Weaknesses in Research Methods of Scientists at Kenya Forest Research Institute (KEFRI) and Interventions for Improvement

GRACE NYAIKAMBA WANG'OMBE

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DECLARATION

This dissertation is my original work and has not been submitted for a degree in any other university or for any other award.

Grace Nyaikamba Wangombe.

Signature…………………………… Date……………………………

This dissertation has been submitted for examination with our approval.

Supervisors:

Dr. Aggrey Bernard Nyende.
JKUAT, KENYA.
Signature………………… Date………………………….

Dr. Vincent Onguso Oeba.
KEFRI, KENYA
Signature………………… Date…

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DEDICATION

To my daughter Risper Watetu who persevered during the two years of my study.

ACKNOWLEDGEMENT

ACRONYMS/ABBREVIATIONS

KEFRI   Kenya Forestry Research institute

RMP   Research Methods Professional

RUFORUM Regional Universities Forum

JKUAT   Jomo Kenyatta University of Agriculture and Technology

DBMS   Database Management System

IMRAD   Introduction, Methods, Results, and Discussion

Rdbms   Relational database management system

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ABSTRACT

Sustainable management, conservation and development of Kenya's forests depend on application of science to generate improved technologies. KEFRI has lately been facing a number of challenges in carrying out its research activities as a result of limited capacity and expertise of research methods skills which are essential in implementing their research activities. As a research methods intern at KEFRI, the main objective of this study was to identify various weaknesses in research methods skills of scientists at KEFRI, during their scientific project implementation and provide ways of improvement. This was achieved through three specific objectives: To develop a database management system for on-going projects to lay the basis for documentation and monitoring of their research activities; to review some of the publications at KEFRI and recommend ways of improving; to improve capacity on research methodology through trainings. The method used in designing the database system involved finding and organizing the information required and dividing it into tables and turning the information items into columns. This was done by specifying the data types and field sizes and specifying primary keys by assigning columns that uniquely identified each row stored in the tables. Each table's primary key was used as a reference in other tables and three primary keys were specified. These were; project ID, Objectives ID and Activities ID. Table relationships were set by taking the primary key on the one side of the relationship and adding it as an additional column to the table on the many side of the relationship. The Cascade Update Related Fields option and the Cascade Delete Related Records options were chosen and the primary keys updated.

On review of documents, technical notes, annual reports, guidelines, research concepts, proceeding papers, papers from a journal and a research note were reviewed. All were graded using general and specific criteria- based on originality of research, academic significance, knowledge contribution at 50%; quality of publications-technical quality; Methodology, findings, clarity of presentation, thoroughness of documentation, citations at 20% ; Relevance/ contribution to policy development at 30%. Training was based on the problems identified during one on one interaction, observation, from data presented by scientists for analysis and a TNA analysis that was carried out. Three tables of project, objective and activities were developed and from these tables forms and reports were generated. Twenty seven percent of the documents reviewed scored less than 80% indicating that they were of low quality. Of the 24 participants 92% (22) indicated that the course was very useful in their areas of research whereas

8% said it was somehow. 88% indicated that the course matched with their qualifications and had gained new skills and techniques in data management and analysis.

The data base system developed has facilities to preserve data integrity is useful in monitoring and documentation of all research activities at KEFRI. The reviewed documents indicated serious gaps in terms of scientific writing at KEFRI and recommendations were provided for improvement. Over 90% of the trainee indicated that they gained new skills which improved their levels of job performance.

CHAPTER ONE: INTRODUCTION

1.1. Background

The objective of vision 2030 is to transform Kenya in to a globally competitive and prosperous nation with high quality of life. The vision targets environmental management focusing on water catchment, promoting on farm forestry, use of forestry biotechnology, conservation of mangrove, control and management of invasive tree species, improving capacity for adoption of technologies and processing of forest products. Sustainable management, conservation and development of Kenya's forests depend on application of science to generate improved technologies (KEFRI, 2009).

Information collected from forests is important in the planning of sustainable management of forest resources. However, the situation in terms of compilation, processing and dissemination of research in the institutions is poor. This has been identified as the major factor affecting the quality of National Forestry Action Plans. Intensive training of officers is necessary and therefore, forest officers should be trained on computer literacy at least in spreadsheets and data management programmes. In addition, databases should be processed, analyzed and published for users (Omoluabi, 2009).

Research from forests is used in three main areas: national policy development and planning; investment appraisal and decision making; international policy development and negotiations. Management of catchment forests requires information that is guided by well researched dynamics of ecosystem interactions. According to KEFRI (2009), there is lack of specific data and information to allow government to determine the impact of watershed degradation on social economic and development attributes. Hard facts and analysis are therefore necessary for foresters to convince governments about forestry concerns. There is need therefore to design means of capturing forest statistics for reliable data collection on the forest industrial sector (Lowe, 2009). Data collection capacity is limited by shortage of funds for operational activities to collect, store, and analyze data relevant to sustainable forest management (Gwaze and Marunda, 2009).

1.2. Problem Statement

KEFRI has inadequate capacity and expertise to strengthen its research in the regional centres and a weak capacity to publish and disseminate its research findings and this has undermined the quality of its research (KEFRI, 2009). In planning and management of its research projects, KEFRI has difficulties in monitoring and documenting its research progress due to lack of a comprehensive database for its research activities. There is need therefore to design means of capturing forest statistics for reliable data collection on the forest as indicated by Lowe, (2009).

1.3. Research Objectives

1.3.1. Main objective

To identify various weaknesses in Research Methods Skills of scientists at KEFRI, during their Scientific project implementation and provide ways of improvement.

1.3.2. Specific objective

1. To develop a database management system for on-going projects to lay the basis for documentation and monitoring of their research activities.
2. To review some of the publications at KEFRI and recommend ways of improving.
3. To improve capacity on research methodology through trainings.

1.4. Justification

Any organization carrying out research must depend on good quality data. Field data is expensive to collect and its value is only maintained if it can be used in future. Well documented, archived data is useful to other researchers and can help in the design of a future study, hence the need to identify the problems of data management and come up with ways to address these problems. Organizations need to develop capacity to generate change and this can only be achieved through capacity building where training need assessment and analysis are important steps in implementation of any training event. This leads to the identification of the needs for knowledge, skills and attitudes at the levels of the organization, the job and the individual. It is difficult for authors and researchers to spot every mistake in their work and hence the need to review published documents and offer suggestions on how they can be improved.

CHAPTER TWO: LITERATURE REVIEW

2.1. Database system

2.1.1. Data management

How data is received, stored, processed, and made available to others, has an effect on the success or failure of an organization. As organizations invest in and become more dependent on information systems, the processes of gathering, managing, and utilizing data become more central to operational success. According to Oeba (2005) there is no clear policy on archiving data at KEFRI and making it available for checking makes it difficult to organize the data. It's also within the mandate of biometrician at KEFRI to adhere to high quality of results, accuracy and validity of the computer programs. However, documentation of all the procedures used in statistical analysis remains a challenge (Oeba, 2005) hence the need to design a database.

According to KEFRI (2009), there is lack of specific data and information to allow government to determine the impact of watershed degradation on social economic and development attributes. Hard facts are therefore necessary for foresters to convince governments about forestry concerns through scientific research which is documented and disseminated.

Data is only valuable when it is accessible and meaning can be extracted from it. This can be achieved through organizing, storing, and analyzing it effectively. Organizations use databases to bring independent sources of data together and store them electronically. A database management system is therefore a set of software programs that allows users to create, edit and update data in database files, and store and retrieve data from those database files. Popular database software includes Microsoft Access 2010, Microsoft SQL Server, MySQL, PostgreSQL and Oracle Database 11g as indicated by Tero, (2011). Different databases are used depending on the nature of the work involved and there are four structural types of database management systems: Hierarchical; Network; Relational, and Object-Oriented (Unknown, unknown). A database then refers to a collection of related files that are integrated, linked or cross-referenced to one another.

2.1.2. Hierarchical Databases

Hierarchical Databases (DBMS), commonly used on mainframe computers. It is one of the oldest methods of organizing and storing data and it is still used by some organizations for making travel reservations. A hierarchical database is organized in pyramid fashion, like the

branches of a tree extending downwards. Related fields or records are grouped together so that there are higher-level records and lower-level records .

2.1.3. Network Databases

Network database looks more like a cobweb or interconnected network of records. In network databases, children are called members and parents are called owners. The most important difference is that each child or member can have more than one parent (or owner).

2.1.4. Relational Databases

In relational databases, the relationship between data files is relational, not hierarchical. Hierarchical and network databases require the user to pass down through a hierarchy in order to access needed data. Relational databases connect data in different files by using common data elements or a key field. Data in relational databases is stored in different tables and these databases work on the principle that each table has a key field that uniquely identifies each row, and that these key fields can be used to connect one table of data to another. They have a complete referential integrity support, including primary/foreign key definition and cascaded updates and deletes.

2.1.5. Object-oriented Databases (OODBMS)

Object-oriented databases use small, reusable chunks of software called objects. The objects themselves are stored in the object-oriented database. This database is able to handle many new data types, including graphics, photographs, audio, and video. An object-oriented database can be used to store data from a variety of media sources, such as photographs and text, and produce work, as output, in a multimedia format.

2.2. Reviews

The main reason of reviewing documents is quality improvement providing feedback which expresses an honest opinion of the work, covering all the important points and suggesting ways of improvement (Coe, 2005). A key component of the review was feedback where whole review process was aimed at giving useful feedback to authors so that they can improve the reviewed and future articles. According to Shanley and Lopez, (2009), most of the world's population that derives their livelihoods from forests are out of the information loop. This is attributed to poor dissemination of published documents. According to Odera et al., (2006), reviews should be based on quality, relevance and adequacy of the document.

According to Day (1993), there are four major sections to a scientific report: Introduction, Methods, Results, And Discussion (IMRAD). However, additional minor sections precede these including the title, abstract, acknowledgements, references, and appendices. According to Spuida (2002), technical documentation involves determining the purpose of the document and the intended audiences since they are intended for different audience.

KEFRI has in the past assessed the implementation of its research and management programmes through internal and external reviews. According to Achia et al., 2004, there were inadequate consultations between Centre Directors and National Programme Coordinators in control and supervision of field research by scientists.

The KEFRI 2008–2012 Strategic Plan has been implemented for the past two and half years and has been reviewed internally. The review team took into account the contents of the entire Strategic Plan, of which there were six key elements as follows: Background covering introduction, establishment, role and research activities of KEFRI; and forestry research challenges; KEFRI mandate, vision, mission and core values; An analysis of strengths, weaknesses, opportunities and threats (SWOT); Goal and strategic objectives of KEFRI; Research and development (R&D) programmes and strategies for programme implementation (KEFRI, 2011). The Strategic Plan was reviewed to examine the implementation status of the activities that were scheduled for the first half of the strategic phase. The review found out that the Strategic Plan had not followed a standard format and related information had been presented in a brief manner throughout the document. A suggestion was therefore given that subsequent strategic plans should take an approach that shows that forestry research is important for socio-economic development of the country and that there is need to aim for research outputs that will have a positive impact on the lives of Kenyan people and the world at large. According to this report, this can be achieved by ensuring that research addresses relevant and current issues in the forestry sector (KEFRI, 2011).

According to the review, KEFRI's Vision was still valid for guiding the core business of the Institute and added that it should focus more on beneficiaries and be rewarded in keeping with current trends. A suggestion was given that the strategic plan should read"A centre of excellence in forest science through technology development, deployment and dissemination of scientific information for improved livelihoods". Other improvements to the Vision were made by proposing strong pillars upon which to build it as follows: Importance of trees and forest in

sustainable livelihood and agro-ecosystems; The Institute's experience, professionalism and comparative advantage in promoting forestry research development nationally and internationally; Commitment in achieving the aspirations of Vision 2030 and meeting our obligations under the new Constitution; Fostering active linkages, partnerships and collaboration with stakeholders. In the mission, there were clear indications that stakeholders have been empowered to improve their livelihoods. This positive contribution of forestry research to society is however not reflected in the Mission statement (KEFRI, 2009). Changes were proposed to make it more people oriented and was reworded to read "To conduct research and provide information technologies for sustainable development of forest and allied natural resources and to enhance socio-economic development" (KEFRI, 2011). Overall these reviews indicated enormous opportunity for improving the expected outputs of KEFRI and any other institutions world-wide. This begged the need for undertaking review of the published KEFRI work which had not been done there before.

2.3. Capacity building in research methodology

The mission, vision, and strategy are the driving forces that give an organization its purpose and direction (Connolly and York, 2002). Staff turnover and the failure to update technology systems are ways through which capacity is eroded (Sussman, 2004). Effective training has to be based on demand and trainers need to know what knowledge, skills and attitudes the trainee possesses and the required levels of these so that training can focus on bringing the trainee to the desired levels of job performance (Franzel, 2003).

A study carried out in Swaziland showed that the forestry section was highly imbalanced with excellent silviculture and management facilities, including advanced research operations in the private sector, whereas a serious lack of trained personnel in silviculture and management in the government forestry section was evident (Dlamini, 2001). According to Gwaze and Marunda, (2001), data collection capacity is limited by shortage of funds to collect, store, and analyze data relevant to sustainable forest management. In previous conducted studies many participants reported difficulties in data collection and analysis due to high staff turnover and lack of skilled staff especially in fields such as data analysis. According to Oeba (2005), problems in data management and analysis are attributed to lack of appropriate skills for data management and analysis hindering forestry research at KEFRI. The 2007 KEFRI training needs assessment

(TNA) identified priority training needs for all cadres. Specific short courses for skills improvement such as scientific writing, research planning and dissemination, data management and project monitoring and evaluation were emphasized (KEFRI, 2009).

The findings of 2010 evaluation showed that during the research cycle process, most scientists needed the inputs of the biometrician at concept development which included planning, methodology, measurements and implementation schedules (Oeba, 2005). The first course on Biometrics was organized after consultations with scientists from all Regional Research Centres and the content was based on training needs assessment that had been carried out (Chiria, 2002).

CHAPTER THREE: METHODOLOGY

3.1. Data management: Database system

In designing the data base system as a way of data management, a relational database management system was designed using Access 2007 program. The following steps were used to achieve the objective.

- The purpose of the database was established
- Finding and organizing the information required
- Dividing the information into tables and turning information items into columns
- Specifying primary keys
- Setting up the table relationships
- Creating and testing database
- Developing sample screens and reports

3.1.1. Purpose of the database

The purpose of this database was to help in monitoring and documentation of research processes at KEFRI. It was intended to be used by all the scientists, National programme coordinators and the centre directors at KEFRI.

3.1.2. Finding and organizing the types information to record in the data base

All the information about the ongoing projects for the year 2010-2011 was collected from all the centres and organized. This information included the projects in all the four research programmes, their objectives and all the activities that were carried out to achieve the objectives (Appendix III).

3.1.3. Dividing information items into major subjects and each subject then becomes a table.

This information was divided into three tables namely, project table, objectives table and activities table and further turned the information items into columns and each item became a field, and was displayed as a column in the table .The data type set for each table field provided the first level of control over what could be entered into a field. The descriptions as to the data types and field sizes settings are in Appendix I.

3.1.3.1. Project table items properties.

For all the items the data types were set as text except the title, budget and time which were set as memo, number and date / time respectively. The project identification, programme, title, sponsor status and project site properties were set as; allow zero length as true, attributes variable length. The budget, date and end date properties were set as; allow zero length as

false, attributes as fixed size and dates show picker as for dates. In all items required was set as false. All items were indexed as yes (no duplicates). The field sizes were set differently as follows.

a) The Project ID field size of 8 characters.

b) Programme field size of 255 characters.

c) Budget with field size as long integer.

d) The project site field size of 100 characters.

e) The sponsor field size of 120 characters.

f) The status of the project field size as 12

3.1.3.2. Objectives table items properties.

The objectives ID, project id and objectives data types were set as text with field size 8 for objectives id and 225 for the other two. In all the items allow zero length was set as true, attributes as variable length and required as false.

3.1.3.3. Activity table items properties

All data types were set as text except the activities identification which was set as auto number. The activity identification properties were set as; attributes fixed size and auto increment. The objectives identification, co- investigator, activities, verifiable indicators and means of verification properties were; allow zero length as true. Attributes as variable length and required as false in all the items. The data sheet properties were set as attachment data with a field size of 4, allow zero length as false, attributes as fixed size. The field sizes were set as follows.

a) Activity ID, field size as long integer,

b) Objectives ID field size set as 8.

c) Principal investigator field size as 60.

d) Co investigator field size as 255.

e) The Verifiable indicators and Means of verification field size as 255.

3.1.4. Specifying primary keys.

Each table was assigned a column that uniquely identified each row stored in the table. This unique identification number was called the primary key of the table and this is a column that is used to uniquely identify each row. Each table's primary key was used as a reference in other tables and three primary keys were specified. These were; project ID, Objectives ID and Activities ID.

3.1.5. Setting up the table relationships

This was done by taking the primary key on the one side of the relationship and adding it as an additional column to the table on the many side of the relationship. The project table primary key was added to objectives table. The objectives table primary key was added to activities table. Referential integrity was enforced by enabling it in the relationships of these tables. The Cascade Update Related Fields option and the Cascade Delete Related Records options were chosen and the primary keys updated.

3.1.6. Creating and testing database

Data was entered into the database for testing purposes and sample screens and reports were developed to assess the performance of the database. Testing was done by: attaching files to records in the database; filtering to limit the number of records in view; updating the data in the data base; exporting data to other programmes; editing and deleting table relationships and removing attachments from records. Then prototyping was done where different report formats and input screens were tried to determine their suitability and effectiveness.

3.2. Review of documents

Seven categories of publications were reviewed based on: Originality of research - academic significance, knowledge contribution at 50%; Quality of publications-Methodology, findings, clarity of presentation, citations at 20% and relevance/ contribution to policy development at 30%. Each of the publication was reviewed citing the weaknesses and strengths in each and suggestions given on how best to improve each document. Points were then awarded as per the criteria and totals of each presented in pie charts which reflected the level of scientific writing at the institution.

The publications are as follows; Guidelines, technical notes, concept notes, journal papers, proceedings, research notes and annual reports.

- ❖ **Guidelines   3**
- ✓ Guidelines for Wood Preservation Using Sap Displacement Method
- ✓ Guideline for Growing Aloes. A Guide for Farmers and Extension Officers
- ✓ Propagation, Establishment and Management of *Melia volkensii*
- ❖ **Technical notes 2**
- ✓ Growth of *Eucalyptus urophylla* S.T. Blake provenances at Gede
- ✓ Vegetative Propagation of *Pinus patula* through Shoot Cutting

❖ **Proceedings   4**
✓ Phototoxic Effects of *Gliricidia sepium* pruning on Maize Germination and Growth
✓ Mangrove Plantation Experiment for controlling Coastal Erosion at Gazi Bay
✓ Production of Briquetted Biomass Fuels Using A Hand Operated Circular Piston Press Briquetter.
✓ Establishment, Biomass Productivity and Quality of improved fallow species at the coastal region of Kenya

❖ **Concept notes   4**
✓ Genetic diversity and conservation of water berry tree populations in open woodland and watersheds
✓ Sustainable management of natural forests and woodlands conservation and management of mangrove forests
✓ Improvement of Tree productivity and Utilization.
✓ Development of wood and non wood forest resources

❖ **Journal papers   3**
✓ Growth performance of *Eucalyptus* hybrid clones and four common landraces in Kenya
✓ Variation of wood properties of *Eucalyptus* hybrid clones and local landraces grown in Kenya
✓ Modelling early growth of *Eucalyptus* hybrid clones at the Kenyan coast

❖ **Research note   1**
✓ Pest and Diseases Associated with *Eucalyptus* in Kenya

❖ **Annual reports   2**
✓ The 2004-2005 and 2007-2008 annual reports

3.2.1. Journals and proceedings

Three papers from a journal and four reports from two proceedings were selected for review and the following points were considered and point awarded in each section depending on JEANRM requirements and specifications on writing reports on proceedings as in table 3.1.

Table 3.1 Reviewing papers from proceedings and the journals

Papers from a Journal	Papers from Proceedings
❖ Title to be concise and specific.	❖ If the title gave a good indication of the content of the paper
❖ An abstract, a brief review of the background of the topic.	❖ If the abstract gave a summary of justification, methodology, results and the conclusion
❖ Techniques employed to conduct the research be described	
❖ Analytical procedures to be described.	❖ If the problem was addressed significantly in the introduction
❖ The results and discussion to relate to objectives	❖ If Materials and methods were described and if the experimental design was appropriate
❖ Tables to be used to clarify and amplify the results without duplication	
❖ Sufficient statistical verification given to show differences in significance	❖ If analytical, statistical procedures were described
❖ A concluding statement amplifying the significance of the results	❖ If results were presented appropriately by use of illustrations and tables
❖ Acknowledgement to be placed after the conclusion /the references to be properly cited and listed	❖ If conclusion related to the objectives
	❖ If the paper suggested a suitable way forward / If references were properly listed

3.2.2. Research concepts, research notes and annual reports

Table 3.2 Reviewing research concepts and annual reports

Research Concepts	Research note	Annual reports
❖ Title of the Project	❖ Title; abstract	❖ If the letter from the CEO of the organization was printed on the inside front page.
❖ Potential Donor	❖ Introduction	
❖ Introduction; Purpose	❖ Materials and methods	
❖ Project Description		
❖ Goals and Objectives	❖ Results /discussions	❖ operations including business conditions
❖ Research questions		
❖ Methodology /Timelines	❖ Conclusions	❖ Financial statement covering revenue, expenses, net income and earnings per share.
❖ Benefits/Anticipated Outcomes	❖ Recommendations	
❖ Support needed and Costs /contact information	❖ Acknowledgements references	

3.2.3. Guidelines and Technical notes

Table 3.3 Reviewing guidelines and technical note

Guidelines	Technical notes
❖ If the titles was disclosed on the top page,	❖ Definition of terms used.
❖ If the audience targeted and the purpose were disclosed on the top page	❖ Sufficient reference to previous material.
❖ acknowledgement of the sources of information	❖ Presentation of concepts, indicating why or how.
❖ Background and justification to be sufficient.	
❖ If instructions emphasized on what was to be done and illustrations were of high quality	❖ Proof - explaining the workings of step by step.
❖ If measurements were clear in terms of precision.	❖ user's guide explain the sequence of steps
❖ If illustrations were self explanatory	
❖ If contents were original, current and accurate.	❖ Conclusion

3.3. Capacity building/ consultations

A review of the previous refresher courses and trainings undertaken by Biometrics Section on data management, data analysis and presentation of results since 2002 was carried out. This lead to identification of areas of weaknesses and recommended for further training. Due to recent recruitment of scientists at KEFRI who had not undertaken such trainings, a Training needs assessment (TNA) was conducted to identify their areas of interest for inclusion in training. Other methods used to identifying areas of weaknesses.

- Observation
- Data from scientists and technical staff
- One on one consultation with scientists

3.3.1. Data Collection

It was also done through observations by interacting with scientists in research activities and recording how they managed their data. Scientists were also asked to give major challenges they faced during their research activities and these were listed alongside the number of scientists. A questionnaire was administered to assess what need requirements existed (Appendix II).

3.3.2. Data Analysis

Data was then analyzed using Excel and result presented in a table per problem and percentages of scientists involved. A training manual was then developed based on these problems and scientists were nominated from different centres to attend the training. A total of 30 scientists were nominated. A descriptive summary of the number of scientists who showed up for the training per centre was also carried out.

3.3.3. Course evaluation

A small course evaluation questionnaire was administered to collect views on the immediate impact of the training, areas for further training and the way forward on how to improve the Biometrics services; discussion on specific areas of data management and general view during the wrap-up session (Appendix IV). Then these responses were analyzed and presented in graphs.

CHAPTER FOUR: RESULTS

4.1. Database system

4.1.1. Table relationships

After enforcing referential integrity, the three tables were joined in a relationship. The relationship lines were drawn between the three database tables. When Referential Integrity was enforced and the check box was selected, the line appeared thicker at each end. In addition, when only the Enforce Referential Integrity check box was selected, the number **1** appeared over the thick portion of the line on one side of the relationship, and the infinity symbol **(∞)** appeared over the thick portion of the line on the other side. This indicated a one to many relationships between the three tables (**1-∞** relationships) as in figure 4.1.

Relationships for PROJECTDB
Tuesday, August 09, 2011
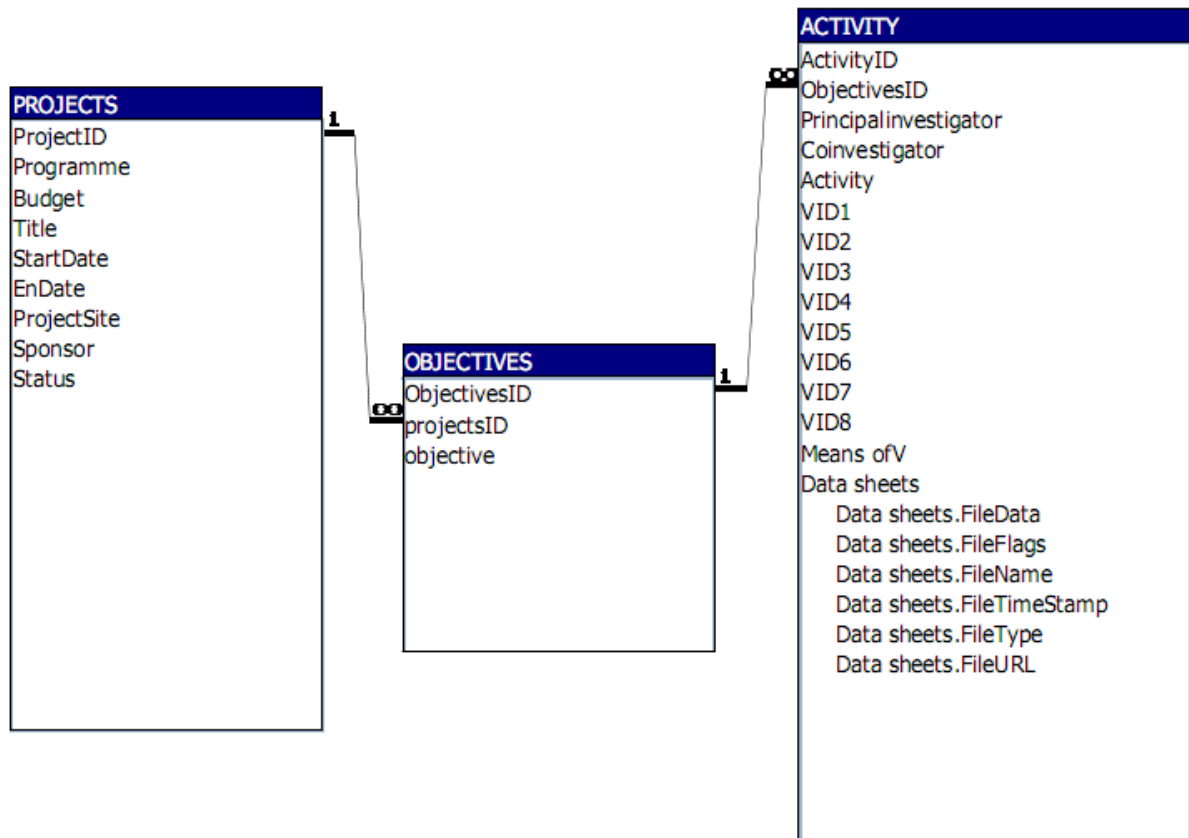
Figure 4.1 Table relationships

4.1.2. Project table in form view design

Figure 4.5 indicated the project table in form view design developed during the testing of the database by developing sample screens and reports. This denoted one project from dry land forestry programme titled management, improvement and domestication priority species which was carried out in Kitui and Kibwezi. The project had a budget of two million and nine hundred thousand Kenya shillings and was expected to run within a period of one financial year.

ProjectID	DF01
Programme	DRYLAND FORESTRY PROGRAMME
Budget	2900000
Title	Management, improvement and domestication of priority species
StartDate	7/1/2010
EnDate	6/30/2011
ProjectSite	Kitui and Kibwezi
Sponsor	
Status	

Figure 4.2 Section of the project table in form view design

4.2. Review of documents

4.2.1. Guidelines reviewed

i). Guidelines for Wood Preservation Using Sap Displacement Method

This guideline followed the KEFRI specified guidelines where the title covered everything inside the guideline. The authors acknowledged the sources of information citing the names of those who had carried out the work and the terms which are not familiar to the audience are well defined under the heading glossary. The table of content was well written with the first pages in roman numbers and from the introduction, paging was in whole numbers. The reasons and importance for wood preservation as well as the purpose of the guideline was well articulated in the introduction of this guideline. The instructions on how to carry out the process were well sequenced with use of headings. The sentences under each heading were written in bullet form, short and clear and in positive form. The use of pictures which were self explanatory and captions to illustrate the preparation and treatment procedures were well used (figure 1-4). In the last page, the authors listed two references which have been cited at the introduction and the preparation of treatment preservative. In general the guide captured the needs of the audience and was easily understood with only eight pages.

ii) Guideline for Growing Aloes.

The guide was quite informative to the intended audience (farmers and extension officers) with instructions, captions and photographs well illustrated. However, in the appendix, the guide had two sections (Aloe sap yield and some economic aspects of Aloe gum production) which the reviewer suggested changes for it to be numbered as appendix I and II. The subtopic on information gap in aloe production was misplaced as the title read, "a guideline for growing Aloes". The intension of the guide was to address the gaps in aloe production and assisting farmers in sustainable production and utilization of aloes in Kenya which the reviewer felt was not in line with the heading. Going with the title, changes were proposed and a suggestion on the intention of the guide to read "to assist farmers and extension officers in sustainable production and utilization of aloes in Kenya".

iii). Propagation, Establishment and Management of *Melia volkensii*

The title captured the attention of the reader. The use of high quality photographs with real colors and the use of captions clearly demonstrated what the authors intended the audience to grasp. Use of simple language and measurement specifications were quite clear in terms of precision such that the audience could easily follow what was stated. In general the content of the guide was adequate to anyone who would be interested in planting this tree. The table

of content and the list of figures are correctly listed with the correct paging. However the authors have not acknowledged the sources of information and no literature material have been cited in the guideline though at the end there are selected readings. It was therefore suggested that all the paragraphs in the introduction required citations from which the authors got the information and that these citations be referenced in the last page under the heading "references'. This was shown in figure 4.3.
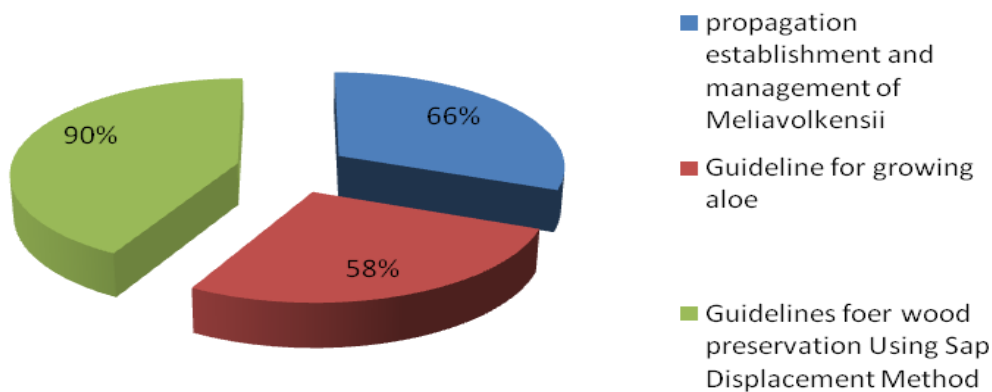
Figure 4.3 Scoring of the guidelines

4.2.2. Technical notes reviewed

i**). Growth of *Eucalyptus urophylla* S.T. Blake provenances at Gede, Kenya**

This was a case of programmes implemented practically. The introduction outlined previous literature, the objective and the site of the trial. The materials and method was clear with all measurements stated, the type of experimental design, number of replicates, and the number of trees in each plot and the spacing, the number of years the data was collected and type of data collected, type of analysis used and the equations used. The transformation for survival done before analysis was also indicated. The section on results and discussion was clear with a table and explanations on survival and germination percentages of various provenances in the nursery at the age of 5 months. A second table of the growth of seven provenances of *Eucalyptus urophylla* at ten years grown at Gede was well explained with percentages and

significant differences at p< or = 0.05. The document had a conclusion. A recommendation was also given. This technical note followed the stipulated guidelines on scientific writing with all the references cited in the document listed at the end. The content of the document was detailed and based on practical experiment.

ii). Vegetative Propagation of *Pinus patula* through Shoot Cutting

 The summary gave the background of the problem, the site, result of analysis and the conclusion. However the note reported that analysis showed no significant difference at $p<0.05$ between shoot cuttings and a significant difference at $p<0.05$ among rooting media which contradicted as to what was significant and not significant. A small p-value of <0.05 indicates statistical significance. If a test of significance gave a p-value lower than the α-level (5%), such results are referred to as statistically significant. Thus from the two p values it's clear that they were statistically significant. The discussion section differed with the results obtained. The two graphs in the result section and the text showed that there were differences in the rooting media in the two sites with a p value of $p<0.001$. The review suggested that the output of analysis at α=5% be shown such that interpretation of the results can be supported. The note further gave a conclusion and recommendation followed by acknowledgement and a list of references which are essential in scientific writing. This was shown in figure 4.4.
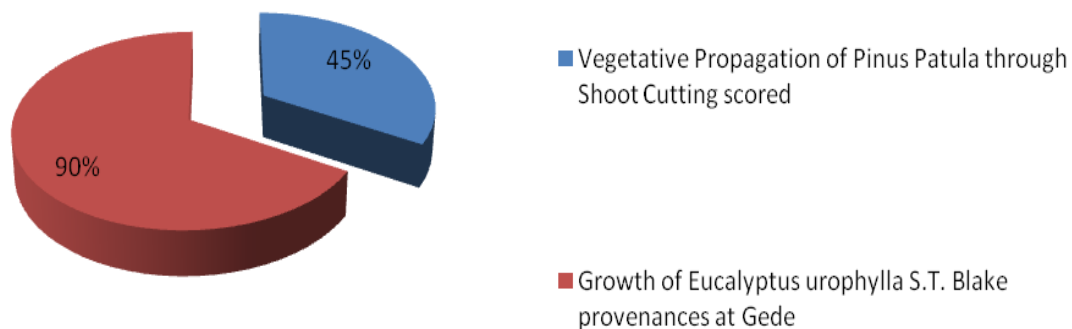

Figure 4.4 Scoring of the technical notes

19

4.2.3. Research   Concepts

i) **Genetic diversity and conservation of water berry tree populations in open woodland and watersheds**

The concept had the title of the project the introduction. The main and specific objectives were indicated as well as the study area and methods were well described. The concept however seems to be incomplete in that it didn't give the budget,   the work plan and the expected outcome. The authors also did not cite the sources of information given in the introduction.

ii). **Sustainable management of natural forests and woodlands conservation and management of mangrove forests**

The paper had the title of the project, the funding programme as natural forests, the principal investigator collaborators and Co- investigators. The introduction showed the study problem giving the importance of mangroves to the local people and the ecological services they provide citing previous literature related to this particular study. The broad and the specific objectives and the activities to be undertaken as well as the study areas were provided. The materials and methods section was clear with a figure showing the experimental layout. The author had given three expected outputs .The   breakdown of the budget and the work plan as per the activity in quarters was provided. Finally, references to the citations were provided.

iii). **Improvement of Tree productivity and Utilization**

The paper indicated the title of the project as improvement of tree seed handling through determination of storage potential at different locations within Kenya. The Principal investigator was indicated as Michael M. Okeyo, the Funding programme as   tree seed programme and the collaborators as Kenya forest service, farmers and seed stockiest. The start and end dates and the study sites are also indicated. The objective was well articulated in the introduction, materials and methods, output, beneficiaries, work plan, budget and references were all included.

iv). **Development of wood and non wood forest resources**

The paper has the title of the paper as utilization of prosopis in the coastal region through development of small scale cottage industry. It's funded by the dry land programme and headed by Mohamed A. Sheikh as the principal investigator alongside associate investigators. The collaborators and start and end dates are indicated. Objectives, methodology and proposed activities, expected output and time frame are clear. However, the author did not

indicate the total budget and a list of references from which literature in the introduction was cited. The scores are as shown in figure 4.5.
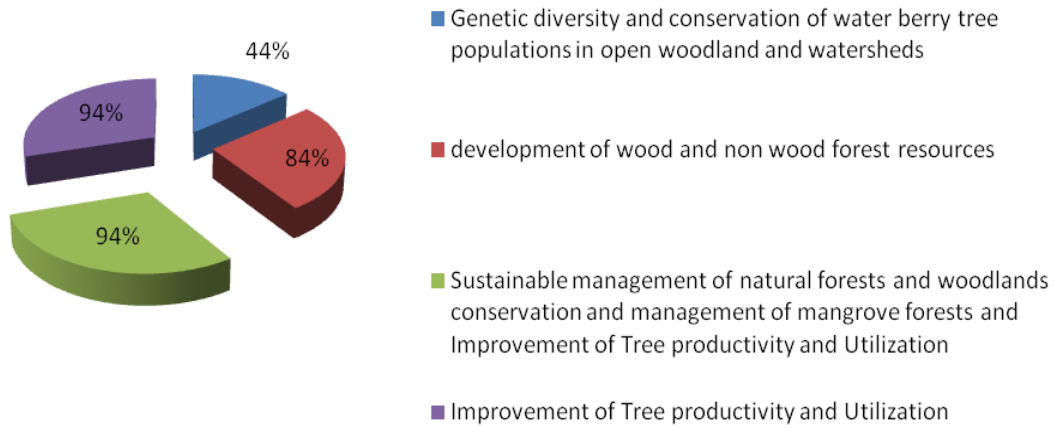
Figure 4.5 scoring of research concepts

4.2.4. Proceedings (papers)

i). Phototoxic Effects of *Gliricidia sepium* pruning on Maize Germination and Growth

The abstract had a summary of the whole report. The background of the problem was given in the introduction and related literature cited. However, the objective of the study was left for the reader to establish. The reviewer suggested an objective to read "to determine the effect of *Gliricidia sepiun* on growth of maize seedlings under different concentrations". The methods were laboratory tests and field experiments. All the steps in each experiment were adequately described giving all the measurements. In the result section, tables were used where table one represented the results of laboratory tests and table two represented results of field test. The discussion section discussed the figures obtained in the two tables and related the results with previous studies. The authors concluded their work and acknowledged the department of forestry and wood science, Moi University for their help and support.

ii). Mangrove Plantation Experiment for controlling Coastal Erosion at Gazi Bay, Kenya

The abstract had the objective, the method, results and conclusion. In the introduction the importance and various threats to mangrove forests were well articulated and sources of

information were well cited. The gap leading to the study was provided in the introduction and the objective had been given. The experimental site was well described and relevant maps and photographs were provided .The method was described under three subheadings as; collection of propagules, experimental design and data collection. The reviewer had the opinion that through the method described, the study could be replicated. The results were presented by use of tables with means and standard errors. Line graphs showing sapling survival against time were given. The paper discussed the results in relation to previous conducted studies giving a conclusion and recommended further studies. Authors also acknowledged those who funded the project and listed the references to their work.

iii) Production of Briquetted Biomass Fuels Using A Hand Operated Circular Piston Press Briquetter

The abstract summarized the paper and the objectives were well articulated. The background to the problem and how it was addressed was given in the introduction. The steps in the materials and methods were clear with measurements and equations used indicating that the process could be replicated. However, in the discussion, the authors indicated statistical analysis which showed significance at 95% confidence interval and this was not reflected in the methods. The reviewer suggested that the method of analysis which resulted to significance at 95% CI be shown at the methods section and the results indicated at the results section. The results were a reflection of the study objectives and were adequately described. The authors concluded their work giving recommendations and acknowledged those who funded the study and the university whose resources were used to achieve the study objectives. A list of materials cited in the document was given at the end.

iv). Establishment, Biomass Productivity and Quality of improved fallow species at the coastal region of Kenya

The problem, method, results and conclusion were summarized in the abstract. The overall and specific objectives were outlined in the introduction with the background information and related literature. The field experiment and design layout were detailed and clear. Laboratory and statistical analysis, yield measurements were given in the material and methods section and were adequate for the procedure to be repeated. The results of each were given in tables and in text indicating the level of significance at 5%. The discussion showed the importance of the study relating the results of the study to previous studies. The conclusion had answered the overall objective though the authors incorporated information on relation to previous

studies as part of the conclusion. The authors' recommended further studies and acknowledgement and references were provided. Scores were as shown in figure 4.6 .
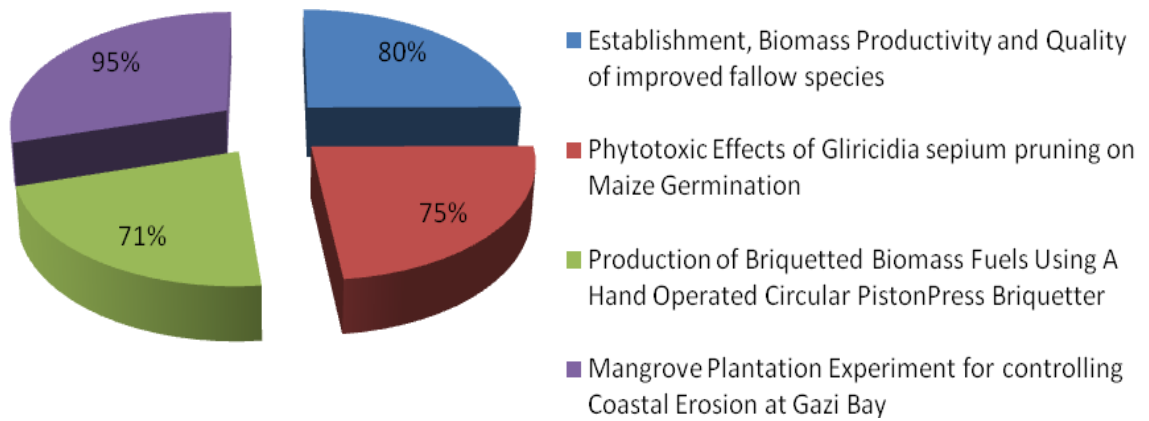

Figure 4.6 Scorings of proceedings

4.2.5. Papers from a Journal

Journal of East African Natural Resources Management (JEANRM)

i). Growth performance of *Eucalyptus* hybrid clones and four common landraces in Kenya

In the abstract, the authors limited themselves to a short description of the problem and its solution by stating the principal objectives and scope of the investigation, describing the methodology employed and summarizing the results, conclusions and recommendation. After the abstract the key words were clearly written. In the introduction, the importance and nature of the problem as well as the previous literature were provided. The objective of the study was well articulated. The materials and methods were described in details and a table of the experimental design on the sites and how replicates were done was given. An additional table summarizing the sites, species and ages assessed was given. The details in this section were adequate and the experiment could be replicated. The methods used in analyzing the results were all listed and equations derived were given. In the result section, tables and figures were used allowing the reader to grasp the information. Discussions of how the results related to previous studies were given. The authors concluded their work and recommended for further studies and acknowledged those who made their work successful. At the end a list of references was given in relation to the citations made in the paper.

ii).Variation of wood properties of *Eucalyptus* hybrid clones and local landraces grown in Kenya

The paper embraced all the sections of a scientific paper as described in Odera et. al, 2006. The abstract summarized the whole paper. The objectives and background were in the introduction and citations to previous studies were given. Materials and method section was detailed with equations to be used listed from one to six. The result and discussion section was detailed with graphs, tables and figures showing variations at different levels. The means of mechanical properties and shrinkage was clearly shown in tables and in the text, relationship of previous studies and the results of the study were compared. The conclusion was clear and in line with the study objectives. The method used was clear and the study could be replicated. A recommendation for further study was given and an acknowledgement was given and a list of references given at the end for future reference.

iii). Modelling early growth of *Eucalyptus* hybrid clones at the Kenyan coast

The paper has all the sections required in scientific writing. Literature well cited in the introduction and what was contained in the report was indicated. The materials and methods

were described with subheadings each showing what was done. Tables were also used in the result section followed by discussion and conclusion of the findings. Then acknowledgement and reference to the literature cited.

4.2.6. Annual   reports

The 2007-2008 annual report contained the letter from the KEFRI director printed on it's inside front page. The next section was devoted to the institutions operations which included reports of the activities carried out under different programmes from the various centres. These reports were a critical analysis of the past years work, and an assessment of prospects, business conditions; information on acquisitions; marketing plans; research and development issues. The financial statement covered the revenue, expenses, net income and earnings per share in detail. The 2004-2005 had followed the specifications on writing annual reports. However the 2007-2008 outlooks were more improved catching the reader's eye. The annual reports scored as in figure 4.7.
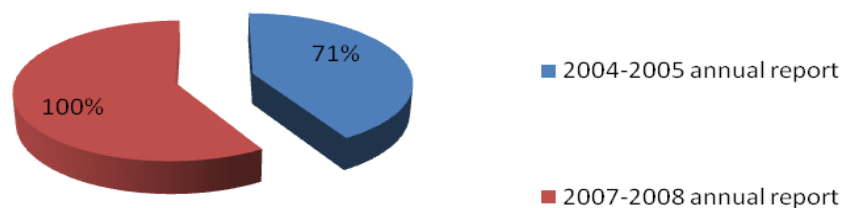

Figure 4.7 Scoring of annual reports

4.2.7. Research note

Pest and Diseases Associated with *Eucalyptus* in Kenya

The research note had followed the KEFRI format of writing scientific papers where the summary had given a summary of the justification, methodology, results and conclusion. The introduction had outlined the background of the problem, cited previous literature and gave

the objective of the study .The justification of the study was given at the introduction. A table of Eucalyptus hybrid clones and commonly grown species planted in trials. The whole process of monitoring, duration of monitoring and the experiments done in identifying these were well described. All the insect pest and diseases that attacked the planted materials were discussed. The conclusion was in line with the objective, acknowledgement and a list of reference given at the end of the paper.

4.3. Capacity building

4.3.1. Problems identified

- ✓ Use of spread sheets without validation checks
- ✓ Inadequate skills in data analysis
- ✓ Lack of data management skills using excels spread sheets.

4.3.2. Scientists observed with problems

A total of 30 scientists were identified with different research problems. Thirty three percent of these had problems in creating spread sheets and using spread sheets with validation checks. Forty percent had problems in analyzing their data while 27% were identified with weaknesses in data management using excel spreadsheets as in table 4.1

Table 4.1 Number of scientists per identified problem

Problem identified	Frequency	
	Number	**%**
Use of spreadsheets	10	33%
Data analysis	12	40%
Data management using excel	8	27%
Totals	30	100%

4.3.3. Participants

The total show number of participants was 25 out of the 33 nominated. The assistant research officers had the highest number of those who attended (10) out of 25 participants followed by

research officers at 33.3% and senior research officers and principal researchers as in figure 4.8.
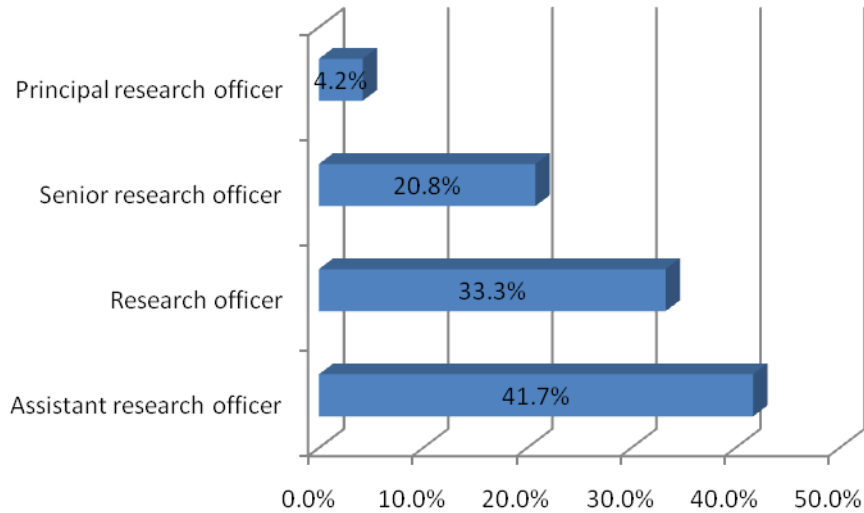
Figure 4.8 Attendance by position

4.3.4. Attendance at centre level

Muguga regional research centre which includes the headquarter had the highest number of participants 32% (8) followed by Maseno at 28% (7) and Londiani at 24% (6) and Gede at 16%(4) as shown in Table 4.2.

Table 4.2 Scientists attendances at Centre Level

Centre	Frequency	
	Number	%
Muguga	8	32%
Gede	4	16%
Maseno	7	28%
Londiani	6	24%
TOTAL	25	100

4.3.5. Usefulness of the course

Of the 25 participants 91.7% (22) indicated that the course was very interesting and useful in their areas of research whereas 8.3% said it was somehow. 87.5% agreed the course matched

with their qualifications and had gained new skills and techniques in data management and analysis during the training.

4.3.6. Difficulties experienced during the training

Participants experienced a number of difficulties during the training where 8.3 percent said yes and 52.2 percent said somehow while 37.5 percent did not have any difficulties. Some of the difficulties which were highlighted were: the content of the course was too much within a short period of time; Practicals were limited to some extent and inadequate skills on spread sheets packages especially MS-excel.

4.3.7. Interval of training follow-ups

Training follow-up based on Yes/No options indicated that 100% of the participants accepted the training follow-ups and revision of particular topics such as; some aspects of data management; spreadsheets design; analysis of survey data and statistical modeling.

On the issue of further statistical training in research methods based on yes /no options, 95.8 % (23) accepted. Twenty five percent of the trainee indicated that trainings should be carried out after every eight months while fifty percent agreed that trainings should be carried out after every four to five months and 20.8% suggested that trainings should be carried out after every three months as indicated in figure 4.9.
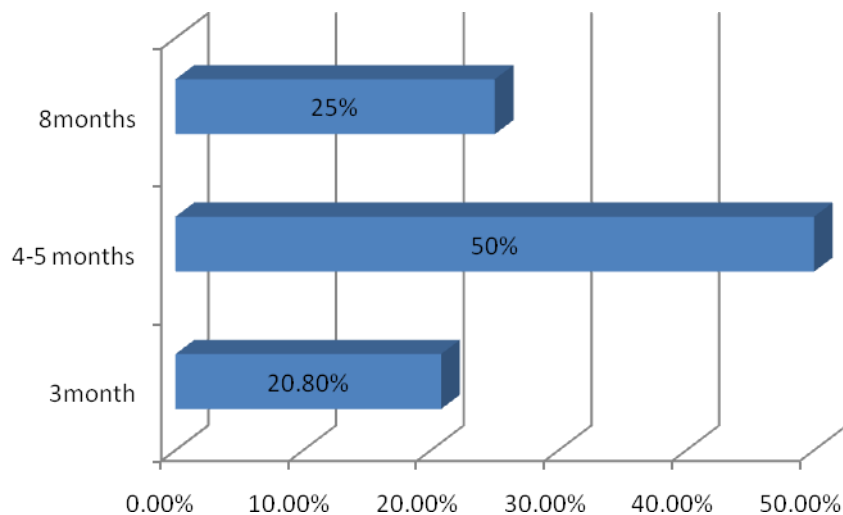
Figure 4.9 Interval of training follow-ups

4.3.8. Need to contact persons in biometrics

Of the 20 participants who responded to this question, 85% indicated that they were willing to consult a research method professional in biometrics in various issues related to their research activities as in table 4.3.

Table 4.3 Need to consult research methods professional

Category	Frequency	
	Number	%
Yes	10	50%
Somehow	7	35%
No	3	15%

4.3.9. Attendance of any previous biometrics course

During the previous training, the following areas had been covered: data entry experimental software; data base; aspects of statistical software; research methods and statistical method. After the training, 58.3% (14) of the participants indicated that they had attended previous Biometric training while 41.7% (10) had not.

CHAPTER FIVE: DISCUSSION

5.1. Database system

This study found out that KEFRI do not have a way of documenting their research progress which is in agreement with Achia, (2004). A relational database system was therefore developed to help in monitoring and documentation of research activities. This database has facilities to preserve data integrity as all the tables were linked and referential integrity enforced meaning that data cannot be duplicated as noted by Coronel and Crockett, (2008). The relationship between data files was relational meaning that data is connected in different files using a key field unlike hierarchical and network databases which requires the user to pass down through a hierarchy in order to access needed data. This relational database is more flexible than either the hierarchical or network database structures. Hierarchical databases are so rigid in their design that adding a new field or record requires that the entire database be redefined. The designed data base can also be used with little training and entries can be modified without redefining the entire structure as is the case with network databases which must be defined in advance and they have a limit as to the number of connections that can be made between records.

Pictures, images, binary files, office files can be saved in the database and applied to tables, forms and reports as attachments. It's also less costly than Object-oriented databases which are more costly to develop.

5.2. Review of documents

The annual reports in terms of content and the quality indicated a lot of improvement. The peer reviewed journal also indicated improvements in reference to scientific writing and reporting original research findings, hence contributing to hand facts necessary in forestry research. With the research note, the review felt that the authors had done well in reference to originality of research, the concepts and the methodology reflecting greater academic significance. With the guideline, some scientists required research skills as emphasized in the published guideline on writing guidelines by Odera et., al, (2006). Some authors required the help of a research methods professional in interpreting and discussing the results as indicated by Oeba, (2005). The review suggested that the persons writing technical notes should gather enough information either by doing research or experimenting and writing the first draft, revise, and edit it as indicated by Spuida, (2002). Growth of *Eucalyptus urophylla S.T. Blake* provenances at Gede, Kenya was rated 90 % while Vegetative Propagation of *Pinus patula*

through Shoot Cutting scored 45% based on the two criterions. Vegetative propagation of *Pinus patula* through shoot cutting scored low because the discussion contradicted with the results and this led a low academic significance and little as to its contribution to policy development. The first technical note scored high because the review found out that the authors had followed the stipulated guidelines and all sections were as per the requirements of scientific writing. Guidelines for Wood Preservation Using Sap Displacement Method scored high as it captured the needs of the audience hence contributing to policy development. The authors had followed the guidelines on writing guide lines as indicated by Odera et al, 2006 thus adding academic knowledge. It was also based on practical applications hence originality in research. Guideline for growing aloe scored 58% because the subtopic on information gap in aloe production was misplaced and the intension of the guide was not in line with the heading. Propagation, Establishment and Management of *Melia volkensii* scored 66 since the authors did not acknowledge the sources of information and no literature material had been cited in the guideline though at the end there are selected readings. Genetic diversity and conservation of water berry tree populations in open woodland and watersheds seemed to be incomplete in that it didn't give the budget, work plan and the expected outcome. The source of information in the introductions was not cited. This made it to score as low as 20 in contribution to academic knowledge, 15 in quality of and 9 in contribution to policy development. Sustainable management of natural forests and woodlands conservation and management of mangrove forests and Improvement of Tree productivity and Utilization embraced scientific writing thus scoring 94%. In development of wood and non wood forest resources, the author did not indicate the total budget and a list of references from which literature in the introduction was cited hence scoring 84%. Mangrove Plantation Experiment for controlling Coastal Erosion at Gazi Bay, Kenya followed all the requirements of scientific report writing and therefore scored 95% while in Phototoxic Effects of *Gliricidia sepium* pruning on Maize Germination and Growth the objective of the study was left for the reader to establish thus scoring 40% in contribution to academic knowledge and overall score of 75%. In Production of Briquetted Biomass Fuels Using a Hand Operated Circular Piston Press Briquetter the authors indicated statistical analysis at 95% confidence interval and from the method section, the methods of analysis had not been indicated. In Establishment, Biomass Productivity and Quality of improved fallow species at the coastal region of Kenya, the authors incorporated relation to previous studies and results as part of the conclusion hence scoring 80%.

5.3. Capacity building

Franzel, (2003) indicated that effective training has to be based on demand on knowledge and skills required by the trainee and this is in agreement with this study where problems were identified, analyzed and a training module developed based on these problems. Assessment of 24 participants showed that the training largely met their expectations, with all participants expressing their willingness to attend more training and 50% of them suggested the intervals of the trainings to be between four to five months. Muguga regional centre had the highest number of trainees as most scientists are based there. The study indicated that 41.7% had not attended any previous training on research methods and this was a great opportunity for them to improve their research skills. The problems identified during the training can be addressed through regular trainings to improve scientific research.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

5.1.1. Data base system

A relational database management system which has facilities to preserve data integrity was created. This database audits all activities carried out by scientists and helps in monitoring and documentation of research at KEFRI.

5.1.2. Review of documents

The reviewed documents indicated that there were serious gaps in terms of scientific writing at KEFRI and recommendations were provided for improvement.

5.1.3. Training

The training need assessment found out that scientists at KEFRI were experiencing various challenges related to data management. Over 80% of the scientists who attended the training agreed that they gained new skills and techniques in data management and analysis during the training. In addition, 41.7% had not attended such trainings and the course offered an opportunity to strengthen their research skill.

5.2. Recommendations

5.2.1. Data base management system

The designed database management system captured only the ongoing projects for the year 2010-2011. Therefore, there is need for a research method professional at KEFRI who will help in managing this data base and incorporate all the other projects that have been carried out at KEFRI in this database and assisting in retrieval of documents.

5.2.2. Review of documents

There is need for a research method professional at KEFRI to help in reviewing of documents before they are published and help in identifying various difficulties experienced by scientists.

5.2.3. Training

The institute should continue such trainings and enhance the interaction between research methods professionals and scientists. The KEFRI management should also be sensitized on the importance of data management as well as the data base. A research methods professional is also needed at each centre to allow closer interaction with the scientists.

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APPENDICES

Appendix I Data types in the data base

Data type	Type of information Stored	Size
Text	Alphanumeric characters Use for text, or text and numbers that are not used in calculations (for example, a product ID).	Up to 255 characters.
Memo	Alphanumeric characters (longer than 255 characters in length) or text with rich text formatting. Notes, lengthy descriptions, and paragraphs with formatting such as bold or italics are good examples.	Up to 1 gigabyte of characters, or 2 gigabytes of storage (2 bytes per character), can display 65,535 characters in a control.
Number	Numeric values (integers or fractional values).for storing numbers used in calculations, except for monetary values .	1, 2, 4, or 8 bytes, or 16 bytes when used for replication ID.
Date/Time	Use for storing date/time values.	8 bytes.
Currency	Use for storing monetary values (currency).	8 bytes.
AutoNumber	A unique numeric value automatically inserted when a record is added.	4 bytes or 16 bytes when used for replication ID.
Attachment	Pictures, Images, Binary files, Office files.	For compressed attachments, 2 gigabytes. For uncompressed attachments, approximately 700k.

Appendix II Need Assessment Questionnaire

This questionnaire is intended to identify areas in research that scientists and other members of KEFRI require further training. Your responses will be confidential.

Section A: BACKGROUND INFORMATION

1. Position………

    1) CRO

    2) PRO

    3) Senior Research Officer

    4) Research Officer

    5) Assistant Research Officer

2. Centre……………………………..

3. Highest academic qualification ………..

    1) PhD

    2) Msc.

    3) Bsc

    4) Diploma

4. Number of biometric trainings attended before

        None   1   2   3

5. State the biometric areas that require further improvement, what kind of skills you expect to gain and mode of delivery.

a)   Biometric areas requiring improvement…………………………

b)   Kind of skills expected to be gained………………………………….

c)   Mode of delivery (tick multiple responses)

   i.   Refresher courses

  ii.   Enhanced of biometric consultations,

 iii.   Short term course, any other specify

6. Which stages of your research process do you exactly require the input of the biometrician?

a)   1…………………

b)   2……………………….

7. Please state the extent at which the previous refresher courses (data management, data analyses and presentation of results) conducted by the biometrician have helped you in your research process.

- Data management inclusive use of Ms excel…………………
- Data analyses inclusive use of software…………………
- Presentation of results………………………………….

8. Do you have difficulties in using SPSS and Excel?

➢ SPSS: 1.Yes   2. No
➢ Excel   1.Yes   2. No

9. Please provide your suggestions on how to improve KEFRI biometrics to enhance its delivery of services to all scientists equally.

 Thank you

Appendix III Contents of the database

DATABASE OF ON-GOING STUDIES: 2010/2011 FINANCIAL YEAR

1. FARM FORESTRY PROGRAMMES

Project FF/01: Diversify tree species on farms in high potential areas

Objective 1: Diversification and demonstration of performance of priority tree species focusing on various promising tree species.

On-farm demonstrations of *Gmelin arborea, M. excelsa and Casuarina equesitifolia* in Mpeketoni – Lamu established .

Project FF/02: Recruitment of tree species for water conservation.

Objective 1. Studies on tree water-relationship and identification of species for water sources protection.

Evaluate tree water relationship among some priority eucalypts and other four indigenous species namely: *Zanthoxylum gilletti, Prunus Africana, Croton microstachys, Croton megalocarpus.*

 Project FF/03: Improvement of on farm tree management practices.

Objective 1. Development of on-farm forestry technologies and management practices.

Project FF/04 Improvement of wood utilization at farm level.

Objective 1: Promotion of efficient processing, marketing and utilization of on-farm tree products through skill improvement

Project FF/05 Development of sources of bio energy at farm level.

5.1 Develop potential biomass energy technologies for various areas in the country

5.2 Develop low-cost press production of briquettes for charcoal fines

5.3   Evaluate fuel yield from two *Acacia* species grown in Rarienda District for charcoal.

Project FF/06: Farm forestry policy analysis

Objective: To guide policy to enhance farm forestry development

Determine the influence of institutional capacity on adoption of forest innovations in Kenya. PhD Programme.

Project FF/07 Programme Coordination, Planning, M & E

7.1Coordinate, facilitate, monitor and evaluate research activities

 7.2Develop farm forestry proposals

7.3Compile, edit and produce annual/ technical reports

7.5.Mentor scientific staff in tree improvement research.

NATURAL FORESTS PROGRAMME

Project NF 01: Policy and Governance Research

1.1 Build Capacity of project staff and train participating community.

1.2 Establish and monitor research sites for long term studies.

1.3 Institutions in Forest Governance and livelihood Improvement E. Obonyo-Kamau PhD Programme.

1.4 Innovative Approaches for mainstreaming INRM in Agricultural Research and Development Institutions in ECA (ASARECA Project).

1.5 Analysis of evolution of ITK as an institution and assessment of impact on forest management.

1.6 Complete documentation of effective systems of incentives necessary for management of decentralization in the forestry sector.

1.7 Investigating the Potential for Payment for Watershed Protection: Case of Ndaka-ini dam, Gatanga district – Kenya (J. Kagombe PhD Study).

1.8 Payment for Environmental Services along Moiben river dam in Cherangany

Project NF 02: Conservation and management of Natural Forests.

2.1 Regeneration and Propagation of Ocotea Usambarensis in Mt.Kenya Forest Ecosystem.

2.2 Assessing and reporting on Permanent Biodiversity plots in Arabuko Sokoke Forest (ASF).

2.3 Investigation on influence of Land use change on stream flow in South West Mau: Cases of Nyando, Ndoinet and Kuresoi rivers.

2.4 Recovery potentials of Human Induced degraded Natural Forests along an altitudinal cline in tropical East Africa (Tom Omenda's PhD Study).

2.5 Consolidating PFM experiences in the Coast Region: ASF and MRIMADZO forests.

Project NF 03 Propagation, management and utilization of wood and non wood natural forest products

3.1 Demonstrating Propagation and Management of Bamboo in Mt.Kenya Region.

3.2 Propagation and Management of Bamboo Resource in Lake Victoria region.

3.3 Demonstrating and propagating bamboo establishment and Management in Mau Forest Blocks.

3.4 Promoting, propagation and Management of Bamboo in Semi-arid areas in Kitui.

3.5 Demonstrating, linking to industry and training Artisans on making furniture weaving, bending and lamination techniques using bamboo resource.

3.6 Develop effective environmentally friendly methods of preserving bamboo for in-door and out-door use.

Project NF 04: Rehabilitation of Natural Forests

4.1 Demonstrating approaches of rehabilitation of degraded Maragoli hills Watersheds.

4.5 Establish Permanent Sample plots and monitor the impact of natural forest rehabilitation in GZDSP areas.

Project NF 05: Assessment and Rehabilitation of Mangrove Resources

5.1 Assessment of mangrove forests stocking rates.

5.2 Rehabilitation of Mangrove forests at Mida Creek and Manda Island.

Project NF 06: Inventory and Economic Valuation of Natural Forests.

6.1 Tradeoffs and Synergies for Sustainable Watershed Management in Western Mau Forests.

6.2 Economic Valuation of Forest Use: A study of Community Dependency on forest resources in West and South Western Mau Forests (D. Langat PhD Study. Programme Coordination

DRYLAND FORESTRY PROGRAMME

Project DF/01: Management, improvement and domestication of priority species

1.1: Maintenance and assessment of *Melia volkensii* spacing trials at Kitui and Kibwezi.

1.2: Finalize valuation of groups' extension model on up scaling of *M. volkensii* planting in Kitui.

1.3: To maintain and assess *M. volkensii* trials in Kitui and Kibwezi area.

1.4: To establish *Terminalia brownii* and *Terminalia prunoides* spacing trials in Kitui .

1.5: To refine propagation methods for *Terminalia spinosa* in Gede.

Project DF/02: Management and control of invasive Prosopis

2.1: Maintenance and assessment of *Prosopis* research plots at Bura, Marigat and Turkana.

2.2: Estimation of *Prosopis* biomass in Kenya using allometric equations and GIS techniques.

2.3: Develop a Prosopis R&D program blueprint.

2.4: Commercialization of Prosopis pods for livestock feeds and restoration of grazing lands.

2.5: Early warning and contingency plans for resource management during crisis situations in Pastoral areas of East and Central Africa.

Project DF/03: Utilization and Marketing of dry land forest products

3.1: Link Boabab juice, vitex jam, 3 aloe products, Tamarindus wine and Tamarindus jam to industry.

3.2: Develop soap and juice from *Tamarindus indica*, and baobab sweet.

3.3: Continue with refinement of 2 products (Aloe gel and health drink) and documenting processing protocols of 8 forest products (vitex payos, 4 aloe products, prosopis animal feed, croton animal feed, and baobab juice.

3.4: To assess factors that motivate entrepreneurship in non wood timber products in drylands (PhD study).

Project DF 04: Woodlands rehabilitation and management

4.1: Maintain and assess Bamboo and *Gmelina arborea* plots in Kerio Valley.

4.2: To evaluate technologies adoption under JICA and BTC funded projects in Ukambani.

4.3: To evaluate effectiveness of CFAs in forest management in upper Imenti - MSc Study.

Project DF 05: Climate change Research

To develop drought tolerant *Melia volkensii.* Varieties.

Project DF O6: To produce publications

Production publications (Scientists encouraged to use this opportunity for production of KEFRI conference papers).

Coordination, planning, monitoring and evaluation

FOREST PLANTATIONS PROGRAMME

Objective 1. Selection of superior trees and establishment of Seed orchards and seed stands

1.1 Establish seed orchards and seed stands.

Objective 2. Demonstration of the management of natural regeneration of P. patula and C. lusitanica

2.1 Demonstrate Management present costs of managing old (10 years) natural regeneration of P. patula and *C. lusitanica*

Objective 3. Introduction of additional commercial species and hybrids.

3.1 Introduce additional commercial species and hybrids.

Objective 4. Maintenance of *Eucalyptus* clones trials

4.1 Maintain 15 trial plots of *Eucalyptus* clones.

4.2 Test wood properties of the approved clones.

Objective 5. Hybridization of local E*ucalyptus* land races

5.1 Hybridize local *E. grandis, E. urophylla, E. camadulensis,* and *E. tereticornis*

5.2 Under take genetic finger printing of local *E. grandis, E. urophylla*, *E. camadulensis* and *E. tereticornis* hybrids

5.3 Secure breeders right for KEFRI improved *E. grandis*

Project FP/02: Integrated Pests and Diseases Management in Forestry Systems

Objective 1. Develop Integrated Pests and Diseases Data Base

1.1 Edit and capture electronically the Archive reference pests and diseases data

1.2 Develop pests and diseases electronic data base with a query facility

1.3 Response to pests and diseases alerts by stakeholders

1.4 Maintain and assess Permanent Sample Plots for Cypress aphid

1.5 Identify and deploy a cheap monitoring tool for Cypress aphid

Objective 2. Rapid assessment of the distribution and economic damage of *Eucalyptus* snout beetle (*Gonipterus coleopteran*) damage monitored

2.1 Evaluate distribution and economic damage of *Eucalyptus* snout beetle.

Objective 3. Assess distribution and economic damage of Economic diseases of *Senna siamea* and *Grevillea robusta*

3.1 Evaluate economic damage of diseases of *Senna siamea* and *Grevillea robusta*

3.2 Identify pathogens for the economic diseases of *S. siamea* and *G. robusta*

3.3 Initiate Strategies for controlling economic diseases of *S. siamea and G. robusta.*

Project FP/03: Develop decision support tools for various forestry systems in Kenya

3.1 Statistical modelling of forest cover and carbon sequestration

3.2 Support Miti Mingi Maisha Bora Project on "Improving procedures for forest resources information management in Kenya"

3,3 Assess quality of the Eucalyptus fuel wood in plantations raised by the Unilever Kenya.

3.4 Document the temporal distribution of Bronze Bug, Thaumastocoris peregrinus (Hemiptera: Thaumastocoridae) in Kenya.

3.5 Design expert system for growing Grevillea robusta in Kenya

Project FP/04: Coordination, planning, monitoring and evaluation

4.1 Monitor and evaluate the Programmes' activities

4.2 Produce annual reports.

4.3 Participate in relevant workshops and conferences.

Appendix IV Course Evaluation Questionnaire

Name...............................

Designation. ....

Station / centre..............................

Usefulness of the Course

1.   Have you attended any previous biometrics training course

2.   How useful was this course in relation to your work.

3.   Did you experience any difficulties during the training

     1. Yes   2. Somehow   3. No

4.   What are the difficulties that you experienced during the training?

5.   How frequent should trainings period be?

     1. Semi annually   2. Annually   3. Bi- annually

6.   Training follow-up

     1. Yes   2.No

7.   What intervals should Internal training follow-ups take place.

    1. 3 months.   2. 4-5 months   3. 8 months

8.   Would you require any revision in any particular topic?

     1. Yes   2. No

9.   If yes, specify these topics.

10.   Would you recommend for further training on statistical methods in Research.

    1. Yes   2. No

11.   Would you Contact a person in Biometrics in future.

     1.   Yes   2. No   3. Somehow

12.   What are your suggestions on the way forward