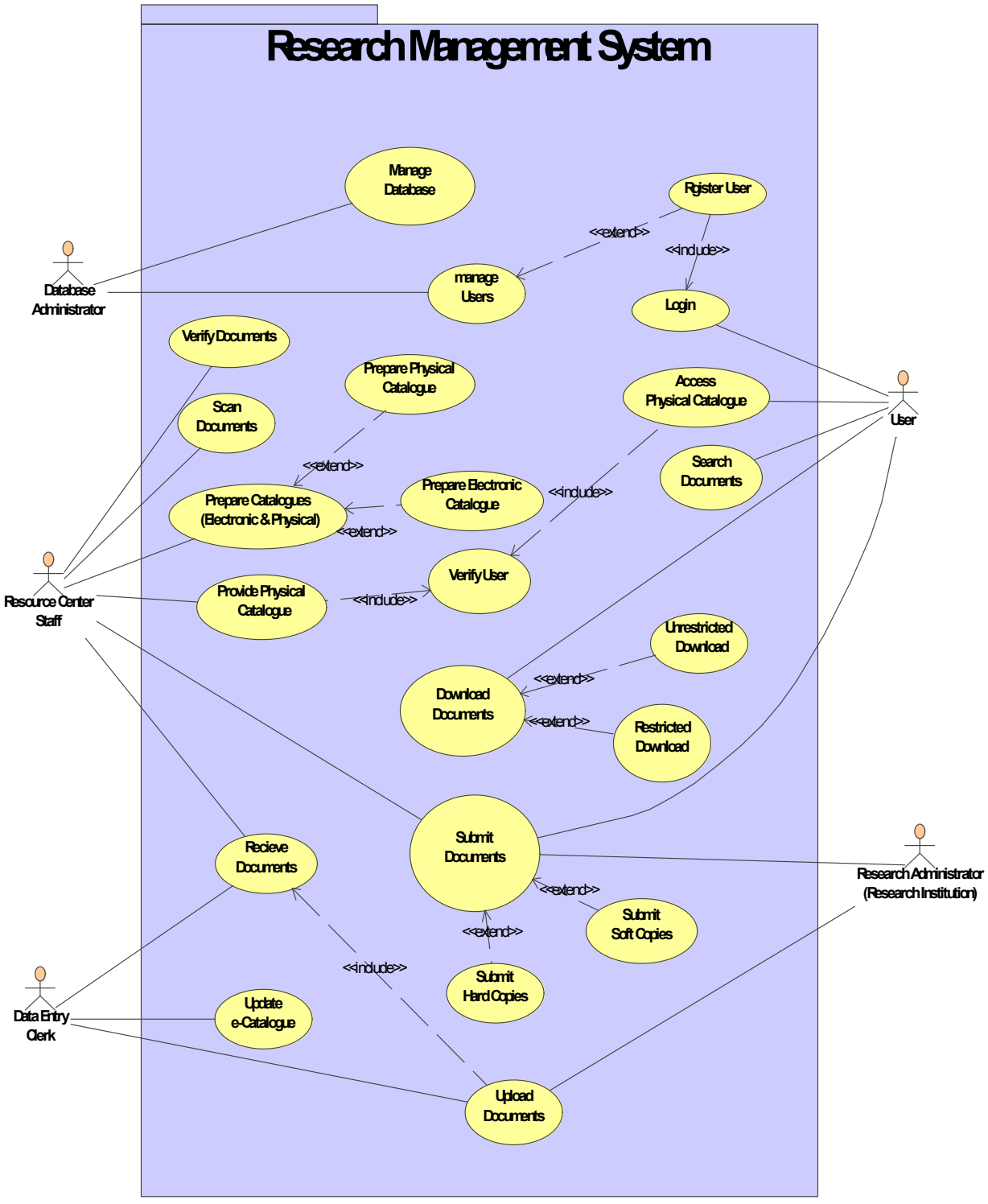
- **User:**

  Includes everybody who needs to access research information. Users can be Registered or unregistered. Access different parts of the Database based on their access levels.

  Users Register and are given access levels; Login; Search for documents; Download documents; Submit Documents as researchers, Access Physical Library; Physically Verified for Physical Access.

- **Research Administrator (Institutions):**

  These are Staff from the Institutions responsible for handling research documents. Could be Librarians or other Staff. They Submit Documents in Hard or Soft Copy or both; Upload Documents to the Database.


Research Management System
Manage Database
Rgister User
<<extend>>
<<include>>
Database Administrator
manage Users
Login
Verify Documents
Prepare Physical Catalogue
Access Physical Catalogue
User
Scan Documents
<<extend>>
Search Documents
Prepare Catalogues (Electronic & Physical)
Prepare Electronic Catalogue
<<include>>
<<extend>>
Verify User
Resource Center Staff
Provide Physical Catalogue
<<include>>
Unrestricted Download
<<extend>>
Download Documents
<<extend>>
Restricted Download
Submit Documents
Recieve Documents
Research Administrator (Research Institution)
<<extend>>
Submit Soft Copies
<<extend>>
<<include>>
Submit Hard Copies
Data Entry Clerk
Update e-Catalogue
Upload Documents

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Research and Development (R&D) has a crucial role in improving the competitiveness of goods and services. Attainment of such goals can be made with better coordination of research and investments in R&D done at acceptable levels. Kenya needs cutting edge scientific and technical tools and expertises to enable her research scientists accomplish their institutional objectives. Other than the strengthening of the local infrastructure as one way of enhancing local capability, ways are required to make global science and technology and knowledge networks work to the country's advantage and perhaps, emphasis need to be placed on the importance of cutting-edge technologies such as information and communication technology (ICTs). Due to their central and enabling nature, it is important that ICT be a key component of the national S&T policy and information system and a network mechanism should be developed for ease of access and retrieval of information. (Wandiga et al., 2004).

There is a lot of research in Kenya but which is not readily available to researchers. Research organizations have information but which is shared to only their intended users. The rest of the stake holders come to learn of this information through conferences and the like.

This research has however, shown that institutions are willing to share their information but regulations that enforce the performance of research in Kenya are not enforced and the science and technology act (CAP 250) is silent on what should be done to defaulters of research regulations. This creates a voluntary type of submission for research information and sharing.

Poor infrastructures, lack of a central point to store information, regulations that exist but are not enforced and institutional information silos have been identified as the major barriers to sharing of research.

This research has also shown that the main format to receive information by research organization is in hard copies of the research information. Even though some organizations are moving towards electronic database storage, hard copy submission remains the main type of submission.

Research information should be uploaded for access through the web interface only if the NCST has the copies of the research documents. This requires that institutions should upload information to the central database if a copy has already been received by the NCST to ensure accessibility.

Some research Organizations confirmed they are not aware of the role of NCST in coordination of research even though they know its existence (NCST).

The research has established that most research institutions still use the manual methods to receive and store research information.

6.2 Recommendations

The National Council for Science and Technology (NCST) is nationally mandated to coordinate all research operations in Kenya. It is suitably placed to host a centralized database. The model being proposed has a very wide range of stakeholders for research information, and therefore its implementation requires involvement of this wide spanning population of stakeholders.

NCST should vigorously create awareness of the roles it plays in coordination of research in Kenya and let stakeholders buy into the benefits likely to accrue due shared central research resources.

Regulations and procedures for any conduct of research done in Kenya should be enforced with penalties or sanctions being imposed on those that default.

Research information should be uploaded for access through the web interface only if the NCST has the copies of the research documents. This requires that institutions should upload information to the central database if a copy has already been received by the NCST. Where a softcopy is not available for past research work, scanning of the hard copy should be done.

Most institutions still use the manual methods to receive and store research information. Institutions should therefore submit both hard and soft copies to the NCST for compilation and subsequent upload into the database. This ensures that information made available on the web is also available in hard copies at the NCST.

6.3 Future Work

The research aimed at proposing a suitable model for managing research. It was envisaged that a prototype system of the proposed model would be provided with this research, however, limited time made this goal unrealizable. Developing of the system remains to be accomplished. To be included in the future are system modules that encompass the research authorization functions which is currently done manually. Inventory of research is another module that has not been addressed and should be included alongside the development. Integration of the Database with similar undertakings in the East African region to widen the research information based should

be explored.

Regulations on conducting research in Kenya are crucial to the success of this model. The source of research information is the research institutions. Sanctions against defaulters of research regulations and procedures should be spelt in the Science and Technology Act (Cap 250) which establishes these research institutions and make submission of this information mandatory.

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APPENDICES

Appendix A: Request Letter to Research Institutions

NYANJE KADZOVU KITSAO,
P.O. Box 20309-00200,
Nairobi,
15th January 2011
Email: skitsao@scienceandtechnology.go.ke,

Dear Sir/Madam,

Research Questionnaire

My Name is **Nyanje Kadzovu Kitsao,** a Master's student at Strathmore University in the Faculty of Information Technology. In partial fulfillment of the requirements for the course, i am carrying out a study entitled 'A web based model for management of research information in Kenya'.

In Kenya the National Council for Science and Technology (NCST) has been given the mandate to coordinate, collect and disseminate research at the national level but, there is still no single source of research information.

> *In the context of this study,* ***research*** *is any original and systematic investigation undertaken in order to increase knowledge and understanding and to establish facts and principles. It comprises the creation of ideas and generation of knowledge that lead to new and substantial improved insights and/or the development of new materials, devices, products and processes etc.*

The attached instrument is aimed at collecting data about activities that manage the information from researches performed in Kenya and any challenges that may be limiting the effective consolidation of this information for a centralized access.

Your organization has been selected to be part of this study and the instrument will be administered to one of your personnel who **manages/ oversees** research activities of the institution/organization. With the help of your answers this model will be made possible.

I kindly, therefore, request for your assistance in completing the attached questionnaire towards achieving this goal. The information collected will be used for **academic purposes** only and will be treated with strict confidentiality.

Yours faithfully,

N.K. Kitsao
Msc. Student

STRATHMORE UNIVERSITY

FACULTY OF INFORMATION TECHNOLOGY

Our Ref.: FIT/MSc.CIS/RL/11/10

15 January 2011

To whom it may concern,

RE:Kitsao Nyanje Kadzovu -055932

This is to confirm that the above named person is a student in our institution (Strathmore University) undertaking a Masters Degree course in Computer Information Systems (*MSc.CIS*).

He is in his final (2nd) year of study and is required to undertake a research project prior to completion of his studies. Your organization/institution has therefore been identified as one that will help him achieve this.

Any assistance accorded to him shall be highly appreciated.

For further clarifications you can get in touch with the undersigned.

Yours Faithfully,

Danny Nyatuka (Mr.)
Evening Faculty Administrator- Faculty of Information Technology
dnyatuka@strathmore.edu

Appendix C: Questionnaire for Research Institutions

Instructions

Most of the questions require you to select one or several of the given options. Please put a tick mark in the appropriate box whenever required. In cases where you are required to write down your brief response(s), please write them in the spaces provided.

General Information

1. Name of Institution (Optional):_____
2. Address of Institution(Optional):_____
3. Job Description of the officer Reporting_____

Research Activities

4. Type of research institution:
   - ☐ Public University
   - ☐ Private University
   - ☐ Public Research Institution
   - ☐ International Research Institution
   - ☐ Other (Please Specify)_____
5. Does the institution perform any research in Kenya?

   ☐ Yes ☐ No [**If not => 17**]
6. How many researches does the institution initiate annually?

   ☐ 0-5 ☐ 6-15 ☐ 16-30 ☐ 31 -50 ☐ Above 50 (Please give an estimate)_____
7. How many researches are completed annually?

   ☐ 0-5 ☐ 6-15 ☐ 16-30 ☐ 31 -50 ☐ Above 50 (Please give an estimate)_____
8. How is the research information recieved?
   - ☐ Manual submission
   - ☐ Electronic Submission
   - ☐ Both manual and electronic submission
   - ☐ Other (specify)_____

---

9. Does the organization have specific documents for recording research information?

   ☐ Yes ☐ No
10. If **Yes**, what Information is captured on the documents? *(Multiple responses allowed)*

- ☐ Researcher details
- ☐ Research details
- ☐ Research Institution details
- ☐ Other (specify any other information captured)_____

_____

11. How is the research information stored?(Multiple responses allowed)
    - ☐ Manual (on paper) files
    - ☐ Electronic files (Word,excell etc)
    - ☐ Electronic database
    - ☐ Other

    (Specify)_____

    _____

12. How is access granted to research documents held by the Institution?
    - ☐ Free access for everyone
    - ☐ Autorization password.
    - ☐ Other

    (Specify)_____

    _____

13. Who is allowed access to research documents held by the Institution?.*(Multiple responses allowed)*
    - ☐ Only to staff
    - ☐ Everyone(Physical Library)
    - ☐ Everyone (Internet access).
    - ☐ Authorized members(Internet access).
    - ☐ Authorized members(Physical Library).
    - ☐ Other(Specify)_____

    _____

14. How is reseach Information held by the Institution disseminated?*(Multiple responses allowed)*
    - ☐ Conferences
    - ☐ Publications
    - ☐ Journals.
    - ☐ Workshops

- ☐ Exhibitions
- ☐ Other(Specify)_____

_____

15. Does the Institution share research information it holds with other Institutions?
    - ☐ Yes ☐ No
16. If **Yes**, please comment on how this sharing is done:_____

_____

17. What barriers exist that hinder sharing of research information in Kenya?(*Multiple responses allowed)*
    - ☐ Poor Infrastructure
    - ☐ Institutional information Silos
    - ☐ No regulations to enforce sharing.
    - ☐ No central point for research information collection.
    - ☐ Other(Specify) _____

_____

National Research Regulations

18. Are you aware of any requirements for conducting of research in Kenya?
    - ☐ Yes ☐ No
19. If Yes, are these regulations observed by the institution? ☐ Yes ☐ No
    (Specify)_____
20. Does the Institution seek authorization for conducting research from the NCST?
    - ☐ Yes ☐ No
21. If not what reasons are there for not doing so?(*Multiple responses allowed)*
    - ☐ Lack of awareness of the role of NCST
    - ☐ Procedures are time consuming
    - ☐ Amount required is too high.
    - ☐ Regulations not enforced.
    - ☐ Other(Specify) _____

22. Does the Institution submit research Documents/reports to the NCST?
    - ☐ No
    - ☐ Sometimes yes, sometimes not
    - ☐ Some of the research information.
    - ☐ Yes, all the research information.

23. In what way can research information be stored for sharing nationally?

☐ Individual research institutions

☐ Central location

☐ Both at individual institutions and centrally with a web portal linking to the reseach institutions.

☐ Other (Specify) _____

_____

24. What method of submission would you prefer for research information to a centralised location managed by theNCST?

☐ No submission

☐ Submission to the NCST for them to upload centrally.

☐ Each Institution to be able to upload information directly to the central storage.

☐ Other (Specify) _____

_____

Thank you very much for your participation

Nyanje Kadzovu Kitsao,

P.O. Box 20309-00200, Nairobi,0722-665-348

skitsao@scienceandtechnology.go.ke

Appendix D: Questionnaire for National Council for Science and Technology (NCST)

Instructions

Most of the questions require you to select one or several of the given options. Please put a tick mark in the appropriate box whenever required. In cases where you are required to write down your brief response(s), please write them in the spaces provided.

Part I General Information

1. Name of Institution (Optional).:.....
2. Address of Institution(Optional):.....
3. Name of Reporting officer (Optional).....
4. Level of Reporting Officer in research Management

   [ ] Management
   [ ] Middle level
   [ ] Operations
   [ ] Other (Please Specify).....

National Research Regulations

5. Are there any regulations for conducting of research in Kenya? [ ] Yes [ ] No
6. Are there research Organizations that are exempted from observing these regulations?

   [ ] Yes [ ] No
7. If the answer to question 3. is **Yes**, which are these Organizations?

   [ ] Public Universities

   [ ] Private Universities

   [ ] Public Research Institutions

   [ ] International Research Organizations

   [ ] Other (Please specify).....

8. If the answer to question 3.is **No**, **Do** all the organizations seek approval for their research?
   [ ] Yes [ ] No.
9. If **Not** what reasons are there for them not to do so?(*Multiple responses allowed)*

[ ] Lack of awareness of the role of NCST

[ ] Procedures are time consuming

[ ] Amount required is too high.

[ ] Regulations not enforced.

[ ] Other(Specify) .....

10. Do all the organizations submit their final reports on research done? [ ]Yes [ ]No
11. If **Not** what reasons are there for them not to do so?(*Multiple responses allowed)*

[ ] Lack of awareness of the role of NCST

[ ] Procedures are time consuming

[ ] Amount required is too high.

[ ] Regulations not enforced.

[ ] Other(Specify) .....

Part II Research data Management

12. How is Data Received from applicants for research approval? (*Multiple responses allowed)*

[ ] In Hard Copies

[ ] In Soft Copies

[ ] Both Soft and Hard Copies

[ ] Other. Specify ……

13. How is Data on final research reports received? (*Multiple responses allowed)*

[ ] In Hard Copies

[ ] In Soft Copies

[ ] Both Soft and Hard Copies

[ ] Other. Specify ……

14. What method of submission would you prefer for research information to a centralised location managed by the NCST?

[ ] No submission

[ ] Submission to the NCST for them to upload centrally.

[ ] Each Institution to be able to upload information directly to the central storage.

[ ] Other (Specify).....

15. How many Proposals are received annually?

[ ] 0-5 [ ] 6-15 [ ] 16-30 [ ] 31 -50 [ ] Above 50 (Please give an estimate).....

16. How many final research reports are received annually?

[ ] 0-5 [ ] 6-15 [ ] 16-30 [ ] 31 -50 [ ] Above 50 *(Please give an estimate)*.....

17. Does the organization have specific documents for recording research information?

    [ ] Yes [ ] No

18. If **Yes**, what Information is captured on these documents?*(Multiple responses allowed)*

    [ ] Researcher details

    [ ] Research details

    [ ] Research Institution details

    [ ] Other (specify any other information captured).....

19. How is the received information stored?

    [ ] In Hard Copy files

    [ ] Electronic files (Word, excell etc)

    [ ] Electronic Database (Specify database)…….

    [ ] Other. (Specify).....

20. How is access granted to research documents held by the Institution?

    [ ] Free access for everyone

    [ ] Autorization password.

    [ ] Other (Specify).....

21. Who is allowed access to research documents held by the Institution?.*(Multiple responses allowed)*

    [ ] Only to staff

    [ ] Everyone(Physical Library)

    [ ] Everyone (Internet access).

    [ ] Authorized members(Internet access).

    [ ] Authorized members(Physical Library).

    [ ] Other(Specify).....

22. In what way should research information be stored for sharing nationally?

    [ ] Individual research institutions

    [ ] Central location

    [ ] Both at individual institutions and centrally with a web portal linking the research institutions.

    [ ] Other (specify).....

23. How is reseach Information held by the Institution disseminated?*(Multiple responses allowed)*

[ ] Conferences

[ ] Publications

[ ] Journals.

[ ] Workshops

[ ] Exhibitions

[ ] Other(Specify).....

24. What are some of the barriers existing that hinder sharing of research information in Kenya?(*Multiple responses allowed)*

[ ] Poor Infrastructure

[ ] Institutional information Silos

[ ] No regulations to enforce sharing.

[ ] No central point for research information collection.

[ ] Other(Specify) .....

Thank you very much for your participation

Nyanje Kadzovu Kitsao,

P.O. Box 20309-00200, Nairobi,0722-665-348

skitsao@scienceandtechnology.go.ke

Appendix E: List of Research Institutions

Public Universities

University of Nairobi

Kenyatta University

Jomo Kenyatta University of Agriculture and Technology (JKUAT)

Moi University

Egerton University

Maseno university

Masinde Muliro University of Science and Technology

Private Universities

Gretsa University

Aga Khan University

KCA University

Daystar University

Catholic University of Eastern Africa

United States International University

Africa Nazarene University

St. Paul's University

Strathmore University

The Presbyterian University of East Africa

Inorero University

Kiriri Women's University of Science and technology

Mt Kenya University

Kenya Methodist University

University of Eastern Africa, Baraton

The Pan Africa Christian University

Adventist University of Africa

East African University

Public Research Institutes

National Council for Science and Technology(NCST)

Kenya Trypanosomiasis Research Institute (KETRI)

National Museums of Kenya

Kenya Marine and Fisheries Research Institute (KMFRI)

National Veterinary Research Centre

Kenya Agricultural Research Institute (KARI)

Kenya Forestry Research Institute (KEFRI)

Kenya Institute of Public Policy Research And Analysis (KIPPRA)

Kenya Industrial Research and Development Institute (KIRDI)

Kenya Medical Research Institute (KEMRI)

Kenya National Academy of Sciences

Coffee Research Foundation (CRF)

International Research Institutes

International Livestock Research Institute (ILRI)

The International Center of Insect Physiology and Ecology (ICIPE)

Centre for Agriculture and Biosciences International (CABI) Africa

World Agro Forestry Center (ICRAF)

African Medical Research Foundation -AMREF

Agricultural Research Foundation-ARF

International Crops Research Institute For The Semi-Arid Tropics (ICRISAT)

International Center For Economic Growth-ICEG

Centre for Science, Technology and Innovations