INFLUENCE OF POST-PRIVATIZATION MANAGEMENT PRACTICES AND MONITORING AND EVALUATION STRATEGIES ON QUALITY OF ARTIFICIAL INSEMINATION SERVICES IN CATTLE IN NYERI COUNTY, KENYA

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DECLARATION

This Thesis is my original work and has not been submitted for the award of a degree in any other university. No part of this thesis should be reproduced without the consent of the Author or that of the University of Nairobi.

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DEDICATION

This work is dedicated to my Father, Bernard Githu Methu. Nothing could have prepared me for your departure.

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ABBREVIATIONS AND ACRONYMS

AfDB	African development Bank
Agrovet	Private Organization Retailing Agricultural and Veterinary Inputs
AI	Artificial Insemination for cattle
ANOVA	Analysis of Variance
B2C	Business to Customer Environment
CAIS	Central Artificial Insemination Service
CDC	Centers for Disease Control
CLEAR	Regional Centers for Learning on Evaluation and Results
df	Degrees of Freedom
DIM	Days in Milk
DPME	South African Department of Planning, Monitoring and Evaluation
DVS	Department of Veterinary Services
ECB	Evaluation Capacity Building
EUROSTAT	Statistical Office of the European Union
FAO	Food and Agriculture Organization
GnRH	Gonadotropin Releasing Hormone
HPI	Heifer Project International
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IFRC	International Federation of Red Cross and Red Crescent Societies
ILO	International Labour Organization
IOCE	International Organization for Cooperation in Evaluation
ISO	International Organization for Standardization
K-S	Kolmogorov-Smirnov Test
KAGRC	Kenya Animal Genetics Resource Centre
KNAIS	Kenya National Artificial Insemination Service
M and E	Monitoring and Evaluation
NASEP	National Agricultural Sector Extension Policy
NCG	Nyeri County Government
NDDP	National Dairy Development Project

OECD	Organization for Economic Cooperation and Development
OIE	*Office International des Epizooties.* (World Organisation for Animal Health)
RoK	Republic of Kenya
SDA	Strategic Development Agency, Armenia
SERVQUAL	Model of Service Quality by Parasuraman *et al*
SHG	Self-Help Groups
SIDA	Swedish International Development Agency
Sig.	Significance
SMS	Short Mail Service
SPSS	Statistical Package for Social Sciences
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
UNIFEM	United Nations Development Fund for Women
US	United States of America
USDA	United States Department of Agriculture
UWE	University of Wisconsin-Extension
VO	Veterinary Officer
WFP	World Food Programme

ABSTRACT

Privatization of some Government functions has meant that Governments have lost their monopoly as sources of technical information as well as their direct control of the quality of services including the practice of artificial insemination in Nyeri County, Kenya. This research sought to investigate the influence of post-privatization management practices and monitoring and evaluation strategies on quality of artificial insemination services. The five objectives pursued in the study were to: establish to what extent artificial insemination capacity building influences quality of artificial insemination services; determine the influence of technology application on quality of artificial insemination services; determine how legal status of service providers influences quality of artificial insemination services; establish the combined influence of post-privatization management practices on quality of artificial insemination services and; establish the moderating influence of monitoring and evaluation strategies on the relationship between post-privatization management practices and quality of artificial insemination services in Nyeri County. The investigation was carried out through a combination of a survey and key informant interviews. The study targeted a total of 8 Veterinary Officers in charge of artificial insemination services, 75 artificial insemination service providers and 204 farmers. Qualitative and quantitative data was collected using questionnaires and interview guides. The data was analysed using statistical tools aided by the Statistical Package for Social Sciences software version 22 and summarized using Tables. Conclusions were made from the data after analysis using Pearson's Product Moment Correlation, Chi Square, ANOVA and Multiple Regression. It was found that 71.9% of AI service providers had received post-qualification training on AI related issues and 74.5% of farmers were able to receive AI information whenever they needed it. The use of sex-selected semen and oestrus synchronization was practiced by 33.51% and 10.11% of farmers respectively. None of the farmers had practiced embryo transfer. The study showed that 89.5% of AI service providers in the study were private, 7% were from cooperative societies and 3.5% were from farmer self-help groups. The results of the hypothesis tests found that there is no significant relationship between capacity building and quality of artificial insemination services for both AI service providers and farmers; Technology application has no significant influence on quality of artificial insemination services for AI service providers but has a significant influence for farmers; There is no significant relationship between the legal status of AI service provider organization and quality of AI services for service providers but there is for farmers; Post-privatization management practices have no significant combined influence on quality of artificial insemination services for AI service providers but they have for farmers and; The strength of the relationship between post-privatization management practices and quality of artificial insemination does not depend on monitoring and evaluation strategies for AI service providers but it does for farmers. The recommendations made from the study were that there is a need to strengthen extension services, incorporate quality and monitoring and evaluation in the training curriculum for service providers and conduct more research in areas relating to quality of artificial insemination services. The findings of the study will be useful to the staff of State Department of Agriculture, Livestock and Fisheries, County Departments in charge of Livestock, AI service providers, farmers and stakeholders in making quality decisions.

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

Artificial insemination (AI) is the human-induced placement of semen into the female reproductive tract for the purpose of fertilization, by means other than the natural processes. Artificial insemination was the first great biotechnology applied to improve reproduction and genetics of farm animals (Foote, 2002). According to Cothren (2012), using AI has the following advantages: It allows efficient control of venereal diseases; it is economical and eliminates purchase of expensive bulls, maintenance costs and possible losses of the bulls; semen from bull studs or imported semen is genetically superior and disease free and; it is the most efficient technique of cattle improvement. One bull can sire 500 to 8000 offspring per year while natural servicing provides a mere 30 to 40; adequate offspring for a reliable evaluation of the breeding value of a bull are available at a relatively young age; frozen semen from proven bulls can be distributed world-wide and; the semen of outstanding bulls can be stored for years and thus used for subsequent breeding programmes.

On farms, AI is used to control breeding among different farm animals. It has been used to produce genetically superior dairy and beef cattle. However, artificial insemination does have its own disadvantages such as: Venereal diseases can be distributed quickly if there is incorrect or negligent handling of equipment and animals; undesirable characteristics and heritable deficiencies are transferred to more offspring and; the possibility of in-breeding is much greater than with natural servicing if proper records are not kept. AI necessitates accurate record-holding and a high level of management, a fact that can result in a high degree of efficiency (Morell, 2011).

The history of artificial insemination in cattle and other animals dates back to ancient times. According to Webb (2003), documents from approximately 1322 A.D. state that an Arab chieftain who wanted to mate his prized mare with a stallion owned by an enemy used cotton containing the scent of the female to excite the stallion, causing him to ejaculate. He placed the released semen in the reproductive tract of the mare, leading to conception. In the 1780s, Italian naturalist Lazzaro Spallanzani artificially inseminated a dog (Richard, 2013). Between 1899 and 1900, Russian scientist Ivanoff began conducting artificial insemination on cattle, horses, birds and sheep. He was the first person recorded to have accomplished the first

successful artificial insemination in cattle. Ivanoff was so successful at artificial insemination that by 1931, Russia had bred approximately 19,800 cows.

Other countries began researching on artificial insemination in cattle throughout the 1930s. In 1936, Denmark founded an artificial insemination association. After his visit to the Denmark facility in 1938, New Jersey native Perry established the first artificial insemination cooperative society at New Jersey State College of Agriculture. In the following two years, seven artificial insemination cooperative societies were formed in the United States of America (US) using the Denmark model (Foote, 2002). In the 1940s, the US Bureau of Animal Industry registered the Santa Gertrudis cow, a new tropical beef breed of cattle developed in southern Texas on the King Ranch, as a direct result of artificial insemination in cattle (Foote, 2002). During that time, scientists realized that collected bull semen could be saved by placing it in egg solution containing antibiotics and chemicals and freezing it for later use. Since then, research has continuously been carried out leading to great improvements in technologies such as multiple ovulations, semen sexing and embryo transfer.

In Kenya, the first insemination in cattle was carried out in 1935 (Duncanson, 1975). During the early days, AI was confined to the collection of semen from bulls on individual farms for use on cows within the same farms from which it was collected for the purpose of controlling infectious reproductive diseases. A survey carried out by Anderson at that time revealed that over 35 per cent of bulls tested were sterile. This emphasized the importance of AI and therefore its use grew steadily. The first AI scheme in Kenya was set up in 1941 on the basis of a community bull scheme. This was followed in 1942 by a scheme operated by the Limuru Cattle Breeders' Association, which was linked to the Kenya National Artificial Insemination Service.

Since Artificial Insemination (AI) was introduced in Kenya through the establishment of the Central Artificial Insemination Station (CAIS) in 1946 (van der Valk, 2008), the service has been run by the Kenyan Government through the Kenya National Artificial Insemination Service (KNAIS). CAIS, situated in Kabete was established by Kenya Gazette Notice number 557 of 19th June, 1946 in order to control reproductive diseases and to improve the genetic quality (van der Valk, 2008). CAIS was later renamed Kenya Animal Genetics Resource Centre (KAGRC) in 2011 after it was converted into a quasi-Government institution by Legal

Notice number 110 of 5th September, 2011 under the State Corporations Act, Cap 146 Laws of Kenya. KAGRC continued to function as the main regulator and national seed bank for cattle semen at the time of writing this thesis.

In an effort to realize its dream of improving service delivery, the Kenyan Government, through the prompting of the World Bank, initiated the Structural Adjustment Programme in 1991 to restore efficiency in all sectors of the economy and consequently raise the rate of economic growth (RoK, 1997a). One of the components of the programme was the privatization and liberalization of Government owned enterprises that could make profit. For services like artificial insemination (AI) which were considered non – essential but too critical to be left solely in the hands of the private sector, privatization was implemented in such a way that the Government still retained the regulatory role (RoK 1997b). Privatization subjected the AI services to the forces of demand and supply. The Government therefore took a regulatory role without actively providing the services.

Donor pressure also played a big role in prompting the process of privatization. According to Sen and Chander (2003), privatization was intended to improve the quality of the services as well as to reduce fiscal constraints on the Governments. The regulatory role of Governments is to ensure that farmers continue to benefit from AI services through reduced incidences of venereal diseases in farm animals; reduced costs associated with rearing breeding bulls and; improved production potential of domestic herds. AI uses sires of superior genetic merit; mates specific sires to individual cows; reduces the number of herd bulls needed in cattle operation; increases genetic potential for replacement heifers and; when combined with estrous synchronization, a shorter calving season can be achieved, resulting in a more consistent, uniform calf crop (Cothren, 2012; Morell, 2011).

Private AI practice has existed in most of the developed world for a long time. In Africa, the service was Government run since the countries gained independence until 1992 when the continent was facing an economic down turn and Government services were becoming too expensive to run (Ouma, 2008). This led to privatization of AI service in Algeria, Angola, Benin, Burkina Faso, Botswana, Comoros, Côte d' Ivore, Egypt, Ghana, Guinea, Kenya, Malawi, Morocco, Niger, Namibia, Senegal, South Africa, Swaziland, Tanzania, Tunisia, Uganda, Zambia and Zimbabwe (Tber, 2009). Three models of privatization were employed namely: provision of AI services by public veterinary personnel on the basis of cost recovery;

complete privatization of veterinary services including AI where private veterinarians provide services with a profit motive in an open market and; a mixed system of cost recovery and privatization policy for veterinary services. All these models finally led to three levels of results which were aimed at state withdrawal; reduction of the budget deficit and; improvement of services. According to Mpelumbe (1993), the models were applied in different countries in accordance to the conceptual model in Figure 1.

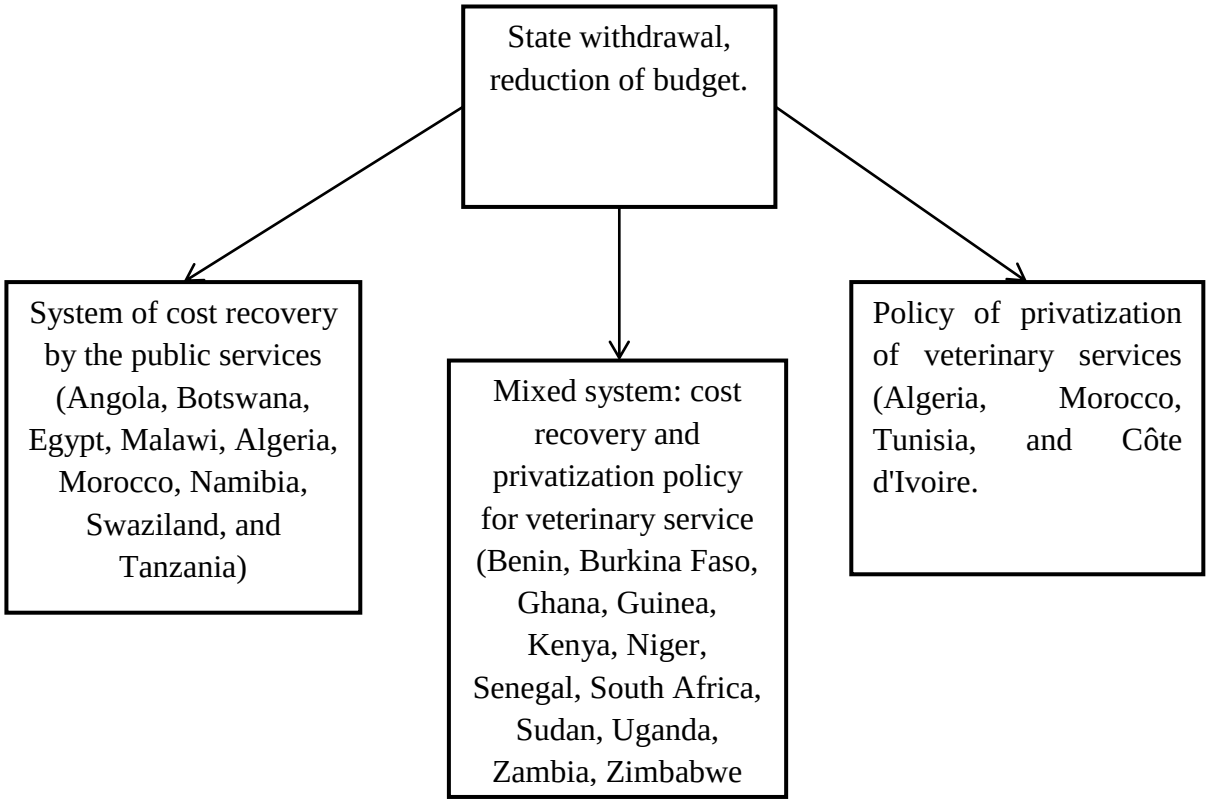

Figure 1. Mode of Privatization of AI in Various African Countries

(Source: Mpelumbe, 1993)

Privatization changed the AI practice landscape such that AI service providers have to run their services as business firms in which quality management is a critical success factor. According to Garvin's (1983) Model of Quality Performance, quality management and performance affects an organization at two levels, production and marketing. At the production level, quality in AI results from the way semen is extracted from bulls; the health status of the bull; and how the semen is stored. The benefits of quality management at the production level consist of fewer cases of acquiring the wrong breed of offspring; higher conception rates hence fewer repeat inseminations; less waste and; more dependable processes. These factors lead to lower production costs, lower liability costs, higher

efficiency and productivity, and increased return on assets and profitability (Handfield, Ghosh, and Fawcett 1998; Kaynak, 2003; Reed, Lemak, and Montgomery, 1996). At the marketing level, quality is affected by how the semen is transported to the farm, the hygiene standards practiced by the inseminator, the insemination procedure; timing of the insemination; the equipment used and the skill of the inseminator. At this level, improved quality increases customer satisfaction, leading to increased sales and a larger market share (Ahire and Dreyfus, 2000; Choi and Eboch, 1998; Handfield *et al*., 1998).

Nyeri County is one of the high potential dairy production Counties of Kenya. Preliminary data indicates that the dairy sub-sector provides for the direct employment of 20% of the working population in the County and supports 80% of the population. The County has a human population of 693,558; 95% of who are in rural families (RoK, 2010a). This population is distributed in 162,427 farm holdings (RoK, 2013). The dairy industry is one of the key economic activities in the largely agricultural County with a cattle population of 222,246 (RoK 2010a). 95% of the cattle population consists of dairy breeds (RoK, 2010b). Other major economic activities are horticulture, coffee and tea farming. The use of AI for breeding in the County is widely accepted by the population and is practiced by 78% of the cattle keepers (RoK, 2010b).

Existing literature on quality studies dwells mostly on product quality with little work having been done on quality of service (Gummenson, 1991). This is notwithstanding the fact that the service industry is the most rapidly growing industry (Henderson, 2012; Bermann 2005; World Bank, 2013). Public services and Government regulated services like AI are more service oriented than they are commodity oriented and are provided on a business to customer (B2C) basis. According to Munusamy, Chelliah and Mun, (2010) satisfying a customer through the provision of appropriate products and services is the ultimate goal and objective in any B2C type of environment. Yi (1991); Anderson (1994) and; Boulding, Kalra, Staelin and Zeithaml (1993) have found that high customer satisfaction levels lead to greater customer loyalty which in turn leads to better achievement of goals and better revenue bases. This also applies to Government services that aim at achieving economic growth and social development.

1.1.1 Capacity Building

The role of capacity building in any business practice is necessitated by the ever changing technologies and operating environment. According to the United Nations Environment Programme (UNEP. 2002), without the necessary capacity, developing countries are not able to identify and solve their own development problems. Similarly, without capacity, the AI practice in Kenya would be handicapped thus hindering the growth of the dairy industry. Capacity building can play a crucial role in ensuring that farmers are able to gauge results and quality of AI service. It is therefore imperative to investigate its role in determining quality of artificial insemination services.

1.1.2 Technology Application

Technology is a key ingredient of human economic development (Ranis, 2011). According to Sen (1997), development can be viewed as human advancement via the enhancement of capabilities generated by a combination of human development and technology. The technology world is very dynamic and requires industry players who are versatile. Newer technologies of inducing bovine conception like multiple ovulation, embryo transfer, oestrus synchronization and semen sexing require inseminators who are skilled and farmers who are conversant with the current trends in the industry and are able to articulate their needs effectively.

Use of electronic Information and Communication Technology (ICT) has become a key aspect of economic activities in most fields, playing the roles of information collection, analysis, storage and dissemination. According to Berman (2015), the advent of computer networks through the use of website resources and networks has transformed information transfer methodologies in AI and dairy production. This however, requires farmers to be capable of independently screening the available information for relevancy and application because of the plurality of sources of information available. This study sought to investigate the role of ICT usage and breeding technology application on quality of Artificial Insemination services in Nyeri County.

1.1.3 Legal Status of Service Provider

The privatization of the AI service in Kenya led to the emergence of three legal types of AI service provider organizations which are private practitioners, farmer groups and cooperative societies. These service provider organizations provide a peculiar kind of oligopoly in which

farmers are the consumers of their services, thus turning the service into a typical B2C market environment. Entry into the market as a service provider is restricted through licensing by the Department of Veterinary Services upon fulfilling the condition that the inseminator should have undergone basic AI training from an institution recognized by the Kenya Veterinary Board. The Government further detached itself from the process of controlling prices hence market forces were allowed to come into play in the process of market liberalization. The competition for market share has forced AI service providers to incorporate aspects of quality in their services. According to Kranton (2008), Consumers decide whether to buy from a firm on the basis of its past quality decisions.

1.1.4 Monitoring and Evaluation Strategies

The relationship between post-privatization management practices and quality of AI services is likely to function better with a system for monitoring and evaluation in place. Most quality management systems include an aspect of continual improvement which relies heavily on monitoring and evaluation systems. Deming's Plan-do-check-act model consists of a distinct check phase in which the implementation of quality improvement is evaluated to determine its effectiveness and to identify the need for further improvements (Deming, 1986). Data collection in modern markets is usually through consumer feedback in exit surveys; product research and customer complaints or compliments. Privatization of AI services meant that the monitoring and evaluation function is no longer solely a function of the Government but has to be shared among the stakeholders in the value chain. This implies that the process of obtaining feedback that would help in making decisions on quality was changed, especially where such decisions have to be made by the Government. Nyeri County being one of the key dairy production areas in Kenya is deemed to have been highly affected by this change. This study therefore, sought to investigate the moderating influence of monitoring and evaluation strategies in managing quality of AI services.

1.2 Statement of the Problem

Privatization of Artificial Insemination Services has spread out the role of Government in the management of the value chain to organizations that are not under their direct control. This has brought about some attendant challenges where Governments have lost their ability to directly influence the quality of services in the value chain. Governments have also lost their ability to influence the flow of monitoring and evaluation information and can therefore only rely on data from private practitioners who are not obliged to give feedback. According to

RoK (2012a), Capacity building and extension services are provided in a largely uncoordinated pluralistic manner hence the quality of information that flows between different users may be in question. As privatization took effect, it became more and more difficult to accurately determine the artificial insemination success rate in terms of number of inseminations that led to conception. Prior to the privatization, the non-repeat method was used to determine the conception rates. This involved monitoring the number of cows requiring repeat insemination due to failure to conceive in the first instance. The efficiency of this method of monitoring fertility is reduced today because of multiple suppliers of semen to individual farms and within herd inseminators, who are not obliged to provide such information to Government (Foote, 2002).

Ouma (2008) found that the demand for AI services is influenced by the farmer's education level, age, experience, herd size and breeds but fell short of studying the role of the quality of AI services as a factor influencing their demand. Feder, Just and Zilberman (1985) found that the impact of farm size on adoption of information and communication technology is mixed because the relationship depends on many factors such as fixed costs, risk preferences, human capital, credit constraints, labour requirements and tenure agreements. They however, did not study the role of the technology in quality of service delivery. Desai and Joshi (2013) studied collective action of self-help groups and community development but did not compare between individual and group performance. The privatized AI system is therefore not well understood. This is compounded by the fact that there seems to be few studies conducted on monitoring and evaluation and quality of AI services. In view of the foregoing, there is a need to investigate how monitoring and evaluation influences the role played by post-privatization management practices among different legal forms of AI service providers on the quality of artificial insemination services as perceived by farmers who are the end consumers of the services as well as the AI service providers.

1.3 Purpose of the Study

This study investigated the influence of post-privatization management practices and monitoring and evaluation strategies on quality of artificial insemination services in cattle in Nyeri County, Kenya.

1.4 Objectives of the Study

The specific objectives of the study were:

1. To establish the extent to which artificial insemination capacity building influences quality of artificial insemination services in Nyeri County.
2. To determine the influence of technology application on quality of artificial insemination services in Nyeri County.
3. To determine how Legal Status of service provider influences quality of artificial insemination services in Nyeri County.
4. To establish the combined influence of post-privatization management practices on quality of artificial insemination services in Nyeri County.
5. To establish the moderating influence of monitoring and evaluation strategies on the relationship between post-privatization management practices and quality of artificial insemination services in Nyeri County.

1.5 Research Questions

This study was guided by the following research questions:

1. To what extent does capacity building influence quality of artificial insemination services in Nyeri County?
2. To what extent does technology application influence quality of artificial insemination services in Nyeri County?
3. How does Legal Status of service provider influence quality of artificial insemination services in Nyeri County?
4. What is the combined influence of post-privatization management practices on quality of artificial insemination services in Nyeri County?
5. What is the moderating influence of monitoring and evaluation on the relationship between post-privatization management practices and quality of artificial insemination services in Nyeri County?

1.6 Hypotheses

This study was guided by the following hypotheses:

1. H_1: Capacity building has a significant influence on quality of artificial insemination services in Nyeri County.
2. H_1: There is a significant relationship between technology application and quality of artificial insemination services in cattle in Nyeri County.

3. H_1: There is a significant relationship between the legal status of AI service provider organization and quality of Artificial insemination services in Nyeri County.
4. H_1: Post-privatization management practices have a significant combined influence on quality of artificial insemination services in Nyeri County.
5. H_1: The relationship between post-privatization management practices and quality of artificial insemination is moderated by monitoring and evaluation strategies.

1.7 Significance of the Study

This study may be a significant endeavour in promoting quality conscious service provision both in the AI field and in other fields of practice in both the private and the public sectors. It is expected be useful to AI service providers because it may provide information that can help accelerate business growth, thus creating more wealth and also providing opportunities for employment to the youth and other people interested in dairy production.

This study is likely to be particularly beneficial to farmers as it may provide greater insights on quality and business approach to farming thus shifting from the common consumptive and sentimental approaches. The staff of the State Department of Agriculture, Livestock and Fisheries; researchers and other stakeholders will benefit from the information which can be applied in policy formulation and decision making on matters relating to AI. Farmers may be sensitized through the information in order to demand quality services from service providers. The trainers of AI service providers who include Universities and Tertiary Institutions can incorporate quality matters into their curriculum in order to produce graduates who are better informed on modern customer focused AI business management.

Economic planners may benefit from the study as they may be able to incorporate aspects of quality implementation and monitoring in their plans in order to ensure better sustainability of programmes and policy. Project Evaluators may also use the information to develop tools that might incorporate quality aspects in project monitoring and evaluation while future researchers might be able to obtain data and information that can be used for further research and for developing content for training in quality of service and in the practice of artificial insemination in general.

This study may also be important to the Government and other service providers as it may strengthen the concept of quality in service provision thus de-emphasizing the construct that

it is only important in tangible commodities. It can be useful in influencing economic trends positively by helping entrepreneurs have a consideration of quality of service in their undertakings. This is because the service industry is currently the fastest growing industry hence competition is likely to grow exponentially.

1.8 Delimitations of the Study

This study was a cross-sectional investigation which was carried out in Nyeri County. This County was selected because it represented both small scale and medium scale dairy keeping areas of Kenya. Small scale farmers were found in the southern parts of the County where the average land size was 1 acre while medium scale areas were found in the northern parts which had an average land size of 7 acres. Nyeri County also had a representation of the three legal forms of AI service providers which were the subjects of this study. The study only covered artificial insemination services in cattle because the practice was still nascent in other animal species and therefore did not experience any post-privatization change.

1.9 Limitations of the Study

This study was limited by the fact that it was carried out in an area consisting of small and medium scale farmers with few demographic differences in terms of culture, geographical conditions and economic systems. This means that the findings cannot be generalized wholly in areas with different conditions and may only be generalized with caution in areas with similar conditions. In order to mitigate against this limitation, the research used a sample that was as diverse as possible through systematic random sampling, transect mapping and using different strata of stakeholders in the artificial insemination industry to corroborate the data collected. The research also used different data collection tools namely questionnaires and interviews on different strata for purposes of triangulation.

The other limitation was brought by the fact that AI service providers operated as mobile units and were hard to find in one place for purposes of responding to the study. This limitation was dealt with by issuing questionnaires at the County Semen Depots. The service providers picked the instruments during their visits to replenish their stocks. Some of the questionnaires were filled during the collection visit while others were picked and returned during the next visit after which the researcher collected them from the depot.

The study was a cross-sectional. This brought the limitation that data was collected at one point in time thus the long term effect of the independent variable on the dependent variable could not be established. Further longitudinal studies can be carried out in order to provide further insight into the long term relationship between the variables.

1.10 Basic Assumptions of the Study

It was assumed in the study that the selected respondents would be available and willing to give the necessary information for the research and that there would be adequate and accessible resources to carry out the research. It was also assumed that there was widespread use of AI by farmers as indicated by RoK (2010b).

1.11 Definition of Significant Terms Used in the Study

Artificial Insemination Is a procedure of manually depositing semen into a female cow's reproductive tract for purposes of fertilization.

Capacity Building Refers to the enhancement of the AI value chain actors' ability to improve quality of services through skill improvement and provision of requisite resources.

Legal Status of Artificial Insemination Service Provider Refers to the different forms of organizations providing artificial insemination services which include private practitioners, cooperative societies and self-help groups.

Medium Scale Farmer Refers to a farmer whose land size is between five and twenty acres.

Monitoring and Evaluation Strategies Refers to the tools, organizational structures and procedures for collecting, analyzing and disseminating monitoring and evaluation data on artificial insemination.

Post Privatization Management Practices Refers to the processes employed in the organization and implementation of artificial insemination services in Nyeri County.

Quality of Artificial Insemination Services Refers to the various parameters that point out the level of satisfaction derived from artificial insemination services.

Small Scale Farmer Refers to a farmer whose land size is less than five acres.

Technology Application Refers to the use of scientific approaches in artificial insemination.

1.12 Organization of the Study

This study is organized into five chapters. The first chapter contains the introduction which sets out the context of the study consisting of the background, the objectives, the research questions, assumptions, limitations and delimitation of the study. The second chapter contains literature review on work done by other scholars on topics related to the dependent and independent variables in an effort to establish knowledge gaps that would be addressed in the process of conducting the research. The third chapter contains the research methodology which was used in the research. It details the study population, sample sizes and sampling procedures, research tools and data collection methods and how the data was analysed to give information that can help in making conclusions for the study. The fourth chapter contains data analysis, presentation and interpretation of findings of the study while the fifth chapter contains summary of findings, discussions, conclusions and recommendations. The main chapters are backed by preliminary pages, references and appendices which include an introduction letter, data collection instruments and copies of the research permits and maps showing the study site.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter gives a literature review on the moderating influence of monitoring and evaluation on the relationship between post-privatization management practices and quality of artificial insemination services. It contains topics on the situation analysis of the AI Services in Kenya, quality of artificial insemination services in cattle; post-privatization management of artificial insemination services; capacity building and quality of artificial insemination; technology application and quality of artificial insemination services; legal status of service provider organization and quality of artificial insemination services and; moderating effect of monitoring and evaluation. It further gives a theoretical review of Balance Theory; Service Marketing Theory and; SERVQUAL Theory. The chapter finally gives the theoretical framework and the conceptual framework for the study.

2.2 Situational Analysis of AI Services in Kenya

Privatization of AI services led to a situation in which the service had to be taken over by non-state organizations. The emerging service providers rendered their services in limited geographical areas mainly due to low financial capacities. According to Nadler, Tushman and Hatvany (1980), an organization is defined by four main characteristics namely an environment, resources, history and strategy. Though these organizations may be weak in one or more of these characteristics, there is a possibility that they have been growing with the passage of time since they were introduced.

A peculiar kind of oligopoly in AI service provision emerged after privatization in which farmers are the consumers of services rendered by specially qualified service providers, thus turning the service into a typical business to customer (B2C) market environment. The Government further detached itself from the process of controlling prices hence market forces were allowed to come into play in the process of market liberalization. The competition for market share has forced AI service providers to incorporate aspects of quality in their services. According to Kranton (2008), Consumers decide whether to buy from a firm on the basis of its past quality decisions.

Privatization was meant to improve quality of service and the effectiveness of Artificial Insemination. However, Mogoa, Omiti, Tsuma and Bwanga (2004) demonstrated that data

between 1990 and 1998 shows a disparity in the performance of AI services and a decrease in the total number of inseminations in different parts of the country by 73.5% from 394,361 in 1990 to 104661 in 1997. This is further confirmed by RoK (2014) who demonstrate that the trend went downward to its lowest in 2002 when 78,771 inseminations were recorded countrywide. Since then, the trend has risen slowly to 222,000 inseminations in the year 2013. Figure 3 illustrates the trends in artificial inseminations between 1989 and 2013:

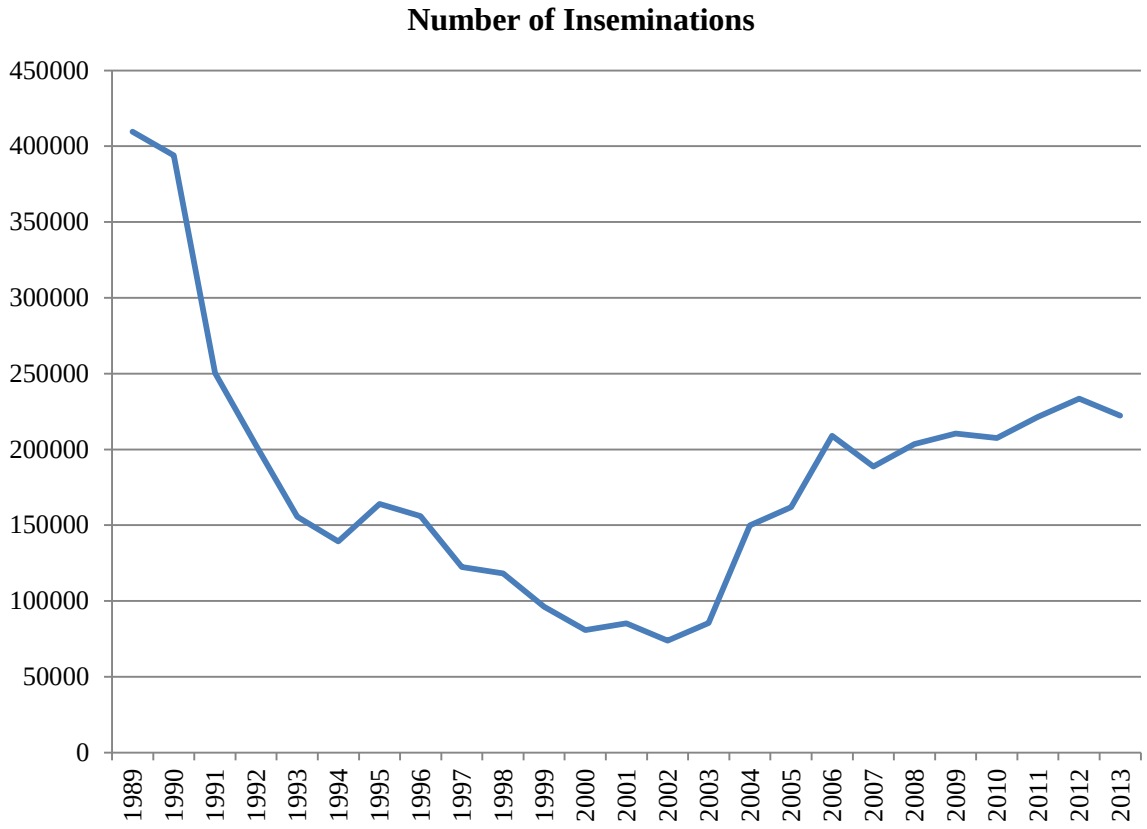

Figure 2. The Kenyan AI Value Chain

(Source: RoK, 2014)

Various projects and programmes have been implemented in Kenya to improve the dairy industry through AI among other interventions. Perhaps the project with the greatest impact was the Dutch Government funded National Dairy Development Project (NDDP) whose implementation started in 1990, with the goal of introducing an intensive dairy management system known as the zero-grazing system initially in six districts of the country but later expanded to cover 25 districts (Muriuki, 2014). In this project, a well-established AI service which was at that time heavily subsidized was one of the enabling factors. Apart from providing further support to AI, the project also had a research unit which together with extension personnel developed standardized extension resources for dissemination to farmers.

Other institutions that have provided support to AI and the dairy industry in general include the United Nation Development Programme (UNDP), Heifer Project International (HPI), Swedish International Development Agency (SIDA) and World Bank among others. These institutions provide support in specific technical areas like AI, extension support, and in some cases logistical support (RoK, 2010b).

Preliminary information indicates that there are 104 AI service providers who include 94 in private practice, 6 in Cooperative societies and 4 self-help groups (DVS, 2013). The self-help groups (SHG) are distributed in Mukurweini and Mathira East and West Sub-Counties while Cooperative societies offering AI services are distributed in Kieni East and Kieni West Sub-Counties. The rest of the Sub-Counties namely Nyeri Central, Tetu and Nyeri South (formerly Othaya) are mainly served by private practitioners. The number of AI service providers is considered representative of AI service providers who offer the services to farmers in Kenya.

2.3 The Artificial Insemination Value Chain in Kenya

The term value chain was coined by Porter (1985) to refer to a set of activities that are performed to design, produce and market, deliver, support a product. It consists of two major categories of activities. The first category is that of primary activities which consists of inbound logistics for inputs; operations; outbound logistics; marketing and sales as well as service in the core value chain creating direct value. The second category consists of activities that support the primary activities of the value chain. These include procurement, research and technology development, human resource management and infrastructure development and maintenance.

The AI value chain in Kenya consists of a chain that starts from bull breeders who are the primary sources of semen. This semen is transferred to laboratories where it is tested, cooled to 4^{o}C and diluted. It is then stored in a special nitrogen tank where it is frozen to -196^{o}C, awaiting distribution to semen depots all over the country. When time comes for distribution on demand by the distributors, the semen is transported to distribution points in the counties where it is stored further awaiting collection by the inseminators for use when demanded by farmers. Watson (1990) indicates that the same procedure is followed in collecting imported semen. However, the semen is imported into Kenya only after it has been frozen to -196^{o}C. An adaptation of Porter's Model to the Kenyan AI value chain is shown in Figure 2.

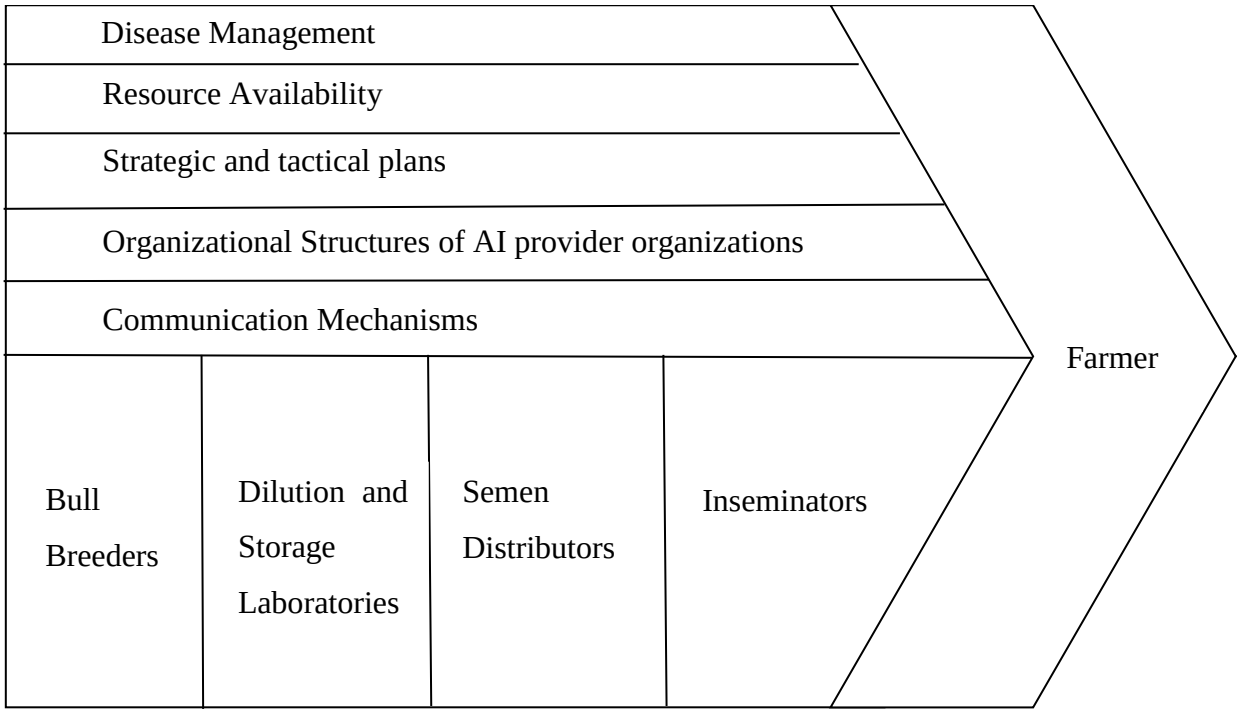

Figure 3. Trends in AI between 1989 and 2013

(Source: Adapted from Porter, 1985).

One of the major reasons for the introduction of AI services was the management of reproductive diseases in cattle. While diseases transmitted by cattle were contained, the challenges of diseases transmitted by the inseminator or his equipment have been reported. According to Eaglesome and Garcia (1997) and Morell (2011), pathogenic micro-organisms in semen for AI are likely to come from various sources. Bacteria may be acquired during semen handling from the bull's prepuce or abdomen as well as the handler or unsterile equipment. Viruses may be acquired from an infected animal or due to cross contamination. The management of reproductive diseases is therefore an integral part of the value chain if quality of AI services is to be realized.

Resources in AI include technical and logistical equipment used in the value chain as well as the funds required to acquire them. According to Mburu, Ojango, Kariuki, and Baltenweck (2011) the resource constraint has a direct effect on the uptake of AI services in Kenya. Resource constraints are likely to occur where both the farmers and AI service providers are financially constrained. This study sought to investigate the distribution of AI related resources and how they affect quality of services.

2.4 Quality of Artificial Insemination Services in Cattle

Quality of service has become an important research topic because of its apparent relationship to costs, profitability, customer satisfaction, customer retention, and positive word of mouth (Buttle, 1996), all of which have a direct influence on performance in any AI service providing organization. Quality of service and consumer satisfaction are related, but distinct constructs. Oliver (1981), Parasuraman, Zeithaml and Berry (1988); and Cronin and Taylor (1992) suggest that the difference between the two is that quality of service is a long-term overall evaluation, whereas consumer satisfaction is a transaction-specific measure. However, it is the view of the researcher that quality is an attribute of the product while satisfaction is manifested in the consumer.

Studies in artificial insemination have dwelt on the technical and scientific aspects of the subject but have not dwelt on the business aspect, neither have they dwelt on issues of the quality of service rendered by the service providers. Studies on quality of service have mainly been carried out in four service categories which are retail banking, credit card, securities brokerage and product repair and maintenance (van Ree, 2009). However, in any business including AI service provision, consumers are arbiters of value (Priem, 2007). Quality of service in artificial insemination services cannot therefore be properly defined without considering the perception of the service consumer, who according to the context of AI in Kenya is the farmer. According to Ouma (2008), the demand for AI services is related to the farmer's education level, age, experience, herd size and breeds of cattle kept.

Literature indicates that there are few studies done on service providers' perception of quality of services, According to Lantis, Green, and Joyce (2002), information about providers' perspectives on quality of service in a healthcare system is surprisingly limited. This also applies to other fields including artificial insemination services. In a study on service quality in the Mauritian Public Services, Ramseook-Munhurrun, Lukea-Bhiwajee and Naidoo (2010) found that while there is a significant shortfall in meeting customer expectations, service providers appear to have a good understanding of what consumer expectations actually are. This indicates that there could be other factors that affect the quality of service provision which suggests further investigations on how service providers perceive quality.

Measurement of quality of services in different fields has involved the use of a number of indicators which have been identified variously depending on the model used. Gronroos (1982a), Lehtinen and Lehtinen (1992), Gummenson (1991) and Edvardsson (1992) identified ten determinants of quality of service which Parasuraman, Zeithaml and Berry (1985) used to develop a conceptual model for measuring quality of service known as SERVQUAL. These determinants are reliability (consistency of performance and dependability); responsiveness (willingness and readiness to perform services); competence (possession of skills and knowledge to perform); understanding (knowing the customer's needs and requirements); access (approachability and ease of access to management); communication (providing the customer with effective information); courtesy (friendliness of personnel and ownership); credibility (trust and personal characteristics of personnel); security (personal safety, financial security, and confidentiality) and; tangibles (physical evidence of service).

Further research led to the reduction of the ten determinants of service quality into five specific dimensions. According to Parasuraman *et al* (1988), these dimensions were listed as: reliability (ability to perform service dependably and accurately); responsiveness (willingness to help and respond to customer needs); empathy (the extent to which caring and individualized service is given); assurance (ability of staff to inspire confidence and trust) and; tangibles (physical facilities, equipment and staff appearance). These determinants of quality of service are applicable in any service business including the artificial insemination industry. It is based on these determinants that quality of AI services is viewed as conception rates; service timeliness; breed type; semen storage equipment type; calving interval and; milk production. The relationship between post-privatization management practices and quality of AI services was therefore studied based on these parameters.

All aspects of quality of AI services must bear on the consumer's needs and wants and it is him who determines what to consume thus influencing the producer's specification of his products. Since the AI Industry is a value chain consisting of various stakeholders, every level in the value chain represents a stakeholder who is both a service producer and consumer and therefore quality of service affects all levels of the value chain. Some authors, however dispute the importance of quality to any firm, including the AI service providing firms. Priem (2007) observes that "remarkably, some strategy scholars (Makadok and Coff, 2002), argue that an understanding of consumer utility is largely superfluous to the overall goal of the

strategy field which is to explain firm profitability, determined by the value captured by the firm". This argument does not consider the fact that utility which depicts ability of a product or service to satisfy is largely a factor of quality hence farmers will not be willing to procure AI services unless they expect to derive satisfaction from them. Quality will thus directly influence the quantity of AI services demanded in the market, thus affecting sales volumes and prices, which in turn directly influence the service provider firm's profitability.

2.5 Post-Privatization Management and Quality of Artificial Insemination Services

The privatization of AI services completely changed the management architecture of the practice. The provision of services was to be taken over by private sector organizations which received no financial backing, in an environment where farmers were not obliged to take services from any particular service provider hence the market was meant to be regulated by forces of demand and supply (RoK 1997b). Key among the emerging management practices were the role of capacity building; the application of technology and; the Legal Status of the resultant service provider organization which form the independent variables of this study. Sections 2.6, 2.7 and 2.8 discuss the management practices emerging after the privatization of AI Services.

2.6 Capacity Building and Quality of Artificial Insemination

Capacity may be defined as the ability to define and realize goals, where defining goals entails identifying and understanding problems, analysing the situation, and formulating possible strategies and actions for response (Segone, Patel, Rouge and Russon, 2006). Segone (2010) explains that capacity development is about creating conditions which support the appropriate actors in assuming the appropriate roles in the process of identifying problems and defining and realizing goals. Capacity building in AI services may therefore be seen as the intentional provision of skills and tools which build up an environment that continuously creates and sustains overall organizational processes needed for making the provision of quality AI services routine. This would therefore imply having an environment that supports resource allocation, continuous learning and skill development and in some cases having mechanisms for performing the monitoring and evaluation function.

Capacity involves knowledge, skills, and problem-solving and decision-making capabilities, as well as resources, supports and structures (UWE, 2008). It is consistent with transformational education and empowerment education, involving activities and processes

that help create, strengthen, and sustain the capacities of AI industry stakeholders and especially with the continuous research and development of new breeding techniques being developed constantly. Such activities and processes include training; technical assistance; mentoring; coaching; developing and/or sharing of learning materials; supporting communities of practice; building resources and support and; promoting a favourable organizational environment to sustain monitoring and evaluation (Taylor-Powell and Boyd, 2008) and the practice in general. These activities and processes can be described in a three-component framework of professional development; resources and supports and; organizational environment.

The ultimate goal of AI capacity building is a sustainable AI practice where practitioners use information and skills for decision-making and provision of quality AI services. According to Preskill and Boyle (2008) Capacity Building involves the design and implementation of teaching and learning strategies to help individuals, groups, and organizations, learn about what constitutes effective, useful, and professional practice. For any practice to be sustained, participants must be provided with leadership support, incentives, resources, and opportunities to transfer their learning to their everyday work. Sustainable practices also require the development of systems; processes; policies; and plans that help influence the way organizations accomplish their missions and strategic goals (Preskill and Boyle, 2008). Efforts have often focused on increasing the capacity based on supply-driven approaches, yet addressing demand is just as important (McDonald, Rogers and Kefford, 2003). It is therefore imperative to ensure that capacity building is tailor-made to meet specific needs of the AI service providers and of the consumers of AI services.

Capacity building has a positive correlation with the quality of services provided. Hui, Lam and Schaubroek (2001) demonstrated that customer satisfaction and conformance improved more where trained quality of service leaders were in place than where there were none in a retail banking environment. According to Ndwiga, Abuya, Mutemwa, Kimani, Colombini, Mayhew and others (2014), capacity building of service providers on integrated HIV, sexual and reproductive health services through peer mentorship motivated them to provide quality services to clients. It is based on this that the study was conducted to investigate whether the same relationship applies in the AI industry in which the AI service providers are the contact persons with the end consumers in the AI value chain, hence can be seen as service leaders. The study also investigated how privatization has affected the AI capacity building process.

2.7 Technology Application and Quality of Artificial Insemination Services

Technology can be defined as the material artefacts used to achieve some practical human purpose and the knowledge needed to produce and operate those artefacts (Braun, 1998). For a long time, the evolution of technology has involved procedural changes on how tasks are done but with the advent of computers, technological changes have leaned towards automation of processes using computer based applications. The same has been the case in artificial insemination where tremendous technological changes have taken place since the first insemination was done.

Use of sex selected semen in AI involves the filtration of semen such that sperm with the X chromosome is separated from that with the Y chromosome. Early research on the use of this technology was done by the United States Department of Agriculture (USDA) before the year 2000. According to Thomas (2015), the first calf borne of frozen sexed semen through AI was born in 1999. In 2004 this process became commercially available in USA through a company called Sexing Technologies with laboratories in Texas, Ohio, Wisconsin and Brazil.

Karabinus, Marazzo, Stern, Potter, Opanga, Cole and others (2014) note that only one method of semen sex selection, flow cytometry is effective. This process consistently results in semen sorted with 90% of the desired sex. While the accuracy is great, the speed and yield of the process is slow and low. In addition, the equipment is extremely expensive and specially trained technicians are needed to assure sorting accuracy. Therefore, there is a fixed cost associated with sorting, which has to be loaded into the cost of insemination.

Oestrus synchronization involves manipulating the oestrus cycle in cows so that they can be bred at a time that is convenient to the farmer. It is done in most cases to make a herd of cows to breed at the same time for ease of management. According to Larson (2014), oestrus synchronization can be a very beneficial tool for dairy producers. Some of the benefits are that synchronization facilitates AI; the use of a synchronization programme can improve the reproductive performance of the herd; a synchronization programme will help decrease the average days in milk (DIM) of the herd, decrease the DIM at first service after calving, and decrease the calving interval. These are all factors that increase profitability.

In order to synchronize a group of cows or heifers into heat and induce ovulation, hormones have to be administered at specific times following a standardized system (O'Connor, 2014). Hormones used in oestrus synchronization include prostaglandin, gonadotropin releasing hormone (GnRH) and Progesterone. The administration of the hormones is done to induce ovulation at the desired time such that AI can be introduced to produce a calf at a planned point in time.

Application of information and communication technology (ICT) in AI refers to the use of electronic media in data collection, analysis, transmission, reporting, storage and developing solutions to problems in AI service provision. In the current world, the use of digital electronic media to perform those tasks has become an integral part of any type of business process. The use of ICT in the AI field is supported by advantages such as a much faster processing of data; information systems can be used to develop information repeatedly with consistent quality; faster and accurate archival and retrieval of data; ease of storage of large quantities of data without consuming much space and; extremely fast communication over vast geographical areas (Ogbomo and Ogbomo, 2008).

Before privatization, there was no use of ICT in the AI industry hence tasks related to data collection, analysis and dissemination of data were performed using pen and paper, which made them prone to error, difficult to conduct on a large scale, and high in transaction costs. Information and communication technology (ICT) tools, including hardware and software that allows users to upload data to storage facilities in real-time have reduced the conventional challenges associated with remote data collection (e-Agriculture, 2012).

Advancement in ICT has taken place to the extent that package software has been developed to aid in solution of various problems in the dairy industry, including genetic matching to establish propensity scores for preferred genetic traits in offspring (Diamond and Sekhon, 2012). Both proprietary and package softwares have been developed to enhance data collection, analysis and use in the AI field of practice. Such softwares have also been developed for specific projects and incorporated into project management information systems making the use of specialized ICT technologies in monitoring and evaluation an unavoidable process. The advantage of having proprietary ICT technologies is that they address specific issues or programme information needs. Their disadvantage, however is that they may be quite expensive and may be prone to mistakes in programming which may

translate into the production of invalid data (Bouras, Kokkinos and Tseliou, 2012), which in AI can lead to immense losses for farmers. Software produced today for purposes of monitoring and evaluation undergoes repeated improvements to the extent that any errors in the processed data are more likely to be attributed to user error than to coding. Feder *et al* (1985) found that the relationship between farm size and ICT adoption depends on many factors such as fixed costs, risk preferences, human capital, credit constraints, labour requirements and tenure agreements.

Technology application has been argued to be one of the key success factors for firms, mainly because the world is shifting to a techno – economic paradigm, both in commodity and service firms. This is well demonstrated in the AI field where technological advancement among all players including small scale farmers, AI service providers and Veterinary Officers is growing rapidly. Sapprasert (2006) demonstrated that both productivity and profitability growth were significantly linked to the level of ICT usage intensity in service firms especially when undertaken jointly with non-technological innovations.

2.8 Legal Status of Service Provider and Quality of Artificial Insemination Services

Privatization of AI services culminated into the emergence of three legal forms of service provider organizations namely cooperative societies, self-help groups and private AI service providers. This study sought to investigate if there is a significant difference between the three service provider forms in terms the quality of AI services realized.

Cooperative societies are registered under the Cooperative Societies Act, Chapter 490, Laws of Kenya (RoK, 2012b), in which they are described as "a society of at least ten persons who are registered as a cooperative society by the Commissioner of Cooperative Development, with or without limited liability". Membership is by shareholding in which no member is entitled to more than 20% shareholding. A cooperative society is considered as a body corporate with perpetual succession and common seal, with powers to hold movable or immovable property of every description and to sue and be sued. Apart from the Cooperative Societies Act, cooperative societies have individual society by-laws which bind the co-operative society and the members. These by-laws also stipulate the nature of business of each society. The Cooperative Societies Act also allows at least two cooperative societies to form and register a Cooperative Union whose membership is the individual societies, but is treated as a cooperative society under the Act. According to Gunga (2008), there are over

11,200 registered cooperative societies in Kenya with a membership of over 6.1 million persons; mobilized domestic savings estimated at over Kenya Shillings 125 billion and employing over 300,000 people.

Cooperative societies which provide AI services in Nyeri County are registered as Dairy Cooperative Societies constituted for the purpose of marketing milk and other farm produce. There are six active cooperative societies in total, which have also formed the Nyeri County Dairy Producers Cooperative Union with the aim of improving farmers' earnings from dairy production through value addition of milk. Coltrain, Barton and Boland (2000) describe value addition as "to economically add value to a product by changing its current place, time, and form characteristics to characteristics more preferred in the marketplace". The Cooperative Union is in the process of establishing a milk processing factory to enable it achieve that aspiration.

Self-help groups consist of a group of people who come together to deal with an issue of common interest. They are loosely bound by law and membership is only restricted by members' acceptance and common interest. They are however, registered by the Commissioner of Social Services. Though the self-help groups are required to have a constitution before registration, the Kenyan law does not confer any legal status to them hence they cannot be considered as body corporates. Desai and Joshi (2013) suggest that members of self-help groups are likely to have greater participation in local programmes; they exercise greater control over decision making and have a greater awareness of where to express grievances about public services.

Preliminary data shows that there are four AI service providing self-help groups in Nyeri County, which are mainly distributed in the eastern part of the County. These groups were mainly started for the purpose of milk marketing after the collapse of cooperative societies in the region, but have divested to providing AI services. Their business is mainly on a transactional basis and profits are usually distributed on a prorata basis. Though self-help groups are formed for a particular purpose, their roles have evolved over time due to the changing needs of the members (Sundaram, 2012).

Private AI service providers are single proprietorships with low level capitalization. These service providers set up business mainly to provide clinical services but later divest into

providing AI services. According to RoK (2010b), a person is required to have undergone at least a two year training programme in animal production or animal health, in order to engage in AI service provision. Cooperative societies and self-help groups are also required to employ duly qualified personnel in order to provide the services.

There are 94 private AI service providers whose qualifications vary from a university degree to certificate level training in Nyeri County. Though these AI service providers are required to register and be licensed by the Veterinary Department, it is not clear how many unlicensed persons are providing the services mainly due to the inability of the State Department of Veterinary Services to closely monitor the value chain due to logistical reasons (RoK, 2010b). This research studied the contribution of each of the three legal forms of AI service providers with a view of trying to recommend on the best approach towards forming an AI service providing organization.

2.9 Moderating Influence of Monitoring and Evaluation

A monitoring and evaluation system for the AI value chain can be thought of as a set of critical parts or constituents, which individually would not function effectively but when put together achieve the purpose for monitoring and evaluation in the AI value chain. IFAD (2014) describes a well-functioning monitoring and evaluation system as one that manages to integrate the more formal, data-oriented side commonly associated with the task of monitoring and evaluation together with informal monitoring and communication. Ograjensek (2003) demonstrated that an integral approach to the use of statistical methods can be proposed in continuous service quality improvement. This implies that a system has to be more realistic and practical than just conforming to principles; hence though there are basic components one would expect in any system, no monitoring and evaluation system is completely similar to another.

Perhaps the most critical questions to have in mind when deciding on a monitoring and evaluation system for the AI value chain are the type of data required; how that data will be collected and; the use to which it will be put. Data on quality of artificial insemination services may be based on the five dimensions of quality of service namely reliability; accessibility; tangibles; empathy and responsiveness. The indicators would therefore give the impetus for developing a data collection system thus enabling the Department of Veterinary Services, which is in charge of AI and service providers, to reap the benefits of using it as a

tool for policy formulation, budgetary planning and implementation. According to Bamberger (2009) many funding agencies and evaluation specialists have tended to assume that, once a developing country Government has seen the benefits of a few well-designed evaluations, the process of building a systematic approach for identifying, implementing, and using evaluations at the sector and national levels, will be relatively straightforward, a fact that may not necessarily hold true for all situations.

Practitioners generally agree that a monitoring and evaluation system should at least be composed of people, procedures, tools, data and technology which interact to provide timely information based on current data to enable managers and stakeholders to make appropriate decisions about a project or programme. According to Gorgens and Kusek (2009), a monitoring and evaluation system should have twelve components classified into three major categories that will be used as a basis for evaluating the monitoring and evaluation system in the AI value chain. These categories are people, partnerships and planning; collection, capture and verification of data and; using data for decision making.

People, partnerships and planning largely refers to the human role in monitoring and evaluation. Gorgens and Kusek (2009) classify this group of components as consisting of organizational structure; capacity; partnerships; monitoring and evaluation plans; budget and; advocacy, communication, and culture for monitoring and evaluation systems. The human role is integral in any monitoring and evaluation system in which they are referred to as stakeholders. In a report by the South African Department of Planning, Monitoring and Evaluation (DPME, 2014), Monitoring and Evaluation often has little influence in departments due to a lack of understanding of its value amongst political and administrative leadership. Senior management often fails to champion monitoring and evaluation, and there is often weak alignment of the practice to policy priorities, planning and budgeting.

The degree of participation of the stakeholders in a monitoring and evaluation system for the AI value chain can vary along a continuum from low to high based on what key steps or activities the stakeholders are involved in. Some steps are more pivotal than others in shaping results. This implies that some stakeholders are primary stakeholders who participate directly in the monitoring and evaluation process while others are secondary since they are only remotely involved in various stages. Regardless of the level, participation is the factor that translates stake holding into tangible benefits. AfDB (2001) holds that increasing stakeholder

participation in a monitoring and evaluation activity contributes to the quality of the results and increases objectivity by achieving balanced analyses, recognizing biases and reconciling perspectives of different stakeholders. It also results in greater accuracy, completeness and fairness of monitoring and evaluation results. This, however, can only be achieved through proper monitoring and evaluation planning and implementation in a structured environment.

Tools mostly used for quantitative data collection in the AI field include codified forms, standardized tests and scaled questionnaires while structured and semi-structured questionnaires, observation checklists and interview guides are mostly used for qualitative data collection. Challenges in transcribing, coding and entering data have led researchers and evaluators to come up with new ways of collecting data that are more efficient and accurate. Researchers have evolved their methods continually, often due to technological breakthroughs that have enabled them to collect, analyse or present data in innovative ways or to obtain a stronger authenticity or reflection of participant perspectives (Markle, West and Rich, 2011). The use of electronic data gathering instruments is gradually replacing the traditional instruments in organizations that use large amounts of data that has to be collected on a regular basis thus enabling the data to be coded and entered on site. This also applies to the AI field as dictated by the evolving trends in the use of technology in managing quality of services.

Stakeholders in the AI field have continued to improve data collection systems gradually to incorporate the use of new and upcoming technologies. Computer based information systems have become major determinants of data collection systems to the extent that it is difficult to think of monitoring and evaluation systems and processes without the use of computer software and hardware. Computer based data collection systems have driven the trends towards automation of the processes thus making data collection easier and more supportive to decision making. According to Carlos, Fernando, Carlos, Jorge, Armando and Giovanni (2013) automation of data collection and analysis processes have several practical advantages such as: providing always-on, real-time data collecting; eliminating manual collecting work and possibility of typing errors, and; easing the deployment process, as wireless networking means no need for cabling.

Data collection, capturing, verification, analysis and feedback make up the implementation of monitoring and evaluation plans. Such implementation entails routine monitoring; periodic

surveys; databases establishment and management; supportive supervision and data auditing and; evaluation and research. It is therefore true that the use of resources is very critical to the successful implementation of the monitoring and evaluation system. Saxena (2012) highlights the challenges in implementing monitoring and evaluation systems as having supply driven systems that die off with the removal of donor funding; lack of appreciation of evidence based monitoring and evaluation to fulfil political correctness and popular belief; a rigid system that doesn't change with the changing environment; having systems that do not scientifically attribute success to projects or programmes; systems that do not have a provision for evaluation; inadequate resources and capacity for monitoring and evaluation; politicization of monitoring and evaluation systems; one way systems that do not accommodate feedback; systems that only focus on successes and overlook failures; lack of leadership and will to champion monitoring and evaluation; low risk-reward ratio for monitoring and evaluation; difficulty in obtaining appropriate data; poor definition of objectively verifiable data; inability to maintain monitoring and evaluation practitioner's independence of view and; limitations in the coverage of the dissemination of findings.

Studies carried out over a long time by numerous authors have shown that information flow along the value chain is a key component of quality of service management in any field of practice or economic activity, including the artificial insemination industry (Bates and Jones, 2012; Gosling, 2010 and Tache, 2011). Organizations or projects therefore, need to sustain monitoring and evaluation processes that enhance information flow in order to maintain and manage quality of service. Data collected on projects and programmes is processed and transmitted so that it can be used to make decisions about changes that can be instituted in order to improve quality.

A monitoring and evaluation system cannot be complete without a system for communicating data from collection points and also transmitting findings from evaluators and analysts to various information consumers. This study viewed communication from the perspective of Shannon and Weaver's Model in which information flow consists of information which is developed at a source, encoded and transmitted through a medium to a receiver who has to decode it in order to make meaning out of it, subject to environmental noise (Al-Fedaghi, 2012). After privatization of the AI services, many players came into place with little Government control over the communication that took place between them. This made the flow of information more complex as each of the stakeholders in AI, including the Veterinary

Department, self-help groups, Cooperative societies providing AI service and the farmers was either a source or a recipient of information at different times.

Literature on monitoring and evaluation of AI in cattle is generally scarce. However, in an overview of monitoring and results measurement system in a project for livestock development in the Syunik Region, the Armenian Strategic Development Agency (SDA) (2012) demonstrates that a monitoring and evaluation system in livestock production projects should be based on the project logical framework and the result chain. This implies that monitoring and evaluation systems for AI should be similar to any other system only that it should be differentiated by the programme logic which varies from one project to another. This study sought to investigate the Influence of privatization on the organization of the monitoring and evaluation system in the AI value chain in Kenya as one of its objectives.

2.10 Theoretical Review

This study was guided by the Balance Theory, The Service Marketing Theory and the SERVQUAL Theory which are reviewed below:

2.10.1 Balance Theory

The Balance Theory was proposed by Heider in 1958 in order to explain how the interrelationship between service organizations, service providers and consumers influence quality of services. The theory explains that there are three interrelated factors which shape relationships between parties in the triad which are sentiments; values and unit relation. Carson, Carson, Knouse and Roe (1997). In artificial insemination, the triad involves service provider organizations, inseminators and farmers who must interrelate to realize quality of artificial insemination services

The theory explains how and why positive or negative relationships among the parties in this triad are developed and; the consequences of these relationships on service quality, affective outcomes, and withdrawal behaviours (Carson *et al*, 1997). Examination of the "service triangle" within this framework can enhance understanding of quality service delivery and guide future research efforts in the continuous improvement domain

The strength of the Balance Theory is that it recognizes that people sometimes notice inconsistent cognitions and that this inconsistency can lead to attitude change. When people are aware of any inconsistency or imbalance in the relationship between the three players in the triad, attitude change can be realized (Zajonc, 1968). It is therefore possible using the theory to predict how people react to balanced or imbalanced situations as long as sentiments, values and unit relations are positive.

The major weaknesses of the Balance Theory are that it does not quantify the strength of the relationship between players in the triad and that it does not make predictions on how an imbalance in the relationship can be restored. Such relationships may be negative and their disparity will either increase or reduce the quality of AI services provided. Furthermore, a positive relation between two players is not affected by the relationship with the third party in the triad. Even though Cronin *et al* (1992) demonstrated that service quality is antecedent to consumer satisfaction, and consumer satisfaction is antecedent to purchase intentions, the Balance theory cannot be useful in determining the trends of consumption of artificial insemination services.

2.10.2 Service Marketing Theory

The Service Marketing Theory was proposed by Christian Gronroos in 1982. The theory describes how service businesses, which have most direct contact with consumers, are the last to adopt a consumer oriented marketing concept (Gronroos, 1982b). It theorizes that service marketing is a continuously evolving practice. The theory postulates that general theories or frameworks for service marketing development seem to have followed two quite different paths. One approach, which covers services offered by service companies, prescribes that services should be developed in a more commodity like manner, enabling the application of existing marketing theories. The second approach, which is a notion that services are different, compared with physical products, holds that marketing concepts and models have to be developed in a more service-like direction (Gronroos, 1982b).

The strength of the Service Marketing Theory is its flexibility in guiding service providers on the approaches for marketing their services. This implies that different approaches to marketing can be taken depending on situational factors. According to Jan (2012) the biggest challenge faced by service firms is heterogeneity and not intangibility. Taking varying approaches in different situations is therefore unavoidable in service marketing.

The weakness of the Service Marketing Theory is that quality of artificial insemination service is difficult to measure using the same measures as tangible commodity quality. The concern for both product and service quality is in enhancing the satisfaction of consumers in utilizing the service. Satisfaction can also be described as a fulfilment response of service and an attitude change as a result of the consumption of a product (Oliver, 1997). According to Gibson (2005) satisfied customers are likely to become loyal customers and that means that they are also likely to spread a positive word of mouth. Oliver (1997) further argues that customer satisfaction can be described as a judgement that a product or service feature, or the product or service itself, provides pleasurable consumption. Understanding which factors influence customer satisfaction makes it easier to design and deliver service offers that correspond to the market demands.

2.10.3 SERVQUAL Theory

The SERVQUAL theory was developed by Parasuraman, Zeithaml and Berry in 1985 (Parasuraman *et al* 1985). It proposes that quality of service is a function of the differences between consumer expectations in the service and the experience of the performance of service along five quality dimensions which are reliability, accessibility, tangibles, empathy and responsiveness.

The application of SERVQUAL is based on contextualizing the five dimensions to the specific service process hence its application in artificial insemination would be totally different from its application in any other field. According to Carman (1990) and Babakus and Boller (1992), SERVQUAL needs to be customized to the specific services in which dimensions of quality of service have to be redefined. This means that for one to be able to measure quality of AI services there would be need to conceptualize the dimensions in terms of indicators that are specific to the practice.

Brysland and Curry (2001) used the SERVQUAL theory to study service improvements in public services in North Lanarkshire using questionnaires with a seven point Likert scale on a sample size of 140, yielding a return rate of 52 questionnaires. All questionnaire responses were negative and an overall departmental weighted SERVQUAL score of -1.6 was recorded, indicating a significant shortfall in meeting customer expectations across all service areas and dimensions. Reliability and responsiveness received the highest gap scores meaning that they

were of high importance while assurance and tangibles received lowest scores indicating they were of low importance to the customers. Brysland *et al* concluded that SERVQUAL was a highly useful tool for measuring quality of service. They further reiterated that SERVQUAL is only useful when customized to the context in which it is applied.

Patterson (2009) used the SERVQUAL theory to perform a preliminary assessment of service quality at trial courts in Georgia. A state-wide survey of court managers was conducted using an online, modified version of the SERVQUAL instrument to identify areas where service quality improvements can be made. The study found slight-to-moderate differences in gap scores among the several classes of courts. In most instances gap scores were highest along the tangible and reliability dimensions and lowest in the areas of empathy and assurance. The study helped to suggest that additional attention and resources are needed for plain language court brochures, modern equipment and technology, and improved dependability in service delivery practices and outcomes. Study findings also suggested that certain service quality gaps could be averted with regular customer service training and greater effort to recognize and reward court staff. Seth, Deshmukh and Vrat (2004) studied the SERVQUAL Theory and expressed it as a mathematical model as follows:

$$SQ = \sum_{j=1}^{k} (P_{ij} - E_{ij})$$

Where:

SQ = overall quality of service;
K = Number of attributes.
P_{ij} = Performance perception of stimulus i with respect to attribute j.
E_{ij} = Quality of service expectation for attribute j that is the relevant norm for stimulus i.

Seth's model provides an easy understanding of the need for AI service providers to exceed farmers' expectations in order for satisfaction to be realized. However, (van Ree, 2009) found that quality of service measurements are dependent on type of service setting, situation, time and need. In addition to this even the customer's expectations towards particular services are dynamic with respect to factors like time, number of encounters with a particular service and the level of competition in the business environment.

Parasuraman *et al* (1988) demonstrated the strength of using SERVQUAL as having a high reliability and validity; can be used to compare service quality across different departments; can be used to compare service quality across different companies; the framework can be

adopted to different industries; companies can use it to better understand customer's expectations and perceptions; problems can be identified according to the different dimensions and; for identification of service trends when used regularly. According to Al Bassam and Al Shawi (2010), SERVQUAL is a tried and tested instrument which can be used comparatively for benchmarking purposes. It benefits from being a statistically valid instrument as a result of extensive field testing and refinement. It can be used on a regular basis to track customer perceptions of service quality in a particular firm compared to its competitors and is applicable across different empirical contexts and in various countries and cultural backgrounds.

Though SERVQUAL is a widely accepted theory of measuring quality of service, it still has its weaknesses. Cronin and Taylor (1992) have argued that the theory confuses satisfaction and state in which that quality of service can be described as an attitude. This in essence implies that satisfaction is a factor of long standing perceptions as opposed to the utility derived from particular transactions. They argued that it is only performance and not the combination of performance and expectation that determines quality of service and it is due to this argument that they developed the SERVPERF model as an alternative measurement tool. However, according to Jain and Gupta (2004) the SERVQUAL scale outperforms the SERVPERF scale by virtue of possessing higher diagnostic power to pinpoint areas for managerial interventions in the event of quality of service shortfalls. It is based on this argument that the researcher prefers to use SERVQUAL as the theoretical underpinning for the study.

Brogowicz, Delene and Lyth (1990) in their use of the theory have raised questions as to whether the gaps have been characterized appropriately. They also argue that the theory has a great orientation towards operational gaps, thus diverting focus from customers and reducing efforts towards understanding their needs and expectations (Brogowicz *et al*, 1990). However, it was the researcher's view that in the process of establishing the gaps between customer needs and services rendered and in trying to reduce the gap as a quality management measure, service providers would be able to clearly understand the quality needs of the farmers and develop appropriate measures to meet them.

Though the Balance Theory and the Service Marketing Theory illustrate service quality as being determined by perception and satisfaction derived from the consumption of a service,

they do not dwell a lot on the process of service quality creation. For that reason, the SERVQUAL theory was found to be more comprehensive both in terms of explaining and measurement; hence it forms the theoretical framework for the study.

2.11 Theoretical Framework

The Theoretical Framework for this study is derived from the Gap Model which was informed by SERVQUAL Theory, developed by Parasuraman *et al* (1988). It identifies quality gaps or differences along the process of a service transaction. A diagrammatic presentation of the Theoretical Framework is shown in Figure 4.

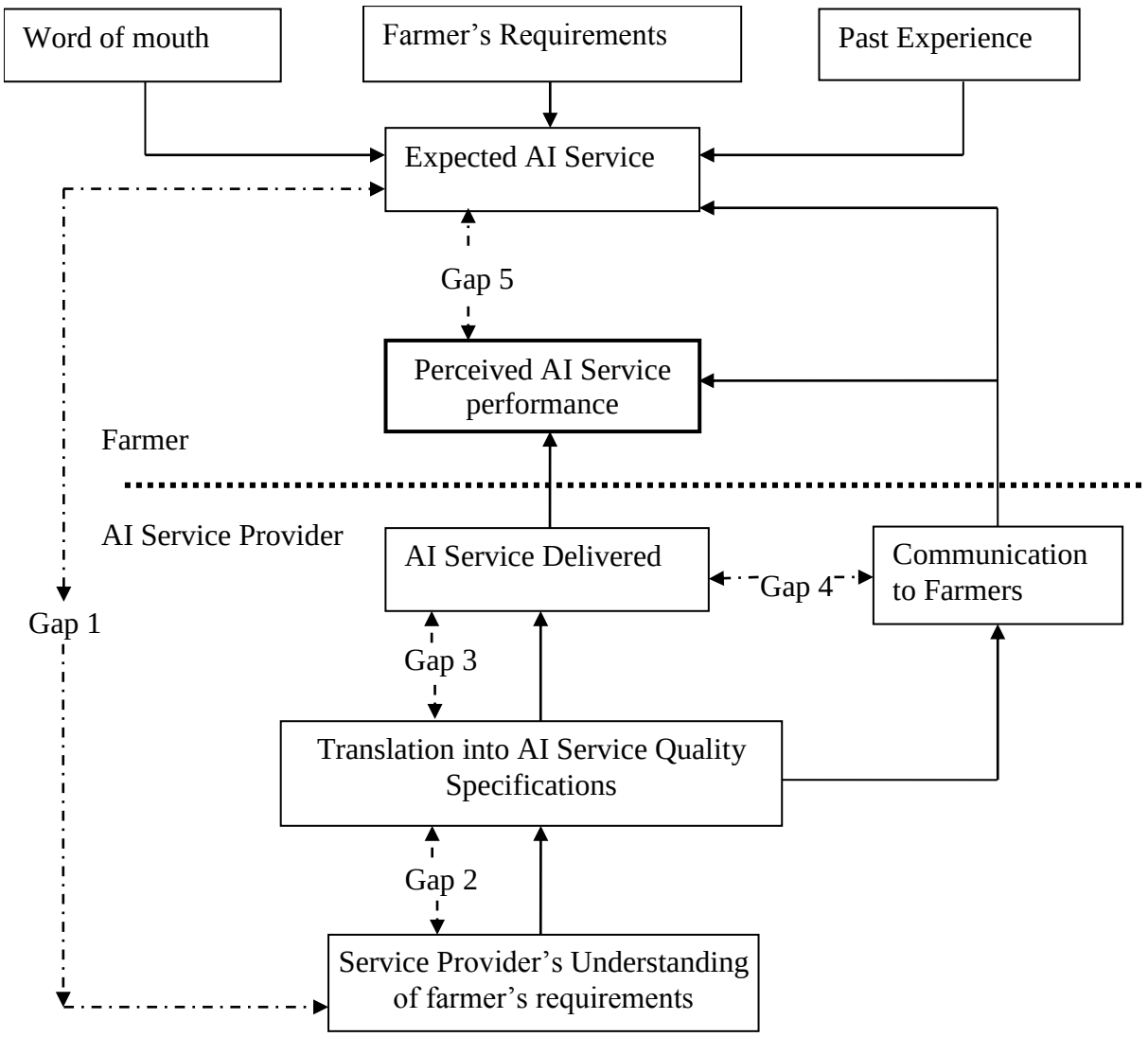

Figure 4. Theoretical Framework

Source: Adopted from Parasuraman *et al*, (1988)

The Theoretical Framework identifies five quality gaps which are the difference between farmers' expectation and AI service providers' understanding of those expectations (Gap 1); the difference between the AI service provider's understanding of the farmer's expectations and actual quality of service specifications (Gap 2); difference between the quality of service specifications and the service actually delivered (Gap 3); difference between actual AI service delivered and what is communicated to the farmers (Gap 4) and; difference between the perceived AI service performance and farmers' expectations(Gap 5).

2.12 Conceptual Framework

The Conceptual Framework guiding this study is shown in Figure 5.

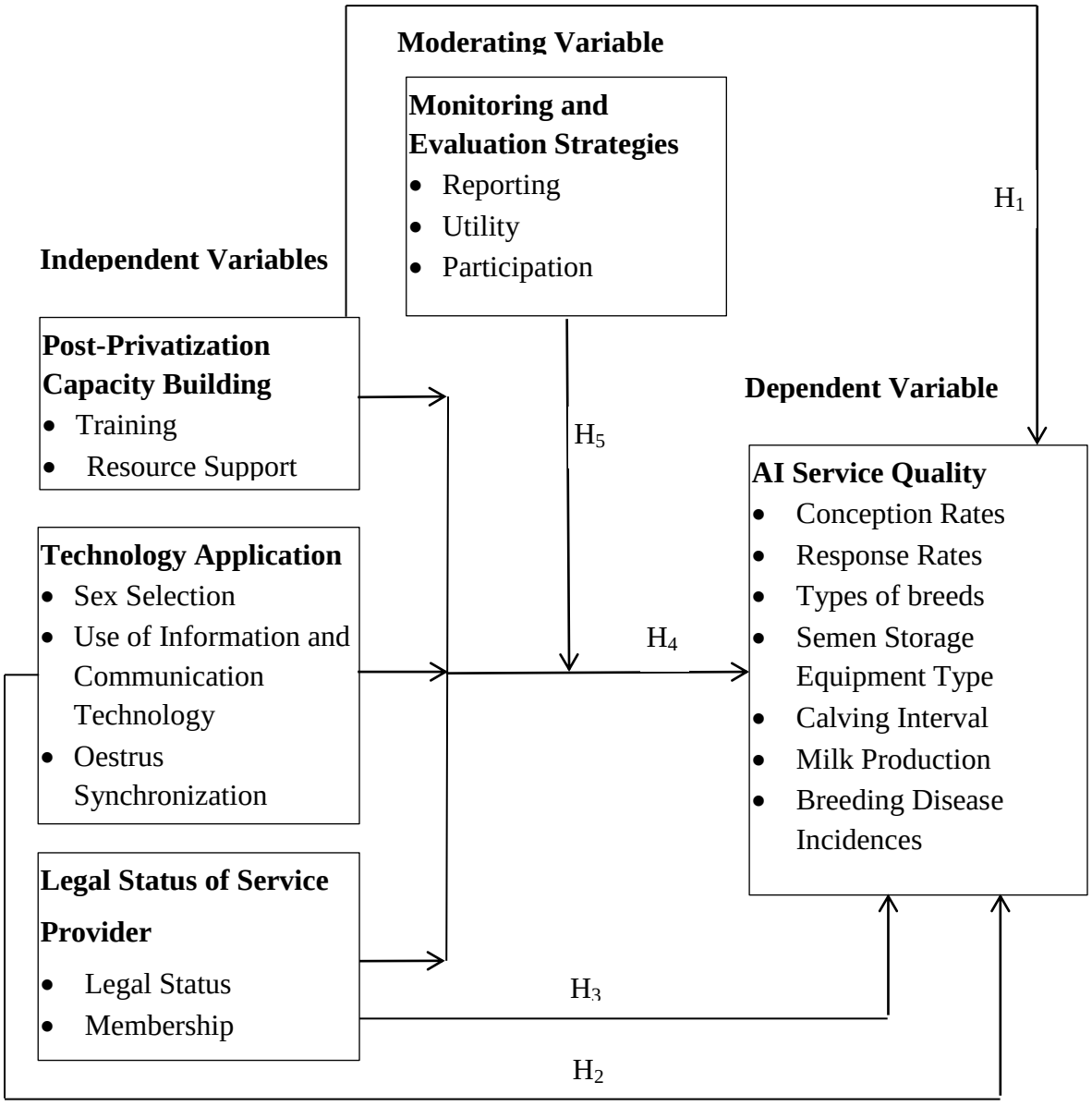

Figure 5. Conceptual Framework of the Study

The Conceptual Framework model shows the relationship between the independent variables, dependent variable and the influence of the moderating variable. In this case there are three independent variables and their patterns of influence on quality of artificial insemination services in cattle are under study. The independent variables of the study are post-privatization capacity building; Information and Communication Technology application and Legal status of service provider. The moderating influence of monitoring and evaluation on the relationship between the independent and the dependent variable is also under study.

2.13 Knowledge Gaps

The rate of consumption of AI services has decreased since the liberalization of artificial insemination services, as shown by Mogoa *et al* (2004). There is therefore a need to establish whether this reduction is related to the quality of the services that are received, especially since the Government's role in the service is merely regulatory. It is also important to identify the role of monitoring and evaluation information on the quality of AI services in cattle in order to develop solutions which would help to improve the services and subsequently increase the uptake among farmers, which in the long run would lead to improved dairy production and farmers' incomes. The improvement will eventually translate into improved milk productivity and subsequent economic growth for the farmers. The study investigated the knowledge gaps identified in the studies highlighted in Table 2.1.

Table 2.1. Knowledge Gaps

Variable	Author	Study	Methodology	Findings	Gap
Quality of Artificial Insemination Services.	Ouma (2008).	Determinants of Demand for AI Services.	Survey.	Demand for AI services is related to the farmer's education level, age, experience, herd size and breeds.	Author did not study the relationship between quality of services and demand. This study investigated the role of the factors influencing quality of AI services.

Variable	Author	Study	Methodology	Findings	Gap
Capacity Building.	Hui, Lam and Schaubroeck (2001).	Can Good Citizens lead the way in providing quality service.	Quasi Experiment.	Customer satisfaction and conformance improved more in branches with trained quality of service leaders than where there were none in a retail banking environment.	Authors focused on the training of service quality leaders and not the role of all players in the industry. The study investigated the role of capacity building on quality of AI service.
Technology Application.	Tata J. S. and McNamara P. E. (2016).	Social Factors That Influence Use of ICT in Agricultural Extension in Southern Africa	Survey.	personal and wider socio-economic conditions do have an impact on the proficiency of extension agents using ICT	Authors did not study the role of technology application in quality of service delivery. The study investigated the role of technology in quality of AI services.
Legal Status of service provider.	Desai and Joshi (2013).	Collective Action and Community Development: Evidence from Self-Help Groups in Rural India.	Survey.	Groups are likely to have increased participation and exercise greater control in local programmes than individuals.	Findings did not make comparisons between group and individual performance. The study investigated the role of organization type on quality of AI services.

Variable	Author	Study	Methodology	Findings	Gap
Monitoring and evaluation strategies.	Ograjensek (2003).	Use of Customer Data Analysis in Continuous Quality Improvement of Service Processes.	Desktop research.	An integral approach to the use of statistical methods can be proposed in continuous service quality improvement.	Author focused on data analytical methods and did not consider monitoring and evaluation systems. The study sought to find out the influence of monitoring and evaluation on the relationship between post-privatization management practices and quality of artificial insemination services.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter gives the research methodology which was used in the study. The research design, target population, sample size and sampling procedures, research instruments, data collection procedure, operationalization of variables and methods of data analysis are given in this chapter. Ethical issues involved in the study are also presented.

3.2 Research Paradigm

A research philosophy is a belief about the way in which data on a phenomenon should be gathered, analysed and used (Rubin and Rubin, 2011). It encompasses the epistemological and ontological approaches to research based on certain paradigms. Avramidis and Smith (1999) described research paradigms as consisting of certain philosophical assumptions that guide and direct thinking and action of a researcher. Though Guba (1990) indicated that the term paradigm has no clear statement of its meaning, there seems to be some agreement in the statement that a paradigm is a basic set of beliefs that guides action. This study adopted pragmatism as the guiding paradigm. Titus, Smith and Nolan (1995) defined pragmatism as an attitude, a method, and a philosophy that uses the practical consequences of ideas and beliefs as a standard for determining their value and truth.

Pragmatism is the appropriate paradigm for this study because it investigates some of the consequences of privatization of AI services. Morgan (2007) described pragmatism as a guiding paradigm in social science research methods which supports work that combines both qualitative and quantitative methods. This paradigm is considered superior to constructivism because even though it aims to generate theory through multiple understandings of social and historical constructs, pragmatism is problem centred and is oriented towards understanding consequences of actions in a real world practice oriented set-up (Creswell, 2009). The paradigm is also considered more useful than post-positivism because the latter assumes that research should not be value-free and unbiased but be value-laden, subjective and inter-subjective, even value-driven within the critical paradigm (McGregor and Murnane, 2010) while the former allows for some flexibility.

The epistemological approaches of pragmatism accommodate both an objective and subjective view implying that even if the researcher's values may not play a very great role in

the interpretation of data, they are not completely invalid in research. Though Morgan (2007) viewed pragmatism as a way to redirect the researcher's attention to methodological rather than metaphysical concerns, the cause-effect relationships are crucial in explaining phenomena. Goldkuhl (2004) pointed out that a pragmatist is not contented with making solely interpretive descriptions but has a fundamental interest in actions and practices. Concomitant to this interest is a concern for what works and how and why it works. Likewise, there is a concern for what does not work and how and why it does not work. Pragmatic ontology is therefore, such that knowledge is constructed based on the world that we live in and explanations that produce the best outcomes.

3.3 Research Design

The study adopted a descriptive cross-sectional survey design complemented by a key informant interview. It took a multi-method approach in which qualitative data was used to provide explanations for quantitative data. The survey was used to collect data from farmers and AI service providers. Orodho (2004) explained that a survey design is quite appropriate for gathering information, summarizing, presenting and interpreting data for the purpose of clarification from a large population.

The survey design enables the researcher to gather both qualitative and quantitative data from a relatively large number of cases at a particular time (Kothari, 1990; Mugenda and Mugenda, 1999). This method was quite appropriate for the study because it assisted the researcher to obtain statistical information on the influence of monitoring and evaluation on the relationship between post-privatization management practices and quality of artificial insemination services. Though Mitchel and Jolley (2013) described a survey design as a fast and inexpensive way to collect a lot of information about a sample's attributes, beliefs and self-reported behaviours, surveys also have disadvantages. According to Hallberg (2008), only superficial knowledge of a certain aspect or phenomenon can be obtained without an in-depth understanding. This justified the use of key informant interviews to complement the survey.

Key informant interviews were used to obtain qualitative data from Veterinary Officers in Sub-Counties because they had key information which was useful in interpreting and explaining the data obtained from the questionnaires. According to Parsons (2008), key informant interviews are in-depth interviews of a select, non-random group of experts who

are most knowledgeable of the organization or issue. Parsons further explains that key informant interviews are useful in supplementing survey findings, particularly for the interpretation of survey results. Frankfort-Nachmais and Nachmais (1996) pointed out that the main disadvantages of interviews are lack of anonymity and interviewer bias. These were countered by ensuring total confidentiality of respondents and corroborating data with other data obtained from questionnaires.

3.4 Target Population

The study targeted three categories of respondents namely farmers, AI service providers and Veterinary Officer in Nyeri County who are distributed in the 8 Sub-Counties of the County. According to RoK (2013), the population of farmers in the study area is 162,427. The County also has 104 AI service providers and 8 Veterinary Officers (DVS, 2013). The AI service providers are categorized as 94 private providers, 6 Cooperative societies and 4 self-help groups. The importance of the different categories of respondents to the study emanates from the fact that the Veterinary Officers provide oversight to the value chain; AI service providers offer the services and farmers are the service consumers hence all of them have important information about the variables in the study. Their selection was based on the fact that they were the main stakeholders in the artificial insemination field and were therefore most likely to have the necessary data for the study.

3.5 Sample Size and Sampling Procedures.

This section describes the approaches used to identify the sample for the study. It includes the sample size determination and the sampling procedures. These are shown in sections 3.5.1 and 3.5.2 respectively.

3.5.1 Sample Size Determination

The sample size for farmers and service providers was calculated based on the following formula by (Yamane, 1967).

$$n = \frac{N}{1 + N(e)^2}$$

Where: n = Sample Size

N = Population Size

e = Sampling Error

The sample size calculation for this study assumed 95% confidence level and 7% sampling error as given by Yamane (1967). Based on the foregoing criteria and the available population, the sample sizes for farmers and private AI Service providers were calculated as follows:

Number of Farmers:

$$n = \frac{162427}{1 + (162427 \times 0.07 \times 0.07)} = 203.82$$

≈ 204

Number of Private AI Service Providers:

$$n = \frac{94}{1 + (94 \times 0.07 \times 0.07)} = 64.36$$

≈ 65

A sample size of 204 was obtained using the above formula from a target population of 162,427 farmers. The total population for AI service providers was 104 which included 94 private AI service providers, 6 cooperative societies and 4 self-help groups. Due to the low number of Cooperative societies and self- help groups, a census was carried out on them. The calculation was therefore only carried out on the 94 AI service providers. The resulting sample size for the AI service providers consisted of 65 private providers, 6 cooperatives and 4 self-help groups giving a total of 75 AI service providers. The population of Veterinary Officers was also too low to warrant sampling hence all the 8 officers were included in the study. A census survey was therefore used for these categories of respondents. Based on calculations using the Yamane (1967) formula, a population size of less than 30 was considered too small to warrant sampling in this study. This was necessary because as the population size decreases, the sampling error increases (Henry, 1990). Below a population

size of 30, the sampling error may be so high that it may affect the authenticity of the research findings.

3.5.2 Sampling Procedure

This study included three categories of respondents namely farmers, AI service providers and Veterinary Officers in charge of AI. The selection of respondents from the different categories is shown in Table 3.1.

Table 3.1. Sample Size Distribution for Different Categories of Respondents

Target Group	**Sample Size Distribution**		**Sampling Method**
	Population	**Calculated Sample Size**	
Farmers	162427	204	Transect mapping
Private Service Providers	94	65	Simple Random Sampling
Cooperative Society AI Service Providers	6	6	Census
Self-help Group AI Service Providers	4	4	Census
Veterinary Officers	8	8	Census
Total	162539	287	

The selection of respondents was done using methods shown in Table 3.1. The procedures followed in order to carry out the selection were as follows:

Selection of Veterinary Officers

A census was carried out on Veterinary Officers due to their small population size as indicated in Table 3.1. Each of the Veterinary Officers charged with the responsibility of supervising AI services in the Sub-Counties was selected for the study. The Veterinary Officers were considered as key informants in the study because they have important information on the history and trends in the AI service. This gave a total of 8 Veterinary Officers, representing the eight Sub-Counties in the study.

Selection of Sampled AI Service Providers

The study population of AI service providers was 104. The AI service providers were distributed in three groups which represented the legal setups of service providers in the study. This distribution consisted of 6 Cooperative societies, 4 self-help groups and 94 private AI service providers. A census was carried on AI service providers from the Cooperative societies and self-help groups because of their low populations. Simple random sampling method was used to select private AI service providers in which respondents' names were drawn randomly from a sampling frame provided by the County Department of Veterinary Services. Simple random sampling method was appropriate for this group because it took account of the mobile nature of the private AI service providers.

Selection of Sampled Farmers

Transect mapping was used to select a sample of 204 farmers from the population of 162,427 because of their sedentary nature. According to Titus (1993), parallel transects at random intervals may reasonably represent different areas within the site and avoid possible biases of regular sampling. This was appropriate in order to capture a sample from a geographical distribution which was adequate and thus ensured that the data had a high level of external validity. Table 3.2 shows the distribution of number of farmers obtained in each Sub-County.

Table 3.2. Distribution of Farmers.

Sub-County	No. of Farmers	Selected Farmers	Number of Farms per Transect
Nyeri Central	31023	38	8
Nyeri South	20462	26	5
Tetu	18423	23	5
Mathira East	15748	20	4
Mathira West	12576	16	3
Kieni East	24718	31	6
Kieni West	18993	24	5
Mukurweini	20484	26	5
Total	**162427**	**204**	

The transect mapping technique was used in order to get an unbiased sample. The determined farmers' sample size was distributed in the 8 Sub-Counties in order to give a sub-sample number of farms which were proportionate to the total number of farm holdings in the Sub-Counties as shown in Table 3.2. Five transect lines were drawn traversing each of the Sub-Counties. On each transect, a number of equidistant farms were selected which corresponded to the number of farms in the Sub-County which were calculated for the study. The approach of the Sub-County based transects was used in order to ensure a proportionate distribution of farmers selected for the study, while at the same time making data collection more organized and manageable.

3.6 Research Instruments

Questionnaires and interview guides were used for data collection in the research. The two types of instruments are discussed in sub-topic 3.6.1 and 3.6.2 respectively.

3.6.1 Questionnaires for Farmers and AI Service Providers

Questionnaires were self-administered and were designed to collect both qualitative and quantitative data on the variables under study from both Farmers and AI Service providers. The questionnaires consisted of six thematic sections which were in line with the variables under study. These sections were biodata, monitoring and evaluation, quality of artificial insemination services, capacity building, technology application and organization of service providers. The importance of organizing the questionnaires according to the thematic sections was in order to enhance their construct validity.

The respondent groups consisted of people who were informed on the issues of concern. This meant that they could easily understand the questions and give responses with a high level of accuracy. The main benefits of questionnaires as a method of data collection were that they are relatively quick to complete, economical and are usually easy to analyse (Bowling, 1997). The questionnaires gave the advantage of easy data analysis because of uniform answering formats. They were also easy to administer to a large number of respondents within a short time frame. However, they brought the disadvantage of being rigid and unable to capture issues that were not directly covered in the questions. This was countered by corroborating information with that collected from the interviews in order to enhance reliability.

3.6.2 Interview Guides for Veterinary Officers

An interview guide was used to collect data from Veterinary Officers. Interviews cover both factual and meaning level in research (Kvale, 1996). They were therefore, useful because it was easy to clarify questions and obtain in-depth information on both the social and the technical aspects of artificial insemination from the Veterinary Officers who were considered to be highly experienced in dealing with related issues and other underlying concerns in the study area. Another advantage of interviews was that they allowed the researcher to understand the full range and depth of information through both qualitative and quantitative data and to capture non-verbal communication from the respondent. The main disadvantage of interviews was possible interviewer bias and difficulty in comparing responses. The disadvantages were overcome by pilot–testing the interview guides in order to decode the meanings posed by the questions in the data collection tools and to gauge respondents understanding of the questions.

3.6.3 Pilot Study

Galitz (2005) defines a pilot study as a mini-version of a full-scale study or a trial run done in preparation of the complete study. According to van Teijlingen and Hundley (2002) and Simon (2011), reasons for conducting pilot studies include developing and testing the adequacy of research instruments; assessing the feasibility of a study; assessing the reliability of instruments and the validity of data collected; identifying logistical problems which might occur using proposed methods and; assessing whether the statistical and analytical processes are efficacious. A sample consisting of 10% of the study sample was randomly selected for pilot testing. According to Connely (2008), extant literature suggests that a pilot sample should be 10% of the sample projected for the larger study meaning that 20 farmers, 6 AI service providers and one Veterinary Officer were appropriate for the pilot test. The pilot study was done in the neighbouring Mathioya Sub-County in Muranga County due to its proximity to the study and respondents had similar characteristics to the study respondents in terms of demography and usage of AI services. The instruments were administered to the respondents by the researcher and were then analysed in order to determine their validity and reliability.

3.6.4 Validity of the Research Instruments

Validity refers to the meaningfulness of research components in terms of whether they actually measure what they are intended to measure (Drost, 2011). Mugenda and Mugenda

(1999) refer to validity as the accuracy and meaningfulness of inferences, which are based on the research results. It implies the approximate truth of propositions, inferences or conclusions. To ascertain construct validity, questionnaires were organized according to themes in line with the objectives. Content validity was assessed by considering the relevance of each question item to the objective through consultation with supervisors and other research experts. The pilot study was also used to pre-test the clarity of the items in the instruments. External validity was ascertained through calculating the appropriate sample sizes and ensuring that the selection of respondents was as evenly distributed as possible.

3.6.5 Reliability of the Research Instruments

A measure is reliable if it consistently produces the same results over repeated tests and it is free from measurement errors (Yang and Miller, 2008). To ensure the reliability of instruments used in this study, the Cronbach Alpha test of reliability was applied on the responses from the pilot study. Cronbach alpha is a measure of internal consistency which describes the extent to which all the items in a test measure the same concept or construct and hence it is connected to the inter-relatedness of the items within the test (Tavakol and Dennick, 2011). According to Yu (2001) Cronbach Alpha is recommended because it can be used for both binary-type and large-scale data.

Data obtained during the pilot study was keyed into a computer using the Statistical Package for Social Sciences (SPSS) version 20 software and a command was given to calculate the Cronbach Alpha Coefficient (α). A coefficient value of 0.6 shows that an instrument is reliable for collecting data as prescribed by Nunnally (1978) who argues that an instrument with a Cronbach alpha coefficient of between $\alpha = 0.5$ and $\alpha = 0.6$ is adequate enough for a study and increasing the alpha value beyond 0.8 is unnecessary. Table 3.3 shows the reliability statistics for the study.

Table 3.3. Reliability Statistics

	No. of Respondents	Cronbach alpha based on Standardized items	No. of items Considered
Service Providers	9	0.7199	6
Farmers	17	0.6344	6

A total of 17 farmers' and 9 AI service providers' questionnaire were used representing 9.55% and 15.5% of the respondents respectively. The resulting Cronbach alpha coefficients for farmers and service providers were α=0.6344 and 0.7199 respectively. The instruments were therefore considered adequate for data collection in the study.

3.7 Data Collection Procedure

Before data collection commenced, letters were obtained from the University of Nairobi and the National Council for Science, Technology and Innovation (NACOSTI) authorizing research to be conducted in the study site. Permits were also obtained from the County Commissioner and the County Director of Education in Nyeri. A prior visit was made to the County Director of Veterinary Services and the Sub-County Veterinary Officers in order to inform them about the research and to book appointments for interviews. During these visits, the Veterinarians were furnished with copies of the research permits in order to assure them of the authenticity of the research. The manager of the local semen depot was also visited in order to inform him of the intended research and to request for his permission to collect data at his premises, which was granted.

Before data was collected from the farmers, prior visits were made in order to inform them about the research and to make individual appointments. Data was collected from the five selected farms along each transect line through self-administered questionnaires. Seventeen of the farmers comprising 9.55% had below primary school certificate levels of education and were thus considered not competent enough to fill the questionnaire by themselves. In such cases, the questionnaire was administered by the Researcher. If it was found that a farmer identified in the transect mapping did not use AI or was unwilling to respond, the next farm along the transect walk was visited until a willing farmer who used AI was found. This did not pose a serious challenge because the prevalence of usage of AI was high at 78%. Data from Veterinary Officers was obtained by ensuring that the researcher honoured all appointments for visiting them. Interviews were conducted using an interview guide (Appendix 4). All the interviews took place in the respective Sub-County Veterinary Offices.

In order to collect data from AI Service Providers of all categories, a message was sent through the Veterinary Officer in charge of the semen depot informing them of the study and the data collection process. After three days, the researcher went to the depot and waited for the service providers who visited to collect their stock to who he issued the self-administered

questionnaires to be filled preferably on the spot. Thirty eight of the service providers agreed to fill the questionnaires then but twenty-six insisted on taking them away to fill them from home and to return them at after a week. Out of those twenty-six, only nineteen returned their questionnaires.

Document analysis was done in order to obtain historical data on the process and progress of the privatization of AI services and to explore the interactions between the variables of the study. Documents that were analysed included operational reports which gave the status of AI services in the County, newsletters which provided information on the trends in the AI services, policies which gave the Government position on the services and research reports which provided information on empirical and theoretical research by other researchers. These documents were useful in providing empirical and theoretical information on the variables under study.

3.8 Data Analysis Techniques

Both qualitative and quantitative data were obtained in the study. Quantitative data was coded and fed into a computer using the Microsoft Excel and Statistical Package for Social Sciences version 20 softwares. It was analysed using descriptive analysis methods comprising of percentages, mean, crosstabulation, Pearson's Chi Square, t-test, Analysis of Variance (ANOVA), Pearson Product Moment Correlation, and Regression analysis. The results were presented using tables. The analysed data was interpreted and inferences drawn using both descriptive and inferential statistics.

Hypothesis testing was done at 95% confidence level as determined during sample size calculation. Different methods of hypothesis testing were applied for different hypotheses depending on the type of data involved. The methods used were applicable because all the tests involved interval data except for data on legal setup which was nominal. In order for the nominal data to be analysed using these tests, it had to be converted into dummy variables. The first hypothesis on the relationship between capacity building and quality of AI services was tested using Pearson Product Moment Correlation Coefficient. The second hypothesis on the relationship between technology application and quality of AI services was also tested using Pearson Product Moment Correlation Coefficient. The third hypothesis on the relationship between legal setup and quality of AI services was tested using One-way ANOVA. The fourth hypothesis was on the combined influence of post-privatization

management practices on quality of AI services was tested using multiple regression analysis. The fifth hypothesis on the moderating influence of monitoring and evaluation was also tested using multiple regression analysis using the following multiple regression equation on moderating Influences as prescribed by Kim, Kaye and Wright (2001):

$$\gamma = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_5 M + \beta_6 XM$$

Where: γ = Dependent Variable (Quality of AI services)

α = constant

β_n = Coefficient

X_n= Independent Variables (X_1 = Capacity building; X_2 = Technology Application and; X_3 = Legal Status of AI service provider)

$X = X_1 * X_2 \ldots\ldots\ldots X_n$

M = Moderating Variables (Monitoring and Evaluation Strategies)

NB: * denotes multiplication

Qualitative data was organized into themes which were used to provide further explanation on quantitative data in order to obtain an in-depth understanding of the AI value chain, the processes involved and the solutions which have been applied in order to deal with challenges in the AI practice.

3.9 Ethical Considerations

Ethical considerations were observed in order to ensure that the basic rights of the respondents were not infringed upon. This was done by first informing and assuring the participants of the nature and purpose of the study through an introduction letter (Appendix 1). All appointments were kept as agreed and all ethical considerations were adhered to as outlined in the introductory letter. All identities were handled with confidentiality and the respondents were treated with respect and care. Bias or discrimination of any kind was also avoided through random sampling. Respondents were not forced to take part in the study and participation was purely voluntary. The researcher explained that there was no monetary gain emanating from taking part in the study in order to manage expectations. All in-text citations were acknowledged by including them in the reference list, and where necessary, consent was sought for using the works of other authors. The thesis was subjected to Turnitin software in order to check for plagiarism.

Identities of respondents were concealed in order to protect them hence they are referred only by the respondent category they represent namely farmers, AI service providers and Veterinary Officers. Where reference is made to individual respondents, identities were coded to provide anonymity. The study was conducted only after permit number NACOSTI/P/15/72626/8778 dated 2nd December, 2015 was obtained from NACOSTI. Authority was also sought from the County Commissioner and the County Education Officer representing the study site.

3.10 Operationalization of Variables

The operationalization of variables is shown in Table 3.4.

Table 3.4. Operationalization of Variables

Objective	Variables	Indicators	Measurement Scale	Approach of Analysis	Tools of Analysis
To establish to what extent capacity building influences quality of artificial insemination services.	**Independent:** Capacity Building	Training; Resource Support.	Interval	Quantitative	Pearson Product Moment Correlation
To determine the influence of technology application on quality of artificial insemination services	Technology Application	Use of information and communication technology; Sex selection; Oestrus synchronization.	Interval	Quantitative	Pearson Product Moment Correlation Pearson's Chi Square

Objective	Variables	Indicators	Measurement Scale	Approach of Analysis	Tools of Analysis
To determine how legal status of service provider influences quality of artificial insemination services.	Legal Status of Service Provider	Legal Status; Membership	Nominal	Qualitative	One-way ANOVA Percentage
To establish the moderating influence of the use of monitoring and evaluation strategies on the relationship between post-privatization management practices and quality of artificial insemination services.	**Moderating:** Monitoring and Evaluation Strategies	Reporting; Utility; Participation.	Interval	Quantitative	Multiple Regression
	Dependent: Quality of AI Services	Conception Rate; Response Time; Type of Breed; Type of Semen Storage Equipment; Calving Interval; Milk Production.	Interval	Quantitative	Mean Percentage

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter gives data analysis, presentation and interpretation of the findings. The findings are given according to the research objectives which were to: establish to what extent capacity building influences quality of artificial insemination services; determine the influence of technology application on quality of artificial insemination services; determine how legal status of the service provider influences quality of artificial insemination services; establish the combined influence of post-privatization management practices on quality of artificial insemination services and; establish the moderating influence of the use of monitoring and evaluation strategies on the relationship between post-privatization management practices and quality of artificial insemination services in Nyeri County. The research was a cross-sectional study and it was therefore, not possible to make inferences of causality. As a result the word "influence" was used to examine how the dependent variable is predicted by the independent variables and the direction of that relationship. Quantitative findings were corroborated with qualitative data whenever it was possible.

The data was examined in order to ensure that the variables of interest were computed and coded appropriately prior to the analysis of findings. Coding and data entry errors were corrected accordingly. There was only one farmer's case where the response on one item was not clear due to a double entry in a Likert scale hence the data on the particular question was discarded. The verified data was then tested for normality of the distribution, independence, homogeneity of variance, factorability and sphericity. This was done in order to determine whether the preferred test statistics would be appropriate. The data satisfied the tests conducted and was therefore considered to have met the threshold required for parametric statistical analysis.

4.2 Questionnaire Response Rates

The questionnaire response rate for the quantitative data was computed in order to establish the efficacy of the research findings. According to Sivo, Saunders, Chang and Jiang (2006), high response rate is one of the factors that enhance external validity. Table 4.1 shows the questionnaire return rate disaggregated by Sub-Counties.

Table 4.1. Farmer Responses by Sub-County

Sub-County	Farmers' Population	Farmers' Sample size	Questionnaires Returned	Percentage of Questionnaire Return Rate
Nyeri Central	31023	38	36	94.74
Nyeri South	20462	26	23	88.46
Tetu	18423	23	21	91.30
Mathira East	15748	20	20	100.00
Mathira West	12576	16	15	93.75
Kieni East	24718	31	26	90.32
Kieni West	18993	24	21	87.50
Mukurweini	20484	26	24	92.31
Total	**162427**	**204**	**187**	92.16

A total of 204 questionnaires were administered to the farmers while 65 were administered to AI service providers. Table 4.1 shows that 187 questionnaires were returned by the farmers giving a response rate of 92.16%. On the other hand, 57 questionnaires were returned by the service providers giving a response rate of 76.0%. According to Babbie (1990), a response rate of more than 70% is considered very good. The obtained response rates were therefore considered to be very good and they allowed a credible analysis of the data to be done and subsequent inferences to be made.

Responses on individual questionnaire items were analyzed in order to bring out an understanding of the response burden. Table 4.2 shows the in-questionnaire response rates for AI service providers and farmers.

Table 4.2. Percentage Question Item Response Rate

	Item Response Rate	Frequency	Percentage
AI Providers	97.6	1	1.8
	98.8	11	19.3
	100.0	**45**	78.9
	Total	**57**	**100.0**
Farmers	< 50	8	4.2
	50 to 80	10	5.3
	81 – 99	56	29.8
	100	113	60.6
	Total	**187**	**100.0**

Table 4.2 shows that out of the 187 farmers involved in the study, the majority comprising 90.4% answered at least 80% of the questions in the questionnaire. These included 114 farmers (60.6%) who gave 100% responses to questionnaire items. On the other hand, all the AI service providers answered more than 97.5% of the questionnaire items, including 45 AI service providers (78.9%) who answered all the questions in the questionnaire. According to Groves, Cialdini, and Couper (1992) questionnaires with a high response burden attract lower responses rate within the questionnaires. Since there were more than 90% of the farmers and AI service providers answering more than 80% of the questionnaires, the response burden in both cases was considered reasonable for the study.

4.3 Demographic profile of the Respondents

The target population for this study was drawn from the players in the AI value chain in Nyeri County. The players were categorized into three groups namely Veterinary Officers, AI service providers and farmers. Veterinary Officers were included because they are charged with the responsibility of performing the regulatory role in the AI practice. They provided qualitative data for the study. All the eight Veterinary Officers involved in the study were males and were in the age category of between 45 and 60 years. All of them were holders of a Bachelor of Veterinary Medicine degree.

4.3.1 General Demographics

This section gives the demographic characteristics of farmers and AI service providers who participated in the study.

Demographic Characteristics of AI Service Providers

AI service providers carry out actual inseminations and are therefore in direct contact with farmers. Table 4.3 shows the demographic characteristics of the service providers who participated in the study.

Table 4.3. Demographic Characteristics of AI Service Providers

		Age (Years)					Total	Percentage
		18–30	**31-40**	**41 50**	**51-60**	**Over 60**		
Gender	Male	11	26	5	0	5	47	82.46
	Female	0	10	0	0	0	10	17.54
	Total	**11**	**36**	**5**	**0**	**5**	**57**	**100.00**
Highest Qualification	Certificate	11	29	4	0	5	49	85.96
	Diploma	0	1	0	0	0	1	1.75
	Degree	0	6	1	0	0	7	12.28
	Total	**11**	**36**	**5**	**0**	**5**	**57**	**100.00**
Experience (Years)	0 – 5	6	11	0	0	0	17	26.32
	6 – 10	5	12	4	0	0	21	36.84
	11 – 15	0	13	1	0	0	14	24.56
	16 – 20	0	0	0	0	0	0	0.00
	21 – 25	0	0	0	0	5	5	8.77
	Total	**11**	**36**	**5**	**0**	**5**	**57**	**100.00**

From the analysis of the demographic characteristics of AI service providers it was found that both male and female service providers had different levels of qualifications. The 57 service providers were not specific to any of the Sub-Counties due to their mobile nature which meant that they could provide their services anywhere within the County. Assessment of their demographic characteristics revealed that the practice is still heavily male dominated with men forming 82.46% and women forming 17.54% of the AI service providers. The women in the study were all aged between 31 and 40 years. A further scrutiny of the data showed that all the female service providers had practiced AI for less than 15 years as shown in Appendix 5. It was further found that majority of the service providers (85%) had a certificate level of qualification as shown in appendix 5. This indicates that there is a need to provide further training to the practitioners. It was also found that 87.72% of the AI service providers had practiced AI for less than fifteen years. Majority of them (36.84%) had served for between six and ten years. The distribution of the years of experience agrees with the national trends

of inseminations which reduced drastically between the onset of privatization in 1992 up to 2002 and has since then been rising gradually (Foote, 2002; RoK, 2014). This means that during the times of lowest activity between 1994 and 2012, training in AI had also reduced drastically.

Farmers are the stock owners and are thus the main consumers of the AI service. They therefore formed an integral component of the primary data sources. Farmers were sampled according to their Sub-Counties due to the sedentary nature of their occupation. This was done in order to obtain a sample which was evenly distributed within the County so as to enhance the external validity of the study. The sample distribution is shown in Table 4.1. This study analysed the demographic characteristics of the farmers in the study in order to explain patterns in quality preferences as well as other variables in the study, based on age distribution, gender, highest education level and farming experience. Table 4.4 shows the observed distribution of the farmers' characteristics.

Table 4.4. Demographic Characteristics of Farmers

		Age					Total Responses	Percentage
		18-30	31-40	41-50	51-60	Over 60		
Gender	Male	5	15	28	41	27	116	62.03
	Female	6	12	22	22	9	71	37.97
	Total	**11**	**27**	**50**	**63**	**36**	**187**	
Highest Education Level	Illiterate	0	0	0	0	4	4	2.16
	Primary Dropout	1	2	2	2	6	13	7.03
	Primary	2	6	6	10	3	27	14.59
	Secondary	2	14	30	26	13	85	45.95
	Tertiary	1	4	8	20	9	42	22.70
	Graduate	4	0	4	4	0	12	6.49
	Post-Graduate	0	0	0	1	1	2	1.08
	No Response	1	1	0	0	0	2	1.08
	Total	**11**	**27**	**50**	**63**	**36**	**187**	
Years of Farming	0 – 2	6	0	0	1	2	9	4.86
	3 – 5	4	18	14	3	2	41	22.16
	6 – 10	1	8	20	19	7	55	29.73
	Over 10	0	1	16	38	27	82	43.24
	Total	**11**	**27**	**50**	**63**	**36**	**187**	

Table 4.4 shows that majority of the farmers in the study were men who comprised of 62.03% while women were 37.97%. It was further found that majority of the farmers had a good level of education since 83.24% had either completed primary, secondary or tertiary

Institutions. The modal class of the farmers consisting of 45.95% had completed secondary school. Only 2.16% of the farmers were illiterate. This implies the need for simplified extension services which are tailor-made to serve the information needs of the farmers. The results are closely corroborated by the Nyeri County Government (NCG) recorded adult literacy rate of 91.8% (NCG, 2013).

Table 4.4 further shows an analysis of farming experience in which 43.24% of farmers had more than ten years of experience in farming. This group is inclusive of the modal class of age-categorized farming experience which consisted of 20.3% of farmers who were aged between 50 – 60 years. This is attributed to the local land holding system where ownership is passed down through generations, coupled with the fact that the youth may not have the purchasing power to enable them own land.

Farmers' monthly income can be used as an indicator of their propensity to acquire AI services. The study sought to find out the income distribution of the farmers in the study. Table 4.5 shows the findings on the question.

Table 4.5. Farmers' Gender and Monthly Income Comparison

Monthly Income	**Male**		**Female**		**Total**	
('000 Kenya Shillings)	**No.**	**%**	**No.**	**%**	**No.**	**%**
0 – 10	38	20.3	29	15.5	**67**	**35.8**
10 – 20	43	23.0	24	12.8	**67**	**35.8**
20 – 50	25	13.4	14	7.5	**39**	**20.9**
50 – 100	9	4.8	4	2.1	**13**	**7.0**
Over 100	1	0.5	0	0	**1**	**0.5**
Total	**116**	**62.0**	**71**	**38.0**	**187**	**100.0**

The analysis of farmers' monthly income showed that most farmers (70.6%) had a monthly income of less than Kenya Shillings (KES) 20,000. A further analysis showed that the mean monthly income of farmers was KES 20,213.90 with a standard deviation of KES 19,238.38. It was also found that 35.8% of the farmers earn between KES 0 and 10,000.00. According to RoK (2008), 47% of the Kenyan population live below the poverty line which is estimated at KES 1,562.00 per month in rural areas and KES 2,913 in urban areas. The same report indicates that 32.9% of the population in the study area live below the poverty line and that 85% of the Kenya population living below the poverty line are in the rural areas (*ibid*).

Comparatively, RoK (2010a) shows that 95% of the population in the study area are in rural households. This implies that the study area has a lower poverty level compared to the national average. This results show that about 30% of farmers in Nyeri County may be struggling to acquire AI services due to their low spending ability.

4.3.2 Herd Structure and Artificial Insemination Use

The herd structure is an indication of the level of dairy production practiced by farmers. This can be viewed as an indicator of the level of wealth in a farmer's possession as well as an indicator of a farmers' potential income from the dairy farm. Table 4.6 shows the average herd structure in the study area.

Table 4.6. Average Herd Structure

	No. of Farms	Percentage of Farms	Minimum in herd	Maximum in herd	Mean	Standard Deviation
Bull calves in herd	34	18.18	0.00	2.00	0.2128	0.4822
Adult Bulls in herd	11	5.88	0.00	2.00	0.0745	0.3184
Heifer calves in herd	111	59.36	0.00	8.00	1.0532	1.2484
Cows in herd	185	98.93	0.00	18.00	2.9149	2.6088

The results of the analysis of the herd structures in Table 4.6 indicates that farmers had an average of 0.2128 bull calves with a standard deviation of 0.4822 and 0.0745 bulls with a standard deviation of 0.3184. A further scrutiny of the data showed that 34 (18.18%) of the 187 farmers kept bull calves while 11 (5.88%) kept adult bulls.

An analysis of cows in herds revealed that the mean number of mature cows in the herds was 2.919 with a standard deviation of 2.6088. These values were found in 185 (98.93%) farms. The mean number of heifers was 1.0532 with a standard deviation of 1.2484. The values were found in 111 (59.36%) farms.

The demand for AI services can be used as an indicator of the degree of usage of AI services instead of natural services. Table 4.7 shows the analysis of the demand for AI services using both local and imported semen.

Table 4.7. Semen Demand

	N	Mean	Standard Deviation	Standard Error
Demand for Local Semen	57	3.75	0.969	0.128
Demand for Imported Semen	57	3.23	0.708	0.094

Table 4.7 shows that the responses of AI service providers on the demand for AI services. Based on a Likert scale of 1 to 5 (where 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High and 5 = Very High), the service providers indicated that the mean of the demand for local semen was 3.75 while the mean for imported semen was 3.23. The standard deviations associated with these means were 0.969 and 0.708 respectively. This means that there is a moderately high demand for AI services in the study area.

Based on the results of the demand for semen shown in Table 4.7, paired sample t-test was used to establish whether there was a significant difference between the demand for local semen and imported semen. The results of the paired sample t-test are shown in Table 4.8.

Table 4.8. Paired Samples t-Test on Semen Demand

	T	Degrees of Freedom (df)	Significance (2-tailed)
Local Semen Imported Semen	3.499	56	0.001

The results on Table 4.8 gave a t-statistic of t(56) = 3.499 with a significance level of 0.001. Basing the inference on $\alpha = 0.05$, the results imply that the demand for local semen is significantly higher than the demand for imported semen at 95% confidence level. This could be attributed to the finding that farmers perceive the imported semen as more expensive and can give a lower conception rate than local semen.

4.4 Tests for Suitability of Data for Parametric Tests

Examining data on quality of AI services in order to ensure that basic assumptions for parametric tests were met was necessary. According to Field (2009), most parametric tests based on the normal distribution have four basic assumptions which should be met before

analyses can proceed. These assumptions are normality, homoscedasticity, serial independence and factorability of the data (Jarque and Bera, 1980). The demographic data (gender, education, qualification level and income) and the legal status of service providers were based on nominal and ordinal scales. The rest of the data for the study variables were measured at the interval level. It was necessary to confirm the assumption of interval data that samples were randomly selected; sample elements were independent and; that characteristics were normally distributed for the dependent variable. The data on quality of AI services was therefore tested for homogeneity; skewness and kurtosis; independence; homogeneity of variance and; factorability and sphericity. The following sections show the results of the tests.

4.4.1 Test of Normality of Data on Quality of Artificial Insemination Services

A series of tests for normality were conducted in order to determine whether the distribution of data was normal. The tests were Normal Quartile-Quartile (Q-Q) plots, P-P Plot, Histogram, Boxplot, Kolmogorov-Smirnov (K-S) test and Shapiro-Wilk test. These tests were useful in determining whether the data met the threshold for a plausible analysis and conclusion.

The Q-Q plot was used to check the normality of the distribution of the data set on quality of AI services. The Q-Q was used to compare observed values of quality of AI services against expected values. Figure 6 shows the results of the Q-Q plots.

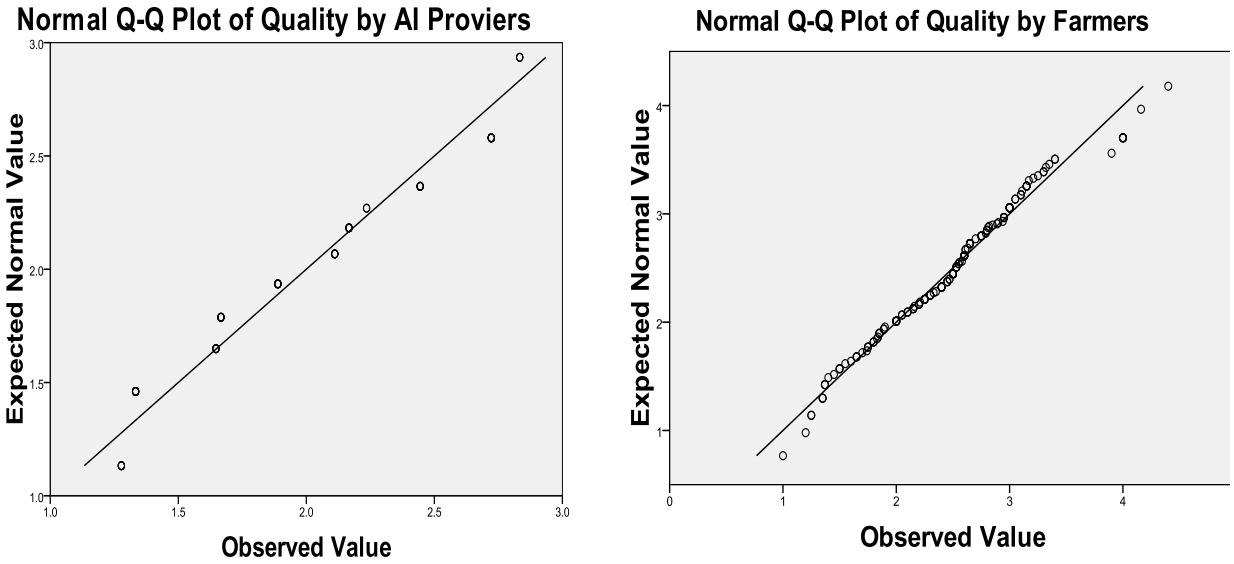

Figure 6. Normal Q-Q Plots for Quality Ratings

The normality test from the Q - Q plots for both farmers and service providers showed that data deviated only slightly from the ideal diagonal line indicating that it was fairly normally distributed. According to Loy, Follett and Hoffman (2014), a data set that is closer to the diagonal implies a more normal distribution.

P-P plots were drawn in order to compare observed cumulative values of quality of AI services against the expected cumulative values with the aim of ascertaining the findings of the Q-Q plots. Figure 7 shows the results of the comparison.

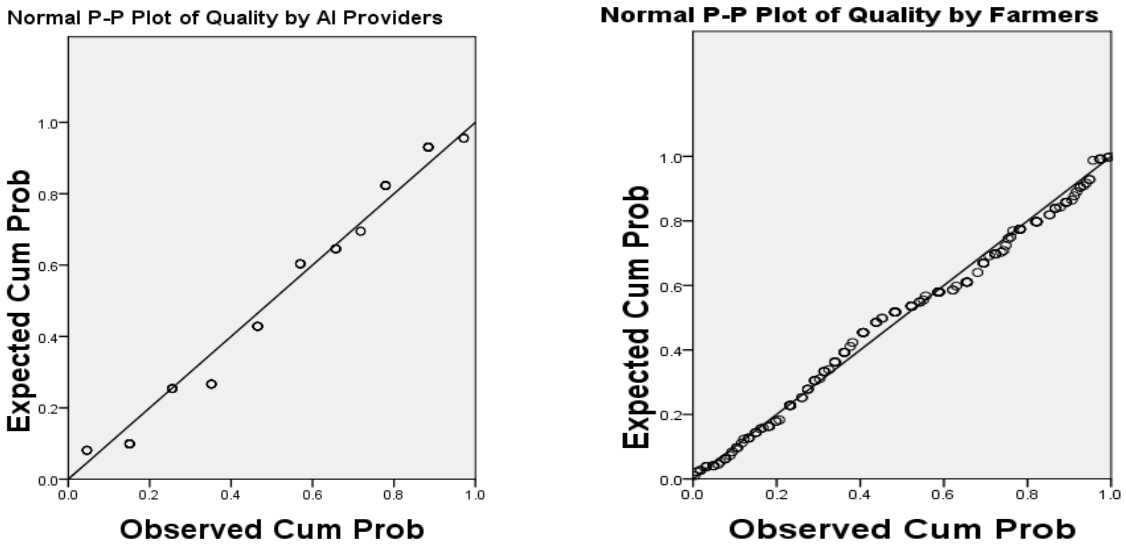

Figure 7. Normal P-P Plots for Quality Ratings

The P-P plots displayed results which were similar to the Q-Q plots and this indicated that the data was distributed close to the ideal diagonal line. This showed that the data for both farmers and AI service providers had a distribution which was fairly normal as indicated by Loy *et al* (2014).

Histogram distributions were plotted to give a visual impression of the distribution of data. Figure 8 shows the distribution which was observed.

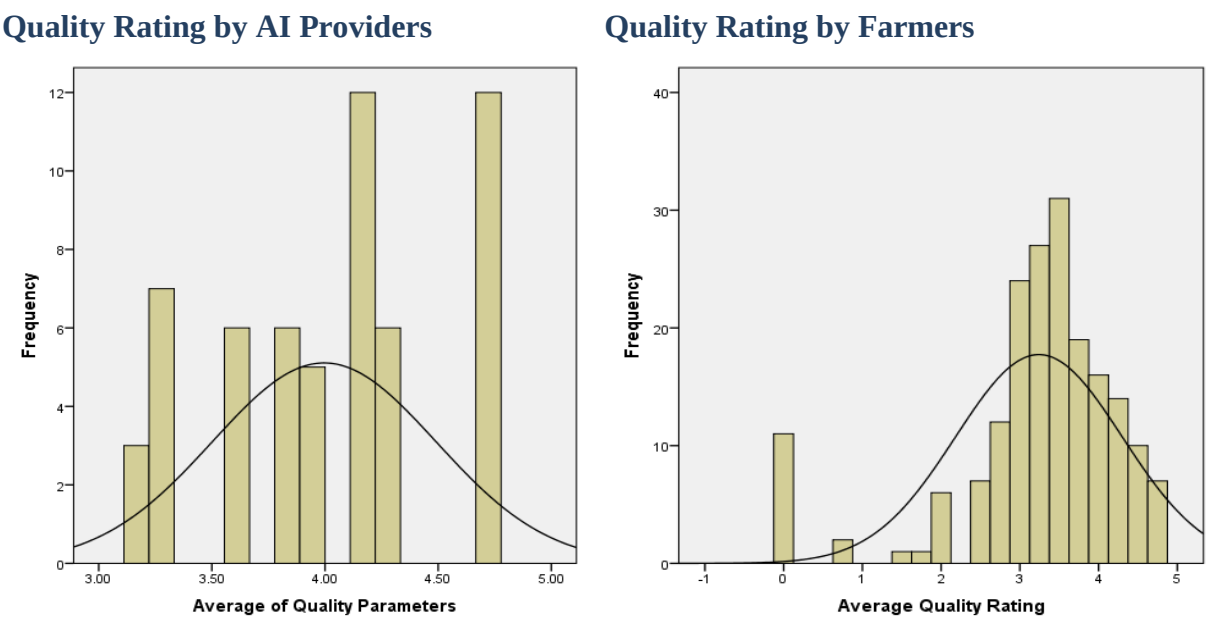

Figure 8. Histograms of Quality Rating

The histogram for AI service providers showed that data was evenly distributed across the quality spectrum with a slight negative skew. The histogram for the farmers on the other hand showed that data was evenly distributed but with a slight negative skew. This is consistent with the central limit theorem that as sample sizes get larger, the less the assumption of normality matters because the sampling distribution will be normal regardless of what the sample data looks like, and as such a test of normality is more likely to be significant even for the data which does not need to be corrected (Elliott and Woodward, 2007; Field, 2013).

The study further sought to test the distribution based on boxplots for males and females in the cases of both AI service providers and farmers and results are shown in Figure 9.

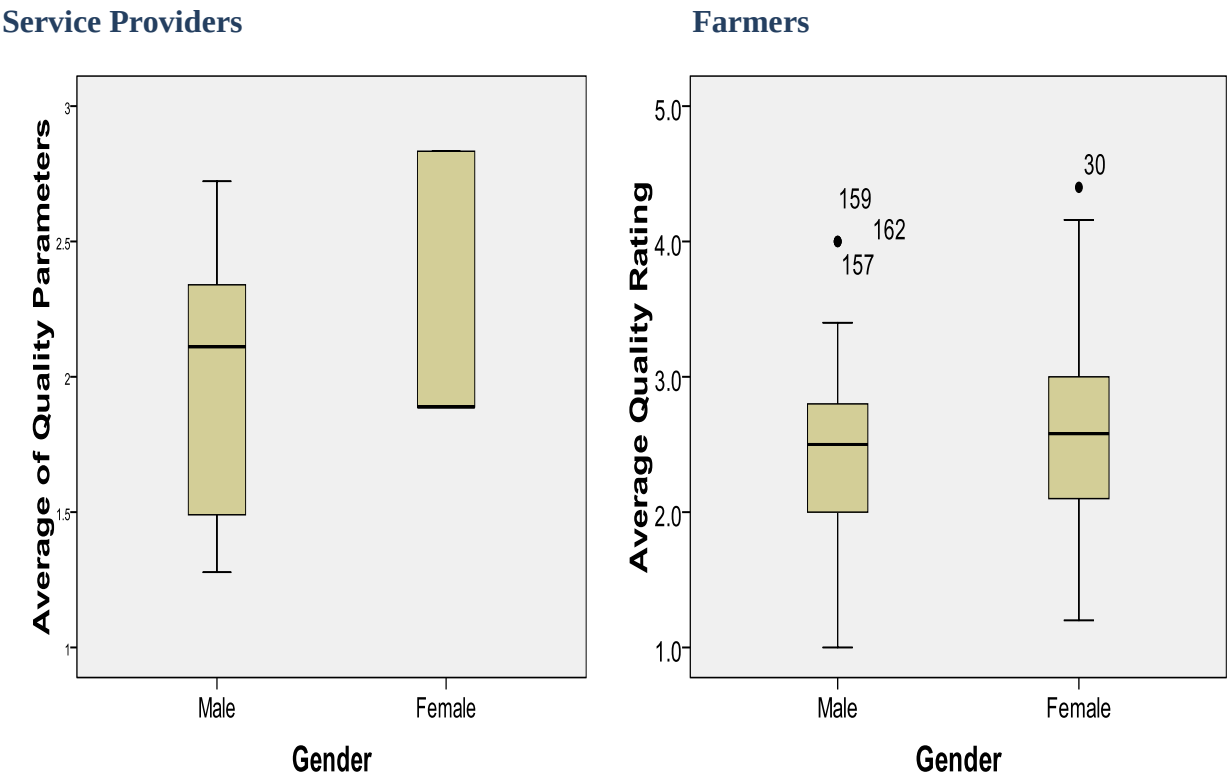

Figure 9. Boxplots for Quality Rating by Gender

The boxplots for both farmers and service providers showing distributions for both males and females were used to identify outliers from the histogram. These are shown with a dot (•) and the case numbers producing those outliers. The plots reveal that there were no outliers for AI service providers. However, in the case of farmers, male respondents numbers 157, 159 and 162 as well as female respondent number 30 were outliers. Revisiting the cases showed that all these cases had a score of 4 or above, which was far above the mean of 2.03. Despite that, the data was considered acceptable since it was within the range of possible scores.

In a nutshell, a visual inspection of histograms, P-P plots, normal Q-Q plots, histograms and box plots showed that the parameters for quality of AI services were approximately normally distributed for both males and females. The distribution was, therefore, considered normal. However, there was still a need to conduct statistical tests in order to confirm the normality of the distributions shown by the visual tests.

The K-S and the Shapiro Wilk tests were used to statistically test the distribution. In both cases, a significance level of less than 0.05 indicates a deviation from normality. Table 4.9 shows the K-S distributions for both farmers and service providers.

Table 4.9. Tests of Normality

		Gender	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
			Statistic	df	Sig.	Statistic	df	Sig.
Average Quality Rating	AI Providers	Male	0.194	47	0.000	0.892	47	0.000
		Female	0.433	10	0.000	0.594	10	0.000
	Farmers	Male	0.084	112	0.049	0.984	112	0.199
		Female	0.109	65	0.052	0.969	65	0.102

a. Lilliefors Significance Correction

Table 4.9 shows that significance values for the K-S test for both male and female AI service providers were 0.00. These significance values were the same in the Shapiro-Wilk test for the same respondents. The significance values suggest that the quality of AI services data provided by AI services deviated from normality. The significance values of the K-S test for both male and female farmers were 0.49 and 0.52 respectively. The significance values of the Shapiro-Wilk test for the same respondents were 0.199 and 0.102 for male and female service providers respectively. According to Razali and Yah (2011), the Shapiro-Wilk test has a greater power of estimation than the K-S test. The distribution of data provided by farmers on quality of AI services was therefore considered normal based on the results of the Shapiro-Wilk Test. According to Elliott and Woodward (2007), the Kolmogorov-Smirnov and Shapiro-Wilk tests are recommended only when dealing with a sample size of less than 50. For large sample sizes (40 or more), central theorem can be assumed, therefore the use of parametric procedures can still be justified.

4.4.2 Test of Skewness and Kurtosis of Data on Quality of AI Services

The data was also tested for skewness and kurtosis which were considered important for confirming statistical assumptions. The standard errors in both cases were converted to z-scores derived by z(skewness) = S-O/SE(skewness) for skewness; and z(kurtosis) = K – O/SE (kurtosis). The observed measures of skewness and kurtosis are shown in Table 4.10, together with the associated standard errors.

Table 4.10. Kurtosis and Skew Measures for Quality Ratings

Statistics	AI Providers	Farmers
N	57	177
Missing	0	11
Skewness	0.196	0.256
Standard Error of Skewness	0.316	0.183
z (skewness)	0.620	1.398
Kurtosis	-1.122	0.362
Standard Error of Kurtosis	0.623	0.363
z (kurtosis)	-1.801	0.997

The coefficients of skewness for both AI service providers and farmers indicated that the quality ratings data was positively skewed. The Z (skewness) score for AI service providers was 0.196/0.316 = 0.620 whereas for the farmers it was 0.256/0.183 = 1.398. Since the z scores for both AI service providers and for farmers fell within the range -1.96<z <1.96 corresponding to 95% confidence level, it was deduced that the level of skewness of quality ratings for both categories of respondents was not significant enough to affect the analysis of data.

The Z (kurtosis) score for quality ratings by AI service providers was -1.122/0.623 = -1.801 while the score for farmers was 0.362/0.363 = 0.997. The coefficient of kurtosis for AI service providers was negative indicating a platykurtic distribution of data on quality ratings. The data for farmers yielded a positive coefficient of kurtosis implying a leptokurtic distribution. Since the Z (kurtosis) for both data sets was within the -1.96 < z < 1.96, it was concluded that the level of kurtosis was not significant enough to adversely affect the results of the analysis. Though Field (2013) explains that these criteria may not be reliable in large samples of more than 200 respondents, the conclusion that the distribution of quality rating by farmers was normal was strengthened by the shape of the distribution histogram. However, the z findings of kurtosis and skewness of the quality ratings by AI service providers was used to make the conclusion that the data was normally distributed.

4.4.3 Test of Independence of Data on Quality of AI Services

Two variables are considered independent if the classification of a case into a particular category of one variable (group variable) has no Influence on the probability that the case will fall into any particular category of a second variable (the test variable). In this test of independence, data on quality of artificial insemination services was tested for independence against gender of both AI service providers and farmers. In order to test for independence, the Chi-Square test and the independent sample t-test were used. Table 4.11 shows the chi-square tests for gender and quality of artificial insemination services.

Table 4.11. Chi-Square Tests for Gender and Quality Scores

		Value	df	Asymptotic Significance (2-sided)
AI Providers	Pearson Chi-Square	57.000[a]	10	0.000
	Likelihood Ratio	52.942	10	0.000
	Linear-by-Linear Association	1.793	1	0.181
	N of Cases	57		
Farmers	Pearson Chi-Square	64.979[b]	69	0.615
	Likelihood Ratio	83.233	69	0.116
	Linear-by-Linear Association	2.021	1	0.155
	N of Cases	177		

a. 19 cells (86.4%) have expected count of less than 5.
b. 134 cells (95.7%) have expected count of less than 5.

The Chi-Square test was used in order to test whether there was a significant association of ratings of quality of AI services between males and females among both farmers and AI service providers. The null hypothesis which stated that there was no significant association between the two variables was tested. If the asymptotic significance of the test statistic turned out to be less than or equal to $\alpha = 0.05$, the null hypothesis would be accepted and it would be concluded that there was no relationship between the variables. The assumption of the Chi-Square Test of Independence was that it can be used for any level of variable, including nominal, ordinal and interval level variables grouped in a frequency distribution. Pearson Chi-Square further assumes that not more than 20% of the cells have expected counts less than 5. In cases where there are more than 20% of the cells with counts less than five, the Likelihood Ratio which is a derivative of Chi-Square is preferred.

Table 4.11 shows that 86.4% of cells for AI providers and 95.7% of cells for farmers have expected counts that were less than 5. The Likelihood Ratio was therefore the most appropriate test for independence. The asymptotic significance of the test statistic for AI service providers (Likelihood ratio =52.942) was p = 0.000. Since this was less than the threshold significance level of α=0.05, the null hypothesis that changes in quality scores are independent of difference in gender was accepted for AI service providers. When farmers were considered, the probability of the chi-square statistic (Likelihood Ratio = 83.233) was p = 0.116. This was greater than 0.05 hence the null hypothesis that changes in quality scores are independent of difference in gender was therefore rejected. It was therefore concluded that while data on the score for quality among AI service providers may be independent of gender, farmers' ratings of quality of AI services was dependent on gender.

An independent sample t-test was done in order to compare means of quality of artificial services between male and female respondents. This was done in order to establish if there is a statistically significant difference between male and female respondents on their experience with quality outcomes on artificial insemination services. The null hypothesis which states that there is no significant difference in means between male and female respondents would be accepted if $p < 0.05$. Table 4.12, provides the test statistic, the degrees of freedom and the p-value.

Table 4.12. Independent Samples t -Test for Quality Scores

		t	df	Sig. (2-tailed)
AI Service Providers	Equal variances assumed	-1.349	55	0.183
	Equal variances not assumed	-1.444	14.139	0.170
Farmers	Equal variances assumed	-1.426	175	0.156
	Equal variances not assumed	-1.386	122.592	0.168

Table 4.12 shows that the level of significance for the t statistic for quality scores in both the data for AI service providers and farmers was greater than α = 0.05. This was true for both cases when equal variances were assumed and when they were not. The null hypothesis that

there was no significant difference in the means of quality scores for male and female respondents in both AI service providers and farmers was therefore rejected. According to Maxwell (1971), the establishment of statistical association by means of chi-square does not necessarily imply any causal relationship between the attributes being compared, but it does indicate that the reason for the association is worth investigating.

4.4.4 Test of Homogeneity of Variance

The homogeneity of variance assumption is one of the critical assumptions underlying most parametric statistical procedures (Abdi, 2007). Levene's test was conducted in order to examine the homogeneity of variances between male and female quality scores for both AI service providers and farmers. The null hypothesis which stated that the variances are homogenous would be considered untrue if the test was significant at $p<0.05$. If this happened, the assumption of homogeneity of variances would be considered to have been violated. It would therefore, be concluded that the variances are significantly different. Table 4.13 gives the results of the Levene's tests for AI service providers and farmers.

Table 4.13. Levene's Test of Homogeneity of Variances

	Levene's Statistic	**df1**	**df2**	**Sig.**
AI Providers	0.559	1	55	0.458
Farmers	0.169	1	175	0.681

From the findings of the Levene's Test, the significance level for AI service providers was $p=0.458$. Since this was greater than the threshold of $\alpha=0.05$ the implication was that the variances of the quality scores for male and female AI service providers were not significantly different. Similarly, the farmers returned a level of significance of $p=0.681$ which meant that the variances of the quality scores for male and female farmers were also not significantly different. This meant that the assumption of homogeneity of variances held true for both cases. According to Nordstokke and Zumbo (2010), if a study can assume identical distributions, then it can assume homogeneity of variances.

Table 4.14 shows the output of the Welch test for both AI service providers and farmers with gender as the factor. The Welch test was conducted as an alternative to the ANOVA F test in

order to compare the means of the quality score for male and female respondents. This test is also referred to as the unequal variance t – test. Although the test is usually conducted where variances are significantly different, it was found necessary because according to Garson (2012), Welch test is usually recommended when equality of group means cannot be assumed.

Table 4.14. Welch's Robust Tests of Equality of Means of Quality Scores

		Statistic[a]	df1	df2	Sig.
AI Providers	Welch	2.086	1	14.139	0.170
	Brown-Forsyth	2.086	1	14.139	0.170
Farmers	Welch	1.921	1	122.592	0.168
	Brown-Forsyth	1.921	1	122.592	0.168

a. Asymptotically F distributed.

The Welch test yielded the F ratio F(1, 14.139) = 2.086 with a significance level of p = 0.170 for AI service providers. The F ratio from the Welch test on farmer respondents' data was F(1,122.592) = 1.921 with a significance level of p = 0.168. Since the *p*-value was larger than 0.05 in both cases, the F ratios were not significant, hence the null hypothesis that the means were not significantly different was accepted in both study populations. According to de Winter (2013) the Welch test is useful for samples with unequal means hence the results of the test on Quality of AI services can be relied upon.

4.4.5 Tests for Factorability and Sphericity

Factorability of data was measured through Principal Component Analysis using the Kaiser-Meyer-Olkin (KMO) Measure to establish the Sampling Adequacy. KMO compares the sizes of the observed correlation coefficients to the sizes of the partial correlation coefficients for the sum of analysis variables. Similarly, the test for sphericity was done using the Bartlett test with the null hypothesis that the correlation matrix is an identity matrix implying that there is no scope for dimensional data reduction for parameters used to measure quality of artificial insemination services. This would be rejected on a standard statistical significance of $p<0.05$. Table 4.15 shows the output of the KMO and Bartlet Test on parameters used to measure quality of artificial insemination services by farmers.

Table 4.15. KMO and Bartlett's Test

AI Providers	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.757
	Bartlett's Test of Sphericity	Approximate Chi-Square	1491.676
		df	153
		Sig.	0.000
Farmers	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.949
	Bartlett's Test of Sphericity	Approximate Chi-Square	2292.651
		df	190
		Sig.	0.000

The output of the KMO and Bartlet Test indicates a significance level of p = 0.00 for Approximate Chi-Square values of $\chi^2 = 1491.676$ and $\chi^2 = 2292.651$ for AI service providers and farmers respectively, The KMO measures of sampling adequacy were 75.7% and 94.9% respectively. The null hypothesis is therefore rejected in both cases. Consequently, both tests for the conduct of factor analysis were satisfied and so the data was considered factorable. According to Anastasiadou (2011), A KMO index greater than 70% is considered factorable.

4.5 Quality of Artificial Insemination Services

Quality has been described as the ability of a commodity or a service to evoke satisfaction through its intrinsic features (ISO, 2008). In this study, quality of AI services was operationalized as conception rate; response time; breed true to type; type of semen storage equipment; calving interval and; milk production. These were considered as key features of dairy production that would evoke the satisfaction of stakeholders.

4.5.1 Calving Interval

The average calving interval is considered as a measure of the quality of artificial insemination services because it can be correlated with AI efficiency (Muriuki, 2014). This study therefore sought to find out the average calving interval in the study area. Table 4.16 shows the descriptive statistics obtained on the average calving interval.

Table 4.16. Calving Interval

		Frequency	Percentage
Service Providers' response	Under 19 Months	14	24.6
	19 – 24	36	63.2
	25 – 30	7	12.3
	Total	**57**	**100.0**
Farmers' Response	Under 19 Months	84	44.9
	19 - 24 Months	74	39.6
	25 - 30 Months	19	10.2
	Over 30 Months	1	0.5
	No Response	9	4.8
Total		**187**	**100.0**

The majority of farmers (44.9%) indicated that their average calving interval was less than 19 months. However, majority of AI service providers (63.2%) indicated that the calving interval was 19–24 months. Using class medians of 15.5, 21.5 and 27.5, the calculated average calving interval as depicted by AI service providers was 20.75 months. This was corroborated by farmers whose responses gave a mean calving interval of 19.35 months based on class medians of 15.5, 21.5, 27.5 and 33.5 months.

4.5.2 Daily Milk Production

Milk productivity is one of the factors used as an indicator of quality of AI services in this study. The study therefore investigated the average daily milk production per cow. Table 4.17 shows the descriptive statistics on milk production in the study area.

Table 4.17. Daily Milk Production per Cow

	N	Mean	Standard Deviation
Milk Production Average	57	11.77	3.31
N	57		

Table 4.17 gives a mean daily milk production of 11.77 kilogrammes with a standard deviation of 3.31. Though average daily milk production levels of 70 kilogrammes have been achieved in the study area, current management systems place the average daily milk production at 12 kilogrammes per cow. (RoK 2011)

4.5.3 Self-Assessment of Providers on Ability to Deliver Quality

In order to establish the service providers' self-assessment of their ability to provide quality artificial insemination services, the study sought to find out their opinions on their ability to promptly respond to farmers' calls for inseminations and to always supply the farmers with the required type of breed. Table 4.18 shows a summary of the responses obtained through a multiple response set considering categories in the range of strongly agree, agree and neutral, based on a five point Likert Scale of strongly agree; agree; neutral; disagree and; strongly disagree.

Table 4.18. Providers' Ability to Deliver Quality

		Responses in Percentage
Ability to Provide Quality Service	Strongly Agree	43.0
	Agree	44.7
	Neutral	12.3
Total		**100.0**

Table 4.18 shows a multiple response set in which 87.7% (43.0% + 44.7%) of the AI service providers were positive that they had the ability to deliver quality of AI services. Only 12.3% of them were non-committal on their ability to provide quality services. Though Priem (2007) states that consumers are arbiters of value, the opinion of service providers can be an indication of the confidence to provide the desired quality of service. According to Gummenson (1991) service provider confidence has a positive correlation with some dimensions of service quality such as reliability, responsiveness and competence.

4.5.4 Semen Storage

The AI service providers were asked whether semen was deep frozen or was stored at room temperature. If frozen, the farmers were asked to indicate the size of their liquid nitrogen

cylinders. Table 4.19 shows the crosstabulation of legal status of service providers and the size of liquid nitrogen cylinders.

Table 4.19. Comparison between Liquid Nitrogen Cylinder Size and Legal Status

		Legal Status of AI Provider			Total
		Cooperative Society	Private Provider	Farmer Self-Help Group	
Liquid Nitrogen Cylinder Size in Litres	5 or Less	0	51	2	53
	Over 35	4	0	0	4
Total		**4**	**51**	**2**	**57**

Table 4.19 revealed that all the AI service providers used liquid nitrogen to store the semen at -196^{o}C. This is likely to lead to a higher efficacy of the semen and thus a higher conception rate. However, the size of the liquid nitrogen cylinder showed that private service providers and self-help groups used small cylinders of less than five litres while service providers from Cooperative societies had big cylinders of more than 35 litres.

4.5.5 Mode of Transport

The mode of transport was considered as an indicator of the ability to provide quality services. This research sought to find out the common mode of transport used by service providers. Table 4.20 shows a crosstabluation of the mode of transport and gender of AI service providers.

Table 4.20. Comparison between Gender and Mode of Transport

		Mode of Transport				Total	
		Private Motorbike		Public Motorbike			
		N	Percentage	N	Percentage	N	Percentage
Gender	Male	47	82.46	0	0.00	47	82.46
	Female	7	12.28	3	5.26	10	17.54
Total		**54**	**94.74**	**3**	**5.26**	**57**	**100.00**

Table 4.20 shows that 94.7% of the service providers used private motor cycles and 5.3% used public motorcycles, implying that all the AI service providers in the study used motorcycles as their means of transport. A further analysis of the data showed that all those

who used public motorcycles were females, implying that female service providers are likely to rely on somebody else to ferry them to service points.

4.5.6 Quality Rating by AI Providers

Perceptive indicators of quality of AI services were tested on a Likert scale of 1 – 5 where 1 was Excellent, 2 was Good, 3 was fair, 4 was Poor and 5 was deplorable. A descriptive analysis was conducted in order to determine the quality rating by AI service providers and farmers. A detailed analysis of the responses given by AI service providers using measures of central tendency (mean and standard deviation) is shown in Appendix 6. A summary of the responses using a multiple response set is shown in Table 4.21.

Table 4.21. Quality Rating by AI Providers

	Rating	**Percentage**
Quality Rating by service providers	Excellent	27.5
	Good	48.2
	Fair	23.1
	Poor	1.2
Total		**100.0**

Table 4.21 shows that majority (48.2%) of the AI service providers indicated that the quality of AI services they provided was good, meaning that there was room for improvement. 27.5% stated that the services were excellent while 23.1% stated that services were fair. Only 1.2% stated that the services were very poor.

4.5.7 Quality Ratings by Farmers

Quality scores were obtained from farmers for purposes of corroborating the AI service provider data. This was important because farmers, who are the final consumers of AI services, were believed to have a first – hand experience on the quality of the services (Priem, 2007). According to Gronroos (1982a); Lehtinen and Lehtinen (1982); Gummenson (1991) and Edvardsson (1992), quality of services can sufficiently be described using ten determinants namely reliability; responsiveness; competence; understanding; access; communication; courtesy; credibility; security and; tangibles. Appendix 7 shows a detailed tabulation of the descriptive statistics of contextualized determinants of service quality based

on the farmers' responses while a multiple response set for the same data is shown in Table 4.22.

Table 4.22. Quality Ratings by Farmers

		Percentage
Quality Scores	Excellent	13.0
	Good	38.6
	Fair	37.7
	Poor	9.6
	Deplorable	1.1
Total		**100.0**

Table 4.22 shows that 38.6% of the farmers indicated that the quality of AI services was good. The second class made up of 37.7% of the respondents stated that the quality of AI services were fair. The other respondents indicated different responses such as Excellent (13.0%), Poor (9.6%) and deplorable (1.1%).

4.5.8 Quality Rating Difference between Service Providers and Farmers

In order to establish whether there was a significant difference between quality ratings by service providers and by farmers, the quality data on quality of AI services from the two sources was subjected to a comparison using the Difference of Means. This was based on a null hypothesis that there was no significant difference between the mean of quality ratings by service providers and by farmers. This hypothesis would hold true if the resulting z statistic lies within the range of $-1.96<z<1.96$. Table 4.23 shows the results of the test for the difference of means.

Table 4.23. Summary of Quality Ratings

Respondents	N	Mean	Standard Deviation	Standard Error	z statistic
Service Providers	57	3.9961	0.49467	0.08307	6.6597
Farmers	177	3.4429	0.7001		

Table 4.23 shows that the average quality rating by AI service providers was 3.9961 with a standard deviation of 0.49467 while the mean rating by farmers was 3.4429 with a standard

deviation of 0.7001. The rating was based on a five point Likert Scale where 1 was excellent and 5 was deplorable. These results imply that quality of services was generally fair.

Table 4.23 further shows that the test for the difference of means of quality ratings by service providers and farmers yielded a z static of 6.6597 which was outside the acceptable range. It was therefore concluded that there was a significant difference between the quality ratings by service providers and the ratings by farmers. This means that the perception of quality held by farmers is different from that held by AI service providers.

4.5.9 Common Diseases in livestock

The study sought to establish the common reproductive diseases in livestock. Qualitative data indicated that the common fertility related diseases in cattle include:

> "Abortion, Brucellosis, Endo-metritis, Infertility, Metritis, Pyometra and Vaginitis."
> (Veterinary Officer 3 (VO3), VO4, VO6, VO7, VO8).

4.5.10 Bottlenecks in AI Services

AI service providers were asked whether there were other bottlenecks that hinder the delivery of quality AI services. This was considered to be important because quality cannot be realized fully unless such bottlenecks are identified. Table 4.24 shows the bottlenecks which were identified in the study.

Table 4.24. Bottlenecks Faced in AI Services

Bottleneck	Yes	No	Total
Skill	0	57	57
Semen Quality	0	57	57
Equipment	0	57	57
Animal Husbandry	46	11	57

Table 4.24 shows that skill, semen quality and equipment were not considered as a bottleneck in the provision of quality AI services. However, the animal husbandry practices were cited as a bottleneck by 80.70% of the AI provider respondents. This suggests that there is a need to focus more on the provision of extension services and the availability of farm inputs. According to RoK (2011), some of the factors contributing to poor returns include low

application of modern technologies since nearly 80 per cent of production is from smallholders with less than 2 ha, and gender inequalities, which constrain resource access.

4.5.11 Regulation by Veterinary Department

The study sought to establish the extent to which the AI services are regulated in order to determine the role of Government through the Department of Veterinary Services in ensuring quality of AI services. This was useful because even if one of the reasons for privatization was to remove Government regulation, the necessity to ensure that AI standards are met cannot be overlooked. The findings of the study on the regulation are shown in Table 4.25.

Table 4.25. Regulation By Veterinary Department

Level of Regulation	Frequency	Percentage
Very High	2	3.5
High	34	59.6
Moderate	21	36.8
Total	**57**	**100.0**

Table 4.25 shows that the service providers indicated that there is regulation by the Veterinary Department, with 59.6% stating that the regulation is high and 36.8% stating that it is moderate. Only 3.5% stated that the regulation is very high. These findings imply that the service providers recognize the role of regulation in quality of AI services thus the likelihood of adhering to such regulation. The findings contradict RoK (2011) who indicate that currently there are no formal guidelines governing the code of ethics and working standards for agricultural sector service providers in Kenya. This coupled with an absence of a regular monitoring system to assess the impact of extension and the different approaches used by different stakeholders implies that service providers in the agricultural sector are largely unregulated. The high level of regulation indicated by service providers was attributed to the fact that they are not allowed to practice without first getting a license from the County Director of Veterinary Services as shown by the qualitative response below.

> "For an AI service provider to start practicing they need to first get licensed by the County Director of Veterinary Services in order to control the invasion of quacks into the market"
> (VO2, VO5).

4.6 Capacity Building and Quality of AI Services

Capacity building was operationalized in this study to mean training and resource support. According to UWE (2008), capacity involves knowledge, skills, and problem-solving and decision-making capabilities, as well as resources, supports and structures. In order to establish the role of capacity building on quality of AI services, the study investigated the highest qualification of service providers, post-qualification training, type of support received and improvement resulting from capacity building.

4.6.1 Highest Qualification of AI Service Providers

The study sought to find out whether the highest qualification of service providers was related to AI services. A crosstabulation of highest qualification and whether that qualification is in an AI related field is shown in Table 4.26.

Table 4.26. Comparison between Highest Qualification and its Relation to AI

Highest Qualification	Is Highest Qualification on AI				Total	
	Yes		No			
	N	Percentage	N	Percentage	N	Percentage
Certificate	44	77.19	5	8.77	49	85.96
Diploma	1	1.76	0	0	1	1.76
Degree	7	12.28	0	0	7	12.28
Total	**52**	**91.23**	**5**	**8.77**	**57**	**100**

Table 4.26 shows that majority (91.23%) of AI service providers had highest qualifications in fields which are related to the AI services. Only 8.77% had their highest qualification not relating to the AI service. These were providers who studied other courses and later took short courses on AI. The implication of this finding is that the 91.23% of the AI service providers have not shifted from their initial professions.

4.6.2 Post-Qualification Training

The study further sought to investigate if any post-qualification training was received in the AI related field in order to improve on the initial skill of the service providers. Table 4.27 shows the responses obtained.

Table 4.27. Post Qualification Training on AI

	Frequency	Percentage
Yes	41	71.9
No	16	28.1
Total	**57**	**100.0**

Table 4.27 shows that there is an investment in skill improvement in the study area. This is evident from the fact that 71.9% of the respondents had undergone some form of post-qualification training. Only 28.1% of the service provider respondents had not undergone any post qualification training. A further scrutiny found that these trainings were done by semen suppliers in an effort to promote their breeds and were skewed towards advertising and marketing.

4.6.3 Resource Support

Resource support was considered as one of the key ingredients that would influence the quality of AI services. This was in view of the fact that external resources have often been deemed as crucial for business expansion. The study sought to find out whether there is any external support to AI service providers either from Government or non-Governmental bodies. Table 4.28 shows the frequencies on the two sources of support.

Table 4.28. Legal Status of AI Business and Support Received

Source of Support	Legal Status of Provider	Support Received				Total
		Yes		No		
		N	Percentage	N	Percentage	
Government	Cooperative society	4	100	0	0	4
	Private	6	11.8	45	88.2	51
	Farmer SHG	2	100	0	0	2
	Total	**12**	21.1	**45**	78.9	**57**
NGOs	Cooperative society	1	25	3	75	4
	Private	10	19.6	41	80.4	51
	Farmer SHG	1	50	1	50	2
	Total	**12**	21.1	**45**	78.9	**57**

Table 4.28 shows that 21.1% of the AI service providers had received resource support from the Government and 21.1% had received support from NGOs. Though the number of AI service providers who had received Government support was the same as those who had received NGO support, the two groups were not entirely mutually inclusive. A further scrutiny of the data showed that 14.0% of the respondents had received resource support from both the Government and NGOs. This implies that 71.8% of AI service providers had not received any resource support whatsoever. A further probe showed that 100% of Cooperative societies and self-help groups had received support from the Government. However, Government support for private AI service providers was low, since it was only 11.8% of them who had received this support.

Support from NGOs favoured self-help groups more than other service providers. This is evident from the fact that 50% of the self-help groups had received some support from NGOs. There was low NGO support to Cooperative societies and private providers where 25% and 19.6% had received some support respectively. This is an indication that NGOs have low confidence in individuals and cooperative societies.

4.6.4 Types of Support Received by AI Service Providers

The type of support given contributes to the improvement in quality of AI services. The study sought to find out the type of support given to AI service providers by Government and NGOs. Table 4.29 shows the details of the support given to the providers in the study area.

Table 4.29. Types of Support Received by AI Providers

Type of Support	Government Support		NGO Support	
	Frequency	Percentage	Frequency	Percentage
Credit	0	0	2	16.7
Equipment	0	0	2	16.7
Training	12	100	10	83.3
Semen Supply	0	0	0	0
Consumable Supplies	0	0	0	0

Table 4.29 shows that the Government did not provide any form of material or financial support to AI service providers. Government support only came in form of training in order to improve the skill of the service providers. On the other hand, NGOs also provided support in form of training with 83.3% of the AI service providers acknowledging support and indicating that they had been trained at least once. NGOs support was not confined to training as was found with Government support. Out of the AI service providers who acknowledged NGO support, 16.7% stated that they had received support in form of credit. Another 16.7% of them indicated that they had received support in form of equipment for AI.

4.6.5 Types of Support Received by Farmers

In order to compare farmer responses with those of service providers, the study investigated the type of support received by farmers. Table 4.30 shows the results of the investigation.

Table 4.30. Support Received by Farmers

		Responses		
		Frequency	**N**	**Percentage**
External Support[a]	Credit Support	4	178	2.2
	Semen Supply	19	178	10.7
	Equipment Support	18	178	10.1

a. Dichotomy group tabulated at value 1.

Table 4.30 indicates that there is a very low level of resource support to farmers since only 2.2% of the farmers indicated that they received credit support. Similarly, only 10.7% and 10.1% of the farmers had received support in terms of semen supply and equipment respectively. It was apparent that NGO support and subsidies for farmers was very low.

4.6.6 Extent of Improvement Resulting from Support

Capacity building in terms of training and material support is likely to bring a positive change in quality of AI services. Training improves a learner's knowledge, skill and attitude hence increases the capacity to solve problems and to make decisions (Camirelli and Falzon, 2014). Other forms of support can also be instrumental in increasing capacities of service providers. This study sought to find the extent to which post-qualification training as well as financial, material and equipment support to AI service providers had helped them improve their AI

businesses. The responses were based on a Likert Scale of 1 – 5 in which 1 was very high and 5 was very low. Table 4.31 shows the response rates obtained on the level of improvement.

Table 4.31. Extent of Improvement Resulting from Support

		Frequency	Percentage
Training Support	Very High	7	12.3
	High	14	24.6
	Moderate	20	35.1
	Not Applicable	16	28.0
	Total	**57**	**100.0**
Financial, Equipment and Material Support	Very High	2	3.5
	High	3	5.3
	Moderate	12	21.1
	Not Applicable	40	70.1
	Total	**57**	**100.0**

From the responses in Table 4.31, it is apparent that all the 41 service providers who had received post-qualification training had recorded some improvement in their businesses as a result of the training. The majority (35.1%) of the AI service providers stated that they had experienced moderate improvement while another 24.6% stated that they had recorded a high level of improvement. Only 12.3% of the service providers stated that they had recorded a very high level of improvement in their AI business as a result of the post-qualification training received.

Table 4.31 further shows that there was a moderate improvement resulting from financial, material and equipment support as indicated by the 17 respondents who indicated that they had received some support. A few of the service providers making up 3.5% stated that they had received a very high level of improvement in their business while another 5.3% had experienced a high level of improvement. This could imply that the level of financial support was low or whenever it was made available it was not used with a high level of efficiency. The low level of support was corroborated by qualitative data from interviews with Veterinary Officers, whose response was,

> "The level of financial support is very low. Most of the donors prefer to support groups and cooperative societies and self-help groups rather than supporting private inseminators. The only reprieve for the inseminators is

through bank and microfinance loans which are low in amount and sometimes not forthcoming due to the low capitalization of most private AI businesses"
(VO1, VO3, VO7)

The level of capacity building of AI service providers can be confirmed by the level of services they are able to provide to farmers. The study sought to find the frequency of certain services which included veterinary disease treatment, artificial insemination, dairy cattle information, input supply and breeding information provision. These were deemed to be indicative of the level of capacity building. Table 4.32 shows the responses obtained from farmer respondents, based on a Likert scale of 1 – 5 where 1 was very frequent, 2 was frequent, 3 was only when needed, 4 was rarely available and 5 was never.

Table 4.32. Multiple Response on Service Availability

	Percentage
Frequent	19.37
Only When Needed	59.52
Rarely Available	12.73
Never	8.38
Total	**100.0**

The multiple response set shown in Table 4.32 on data for AI Service, Dairy Information, Input Supply, Extension Services and Breeding Information revealed that services were largely available only when needed as indicated by 59.52% of the farmers. This is attributed to the cost of providing such services which makes it difficult for service providers to provide them using a supply-driven approach without the demand for them. The conflicting interests of farmers, some of who may not regard dairy production as their main economic activity may be another hindrance to their access to AI related services.

4.6.7 Frequency of Training

Training is probably the most common and easiest form of capacity building which is given to farmers. This study therefore sought to find out the frequency of training from various stakeholders in the twelve months preceding the study in order to establish the level of activity of the stakeholders in capacity building. Table 4.33 shows the responses obtained on the frequency of training.

Table 4.33. Frequency of Training

Training Organizer	N	Trainings Done		Number Trained	
		Mean	Standard Deviation	Number	Percentage of sample
Government	173	4.3092	3.5254	145	83.81
Cooperative Societies	169	2.5296	2.8013	119	70.41
Farmer Groups	171	3.1579	3.1536	128	74.85
Semen Suppliers	171	1.3480	2.5605	61	35.67
AI Providers	172	2.3692	3.6333	91	52.91

Table 4.33 shows that the Government is the most active provider trainings to farmers both in terms of number of trainings and the spatial and temporal coverage of the trainings. This is demonstrated by the mean of 4.302 trainings per person. The data shows that 83.81% stated that they had received Government training at least once. Farmer groups were the next most active with a mean of 3.1579 trainings and coverage of 74.85% of the farmers. They were followed by cooperative societies with a mean of 2.5296 trainings and a coverage of 70.41% of the farmers. AI service providers were next with a mean of 2.3692 trainings and a coverage of 52.91% of the farmers. The results further showed that semen suppliers played a minimal role in farmer training with a mean of 1.348 trainings and a coverage of 35.67% of the farmers.

4.6.8 Existence of Farm Plans

The existence of a documented farm plan is an indicator of a farm business with a strategic direction. This may in turn be attributed to the level of capacity building received by farmers in form of training. The study sought to find out how many farmers had documented farm plans which they used to guide them in the farm activities. Table 4.34 shows the number of farmers who had farm plans.

Table 4.34. Existence of Farm Plans

	Frequency	Percentage
Yes	22	11.8
No	153	81.8
No Response	12	6.4
Total	**187**	**100.0**

Table 4.34 shows that only 22 farmers had written farm plans indicating a prevalence rate of 11.8%. This implies that farmers make and record most decisions mentally without writing them down, exposing them to recall errors and inconsistencies in the implementation of such decisions.

4.6.9 Most Significant Source of AI Information

Farmers were also asked to indicate their most significant source of information. This was considered to be an indication of whether they are able to actively seek for information or they rely on information received passively. Table 4.35 shows the responses obtained.

Table 4.35. Most Significant Source of AI Information

	Frequency	Percentage
Extension Services	75	39.9
Tours	15	8.0
Farmer Discussions	41	21.8
Internet	9	4.8
On-farm Experiences	35	18.6
No Response	12	6.9
Total	**187**	**100**

Table 4.35 shows that the most significant sources of AI information to farmers were extension services, farmer-to-farmer discussions and on-farm experiences which were considered as passive sources of information in which farmers did not have to exert any effort in acquiring. The percentages of farmers receiving information from these sources were 39.9% for extension services and 21.8% for farmer-to-farmer discussions, giving a total of 80.3% of the farmers. The implication of this is that majority of farmers were still passive about seeking information and relied on information that came to them rather than actively

seeking for it from external sources. The results further indicated that few farmers were willing to spend money to obtain information as shown by 8.0% of the respondents who went for farmers' tours and 4.8% who relied on the internet, giving a total of 12.8% of the farmers.

4.6.10 Sources of Farm Inputs

The source of farm inputs can also be an indication of the capacity of farmers in running their dairy enterprises. Inputs sourced from agrovet shops are likely to be on individual terms whereas inputs sourced from cooperative societies and self-help groups could indicate that farmers were able to use networks in order to obtain the inputs, thus giving them better terms of purchase. Table 4.36 shows the main sources of inputs for the farmer respondents.

Table 4.36. Sources of Farm Inputs

	Frequency	**Percentage**
Cooperative Societies	19	10.1
Self Help Groups	6	3.2
Private Agrovets	153	81.4
No Response	9	5.3
Total	**187**	**100.0**

Table 4.36 shows that the majority of farmers (81.4%) purchase their inputs from agrovet shops. Only 10.1% purchase from the cooperative societies and 3.2% from self-help groups, thus enjoying the synergy brought about by combining efforts of farmers coming together. This was confirmed by a further probe from Veterinary Officers, who showed that despite the benefits of purchasing inputs together, management issues in the cooperative societies and groups have led farmers into shying away from investing in such bodies.

> "Most cooperative societies have closed down because of management wrangles and poor returns for farmers from sale of produce. Cases of farmers receiving negative returns are not uncommon"
> (VO4)

According to the secondary data from the Veterinarians, the main reason for the formation of self-help groups was to maintain the benefits of the synergy of marketing produce together while at the same time avoiding the problems associated with cooperative societies. This

implies that the self-help groups were mainly formed as an escape mechanism from the problems associated with cooperative societies.

> "Many farmers have opted to operate either as individuals or in groups. Their mode of operation has been mostly transactional where produce is combined and marketed together. Costs are shared according to quantity of produce and the proceeds are then issued on the same basis".
> (VO8).

> "The low level of purchasing for self-help groups can be attributed to the procedure of procuring which involves ordering and waiting for supplies unlike private agrovets where most purchases are readily available and transactions are mostly over the counter"
> (VO5).

4.6.11 Hypothesis Test on Capacity Building

The first hypothesis of the study predicted that capacity building has a significant influence on quality of artificial insemination services in Nyeri County. The relationship between capacity building and quality of artificial insemination services was established through linear regression equation of the average of the outcomes of capacity building on quality parameters for service providers and farmers. This was done with the assumption that the data was homoscedastic hence a uniform distribution of error terms with uniform variance across the data range. Table 4.37 shows the results of the regression analysis for service providers and farmers.

Table 4.37. Linear Regression of Capacity Building on Quality of Services

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Standard Error	Beta		
Service providers	Constant	1.811	0.141		12.83	0.000
	Capacity Building	0.05	0.037	0.179	1.346	0.184
Farmers	Constant	2.132	0.125		17.057	0.000
	Capacity Building	-0.04	0.046	-0.066	-0.872	0.384

Dependent Variable: Average of Quality Parameters for service providers and farmers respectively

Table 4.37 shows that the intercepts of the regression equations were 1.811 for service providers and 2.132 for farmers. This implies that without any capacity building, the quality

of AI services was expected to be good while for the farmers it was expected to be fair. This was based on the equidistant distribution of measures of quality of service on the Likert Scale for measuring quality parameters. The regression coefficient for service providers was 0.05 which implies that for every extra unit of capacity building, there was a quality increase of 0.05. The regression model emanating from the analysis is thus:

Quality of AI Services (Service Providers) = 1.811 + 0.05 Capacity Building

The regression coefficient for farmers on the other hand was -0.04 with a y intercept of 2.132, which implies that for every extra unit of capacity building, there was a quality decrease of 0.04 as shown in the following regression model:

Quality of AI Services (Farmers) = 2.132 – 0.04 Capacity Building

A t-test was carried out in order to determine the statistical significance of the relationship. The test was considered appropriate because the relationship was bivariate. The test revealed a t statistic of t(56)=1.346 with a significance level of p=0.184 for service providers. The t statistic for farmers was t(186)= -0.872 with a significant level of 0.384. This meant that at $\alpha = 0.05$, there was no significant relationship between capacity building and quality of AI services. A correlation analysis was done in order to confirm the null hypothesis or to reject it. This helped to analyse the strength of the relationship between capacity building and quality of AI services as hypothesized. Table 4.38 shows the Pearson Product Moment Correlation Coefficient derived after the analysis.

Table 4.38. Correlation Analysis for Capacity Building and Quality

	R	R Square	Adjusted R Square	Standard Error of the Estimate
Service Providers	0.179[a]	0.032	0.014	0.498
Farmers	0.076[a]	0.006	0	0.6330958

a Predictors: Constant, Extent of Improvement from Training

The results of the correlation analysis showed a correlation coefficient of r = 0.179 for service providers and r = 0.076 for farmers which indicated a very weak correlation between the variables under analysis. From this finding therefore, it was concluded that there was no significant relationship between capacity building and quality of AI services.

A comparison with the qualitative data was done to confirm the level of capacity building received by AI service providers. Veterinary Officers confirmed that there was little Government support given to the service providers and there was no requirement for them to attend any refresher courses. The Veterinary Officers further stated that there were few trainings by suppliers of semen and AI equipment but these were only geared towards promoting their sales as shown in the verbatim responses of the Veterinary Officers.

1. "No formal post-qualification training on the supervision of AI services has been offered." (VO1).
2. "However, semen suppliers have been organizing short refreshers courses which are mostly intended to popularize their semen brands." (VO6)
3. "There is no requirement that AI service providers undertake any refresher courses after they have been qualified and certified." (VO3)
4. "Most service providers, especially the private ones have not gone for any post-qualification training" (VO5).

4.7 Technology Application and Quality of AI Services

Technology application was operationalized to mean breeding technologies such as sex selection, oestrus synchronization and embryo transfer as well as the application of ICT in dairy farming. Various authors have shown that technology advancement in dairy farming is taking place continuously (Thomas, 2015; Larson, 2014; Karabinus *et al*, 2014 and Ogbomo and Ogbomo, 2008).

4.7.1 Service Providers Assessment of Farmers using Various Technologies

The study sought to find out from AI service providers the percentage of farmers who apply various breeding technologies in Nyeri County. The responses were categorized on a five point Likert Scale where 1 was none and 2, 3, 4 and 5 represented the four quartiles in an ascending order. A descriptive analysis of the results is shown in Table 4.39.

Table 4.39. Service Providers Assessment of Farmers using Various Technologies

Technology	N	Minimum	Maximum	Mean	Standard Deviation
Sex Selected Semen	57	1	3	1.96	0.462
Oestrus Synchronization	57	1	4	1.89	0.451
Embryo Transfer	57	1	1	1.00	0.000

Table 4.39 shows the means of the results on the number of farmers who apply breeding technologies. Basing the results on an equidistant Likert scale, the results were interpreted such that 1 was interpreted to mean none; 1.1 - 2 meant 15% – 25%; between 2.1 and 3 meant 26% - 50%; between 3.1 and 4 was interpreted to mean 51% - 75%; between 4.1 and 4.9 meant 76% - 99% and 5 meant 100%. The results therefore showed that sex selected semen had a mean of 1.96 implying that this technology was practiced by slightly less than and 25% of the farmers. Similarly, the mean for Oestrus synchronization was 1.8 implying that less than 25% of farmers practiced the technology in their farms. The results for embryo transfer was 1.00 implying that none of the farmers practiced it.

The quantitative data on on-farm technology application was corroborated by the qualitative data from Veterinary Officers:

> "Use of sex selected semen and oestrus synchronization is practiced by a few progressive farmers. However embryo transfer is a technology that has not reached the County. It requires specialized training and expensive procedures which might not break even for local farmers. The cost of providing these technologies to the farmers is almost double the cost of ordinary semen and the conception rates tend to be lower thus discouraging the adoption rates"
> (VO2, VO5, VO8)

4.7.2 Breeding Technology Used

In order to corroborate the responses of the AI service providers on technology application, the study sought to find out the number of farmers in the sample who applied various breeding technologies. Table 4.40 shows the farmers' responses on the type of breeding technology used.

Table 4.40. Type of Breeding Technology Used

	Embryo Transfer		**Sex selected Semen**		**Oestrus Synchronization**	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Yes	0	0	63	33.51	19	10.11
No	176	93.62	112	59.57	157	83.51
No Response	11	6.38	12	6.91	11	6.38
Total	**187**	**100**	**187**	**100**	**187**	**100**

The comparison of the AI service providers' with farmers' responses confirmed that the trend of technological advancement in breeding was realized by only a small percentage of the farmers. The farmers also confirmed that embryo transfer is not practiced in the study area. The results also showed that 33.51% of the farmers used sex-selected semen while 10.11% practiced oestrus synchronization.

4.7.3 Channels of Communication between AI Providers and Farmers

The study sought to find out how ICT is applied in dairy farming in Nyeri County in order to establish its role in quality of AI services. In order to achieve this, an enquiry was made on the frequency with which service providers communicated to farmers using various channels that are considered as components of ICT. Table 4.41 shows a descriptive analysis of the responses obtained, based on a Likert Scale of 1 – 5 where 1 was "never"; 2 was "rarely"; 3 was "only when needed"; 4 was "frequently" and 5 was "very frequently".

Table 4.41. Channels of Communication-AI Providers to Farmers

	N	Minimum	Maximum	Mean	Standard Deviation
Internet	57	1	2	1.30	0.462
Mobile Phones	57	3	5	4.93	0.371
Landline	57	1	3	1.14	0.398
Hand Delivered Notes	57	1	5	1.23	0.627
Sent Oral Messages	57	1	5	2.89	1.345
Message Kiosks	57	1	5	2.47	1.465
Physical Contact	57	1	5	2.70	1.267

The interpretation was based on an equidistant scale where a mean of 1 meant never; between 1.1 and 2.0 meant rarely; between 2.1 and 3.0 meant "only when needed"; between 3.1 and 4.0 meant frequently and between 4.1 and 5.0 meant "very frequently". The interpretation therefore, was that internet, landline telephones and hand-delivered notes which had mean scores of 1.3, 1.14 and 1.23 respectively are rarely used by AI service providers. Message kiosks, physical contact and oral messages which had mean scores of 2.47, 2.70 and 2.89 respectively were used only when needed. These may not therefore be the most preferred methods of communication and were probably used in cases of emergencies; when they were the most convenient at a given time or when the message to be communicated was so crucial

that it could not be transmitted otherwise. The use of mobile telephones was the most widespread with a mean of 4.93, indicating that it was very frequently used.

4.7.4 Channels of Information Received by Farmers

In an attempt to corroborate the data on communication channels, farmers were asked to indicate the frequency in which they receive AI related information from similar channels. This was to ascertain the degree to which ICT is used in order to create a strong channel of information flow between Farmers and AI service providers. The results are shown in Table 4.42.

Table 4.42. Channels of Information Received by Farmers

	N	Minimum	Maximum	Mean	Standard Deviation
Radio	176	1	5	3.05	1.220
Television	176	1	5	2.31	1.135
Mobile Telephone	174	1	5	1.68	1.074
Landline Telephone	172	1	3	1.10	0.336
Internet	172	1	5	1.69	1.110

Table 4.42 indicates that the commonest channel of receiving information by farmers was the radio with a mean of 3.05 which implies that it was frequently used. Television had a mean of 2.31 implying that it was often used as a source of AI related information. Internet, mobile and landline telephones had means of 1.69, 1.68 and 1.10 respectively meaning that they were seldom used for acquiring AI related information.

4.7.5 Channels of Communication by Farmers

The study investigated the channels used by farmers in order to communicate with AI service providers. This was in recognition of Shannon and Weaver's model of communication which describes communication as being a two way process of sending and receiving information through a medium. Farmer respondents were therefore asked to indicate the frequency of using various ICT media and the results shown in Table 4.43 were obtained.

Table 4.43. Channels of Communication by Farmers

Channel	N	Minimum	Maximum	Mean	Standard Deviation
Email	170	1	5	1.22	0.692
Mobile Telephone	174	1	5	3.09	1.291
Landline Telephone	172	1	4	1.12	0.408
Hand Delivered Notes	169	1	5	1.34	0.793
Oral Intermediary	170	1	5	1.64	1.074
Message Kiosk	173	1	5	2.16	1.199
Physical contact	173	1	5	3.87	1.285

Table 4.43 shows that physical contact had a mean of 3.87 which implies that farmers frequently communicate with AI service providers through physical contact. This, according to the data, is the most common channel of communication to service providers. The data also shows that mobile telephones had a mean of 3.09, which implies that farmers communicated with AI providers using mobile telephones when there is a need. This was the second most common channel of communication for farmers to AI service providers. The third most common channel was the use of a message collection point (message kiosk) which had a mean of 2.16 indicating that it was rarely used. Other channels were oral intermediary, hand – delivered notes, email and landline telephones with means of 1.64, 1.34, 1.22 and 1.12 respectively. This implies that majority of respondents rarely used these channels to communicate with AI service providers.

4.7.6 Presence of Database

The presence of a database may indicate a demand for information, while the location of the database may indicate the level of plurality in managing the data and the level of ICT usage in accessing the data. This study therefore sought to find out if a database for AI information existed and whether it was centrally located or scattered. The study also sought to find out who maintained the database and the results shown in Table 4.44 were obtained.

Table 4.44. Presence of Database

		Frequency	Percentage
Presence of Database	Yes	45	78.9
	No	12	21.1
	Total	**57**	**100.0**
Location of Database	Central	28	49.1
	Scattered	17	29.8
	Not Applicable	12	21.1
	Total	**57**	**100.0**
Who Maintains Database	Government	16	28.1
	Private Practitioners	17	29.8
	Suppliers	7	12.3
	Cooperative Societies	5	8.8
	Not Applicable	12	21.1
	Total	**57**	**100.0**

Table 4.44 shows that 78.9% of the service provider respondents knew that there was a database on AI while 21.1% were not aware of the existence of the database. This indicates that those who were not aware of the database had not been updating themselves with new information on AI through the internet, hence they were only using the knowledge they gained during training for their practice.

Among the respondents who were aware of a database, 49.1% indicated that the database was centrally located while 29.8% indicated that the database was scattered. This implies that the service providers relied only on one source of data and were not aware of other sources. In regards to who maintains the database, Government, private practitioners, suppliers and cooperative societies were pointed out by 28.1%, 29.8%, 12.3% and 8.8% respectively. This implies that there was a plurality of sources of information for service providers; hence ICT can be useful for farmers who want to research on farm related issues.

4.7.7 Hypothesis Testing on Technology Application

The second hypothesis in this study was that there is a significant relationship between technology application and quality of AI services. In this study, technology application was operationalized to include the use of ICT and breeding technologies such as sex selected

semen, oestrus synchronization and embryo transfer. A linear regression analysis was used to determine the relationship between the use of ICT and quality of AI services. The assumptions of normality, homoscedasticity, and independence were maintained in this test. The results of the regression analysis are shown in Table 4.45.

Table 4.45. Linear Regression of ICT use on Quality of Service

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Standard Error	Beta		
Service Providers	Constant	4.327	0.664		6.517	0.000
	ICT Use	-0.106	0.212	-0.067	-0.501	0.618
Farmers	Constant	2.722	0.210		12.988	0.000
	ICT Use	0.284	0.091	0.228	3.122	0.002

Dependent Variable: Average Quality Rating

Table 4.45 shows that the linear regression equation for service providers had a y-intercept of 4.327 and a slope of -0.1063. This implies that based on the equidistant distribution of responses, the service providers believed that without the use of ICT, quality of AI services was excellent but gradually declined when ICT was used. The presentation of this relationship was thus,

Quality of AI Services (Service Providers) = 4.3272 – 0.1063 ICT Use

Farmers on the other hand indicated that the y intercept for the relationship between ICT use and quality of AI services was 2.7216, with the regression line displaying a slope of 0.2836. This implies that without any use of ICT, the quality of service based on the equidistant distribution of scores on the Likert scale for quality parameters is poor. The application of ICT in AI services however, brings about an improvement in the quality of AI services. The presentation of the regression equation therefore is:

Quality of AI Services (Farmers) = 2.7216 + 0.2836 ICT Use

A further analysis of the relationship between ICT use and quality of AI services using a t-test revealed a t statistic of t(56) = 0.5011 with a significance level of 0.6813 for AI service

providers which was above the threshold of $\alpha = 0.05$ implying that this relationship was not significant and could therefore not be relied upon. The t statistic for farmers was $t(186)=3.1225$ with a significance level of $p=0.0021$. This implies that at $\alpha=0.05$, there was a significant positive relationship between the use of ICT and the quality of AI services for farmers. Qualitative data supported this finding where mobile phones were reported to have a tremendous influence on service delivery to farmers as shown in the following response:

> "The use of ICT in AI is growing. Almost all farmers have access to mobile telephones. The use of internet is only confined to the younger generations. Landlines were used in the past but are no-longer used."
> (VO4, VO5).

The data for both models was taken through a Pearson Product Moment correlation in order to verify the hypothesis test and to explain the degree to which collected data can be explained by the resulting regression equations. Table 4.46 shows the output of the correlation analysis.

Table 4.46. Correlation between ICT Use and Quality of Services

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate	df1	df2
Service Providers	0.067421	0.004546	-0.01355	0.498006	1	55
Farmers	0.228496	0.05221	0.046856	0.874732	1	177

The results of the regression analysis gave a correlation coefficient of $r = 0.067421$ which implies that there is a very weak correlation between ICT use and quality of AI services experienced by the service providers. The results gave a coefficient of determination $r^2 = 0.004546$ meaning that only 0.4546% of the quality of services experienced by service providers can be explained by the level of ICT usage by the AI service providers. This implies that there was almost no correlation between the use of ICT and quality of AI services for the service providers. However, there was a weak correlation between the two variables for farmers of $r=0.228496$ giving a coefficient of determination of $r^2= 0.05221$. This implies that 5.221% of quality of AI services experienced by farmers can be explained by the level of use of ICT by the farmers.

Pearson's Chi Square distribution was used to test the significance of the association between breeding technologies and quality of AI services because it involved nominal data. According to Zibran (2007), Chi-square (χ^2) test is a nonparametric statistical test used to determine if the two or more classifications of the samples are independent or not and can only be applied to qualitative data classified into categories, or labelled using nominally scaled variables. Breeding technologies were operationalized to include semen sexing, oestrus synchronization and embryo transfer. The Chi square test was carried out in order to find out if there was any dependence between the use of at least one of the technologies by farmers and the quality of AI services. The test was not done for AI service providers because they were all found to have used at least one of the technologies. Table 4.47 shows the results of the Chi Square test of independence carried out on the indicators.

Table 4.47. Independence between Breeding Technology and Quality of AI Services

	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	60.794[a]	50	0.141
Likelihood Ratio	77.459	50	0.008
Linear-by-Linear Association	4.316	1	0.038
N of Cases	176		

a. 101 cells (99.0%) have expected count less than 5. The minimum expected count is 0.45.

From Table 4.47 it is observed that the Chi Square test violated the assumption for not more than 20% of the cells having an expected value of less than 5. The Likelihood Ratio was therefore used to test the level of dependence between the variables. This test returned a likelihood ratio of 77.459 with a significance level of $p = 0.008$. Since the level of significance for the study was $\alpha = 0.05$, the hypothesis that there was an association between technology use and quality of AI services was accepted.

The conclusion therefore, was that there was no significant relationship between the use of technology and the quality of AI services experienced by AI service providers. On the other

hand, there was a significant relationship between the use of technology by farmers and the quality of AI service they experienced on the farms.

4.8 Legal Status of Service Provider and Quality of AI Services

The different legal aspects of service providers emanating from the privatization of AI services imply that the management of the service provider organizations is different, thus affecting the quality of AI services. Legal status was therefore an independent variable in this study. This was operationalized as the legal registration type of the service provider and the percentage of farmers who are members.

4.8.1 Distribution of Legal Status of AI Service Providers

The study sought to find out the legal registration types of the AI service providers by investigating the two indicators of legal status namely the type of organization and number of practitioners involved. Table 4.48 shows the different legal forms of service providers found in the study area.

Table 4.48. Legal Status of AI Business

	Frequency	Percentage
Government	0	0
Cooperative Society	4	7.0
Private Provider	51	89.5
Farmer Self-Help Group	2	3.5
Other	0	0
Total	**57**	**100.0**

From the findings in Table 4.48, it is apparent that there were only three legal types of AI service providers namely farmers' cooperative societies, private service providers and farmers' self-help groups. The table also shows that majority (89.5%) of service providers were private. Cooperative societies and farmers' self-help groups comprised of 7.0% and 3.5% of service providers respectively. Notably, there was no service provision from Government. This data was corroborated by the qualitative data from Veterinary Officers who said that:

> "The privatization process led to the total withdrawal of Government from the provision of AI services and any Government veterinarian or Animal Health Assistant who offers the service is doing so in a private capacity and

not as part of official work. The role of Government has therefore become purely regulatory."
(VO7)

4.8.2 Provision of AI Services by Cooperative Societies and Self-Help Groups

The study further investigated the distribution of farmers' membership to the different legal forms of service providers. This assumed a state of mutual exclusivity in the membership. The findings on the distribution are shown in Table 4.49, which is a crosstabulation of whether they were members of self-help group or cooperative societies and whether AI services are provided by the self-help group or cooperative society in which they are members if applicable.

Table 4.49. Comparison between Group Membership and Group AI Service Provision

		Group Provision of AI						Total
		Yes	Percentage	No	Percentage	Not Applicable	Percentage	Percentage
Membership in SHG or Cooperative Society	Yes	55	31.3	46	26.1	0	0	**57.4**
	No	0	0	0	0	75	42.6	**42.6**
Total		**55**	**31.3**	**46**	**26.1**	**75**	**42.6**	**100.0**

Table 4.49 shows that 57.4% of farmers are either members of cooperative societies or self-help group. Included in that category of farmer respondents are 31.3% who stated that they were members of self-help groups or cooperative societies which provide AI services while 26.1% were members of entities that did not provide the service. This implies that 68.7% of the farmer respondents relied on private AI service providers, including the 26.1% whose entities did not provide the service.

The results on Table 4.49 are corroborated by the qualitative data from Veterinary Officers which showed that:

> "Most farmers were originally members of cooperative societies. The liberalization of markets brought about the downfall of many of the cooperative societies, mostly prompted by poor management and low returns from the sale of produce that resulted from hidden and often unreasonable costs incurred by the cooperative societies. Some farmers have later formed self-help groups for purposes of marketing milk and other

> farm produce in combined bulk after which the costs and proceeds are shared according to each farmer's quantity of produce". (VO7)

Upon probing why some cooperative societies had to close down, the following responses were obtained:

> "Extremely high costs of operations led to situations where after delivering their dairy products for a month, farmers would find themselves in debt due to resultant negative returns because the costs were higher than the value of produce." (VO4)

> "Milk prices went down to uneconomical levels after privatization and collapse of the major milk buyers thus destroying the financial bases of most cooperative societies. The prices only started recovering in the year 2013". (VO1)

4.8.3 Entity Member Cost Differences

The study further probed to find out whether farmers who were members of cooperative societies or self-help groups had experienced any cost differences in AI services. The results of the probe are shown in Table 4.50.

Table 4.50. Entity Member Cost Differences

	Frequency	Percentage
Yes	27	14.4
No	28	14.9
Not Applicable	121	64.4
No Response	11	6.4
Total	**187**	**100.0**

Table 4.50 shows that among the farmers who were members of cooperative societies or self-help groups, only 46.0% had experienced a cost difference in the service between members and non-members.

4.8.4 Hypothesis Testing on Legal Status

The third hypothesis of the study stated that there is a significant relationship between the legal status of AI service provider organization and quality of artificial insemination services in Nyeri County. This relationship was tested by conducting a one-way ANOVA in order to

investigate whether there is a significant difference in the quality of AI services from the three legal forms of service providers for both AI service providers and farmers. The results of the test on service providers are shown in Table 4.51.

Table 4.51. ANOVA of Quality Based on Legal Status for Service Providers

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.8488	2	0.4244	1.782926	0.177901
Within Groups	12.8540	54	0.2380		
Total	**13.7028**	**56**			

Table 4.51 gives a mean square between groups of 0.4244 and a mean square within groups of 0.2380 thus giving an F statistic of F(2,54) = 1.78292. The level of significance of the statistic was p=0.177901. Since the p level was greater than $\alpha = 0.05$, it was concluded that the F statistic was not significant, implying that there was no significant difference in quality of AI services experienced by service providers regardless of whether they operated as private providers, cooperative societies or self-help groups.

The test was repeated for farmers in order to establish whether there was a significant difference in the quality of AI service experienced when provided by any of the three legal forms of service providers giving the results shown in Table 4.52.

Table 4.52. ANOVA of Quality Based on Legal Status for Farmers

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.907385	2	3.453693	4.819695	0.009185
Within Groups	123.9682	173	0.716579		
Total	130.8756	175			

The mean square between groups for farmers was 3.4537 while the mean within groups was 0.7166. This therefore yielded an F statistic of F(2,173) =4.8197. The significance level associated with this F statistic was p = 0.009185. This implies that with α=0.05 the F statistic was significant. It was therefore concluded that there is a significant difference in quality of

AI services between AI service provider organizations of different legal types. This implies that according to farmers' experiences there is a significant difference in the quality of AI services resulting from the different legal statuses of AI service providers.

In view of the significant difference displayed by the One-way ANOVA test on the relationship between the legal status of service providers' and farmers' experience of quality of AI services, the probed further to find out where the source of the difference was coming from. It was therefore imperative to conduct a post-hoc test that would identify that source of difference. A Tukey's Honest Significant Difference (HSD) test was therefore carried out and the results shown in Table 4.53 were obtained.

Table 4.53. Tukey's HSD Test on Legal Status of Service Providers for Farmers

Legal Status (i)	Legal Status (j)	Mean Difference (i-j)	Standard Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Cooperative Societies	Private	-0.4598	0.1666	0.0175	-0.8535	-0.0660
	SHG	0.0206	0.3067	0.9975	-0.7044	0.7456
Private	Cooperative	0.4597	0.1666	0.0175	0.0660	0.8535
	SHG	0.4804	0.2775	0.1966	-0.1756	1.1364
SHG	Cooperative	-0.0206	0.3067	0.9975	-0.7456	0.7044
	Private	-0.4804	0.2775	0.1966	-1.1364	0.1756

* The mean difference is significant at the 0.05 level.

The results of the Tukey's Test revealed that the level of significance of the difference between cooperative societies and self-help groups and between private AI service providers and self-help groups was p=0.99751 and p=0.196567 respectively which meant that at $\alpha = 0.05$ there were no significant differences between cooperative societies and self-help groups and between private AI service providers and self-help groups. The results further showed that the level of significance of the difference between cooperative societies and private AI service providers was p=0.017498. This implies that at $\alpha = 0.05$ there was a significant difference in the quality of AI services experienced by farmers between cooperative societies and private AI service providers

4.9 Combined Post-Privatization Management Practices and Quality of Services

The fourth hypothesis in the study predicted that post-privatization management practices have a significant combined influence on quality of artificial insemination services in Nyeri County. In this study, post-privatization management practices were capacity building, technology application and the legal form of service provider. In order to find the combined Influence of the variables forming post-privatization management practices, a multiple regression analysis was done with quality of AI services as the dependent variable while capacity building, technology application and legal status formed the independent variables. The legal status was a categorical variable and hence had to be converted into three dummy variables representing the three legal types namely private service providers, cooperative societies and self-help groups. Table 4.54 shows the results of the multi-linear regression analysis for both farmers and service providers.

Table 4.54. Combined Influence of Post-Privatization Management Practices

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Standard Error	Beta		
1 Service Providers	Constant	3.4047	0.7532		4.5206	0.0000
	Capacity Building	0.1697	0.0981	0.2334	1.7297	0.0896
	Technology Use	0.0717	0.2251	0.0455	0.3186	0.7513
	Cooperative Dummy	-0.3971	0.2718	-0.2069	-1.4609	0.1501
	SHG Dummy	0.1698	0.3593	0.0637	0.4726	0.6385
2 Farmers	Constant	2.7011	0.2515		10.7411	0.0000
	Capacity Building	0.1487	0.0528	0.2031	2.8183	0.0054
	Technology Use	0.1820	0.0912	0.1471	1.9949	0.0476
	Cooperative Dummy	-0.4002	0.1660	-0.1790	-2.4114	0.0170
	SHG Dummy	-0.4277	0.2701	-0.1148	-1.5834	0.1152

Dependent Variable: Average Quality Rating

Table 4.54 shows the results of the multiple regression analyses which were run in order to predict the combined influence of capacity building, technology use and legal status on quality of artificial insemination services. Since the analysis used three dummy variables for the legal status of AI service providers, three regression models were developed from AI service providers and three from farmers. The results from service providers gave the

following regression models for private providers, cooperative societies and self-help groups respectively:

Quality of Services (Private Providers) = 3.4047 + 0.1697 Capacity Building + 0.0717Technology Application

Quality of Services (Cooperative Societies) = 3.1076 + 0.1697 Capacity Building + 0.0717Technology Application

Quality of Services (Self Help Groups) = 3.5746 + 0.1697 Capacity Building + 0.0717Technology Application

Analysis of data from farmers was also done in order to establish multiple regressions explaining the combined influence of the independent variables on quality of AI services. The resulting regression models show the relationships when services were obtained from private AI providers, cooperative societies and self-help groups respectively.

Quality of Services (Private Providers) = 2.7011 + 0.1487 Capacity Building + 0.1820Technology Application

Quality of Services (Cooperative Societies) = 2.3009 + 0.1487 Capacity Building + 0.1820Technology Application

Quality of Services (Self Help Groups) = 2.2734 + 0.1487 Capacity Building + 0.1820Technology Application

One-way analysis of variance (ANOVA) on the data for both service providers and farmers was carried out in order to ascertain the level of significance of the relationship between post-privatization management practices and quality of artificial services. Table 4.55 shows the results of the ANOVA.

Table 4.55. ANOVA of Post-Privatization Management Practices and Quality

Model			Sum of Squares	df	Mean Square	F	Sig.	Deduction
1.	**Service Providers**	Regression	1.5564	4	0.3891	1.6659	0.1720	Not significant
		Residual	12.1463	52	0.2335			
		Total	13.7028	56				
2.	**Farmers**	Regression	15.1486	4	3.7872	5.5960	0.0003	Significant
		Residual	115.727	171	0.6768			
		Total	130.875	175				

The results of the ANOVA in Table 4.55 gave an F statistic of $F(4,52)=1.6659$ with a significance level of $p=0.1720$ for service providers. For the farmers the F statistic was $F(4,171)=5.960$ with a significance level of 0.0003. Basing the test on a threshold significance of $\alpha=0.05$, it was concluded that the relationship was significant for farmers but was not for service providers. Consumer satisfaction is generally defined as an evaluative response concerning the perceived outcome of a particular consumption experience (Cronin and Taylor 1994). In this case it can be argued that combined post-privatization management practices had a statistically significant influence on the level of satisfaction of the farmers from AI services.

A Pearson Product Moment Correlation test was carried out for farmers in order to establish the level of association between the independent variables and quality of AI services. This was not done for service providers because the relationship between post-privatization management practices and quality of AI services was not significant for them. The results of the correlation are shown in Table 4.56.

Table 4.56. Correlation of Post-Privatization Management and Quality

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.340(a)	0.116	0.095	0.823

The results of the ANOVA showed a significant relationship between post-privatization management practices and quality of AI services while the Pearson Product Moment Correlation showed an Adjusted r^2=0.095. This implies that only 9.5% of the data on quality of AI services can be attributed to post-privatization management practices while the rest of the data may be due to other factors.

It was concluded that although there was a combined influence of capacity building, technology use and legal form of service provider on quality of service experienced by AI service providers and farmers respectively, the relationship was significant for farmers but was not for AI service providers.

4.10 Monitoring and Evaluation Strategies

Monitoring and evaluation have been variously defined as a process that involves planning, data collection, analysis and use (Kusek and Rist, 2004; UNDP, 2009). This study sought to find out the extent to which these functions are applied in the AI practice in Nyeri County.

4.10.1 Monitoring and Evaluation Organization

This study sought to establish the moderating Influence of monitoring and evaluation on the relationship between post-privatization management practices and quality of AI services. The study therefore investigated the extent to which AI service providers thought there was an organized monitoring and evaluation system for AI services in Nyeri County. The results are shown in Table 4.57.

Table 4.57. Monitoring and Evaluation Organization

Response	Frequency	Percentage
Highly Organized	6	10.5
Organized	15	26.3
Neutral	25	43.9
Disorganized	7	12.3
Highly Disorganized	4	7.0
Total	**57**	**100.0**

Table 4.57 shows that majority of the AI service providers were non-committal about the level of organization of monitoring and evaluation with a modal frequency of 43.9%. The

second category making up 26.3% of the AI service providers indicated that there was some degree of organization of monitoring and evaluation of AI services in the County. These were part of the 36.8% of the AI service providers who were positive that there was some level of organization. Only 19.3% of the AI service providers thought that the monitoring and evaluation practice was disorganized. This included 7% of the respondents who said that the monitoring and evaluation process was highly disorganized.

4.10.2 Presence of Monitoring and Evaluation Forms

The study sought to find out whether there were any special forms that were used as templates for data collection in monitoring and evaluation of AI services in the County. The presence of such forms would be an indication of some level of prior planning and indicator setting for the practice. Table 4.58 shows the responses obtained.

Table 4.58. Presence of Monitoring and Evaluation Forms

	Frequency	Percentage
Yes	52	91.2
No	5	8.8
Total	**57**	**100.0**

It was found that 91.2% of the respondents were positive that there were forms which were to be filled in order to return artificial insemination data. This implies that 90% of the AI service providers are involved in feeding data back to the regulating authorities using formalized instruments. If this is true, then there is likelihood that up-to-date information about the practice would be available on demand by stakeholders.

4.10.3 Recipients of AI Information

An assessment was done in order to find out who were the recipients of monitoring and evaluation reports from AI service providers. A scale of 1 – 5 was used to rank the level of reporting where 1 indicated that respondents strongly agreed that they received the information, 2 indicated agreed, 3 indicated non-committal, 4 indicated disagreed and 5 indicated that respondents strongly disagreed. Table 4.59 shows the results obtained from the AI service providers on the recipients of monitoring and evaluation information.

Table 4.59. Recipients of AI Information

Recipient	N	Minimum	Maximum	Mean	Standard Deviation
Government	57	1	5	2.26	1.094
Private Veterinarians	57	2	5	3.28	1.411
Suppliers	57	2	5	2.63	1.046
Cooperative Societies	56	2	5	3.63	1.001
Farmers	57	1	5	2.79	1.448

It was apparent that Government Veterinary Department was the greatest recipient of monitoring and evaluation information with a mean score of 2.26, followed by suppliers and farmers with mean scores of that 2.63 and 2.79 respectively. This implies that AI service providers furnished the three categories of recipients with monitoring and evaluation information. The AI service providers were largely non-committal about providing monitoring and evaluation information to cooperative societies (mean = 3.63) and private veterinarians (mean=3.28) indicating that such information was probably available only on request.

4.10.4 Level of Involvement in Monitoring and Evaluation

It was important to establish the level of involvement of AI service providers since this would show the level of buy-in of the service providers in the monitoring and evaluation process. On a scale of 1 – 5 where 1 meant strongly agreed, 2 was agreed, 3 was non-committal, 4 was disagree and 5 was totally disagreed, respondents were asked about their level of involvement in various monitoring and evaluation aspects giving the results shown in Table 4.60.

Table 4.60. Level of Involvement in Monitoring and Evaluation

Area of Involvement	N	Minimum	Maximum	Mean	Standard Deviation
Planning	56	1	4	2.36	0.819
Decision on Indicators	57	1	5	3.00	1.323
Data Collection	57	1	5	2.58	1.194
Discussion of Findings	55	1	5	2.65	1.265

It was found that that there was some degree of involvement in monitoring and evaluation process of the AI practice, particularly in planning, data collection and discussion of findings

with mean scores of 2.36, 2.58 and 2.65 respectively. These mean scores imply that the respondents agree that they were involved in the monitoring and evaluation aspects. However, when it comes to deciding on indicators for monitoring and evaluation, the service provider respondents returned a mean score of 3.00 with a standard deviation of 1.323. This is interpreted to mean that the respondents were non-committal on their level of involvement in indicator selection. This implies that there was a low level of involvement in making decisions on the indicators upon which monitoring and evaluation data would be collected. Qualitative data showed that fear among service providers was one of the key reasons hindering participation as shown in the response below from Veterinary Officers.

> "Private AI service providers shy away from participating in monitoring and evaluation for fear that if they disclose business information it might attract taxes from Government (Kenya Revenue Authority). Sometimes the request for information on breeding is treated with a lot of suspicion." (VO2, VO6, VO7, VO8)

4.10.5 Usefulness of Monitoring and Evaluation Findings

The study sought to find out the extent to which monitoring and evaluation information was useful to respondents. Table 4.61 shows the responses obtained from the sampled AI service providers. The analysis was based on a Likert scale of 1 – 5 in which 1 represented strongly agreed, 2 stood for agreed, 3 was non-committal, 4 was disagreed and 5 was strongly disagreed.

Table 4.61. Usefulness of Monitoring and Evaluation Findings

	N	Minimum	Maximum	Mean	Standard Deviation
Usefulness in AI Practice	57	1	3	1.81	0.766
Usefulness in Dairy Enterprises	57	1	3	2.05	0.789

Table 4.61 shows the results on whether there was agreement that monitoring and evaluation information was useful. The analysis gave mean scores of 1.81 and 2.05 for the AI practice and the dairy enterprises respectively. The respective standard deviations for these means were 0.766 and 0.789. This was interpreted to mean that respondents strongly agreed that monitoring and evaluation information is useful in the AI practice and in the dairy enterprises.

4.10.6 Farmers Keeping Various Farm Records

Farmer respondents were also studied in order to give credence to the findings on AI service providers. One of the key issues probed was whether farmers kept farm records on various aspects of the dairy enterprises. The rationale was that it is from these records that monitoring and evaluation data would be obtained. The farmers were asked to rate the level of agreement to the statement that they kept accurate records. The responses were based on a rating scale of 1 – 5 where 1 was strongly agreed and 5 was strongly disagreed. Table 4.62 shows the responses obtained in percentages in each category.

Table 4.62. Farmers Keeping Various Farm Records in Percentages

Response	Milk Record	AI	Fertility Diseases	Farm Income	Dairy Expenditure
Strongly Agree	27.1	29.3	10.6	21.3	16
Agree	39.4	47.3	16	36.2	24.5
Non-committal	21.3	11.2	40.4	20.2	28.7
Disagree	4.8	3.7	15.4	8	12.8
Strongly Disagree	2.7	3.2	11.7	8	12.2
No Response	4.8	5.3	5.9	6.4	5.9

Table 4.62 shows that 66.5% (27.1% + 39.4%) of farmers kept milk records while 76.6% (29.3% + 47.3%) of the farmers kept AI records. It was also found that 57.5% of the respondents agreed to keeping records on farm income. Other types of records were rarely kept. A probe on why farmers mainly kept the two types of records revealed that those records were service summary sheets issued by inseminators after every insemination and the monthly milk collection records issued by milk marketing organizations such as cooperative societies and self-help groups. This implies that the level of deliberate record keeping was low among the respondents.

4.10.7 Communication with Technical People

This research sought to find out the frequency in which farmer respondents communicate with technical stakeholders in the AI practice, particularly the Veterinarians who provide the regulatory function and the AI service providers who inseminate the cows. Table 4.63 shows

the percentage frequency of communication with the officers on matters related to AI and general dairy management.

Table 4.63. Communication with Technical People in Percentages

Frequency	AI Service Provider	Veterinarian
Weekly	0.5	0.0
Fortnightly	1.1	2.1
Monthly	8.0	7.4
Quarterly	3.7	1.6
Half Yearly	1.6	2.1
When Needed	79.3	76.6
Never	1.6	5.3
No Response	4.3	4.8
Total	**100.0**	**100.0**

Table 4.63 shows that majority of the farmers communicate with technical people only when they need them. The findings show that 95.7% of the farmers communicated with service providers and 95.2% communicated with Veterinary Officers. However, a few farmers agreed that they communicate regularly with technical people even when they have no immediate problem. There were 1.6% and 5.3% of farmers who did not communicate with AI service providers and Veterinary Officers respectively.

4.10.8 Mode of Communication with Technical People

The study sought to find out the mode of communication used by farmers to contact technical people and the results shown in Table 4.64 were obtained.

Table 4.64. Mode of Communication with Technical People

	Frequency	Percentage
Written	8	4.3
Verbal	167	88.8
Not Applicable	3	1.6
No Response	9	5.3
Total	**187**	**100.0**

Out of the farmers who communicated to the technical people, 4.5% of the farmers used written communication while 93.8% used verbal communication as the mode of communication as shown in Table 4.64.

4.10.9 Information Communicated to Technical People

The type of AI-related information which is communicated to technical people indicates the type of indicators to which monitoring and evaluation information is of interest. This study sought to find out which key information is passed on to the technical people. Table 4.65 shows a multiple response on farmers who agreed that they reported to technical people on some key types of information in AI.

Table 4.65. Information Communicated to Technical People

		Responses	
		N	**Percentage**
Information Provided[a]	No. of Inseminations	74	39.36
	Specific Bulls	53	28.19
	Conception	62	32.98
	Offspring born	56	29.79
	Offspring Surviving First Year	47	25.00

a. Dichotomy group tabulated at value 1.

Table 4.65 shows that 39.36% of the farmers gave information about the inseminations which have been done; 28.19% gave information on specific bulls used during insemination; 32.98% gave information on successful conception; 29.79% gave information on offspring born and 25% reported on offspring which survived during the first year. A further probe revealed that the other information shared with Veterinarians included heat signs; calf sex; gestation and expected calving date; fertility diseases; silent heat problems; number of repeated inseminations; parity of cows; cost of AI service; general animal health; disease control and deworming records. This agrees with RoK (2012a) who show that farmers will only seek services when there is a problem and will rarely give unsolicited monitoring information to service providers.

4.10.10 Hypothesis Test on Moderating Influence of Monitoring and Evaluation

The fifth hypothesis of the study was that the strength of the relationship between post-privatization management practices and quality of artificial insemination depends on monitoring and evaluation strategies. This study sought to test the hypothesis by using a multiple regression analysis ($\gamma = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_5M + \beta_6XM$) prescribed by Kim *et al* (2001). In the study, monitoring and evaluation was operationalized as reporting, utility of monitoring and evaluation and Participation in monitoring and evaluation. The test assumed normality, homoscedasticity and independence for all variables except for the legal form of AI service providers whose data was nominal and had therefore to be converted into dummy data. Table 4.66 shows the multiple regression output of the moderating influence of monitoring and evaluation.

Table 4.66. Moderating Influence of Monitoring and Evaluation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Standard Error	Beta		
Service Providers	Constant	11.521	2.151		5.356	0.000
	Monitoring and Evaluation	-1.508	0.366	-3.142	-4.126	0.000
	Capacity Building	-1.296	0.379	-1.783	-3.416	0.001
	Technology Application	-1.199	0.395	-0.760	-3.033	0.004
	Moderated Variables	0.166	0.041	4.174	4.017	0.000
	Cooperative Dummy	-0.261	0.244	-0.136	-1.070	0.290
	SHG Dummy	-0.083	0.322	-0.031	-.256	0.799
Farmers	Constant	1.196	0.442		2.703	0.008
	Monitoring and Evaluation	0.407	0.078	0.446	5.205	0.000
	Capacity Building	0.188	0.100	0.249	1.875	0.063
	Technology Application	0.179	0.120	0.144	1.495	0.137
	Moderated Variables	-0.006	0.011	-0.089	-0.523	0.602

Dependent Variable: Average of Quality Parameters

Table 4.66 shows the data which was obtained from AI service providers. The following regression models of the moderating influence of monitoring and evaluation strategies on the relationship between post-privatization management practices and quality of AI services were obtained:

$$\gamma(\text{Private Providers}) = 11.521 - 1.296X_1 - 1.199X_2 - 1.508M + 0.166XM$$

γ(Cooperative Societies) = 11.521 – 1.296X_1 – 1.199X_2 - 1.508M + 0.166XM

γ(SHG) = 11.521 – 1.296X_1 – 1.199X_2 - 1.508M + 0.166XM

Where: γ = Quality of AI services

α = constant

β_n = Coefficient

X_1= Capacity Building

X_2= Technology Application

X = X_1*X_2 ……..X_n

M = Monitoring and Evaluation Strategies (Moderating Variable)

NB: * denotes multiplication.

The regression analysis of the moderating Influence of monitoring and evaluation strategies as experienced by farmers is shown in the following regression model derived from Table 4.66:

γ = 1.196 – 0.188X_1 + 0.179X_2 + 0.407M - 0.006XM

A further scrutiny of the results of the regression analysis show that there was no difference in the quality of AI services experienced by farmers regardless of whether the service provider was private, cooperative society or self-help group in the presence of the moderating variable.

An analysis of variance was also carried out in order to give credence to the regression models obtained by determining the level of significance of the relationships between the independent, moderating and the dependent variables. The null hypothesis for the ANOVA was that none of the predictor variables can be used to predict the response variable in both cases. Table 4.67 shows the results of ANOVA for farmers and service providers.

Table 4.67. ANOVA for the Moderating Influence of Monitoring and Evaluation

Model		Sum of Squares	Df	Mean Square	F	Sig.
Service Providers	Regression	1.140	2	0.570	2.449	0.096
	Residual	12.563	54	0.233		
	Total	13.703	56			
Farmers	Regression	29.125	5	5.825	9.732	0.000
	Residual	101.75	170	0.599		
	Total	130.876	175			

The results obtained from the model gave an F-statistic of F(2,54) = 2.449 with a significance level of p=0.096. Since this significance level was greater than $\alpha = 0.05$, the null hypothesis was accepted and it was deduced that the predictor variables cannot be used to predict quality of AI services in the presence of monitoring and evaluation in the case of AI service providers. In the case of farmers, the analysis gave an F-statistic of F(5,170)=9.732 with a significance level of p=0.000. In this case, the null hypothesis is therefore rejected and it is concluded that the independent variables can be used to predict quality of AI services to farmers in the presence of monitoring and evaluation which is a moderating variable.

The study further sought to find out the extent to which variability in the dependent variable could be explained by the independent and the moderating variables by performing an analysis of the adjusted coefficient of determination denoted as r^2. This was carried out for the case of farmers only because it had been established that there was no significant relationship between the independent, moderating and dependent variables in the case of AI service providers. Table 4.68 shows the results of the analysis.

Table 4.68. r^2 Analysis for the Moderating Influence of Monitoring and Evaluation

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.515[a]	0.266	0.249	0.777

a. Predictors: Constant, Moderated IVs, Monitoring and Evaluation, Technology Application, Capacity Building

Table 4.68 gave an adjusted coefficient of determination of Adj. $R^2 = 0.249$ and a correlation coefficient of R = 0.515. The adjusted R^2 of 0.249 indicates that 24.9% of the variability in quality of AI services can be explained by the predictor and moderating variables. This means that there was a moderately strong correlation between the moderating Influence of

monitoring and evaluation, capacity building, technology application, the legal form of AI service provider and the quality of AI services experienced by farmers.

The results of the test of the fifth hypothesis were that in the case of AI service providers, the strength of the relationship between post-privatization management practices and quality of AI services does not depend on monitoring and evaluation strategies based on the results of the Analysis of Variance. However, for the case of farmers, the strength of the relationship depends on monitoring and evaluation strategies.

CHAPTER FIVE
SUMMARY OF FINDINGS, DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of findings, discussion, conclusions and recommendations emanating from the results of this study. The purpose of the study was to investigate the influence of post-privatization management practices and monitoring and evaluation strategies on quality of artificial insemination services in cattle in Nyeri County, Kenya. The study was prompted by the fact that though dairy production is a major activity in the livestock sector and an important source of livelihood for about 600,000 small-scale farmers (Karanja, 2003), studies on quality of AI services are limited (Ouma, 2008; Feder *et al*, 1985; Foote, 2002). It was observed that most studies on the AI practice dwelt mainly on the technical aspects.

5.2 Summary of Findings

The study had five hypotheses which were based on the themes of the following research objectives: There is a significant relationship between capacity building and quality of AI services; technology application has a significant influence on quality of AI services in cattle; there is a significant relationship between the legal status of AI service provider organization and quality of AI services; post-privatization management practices have a significant combined influence on quality of AI services and; the strength of the relationship between post-privatization management practices and quality of AI depends on monitoring and evaluation strategies. The hypotheses, test results and interpretations are summarized in Table 5.1.

Table 5.1. Summary of the Findings

Objective	Respondents	Hypothesis Test	Test finding	Reference Tables	Interpretation
To establish to what extent artificial insemination capacity building influences quality of artificial insemination services	Service Providers	Pearson Product Moment Correlation	Adj R^2=0.0141; t(56)=1.346; p=0.184	Table 4.38 Table 4.37	There is no significant relationship between capacity building and quality of artificial insemination services for AI service providers
		Percentage	71.9% of AI service providers had received post-qualification training on AI related issues.	Table 4.27,	
	Farmers	Pearson Product Moment Correlation	Adj R^2=0.00; t=-0.872; p=0.384	Table 4.38 Table 4.37	There is no significant relationship between capacity building and quality of artificial insemination services for farmers.
		Percentage	12.8% of farmers actively sought AI information while 80.3% were passive recipients of the information	Table 4.35	

Objective	Respondents	Hypothesis Test	Test finding	Reference Tables	Interpretation
To determine the influence of technology application on quality of artificial insemination services	Service Providers	Pearson Product Moment Correlation	ICT: Adj R^2= -0.01355; t= -0.501; p=0.618	Table 4.46 Table 4.45	ICT application has no significant influence on quality of artificial insemination services for AI service providers
	Farmers	Pearson Product Moment Correlation	ICT: Adj R^2=0.04686; t=3.1225; p=0.0021	Table 4.46 Table 4.45	ICT application has a significant influence on quality of artificial insemination services for farmers
		Pearson's Chi Square	Breeding Technology: Likelihood Ratio = 77.459; p=0.008	Table 4.47	Use of Breeding Technology has a significant influence on quality of artificial insemination services for farmers
		Percentage	The use of sex-selected semen and oestrus synchronization was by 33.51% and 10.11% of farmers respectively. None of the farmers had practiced embryo transfer	Table 4.40	

Objective	Respondents	Hypothesis Test	Test finding	Reference Tables	Interpretation
To determine how Legal Status of service provider influences quality of artificial insemination services	Service Providers	One-way ANOVA Percentage	F(2,54)=1.782926 P=0.177901 89.5% of AI service providers in the study were private, 7% were from cooperative societies and 3.5% were from farmer self-help groups.	Table 4.51 Table 4.48	There is no significant relationship between the legal status of AI service provider organization and quality of AI services for service providers
	Farmers	One-way ANOVA	F(2,173)=4.81969 P=0.009185	Table 4.52	There is a significant relationship between the legal status of AI service provider organization and quality of Artificial insemination services for farmers

Objective	Respondents	Hypothesis Test	Test finding	Reference Tables	Interpretation
To establish the combined influence of post-privatization management practices on quality of artificial insemination services	Service Providers	Multiple Regression Analysis	F(2,54)=1.6659; p=0.1720	Table 4.55	Post-privatization management practices have no significant combined influence on quality of artificial insemination services
	Farmers	Multiple Regression Analysis	F(4,171)=5.5960; p=0.0003 R=0.34 Adj R^2=0.095	Table 4.55 Table 4.56	Post-privatization management practices have a significant combined influence on quality of artificial insemination services

Objective	Respondents	Hypothesis Test	Test finding	Reference Tables	Interpretation
To establish the moderating influence of the use of monitoring and evaluation strategies on the relationship between post-privatization management practices and quality of artificial insemination services	Service Providers	Multiple Regression Analysis	F(2,54)=2.449; p=0.096	Table 4.67	The strength of the relationship between post-privatization management practices and quality of artificial insemination depends on monitoring and evaluation strategies
	Farmers	Multiple Regression Analysis	F(5,170)=9.732; p=0.000; R=0.515; Adj R^2=0.249	Table 4.67 Table 4.68	The strength of the relationship between post-privatization management practices and quality of artificial insemination does not depend on monitoring and evaluation strategies

A descriptive survey design which was complimented by key informant interviews was used on a total of 287 respondents. These included 204 farmers, 75 AI service providers and 8 Veterinary Officers. Responses were received from 187 farmers, 57 service providers and 8 Veterinary Officers giving response rates of 92.16% of farmers, 76% of AI service providers and 100% of Veterinary Officers. The sample for private AI service providers was drawn using simple random sampling from a sampling frame while the sample for farmers was drawn using transect mapping. Census enumerations were done for veterinarians, cooperative

society and self-help group AI service providers. Questionnaires with both open and closed ended questions were administered to both farmers and AI service providers while key informant interviews were done with Government veterinarians. The data collected was analysed qualitatively and quantitatively. The results were summarized and presented in tabular forms. The findings have been discussed based upon the overall purpose of the study, the objectives, the conceptual framework and the theoretical underpinning. Finally, Conclusions and recommendations were made based on the findings of the study. The summaries of findings for each of the hypotheses are shown in the following sections:

5.2.1 Influence of Capacity Building on Quality of AI Services

The study showed that 71.9% of AI service providers had received some post-qualification training. It further showed that 74.5% of farmers had access to AI related information. A regression analysis was carried out to test the hypothesis that capacity building has a significant influence on quality of AI services in dairy cattle for both farmers and service providers, yielding the following regression models:

Quality of AI Services (Service Providers) = 1.811 + 0.05 Capacity Building

Quality of AI Services (Farmers) = 2.132 – 0.04 Capacity Building

These models had adjusted regression coefficients of r^2 (service providers) = 0.014 and r^2(farmers)= 0.0. This means that there was an extremely weak correlation between service providers' capacity building and quality of AI services while there was no correlation at between the capacity building of farmers and quality of AI services.

5.2.2 Influence of Technology on Quality of AI Services

The second hypothesis in the study was that Technology application has a significant influence on quality of artificial insemination services in dairy cattle. In this study, Technology application was operationalized to include the use of ICT and the use of breeding technologies. The relationship between the application of ICT and quality of AI services was tested using a linear regression analysis for both service providers and farmers yielding the following regression models:

Quality of AI Services (Service Providers) = 4.3272 – 0.1063 ICT Use

Quality of AI Services (Farmers) = 2.7216 + 0.2836 ICT Use

The corresponding significance levels were p(service providers)=0.6813 and p(farmers)=0.0021. This implies that at $\alpha = 0.05$ the regression equation for service providers was not significant while for farmers it was significant. Subjecting the data for AI service providers to a Pearson Product Moment Correlation gave an adjusted r^2 of 0.01355 implying a very weak correlation between ICT use and quality of services. The data for farmers gave an adjusted r^2 of 0.04686 which was also a very weak correlation.

It was found that among the available breeding technologies in Kenya, sex-selected semen was used by 33.5% while oestrus synchronization was used by 10.11% of the farmers in the study. Embryo transfer was not in use in the study area. Pearson's Chi Square was the preferred method of analysis of the association between the use of breeding technologies and quality of AI services. However, the data showed more that 20% of the cells having counts less than 5 hence the likelihood ratio was used. The resultant Likelihood Ratio was 77.459 with a significance level of $p = 0.008$. At an acceptable significance level of $\alpha = 0.05$, it was concluded that breeding technology has no significant influence on quality of AI services. The results of the hypothesis test therefore, were that technology application has no significant influence on quality of AI services for farmers but the influence is significant for service providers.

5.2.3 Influence of Legal Status on Quality of AI Services

It was found that the distribution of AI service providers consisted of 3.5% of the service providers in self-help groups, 7% in cooperative societies and 89.5% were private. ANOVA was used to test the hypothesis that there is a significant relationship between the legal status of AI service providers and quality of artificial insemination services for both service providers and farmers. Data from AI service providers returned an F statistic of $F(2,54)=1.782926$ with a significance level of 0.177901. The responses from farmers yielded an F statistic of $F(2,173)=4.819695$ with a significance level of 0.009185. Since the threshold significance level was $\alpha=0.05$, it was concluded that there was no significant difference in the quality of AI service experienced by service providers. However, for farmers there was a statistically significant difference in the quality of AI services. A further exploration of the farmers' data through Tukey's HSD test revealed that the difference in the quality of services experienced by farmers emanated from a difference between cooperative societies and private service providers.

5.2.4 Combined Influence of Post-Privatization Management Practices

The hypothesis that Post-privatization management practices have a significant combined influence on quality of artificial insemination services was tested using a multiple regression analysis for both service providers and farmers, in which the post-privatization management practices were capacity building, use of ICT and the legal form of service provider. Since the legal form of service provider involved nominal data, the use of dummy variables was necessary. The resulting multiple regression models for service providers were as follows:

Quality of Services (Private Providers) = 3.4047 + 0.1697 Capacity Building + 0.0717Technology Application

Quality of Services (Cooperative Societies) = 3.1076 + 0.1697 Capacity Building + 0.0717Technology Application

Quality of Services (Self Help Groups) = 3.5746 + 0.1697 Capacity Building + 0.0717Technology Application

The corresponding levels of significance were p=0.0896 and p=0.7513 for capacity building and technology use respectively. Based on the threshold significance level of $\alpha = 0.05$, it was established that none of the predictor variables were statistically significant in predicting the quality of service for service providers.

The multiple regression models for farmers were:

Quality of Services (Private Providers) = 2.7011 + 0.1487Capacity Building + 0.1820Technology Application

Quality of Services (Cooperative Societies) = 2.3009 + 0.1487Capacity Building + 0.1820Technology Application

Quality of Services (Self Help Groups) = 2.2734 + 0.1487Capacity Building + 0.1820Technology Application

The corresponding levels of significance based on a t-test were p=0.0054 and p=0.0476 for capacity building and technology use respectively. This means that the predictors for quality

of AI services were statistically significant for farmers at a threshold significance level of α=0.05.

5.2.5 Moderating Influence of Monitoring and Evaluation Strategies

The hypothesis that the strength of the relationship between post-privatization management practices and quality of artificial insemination depends on monitoring and evaluation strategies was tested using a multiple regression analysis prescribed by Kim *et al* (2001) for moderating influences. This test was done for both service providers and farmers. The use of dummy variables was necessary for legal status of service providers which was a nominal variable in both cases. The resulting regression models for service providers were:

$$\gamma \text{ (Private Providers)} = 11.521 - 1.296X_1 - 1.199X_2 - 1.508M + 0.166XM$$

$$\gamma \text{ (Cooperative Societies)} = 11.521 - 1.296X_1 - 1.199X_2 - 1.508M + 0.166XM$$

$$\gamma \text{ (SHG)} = 11.521 - 1.296X_1 - 1.199X_2 - 1.508M + 0.166XM$$

Where: γ = Quality of AI services
α = constant
β_n = Coefficient
X_1= Capacity Building
X_2= Technology Application
$X = X_1 * X_2 \ldots\ldots\ldots X_n$
M = Monitoring and Evaluation Strategies (Moderating Variable)
NB: * denotes multiplication.

The regression model for farmers in all legal forms was:

$$\gamma = 1.196 - 0.188X_1 + 0.179X_2 + 0.407M - 0.006XM$$

A significance test based on ANOVA yielded F statistics of F(2,54)=2.449 and F(5,170)=9.732 for AI service providers and farmers respectively. The corresponding levels of significance were p(service providers)=0.96 and p(Farmers)=0.000. At a threshold significance level of α=0.05, it was concluded that monitoring and evaluation has no

significant influence on the strength of the relationship between post privatization management practices and quality of artificial insemination services for service providers. However, monitoring and evaluation does have a significant influence on the strength of the relationship for farmers.

5.3 Discussion of the Findings

The findings of the study are discussed in this section in relation to the research hypotheses. Both qualitative and quantitative data were examined before the analysis in order to ensure that variables of interest were appropriately computed and coded. Errors found during coding and data entry were identified and corrected accordingly. One farmer had a response with double entry for a Likert scale in a closed ended question. In that case, the particular question for that farmer was discarded.

The first step in the analysis was to establish the response rate. This was done in order to determine the external validity of the study. According to Sivo *et al*. (2006), a high response rate is one of the factors that enhance external validity. A response rate of more than 70% is usually considered very good (Babbie, 1990). The study gave response rates of 87.25% for farmers and 87.69% for AI service providers which were therefore considered appropriate for further analysis. All the Veterinary Officers targeted for the study participated in the key informant interviews.

The quantitative data was tested for various assumptions to determine whether the intended statistical tests would be appropriate. The data was checked for normality, skewness, kurtosis, independence, homogeneity of variance, factorability and sphericity. The data satisfied the tests and was therefore considered to be appropriate for the intended statistical analysis.

The quantitative analysis was done on data for the independent, moderating and dependent variables. The independent variable was post privatization management practices which consisted of post-privatization capacity building, technology application and the legal form of AI service provider. The dependent variable in this study was quality of AI services which was operationalized as Conception Rates; Response Rates; Breed True to Type; Semen Storage Equipment Type; Calving Interval; Milk Production and; Breeding Disease Incidences. The moderating variable was monitoring and evaluation strategies. This was operationalized as reporting, utility and participation in monitoring and evaluation. Since this

was a cross-sectional study, there was no investigation of causality hence the study dwelt on establishing the influence of the independent variable and the moderating Influence of the moderator variable. The quantitative findings were corroborated with qualitative data whenever it was possible.

The study had two sources of quantitative data, AI service providers and farmers. Qualitative data was obtained from Government Veterinarians. Findings generally indicated a more normally distributed data on quality from farmers than from service providers. This was attributed to the fact that farmers are the end consumers of the AI services while AI service providers play a part in service provision in the AI value chain. The fact that the sample size for farmers was greater than for AI service providers was also a contributor to the tendency of the distribution of data towards normality. The findings resonate with the statement by Priem (2007) that consumers are the best evaluators of quality. Various studies on quality have therefore focused their quality measurements on end-consumers' evaluations (Krystalis and Ness, 2005; Zeithaml, 1988 and Garofalakis, Stefani, Stefanis and Xenos, 2007). In this study, data from both categories of respondents was considered useful for comparison purposes and to give further insight of quality at the final consumer level and within the value chain.

It was found that there was a very low presence of bulls and bull calves (5.85% and 18.08% of farms respectively) indicating that farmers heavily relied on AI for breeding their cattle. This was attributed to the reason that bulls are expensive to maintain (Cothren, 2012; Morell, 2011) and since the major source of revenue from dairy farming is milk production, bulls provide very low returns to investment. According to RoK (2010b), AI is practiced by 78% of the farm-holds in the study area.

A comparison of the demand for locally produced semen with imported semen showed that the demand for local semen was significantly higher than for imported semen. This is attributed to the higher cost of imported semen as compared to local semen as reported by RoK (2010b). Though offspring from imported semen were said to perform better, the farmers' earning power could be a hindrance to its demand.

Farmers and service providers had different perceptions of quality in AI services. Table 4.23 shows that there was a significant difference between quality ratings by farmers and by AI

service providers. This may be attributed to the argument by Makadok and Coff (2002) that an understanding of consumer utility is largely superfluous to the overall goal of the strategy field which is to explain firm profitability, determined by the value captured by the firm. This agrees with Priem (2007) that consumers are arbiters of value. The implication is that service providers may be more concerned with financial returns rather than the quality of service which is a concern for consumers.

An assessment of the semen storage equipment showed that all the private AI service providers used small-sized liquid nitrogen tanks with a capacity of less than 5 litres. Cooperative societies on the other hand used large tanks with a capacity of more than 35 litres. This may be an indication of a low level of resources available to private AI service providers. However, the size of the liquid nitrogen tank has not been shown to affect sperm viability if the handling is right (Brockbank, Covault and Taylor, 2004). The length of time of storage however, may affect sperm viability. A study by Malik, Laily and Zakir (2015) found that the concentration of sperm in semen after one year of storage in liquid nitrogen resulted in similar concentration after storage for as long as six years. However, the viability and motility sperm thawed after storage in liquid nitrogen for six years was lower than that thawed during the first and second years regardless of the size of liquid nitrogen tanks.

Provision of AI services require quick and easy movement from place to place since service points are usually scattered and service requests are sporadic. The current situation is unlike the pre-privatization period where AI service providers had pre-planned routes to be covered daily. The current system of service provision requires the service providers to respond to farmers' demand for the service, implying that it is not easy to plan in advance the route to be covered during the day. This brings out an attendant need for a swift mode of transport to enable the AI service providers to swiftly respond to emerging demands for AI services. The study found that all the service providers used motor cycles for their transport needs. However, it was found that female AI service providers had a tendency to use a third party to ferry them on motor cycles to the service points as opposed to the males who used private self-ridden motor cycles. In a study on motorcycle transportation, Dinye (2013) concluded that the increasing growth in the number of motorcycles has come to solve the mobility needs of many urban residents in the light of poor and inadequate public transport system as well as poor road conditions particularly those leading into the peri-urban areas.

Maintenance of hygiene and disease control is paramount for the profitability of a dairy enterprise. According to Byarugaba, Nakavuma, Vaarst and Laker (2008), there is a high positive correlation between factors such as hygiene in AI and semen quality and the calving intervals. In this study, reproductive diseases were found to significantly affect the quality of AI services. The most common diseases were abortion, brucellosis, endo-metritis, infertility, metritis, pyometra and vaginitis. According to Lamy, van Harten, Sales-Baptista, Guerra and de Almeida (2012), diseases and parasites are the most severe factors that impact on livestock production and productivity, including the effectiveness of artificial insemination services. Diseases can also be an indicator of the quality of AI services especially when the focus is on reproductive diseases since they affect other factors like conception rates and calving interval.

The study hypotheses were tested using various statistical analysis tools. Inferences were made from the analysis in order to accept or reject the study hypotheses. The findings on the hypotheses are discussed in the sub-sections that follow.

5.3.1 Capacity Building and Quality of AI Services

The study found that 91.3% of AI service providers engaged in the service provision after their first qualification and have remained in the profession. The rest of the service providers had qualified in other fields before studying in AI related courses. This shows that the service is a good and reliable employer. It can also mean that investment in AI training is likely to give better returns in terms of national economic growth. According to the European Centre for the Development of Vocational Training (CEDEFOP) (2013), pragmatic use of qualifications at a micro level among service providers contributes to a well-functioning system. This calls upon the trainees to learn not only the technical aspects of AI service provision but also to gain knowledge on business processes. According to Jyothi (2011), learning demands of the business process are influenced by factors like frequent changes in technology, attrition of employees, downsizing, and competition.

Table 4.40 shows that Government support only came in form of training while NGOs had gone further to provide support in form of equipment mainly to cooperative societies and self-help groups. All the cooperative societies and Self-help groups had received some support but they were too few to make a significant contribution to quality improvement. This may be one of the reasons why capacity building has little influence on quality of AI

services. This agrees with Isyaku (2000) who argued that the process of training and capacity development is a continuous one. Olaniyan and Ojo (2008) further postulate that training and re-training of farmers should be vigorously pursued in order to achieve desired levels of quality.

Resource support for AI service providers was very low and tended to favour cooperative societies and self-help groups. This agrees with Catley, Leyland, Mariner, Akabwai, Admassu, Asfaw and others (2004), who stated that there is a tendency to direct more capacity building efforts towards groups and associations by Governments and NGOs than to individuals. Resource support for farmers seems to be threatened with supplies reducing further and further. While the original goals of subsidizing agriculture were to facilitate the economic viability of small family farms and to ensure national food security, La Vina, Fransen, Faeth and Kurauchi (2006) indicate that the current subsidy system is far removed from this vision. According to the National Agricultural Sector Extension Policy, with the immediate application of privatization and sector led agriculture, Government will continue playing an active role in offering fully subsidized public extension services with the intention of gradually withdrawing from some services and partially charging for other services (RoK, 2012a). Resource support has therefore greatly suffered as a result.

Though resource support was received by few AI service providers, those who received indicated that there was a resultant business improvement. The findings agree with Catley *et al* (2004) who indicated that service providers receiving regular refresher courses were able to give better quality services. According to Sontag-Padilla, Staplefoote and Morganti (2012), under-resourced firms are likely to produce goods and services that are not of good quality.

The results of the study show that there was little overall contribution of capacity building towards the quality of artificial insemination in the study area, both for AI service providers and farmers (adjusted r^2 = 0.014 and 0.00 respectively). For service providers, this was attributed to the fact that even if 71.9% of them had received some post qualification training on AI management, only 21.1% of the respondents had received some material support. In a scenario where the AI businesses had low capitalization evident from the size of liquid nitrogen tanks and the use of motorbikes as modes of transport, the implication of these results is that AI service providers were constrained in institutionalizing organizational improvements. In a study conducted by Minzner, Klerman, Markovitz, and Fink (2014), it

was found that organizational improvements that results from capacity building include long-term planning, human resources management, technology access and use, and financial management systems. All these are likely to positively influence the quality of services.

In the case of farmers, data showed that the only type of capacity building was through training. The study found that the mean number of trainings that a farmer had received in the past one year was 4.302 with a standard deviation of 3.525. This shows a very high level of variability implying that few farmers received many trainings while many of them received very few or no training at all. Further examination of data indicates that there was very little capacity building of both service providers and farmers from both Government and NGOs as shown in Table 4.39 where support to private service providers was only received by 11.8%. According to Farrington (2016), some NGOs reject existing social and political structures and see themselves as engines for radical change; others focus on more gradual change through development of human resources to meet their own needs or to make claims on Government services. The low level of support from NGOs is an indication of low interest in the AI value chain.

Table 4.35 shows that extension services and farmer-to-farmer discussions were the most significant sources of information on AI. Few farmers were willing to spend money to obtain information as is shown by 8.0% of them who went for farmers' tours and 4.8% who relied in the internet, giving a total of 12.8% of the farmers. Though there has been a desire to steer the agricultural sector towards sector-led extension services (RoK, 2012a), the implication of this results are that services that do not give direct returns or can be foregone are likely to be neglected.

The study found that the prevalence of deliberate farm planning was very low. Records kept were mainly documents obtained after transactions on insemination and milk sales. This might be indicative of the fact that decisions are not guided by a roadmap; they are made on the spur of the moment and cover a short span of time. According to RoK (2012a), planning at the production level is likely to have a positive Influence on food security and by extension income security.

The study found out that the most preferred source of farm inputs and AI services were the private service providers. This was attributed to management problems and the high level of

bureaucracy associated with transacting with cooperative societies and self-help groups. According to Wanyama (2009), the cooperative movement in Kenya has largely been invisible and silent largely due to the leadership and management problems. This may be a major reason why farmers prefer to obtain inputs from private vendors.

Promoting private sector investment and participation in all aspects of agricultural development has been one of the aspirations of the Kenyan Government (RoK, 2011). The results in this study however, show that this aspiration is yet to be reached. However, the availability of services on demand indicates that there is capacity to deal with incidental issues which may arise from time to time. This is consistent with the Government recommendation of shifting from supply driven to demand driven extension services in the agricultural sector (RoK, 2012a).

Hypothesis testing in the study led to the conclusion that there was no significant contribution of capacity building to the quality of AI services. Other studies such as Hui *et al* (2001); Ndwiga *et al* (2014) and Mery, Dobrow, Baker, Im and Brown (2015) show contrary results that capacity building has a positive correlation with quality of services provided in a banking and a health environment respectively. This was attributed to the little support in terms of capacity building given to AI service providers and farmers which means that the effect of such support would be negligible. There was also a tendency to offer more support to self-help groups and cooperative societies which formed only 10.5% of the AI service providers in the study area.

5.3.2 Technology Application and Quality of AI Services

Both qualitative and quantitative data were analysed to assess the influence of technology application on quality of AI services. The data revealed that the breeding technology mostly practiced was the traditional AI in which the only manipulation of the semen involves dilution and freezing and the process is largely dependent on the natural oestrus cycle of the cow. Newer breeding technologies like oestrus synchronization, semen sexing and embryo transfer are technologies that emerged after privatization. The study revealed that the level of adoption of these technologies was low even if they had a significant influence on quality of AI services. The percentages of farmers who had used the oestrus synchronization, semen sexing and embryo transfer technologies at least once were 10.8, 36.0 and 0.0 respectively.

The low use of oestrus synchronization and semen sexing could be attributed to the higher comparative cost in relation to traditional AI services. This however, seems contrary to the findings of DeVries (2010) who argued that the cost difference between sexed and unsexed semen is minor. Perhaps the cost disparities in the study area are the results of the free market orientation of the AI practice. Sexed semen also reduces the conception rates by approximately 20% thus increasing the cost of insemination by forcing the farmers to do repeat inseminations (Fetrow, Overton and Eicker, 2007).

Embryo transfer was not practiced in the study area. This was attributed to the high cost of the technology and the lack of trained personnel to carry out the process. According to Rege (2016), embryo transfer coupled with in vitro fertilization is not economically feasible for commercial use on small farms at present. Kahi and Rewe (2008) further found that biotechnologies in livestock production have been applied mostly in developed countries but their application in Africa is minimal due to reasons related to economic growth such as poor infrastructure, technical and educational capacity. However, embryo transfer technology can greatly contribute to research and genetic improvement in local breeds. The same author also points out that no other technology in agriculture, except hybrid seed and fertilizer use, has been so widely adopted globally as AI.

It was found that there was no significant relationship between the use of breeding technology and the quality of AI services experienced by AI service providers though the relationship was significant for farmers. However, the influence was low due to the higher costs and lower conception rates associated to the use of such technologies. This is contrary to DeVries (2010) who argues that the cost difference between the use and non-use of the breeding technologies is minimal. Another conclusion was made that farmers are able to embrace technology better than service providers. This could be attributed to the fact that farmers are the service consumers hence determine the service specifications.

It was found that the use of ICT had a significant influence on quality of AI services for farmers but not for service providers. Findings on the use of information and communication technology revealed that use of mobile telephones was the most common mode of communication between farmers and service providers. The use of the internet either to communicate or to access AI related information was very low. This was attributed to the fact that even though mobile phones are easily available and easy to use, most farmers have not

appreciated the internet as a means of transferring and sharing information. This fact is aggravated by the low internet connectivity in some of the rural areas in the study area. The study further found that the use of internet in AI was confined to younger people aged 40 years and below. Data showed that majority of farmers (79.6%) were above 40 years of age meaning that only 20.4% of the farmers were likely to have a high propensity to use the internet. ICT illiteracy among older people may also be a factor hindering the use of internet in the study area. This tends to agree with the assertion by Chapman and Slaymaker (2002) that rural areas are often characterized as information-poor. The potential of ICTs to support the improvement of currently inadequate extension and education services, and ensure farmers have access to reliable information about agricultural technologies and markets, is the subject of considerable interest for researchers and Governments (Zijp, 1994; FAO, 1998).

It was also found that unlike other modes of communication, use of mobile telephones was the most widespread with both farmers and service providers stating that they used them very frequently. This agrees with Sapprassert (2006) that current trends in technological advancement are relying heavily on ICT. The mobile phone is the most available ICT equipment in the study area hence its widespread use for communication. This implies that any shift in the communication channels is likely to be towards ICT related systems like mobile telephones and computers.

The study showed that sources of AI information for service providers and farmers were many and scattered. This necessitated the use of ICT to research on farm related issues. According to Ogbomo and Ogbomo (2008), use of remotely located data may attract the use of ICT if it is to be accessed quickly over vast geographical areas. Nagesh, Khandelwal and Caicedo (2014) suggest that accessing data from remote locations has many advantages such as zero maintenance of local databases, unlimited storage space to store both data and images and as a result fewer memory leaks and application crashes.

The widespread use of mobile telephony may be associated with their low cost of acquisition and use. However the use of internet was quite low. Rao (2009) lists the reasons for the low usage of the internet as lack of awareness about benefits of the ICTs; lack of access facilities; language barriers in using the internet; lack of local language information products; non-availability of Government information through online channels and; lack of motivation to

use information over the internet. Low usage of the internet was also attributed to poor infrastructural development in the rural parts of the study area. According to Castello and Braun (2006), existing public rural development service structures have very limited outreach.

Plazibat, Krcum, Skracic (2015) indicated that the tools of quality traditionally used in production processes can be efficiently applied in determining the characteristics of services. ICT can be one of the tools that can be used to enhance service quality. The study found that ICT has a positive Influence on quality of AI services in the case of farmers. However, for service providers, ICT has a negative Influence on quality of AI services. The results displayed by service providers are contrary to the findings of Sapprasert (2006) who demonstrated that both productivity and profitability growth were significantly linked to the level of ICT usage intensity in service firms especially when undertaken jointly with non-technological innovations.

According to Mickelsen, McNeil, Parikh and Persof (2011), one of the principal drivers behind technology-led quality improvement is the reduction in the frequency of poor quality experiences. This could be the reason why there was no relationship between ICT use and quality of services for AI service providers because they are not service consumers hence they are likely to face no incidences of poor quality experiences. Another reason for the indifference on quality of AI services by service providers may be attributed to argument that an understanding of consumer utility is largely superfluous to the overall goal of service vendors whose overall aim is firm profitability (Makadok *et al* (2002).

5.3.3 Legal Status of Service Provider and Quality of AI Services

The study sought to find out whether the legal status of AI service providers has an influence on the quality of AI services. The collected data revealed that there were only three legal forms of service providers in the study area namely private, self-help groups and cooperative societies with a market share of 89.5%, 7.0% and 3.5% respectively.

The study concluded that there was no significant difference in the quality of service experienced by AI service providers in respect of the legal status of the organizations they presented. However, farmers were able to experience a difference in the quality of services emanating from the different legal types of service providers. The findings on farmers were

consistent with Coltrain *et al* (2000) and Desai and Joshi (2013) who found that groups and cooperative societies are able to reduce costs of operations and increase participation as well as enjoying better returns from economic activities.

Private AI service providers, who were the majority (89.5%), were sole proprietorships in which the service provider was the only employee. Similarly, farmers' self-help groups and cooperative societies were managed with very little Government indulgence in their management (Mogoa *et al*, 2004). Government indulgence in cooperative societies is only in auditing their books. Self-help groups only receive Government indulgence in cases of solving disputes (RoK, 2012b; Sundaram, 2012). The implication of this finding is that maintenance of standards in AI may not be uniform.

The high level of market share held by private providers was attributed to the large number of private practitioners and probably the low level of bureaucracy that is associated with private businesses, particularly where the proprietor is the service provider in a single-employee sole-proprietorship organization. This also bypasses many steps in the SERVQUAL Model because a service transaction is only dealt with by two people, the farmer and the service provider. Mikami (2007) points out that it is often argued that cooperative firms are financially less viable than investor-owned firms. The data also showed that even among the farmers who were members of cooperative societies or self-help groups which provided the service, there was a tendency to seek it from private providers. In a study aimed at examining the situations of sole proprietorships in an e-commerce environment, Permwanichagun, Kaenmanee, Naipinit and Sakolnakorn (2014) found that products of a sole proprietorship are selected for many reasons: 42.22% due to the goods' value to the target group; 29.98% as a result of quality; 15.79% the fact that it is a modern product; and 12.01% due to the utility of the product.

It was found that the formation of self-help groups is a recent development. According to qualitative data obtained in the study, it was established that the groups started forming after privatization. This was triggered by cases of poor management practices in the cooperative societies which brought about very high operational costs thus rendering them insolvent. The fall of milk prices to untenable levels aggravated the situation. Only a few cooperative societies survived this trend. Those that survived had to depend a lot on donor funding to stay in business. The funding has enabled them to purchase high volume liquid nitrogen

containers unlike other forms of service providers. Wanyama (2008) agrees that it may be true that a significant proportion of cooperative societies registered in Kenya are dormant and demonstrates that the trend had been rising, even though new cooperative societies continued to be registered at the time of his publication. The cooperative movement has continued to play an important role of savings mobilization and providing employment in Kenya (Gunga, 2008).

It was found that 46% of farmers who were members of cooperative societies and self-help groups had enjoyed a lower cost of AI services as compared to when the services were provided to non-members. In a study carried out in Kericho, Kenya to investigate the impact of co-operative movement in rural development Gweyi, Ndwiga and Karagu (2013) agreed with the research findings by showing that 61% of respondents said that Co-operative development framework has a role on poverty eradication strategies while 39% of the respondents argued that Co-operative development framework has no role on poverty eradication strategies.

5.3.4 Combined Influence of Post Privatization Management Practices

This research sought to find out the combined Influence of post privatization management practices which include capacity building, use of technology and the legal form of service providers. The investigation was based on the assumption that the combined Influence of the independent variables can differ from the sum of the individual variables due to interactions that would either bring a synergistic or an antagonistic effect.

The study expressed the relationship between post-privatization management practices and quality of artificial insemination services in a multiple regression equation. The findings were that the relationship for farmers was statistically significant but for service providers it was not. This could be attributed to the construct that consumers are the best placed people to define quality of services (Priem, 2007). Surprenant and Solomon (1987) enforce Priem's argument by suggesting that customers and service providers have roles to play during and possibly after service encounters and that these roles are based on "interpersonal interactions" between organizations and customers. The case of service providers may be explained by the argument by Makadok and Coff (2002) that from a service provider's point of view, an understanding of consumer utility is largely superfluous to the overall goal of the strategy field which is to explain firm profitability, determined by the value captured by the firm. One

of the key roles of the service recipient is in communicating clearly their requirements as demonstrated by the SERVQUAL Model. The service provider also has a duty of translating those requirements into actions that lead to their fulfilment and to farmers' satisfaction.

It was concluded that although there was a combined influence of capacity building, technology use and legal form of service provider on quality of service experienced by AI service providers and farmers respectively, the relationship was significant for farmers but was not for AI service providers. The findings are in line with Priem (2007) who stated that consumers are arbiters of value. This suggests that a farmer's assessment is a useful tool in bringing out an understanding of the quality of AI services in Nyeri County. Nathans, Oswald and Nimon (2012) suggest that when there is a combined influence on a dependent variable, the independent variables have either a synergistic or antagonistic effect on one another. The higher coefficients of the independent variables in the combined Influences as compared to the variables in the individual regression equations suggest a synergistic effect.

5.3.5 Moderating Influence of Monitoring and Evaluation

It was hypothesized that the strength of the relationship between post-privatization management practices and quality of AI services is dependent on monitoring and evaluation practices. Hypothesis testing found that this proposition held true for farmers who are the service consumers but did not hold true for AI service providers. In the case of the service providers, the strength of the moderation would not be significant since the study had already found that there was no significant relationship between post-privatization management practices and quality of AI services.

The findings that monitoring and evaluation has a significant moderating influence corroborates with various authors. Titus and Brochner (2005); Soosay and Fearne (2010) and; Harty, Kouider and Paterson (2016) argue that the flow of monitoring and evaluation information is critical in defining business and project success. This suggests that for farmers to experience high quality AI services, the practice of monitoring and evaluation would play a crucial role. According to CLEAR, (2013), Kenya, South Africa, and Uganda have specific examples of how Government entities are using Monitoring and Evaluation information to improve performance.

The research indicates that majority of the AI service providers (70.2%) were aware of a monitoring and evaluation system for AI services. However, 43.9% of them were non-committal about the level of organization of monitoring and evaluation. This implies that the players in the practice appreciated monitoring and evaluation and were likely to have been active participants in the process, considering that they are key sources of primary information. An organized system would imply that data is filled in special templates for easy analysis (Speckly, 2009). This was confirmed by 90.2% of the AI service providers who said that they participated in providing monitoring information using specially designed forms. According to Castro (2006), proper monitoring and evaluation tools, as well as a system which brings together all the different institutional efforts are paramount for the success of the system. The need for a reliable source and flow of data is reiterated by Kusek *et al* (2004) that producing a continual flow of feedback and data on monitoring and evaluation systems helps decision makers manage more effectively.

Information sharing by AI service providers was skewed towards Government, input suppliers and farmers. Sharing with cooperative societies and self-help groups was limited. According to Speckly (2009), reporting to stakeholders helps them to monitor how a project is being managed and how the stakeholders perceive the quality and style of management. The study therefore shows that the level of interest in quality of AI services is high among Government, semen suppliers and farmers.

It was also found that there was a low level of involvement in making decisions on the indicators upon which monitoring and evaluation data would be collected. According to the International Federation of Red Cross and Red Crescent Societies (IFRC, 2011), greater participation can help cross-check data accuracy and improve critical reflection, learning and utilization of information. Fear of taxation among service providers was one of the key reasons hindering the sharing of data. This implies a need on the sensitization of the service providers on the importance of the data for decision making among stakeholders.

The research showed that 40% of the farmers kept records on farm income. However, the records kept were mainly transaction documents from inseminations and milk sales, implying that the level of deliberate record keeping was very low. This also implies that farmers are not able to gain from the benefits of records on their farms. According to UNDP (2009), the

value of monitoring and evaluation is determined by the extent to which the information is used by decision makers and a wider audience.

It was found that the level of communication between farmers and technical people who include AI service providers, Veterinary officers and extension officers was high. Almost all farmers had an interaction with the technical people in the one year preceding the study. According to Kusek *et al* (2004), continuous communication is important as a management tool to provide feedback to decision makers. The research however found that most of the communication is verbal meaning that no records of the communications are kept for future reference. This is likely to lead to loss of data due to memory loss and recall errors. Though the advantages of written communication are ease of preservation, permanence and greater precision (Daft, 2015), verbal communication does not require much effort to prepare and may use less time to communicate hence it may be more useful for information that does not require future reference. This may be the reason for the high usage of verbal communication.

It was concluded that the strength of the relationship between post privatization management practices and quality of AI services depended on monitoring and evaluation in the case of farmers. However, for service providers, the relationship did not depend on monitoring and evaluation. The data from AI service providers contradicted Munthiu, Velicu, Tuta and Zara (2014) who showed that marketers should always bear in mind the fact that service quality monitoring and evaluation presupposes not only the appreciation of the final results, but also of the service delivery process which in the case of AI services is best done by the farmers. The findings on farmers agree with Perrin (2012) that monitoring and evaluation represents a management tool that can help in setting directions; assessing progress; learning about the types of approaches that appear to work or not in varying circumstances and making decisions.

5.4 Conclusions of the Study

The following conclusions were made from the study. Firstly, it was concluded that capacity building has no significant influence on quality of AI services. These findings disagreed with those of Hui *et al* (2001) and Ndwiga *et al* (2014) who found that capacity building has a positive correlation with quality of services provided in a banking and health environment respectively. The disparity was attributed to the little support in terms of capacity building

given to AI service providers. The other reason that could lead to this scenario is the possibility that the capacity building that took place may not have been addressing the capacity needs of both AI service providers and farmers.

The second conclusion made was that there is no significant relationship between the use of technology and the quality of AI services experienced by AI service providers. On the other hand, there is a significant relationship between the use of technology by farmers and the quality of AI service they experienced on the farms. Though the number of farmers using sex selected semen and oestrus synchronization was low, they reported a higher quality of AI services agreeing with Larson (2014) and O'Connor (2014) that the two technologies can lead to a higher probability of obtaining a progeny of the farmer's choice. The absence of a significant relationship between technology use and quality of service for AI service providers was attributed to the fact that quality is best measured from a consumer's perspective (Priem, 2007).

The third conclusion was that there is no significant relationship between the legal setup of service provider organization and quality of AI services experienced by AI service providers. However, in the case of farmers, there is a significant relationship between the legal setup of service provider and quality of AI services. The absence of a significant relationship for service providers can be attributed to the fact that the service providers are part of the organizations they represent and it was therefore hard for them to gauge the quality of their own services. The findings on farmers on the other hand were consistent with Coltrain *et al* (2000) and Desai and Joshi (2013) who found that groups and cooperative societies are able to reduce costs of operations and increase participation as well as enjoying better returns from economic activities.

The fourth conclusion was that post-privatization management practices have no significant combined influence on quality of artificial insemination services experienced by AI service providers. However, in the case of farmers, post-privatization management practices have a significant combined influence on quality of artificial insemination services. The findings agree with Priem (2007) who stated that consumers are arbiters of value. This suggests that farmer's assessments might be a useful tool in bringing out an understanding of the quality of AI services in Nyeri County.

The fifth conclusion was that the strength of the relationship between post-privatization management practices and quality of AI services does not depend on monitoring and evaluation strategies based on the results of the Analysis of Variance in the case of service providers. However, for the case of farmers, the strength of the relationship does depend on monitoring and evaluation strategies. This is contrary to DPME (2014) who indicate that monitoring and evaluation often have little influence in departments due to a lack of understanding of the value of monitoring and evaluation amongst political and administrative leadership. The conclusion however, agrees with Bates and Jones (2012), Gosling (2010) and Tache (2011) who state that information flow along the value chain is a key component of quality of service management in any field of practice or economic activity.

Finally, it was found that service provider definition and rating of quality of AI services was overrated. Furthermore, their responses showed no significant relationships between the independent variables and quality of artificial insemination services. This led to the conclusion that farmers, who are end consumers of the AI services are in a better position to describe quality of AI services. This finding is in agreement with Priem (2007) who described consumers as arbiters of value based on quality. Chandrupatla (2009) further reported that for quality to be realized and measured, the customer's needs should be translated into measurable characteristics in a product or service

5.5 Contribution to Knowledge Gap

The study contributed to the identified knowledge Gaps through the conclusions shown in Table 5.2

Table 5.2. Contribution to Knowledge Gaps

Objective	Knowledge Gap	Conclusion Made
To establish to what extent artificial insemination capacity building influences quality of artificial insemination services.	Authors focused on the training of service quality leaders and not the role of all players in the industry. The study investigated the role of capacity building on quality of AI service.	There is no significant relationship between capacity building and quality of artificial insemination services for AI service providers and farmers.

Objective	Knowledge Gap	Conclusion Made
To determine the influence of technology application on quality of artificial insemination services.	Authors did not study the role of technology application in quality of service delivery. The study investigated the role of technology in quality of AI services.	ICT application has no significant influence on quality of artificial insemination services for AI service providers. However, the influence is significant for farmers. Use of Breeding Technology has a significant influence on quality of artificial insemination services for farmers.
To determine how Legal Status of service provider influences quality of artificial insemination services.	Findings did not make comparisons between group and individual performance. The study investigated the role of organization type on quality of AI services.	There is no significant relationship between the legal status of AI service provider organization and quality of AI services for service providers. The relationship is significant for farmers.
To establish the combined influence of post-privatization management practices on quality of artificial insemination services.	Author did not study the relationship between quality of services and demand. This study investigated the role of the factors influencing quality of AI services.	Post-privatization management practices have no significant combined influence on quality of artificial insemination services for AI service providers. The combined influence is significant for farmers.

Objective	Knowledge Gap	Conclusion Made
To establish the moderating influence of the use of monitoring and evaluation strategies on the relationship between post-privatization management practices and quality of artificial insemination services.	Author focused on data analytical methods and did not consider monitoring and evaluation systems. The study sought to find out the influence of monitoring and evaluation on the relationship between post-privatization management practices and quality of artificial insemination services.	The strength of the relationship between post-privatization management practices and quality of artificial insemination depends on monitoring and evaluation strategies for AI service providers. The practices do not depend on monitoring and evaluation for farmers.

5.6 Recommendations

The recommendations made from this study are given in the following sections:

5.6.1 Recommendations for Practice

It was found that privatization of agricultural services gave rise to a plurality of service providers. This led to a situation in which extension messages are not harmonized and are sometimes not suited to the situations in which they are delivered. There is therefore, a need to strengthen extension services which will lead to growth in the sector through improved productivity through improving the artificial insemination system and reducing the current calving interval. This can be achieved if the State Department of Agriculture, Livestock and Fisheries engages in constant capacity building of AI service providers and other Extension Officers. This can also be enhanced by regularly carrying out assessments of farmer's training needs in order to develop tailor-made extension services that meet those needs. This can be done annually by stakeholders with the leadership of the State Department of Agriculture, Livestock and Fisheries.

It was found in the study that the use of ICT among farmers is low, especially among farmers above 50 years of age. It was also found that 53% of farmers were above 50 years of age. The State and County Departments of Agriculture can set up an easily accessible electronic database that can be referred to by AI service providers and farmers to get the latest information on AI services and other agricultural enterprises. This can be done by taking advantage of the ICT infrastructure already in place; improving internet access in the rural

areas and developing easy-to-use applications that are not difficult to understand. It would be useful to enhance the use of mobile phones in communicating and accessing information on AI services. This can be achieved by developing a mobile telephone application that is easy to use by both farmers and service providers.

There is a need for farmer sensitization on breeding technologies such as sexed semen, oestrus synchronization and embryo transfer with an aim of increasing their use. This can be done by developing a mechanism where AI service providers meet monthly to be sensitized on how to apply new technologies and developing extension messages that would sensitize farmers on the advantages and cost implications of using the new technologies. The state Department of Agriculture can enhance this by setting up a mechanism that ensures constant refresher trainings for AI service providers.

The following recommendations were made to the State Department of Finance for implementation in conjunction with the State Department of Agriculture, Livestock and Fisheries. The first recommendation was that government subsidies should be introduced on the use of the technologies in order to make them more accessible and to make it more attractive for farmers to apply them. This can be done by removing taxes associated with agricultural inputs as well as meeting part of the cost of manufacture or importation of such inputs. The achievement of this recommendation requires close monitoring of the importation, manufacture and sale of the agricultural inputs.

There is a need to provide capacity support to private AI service providers by Government in order to increase their ability to deliver better quality of services through provision of credit facilities. This is crucial because capacity building support was found to be low. Support to cooperative societies and self-help groups would also go a long way in increasing participation in enhancing quality of AI services thus increasing farm productivity and profitability as well as other benefits to members. The State Department of Finance therefore, can contribute to solving the problem by providing budgetary support to the State Department of Agriculture, Livestock and Fisheries which will develop and implement the appropriate programmes.

Capitalization of enterprises related to dairy production, including AI, was found to be low, thus affecting their scale of production and profitability. There is therefore, a need to set up a

revolving fund in order to enable service providers and farmers grow and improve the AI industry which would enhance growth of dairy production. The revolving funds could be set by combining inputs of the Ministry of Finance, Ministry of Agriculture, Livestock and Fisheries and private sector players like banks and micro-finance institutions.

5.6.2 Implications for Academia

It was found that inadequate skills and high costs were the key contributing factors to the low use of breeding technologies. None of the service providers in the study area had the skill to perform embryo transfer while oestrus synchronization was only practiced by service providers with a Bachelor of Veterinary Medicine degree. There is therefore, a need to develop a refresher training for existing AI service providers on these technologies in order to enhance their uptake.

The business management skills for AI service providers were not established by this study. However, this study recommends the incorporation of such skills in their training curriculum. Such a training curriculum could include basic management skills, quality management in AI service and monitoring and evaluation. These training should be made compulsory for pre-service animal health and animal production training courses for professionals and para-professionals because it could lead to creating a work culture that embraces quality in the practice.

5.6.3 Implications for Practice

There should be a greater involvement and sensitization of farmers and other players in the AI value chain on the monitoring and evaluation process in order to enhance management. This should be done in order to harmonize the monitoring and evaluation system in use so as to take care of the information needs of all the players in the AI value chain. This would also enable the players to quickly get information on emerging issues in the value chain and would empower the farmers with useful information for decision making.

Extension and AI service providers can enhance the efficiency and effectiveness of technology through promoting its uptake and striving to improve the quality of services. This can be achieved through facilitating the formation of service providers' fora which would facilitate the strengthening of AI services through continuous capacity building and group

access to funding. A policy requiring refresher courses for service providers can also be useful in enhancing technical capacity in artificial insemination.

5.7 Suggestions for Further Research

The following suggestions for further research were made from the study. Firstly, the study did not find any evidence suggesting that skill-based capacity building was carried by service providers and extension officers on farmers. It would therefore be of interest to carry out a capacity needs assessment that would provide useful information for tailoring extension services to the specific needs of the study area. The study could focus on various aspects of dairy production including factors which influence the calving intervals; usage and efficiency of the small sized liquid nitrogen tanks used by private AI service providers and factors which influence costs of various breeding technologies in cattle.

Secondly, a comparative analysis of the role of various legal forms of AI service providers on productivity and profitability of the dairy value chain would be a useful source of new knowledge, a subject that was out of the scope of this study. The study could also include an investigation of the roles and challenges of the cooperative movement in the dairy industry to give more insight on the dismal performance of the cooperative movement in the County.

Finally, the role of ICT in dairy production can provide useful information for implementing innovations in the sector. Specifically, ICT aided genetic matching technology and monitoring and evaluation can be studied to give insights on how such technology can be used to improve quality of AI services.

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APPENDICES

APPENDIX 1: INTRODUCTION LETTER

Alex M. Methu,
P. O. Box 3101-10140,
NYERI.
7th December, 2015.

To Whom It May Concern

Dear Sir / Madam,

RE: FILLING OF RESEARCH QUESTIONAIRE.

I am a student at the University of Nairobi pursuing a Doctor of Philosophy Degree in Project Planning and Management. I am currently undertaking a research on the **Influence of Post-Privatization Management Practices and Monitoring and Evaluation Strategies on Quality of Artificial Insemination Services in Cattle in Nyeri County, Kenya.** The questionnaire attached is meant for collecting information which will assist in the study.

Kindly complete the questionnaire as honestly as possible. All the information you give will be used only for academic purposes and your identity will be treated with confidentiality. Your positive response will be highly appreciated.

Yours Faithfully

Alex M. Methu,
L83/81021/2011.

APPENDIX 2: QUESTIONNAIRE FOR AI SERVICE PROVIDERS

Instruction

Please fill the questionnaire as honestly and objectively as possible by ticking in the appropriate boxes or filling in the spaces provided.

Part 1: Biodata

1. What is your gender? Male [ ] Female [ ]

2. What is your age in years?

   18-30 [ ] 31-40 [ ] 41-50 [ ] 51-60 [ ] Above 60 [ ]

3. What is your highest qualification?

   a) Certificate [ ]
   b) Diploma [ ]
   c) University Degree related to artificial insemination [ ]
   d) University Degree Not Related to artificial insemination [ ]
   e) Post-Graduate Qualification [ ]

4. How many years have you provided AI services in cattle?

   0 – 5[ ] 5 – 10[ ] 10 – 15[ ] 15 – 20[ ] 21 – 25[ ] Over 25[ ]

5. How do you rate the demand for the following types of semen?

	Very Low	Low	Moderate	High	Very High
Local Semen	[ ]	[ ]	[ ]	[ ]	[ ]
Imported Semen	[ ]	[ ]	[ ]	[ ]	[ ]

Part 2: Monitoring and Evaluation

6. To what extent would you say that monitoring in the AI field is organized?

Highly organized	Organized	Neutral	Disorganized	Highly disorganized
[ ]	[ ]	[ ]	[ ]	[ ]

7. Does your organization have specialized documents or forms for reporting on artificial Insemination? Yes [ ] No [ ]

8. To what extent do you agree that you give adequate reports to the following regularly?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a) Government	[ ]	[ ]	[ ]	[ ]	[ ]
b) Private Veterinarians	[ ]	[ ]	[ ]	[ ]	[ ]
c) Suppliers	[ ]	[ ]	[ ]	[ ]	[ ]
d) Farmers	[ ]	[ ]	[ ]	[ ]	[ ]
e) Cooperative Societies	[ ]	[ ]	[ ]	[ ]	[ ]

9. To what extent would you agree that you are involved in the following?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a) Planning for monitoring and evaluation in dairy cattle	[ ]	[ ]	[ ]	[ ]	[ ]
b) Deciding on the evaluation information to collect	[ ]	[ ]	[ ]	[ ]	[ ]
c) Data collecting on artificial insemination	[ ]	[ ]	[ ]	[ ]	[ ]
d) Discussing results of evaluation of AI services	[ ]	[ ]	[ ]	[ ]	[ ]

10. To what extent do you agree with the following statements about the usefulness of monitoring, evaluations and research on AI in your area?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a) Data collected on AI in your area is useful to you	[ ]	[ ]	[ ]	[ ]	[ ]
b) AI reports help in day-to-day decision making on dairy farming	[ ]	[ ]	[ ]	[ ]	[ ]

Part 3: Quality of Artificial Insemination Services

11. What is the average calving interval in your work area?

Less than 19 Months	19 – 24 Months	25- 30 Months	Over 30 Months
[ ]	[ ]	[ ]	[ ]

12. To what extent would agree that you are able to respond to farmers' calls for insemination within the time when the cow is fertile?

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
[ ]	[ ]	[ ]	[ ]	[ ]

13. To what extent would you say you are always able to supply the farmer with the required breed type?

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
[ ]	[ ]	[ ]	[ ]	[ ]

14. What is the average daily milk production in litres per cow in your work area?

0 – 5 [ ] 5 – 10 [ ] 10 – 15 [ ] 15 – 20 [ ] Over 20 [ ]

15. What type of AI service do you provide?

Room temperature [ ] Deep frozen [ ]

16. Do you have a liquid nitrogen tank? Yes [ ] No [ ]

17. If Yes, What size in litres of liquid nitrogen container do you use?

5 or less [ ] 6 – 15 [ ] 16 -25 [ ] 26 – 35 [ ] over 35 [ ]

18. What is your usual mode of transport for reaching farms?

Private car [ ] Public car [ ] Private motorbike [ ] Public motorbike [ ]
Bicycle [ ] Walking [ ]

19. How do you rate yourself in the following about your artificial insemination service practice? (Please tick the appropriate box)

	Deplorable	Poor	Fair	Good	Excellent
a) Conception rates	[ ]	[ ]	[ ]	[ ]	[ ]
b) Response time to farmer's call	[ ]	[ ]	[ ]	[ ]	[ ]
c) Breeds are true to type	[ ]	[ ]	[ ]	[ ]	[ ]
d) Semen Storage	[ ]	[ ]	[ ]	[ ]	[ ]
e) Calving Interval	[ ]	[ ]	[ ]	[ ]	[ ]
f) Milk Production	[ ]	[ ]	[ ]	[ ]	[ ]
g) Meeting farmers' expectations	[ ]	[ ]	[ ]	[ ]	[ ]
h) Providing timely Services	[ ]	[ ]	[ ]	[ ]	[ ]
i) Providing complete services	[ ]	[ ]	[ ]	[ ]	[ ]
j) Treating farmers with courtesy	[ ]	[ ]	[ ]	[ ]	[ ]
k) Consistently Effective Services	[ ]	[ ]	[ ]	[ ]	[ ]
l) Ease of accessibility	[ ]	[ ]	[ ]	[ ]	[ ]
m) Providing convenient services	[ ]	[ ]	[ ]	[ ]	[ ]
n) Guaranteeing conception	[ ]	[ ]	[ ]	[ ]	[ ]
o) Ability to solve other problems	[ ]	[ ]	[ ]	[ ]	[ ]
p) Understand farmers' needs	[ ]	[ ]	[ ]	[ ]	[ ]
q) Provide extra services	[ ]	[ ]	[ ]	[ ]	[ ]
r) Use of the right Equipment	[ ]	[ ]	[ ]	[ ]	[ ]

20. Please list five most common reproductive diseases in your area of operation.

a) .....

b) .....

c) .....

d) .....

e) .....

21. To what extent are you regulated by the Veterinary Department your AI practice?

Very High	High	Moderate	Low	None
[ ]	[ ]	[ ]	[ ]	[ ]

22. What bottlenecks do you face in ensuring the quality of artificial insemination services to farmers?

Inadequate skills	Poor semen quality	Poor Equipment	Poor animal husbandry
[ ]	[ ]	[ ]	[ ]

Other (Please specify .....)

Part 4: Capacity Building

23. Is your highest qualification related to AI? Yes [ ] No [ ]
24. Have you received any post-qualification training in AI? Yes [ ] No [ ]
25. If yes, to what extent have the trainings attended improved your ability to deliver high quality services?

Very High	High	Moderate	Low	Very Low	Not Applicable
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

26. Have you received any Government support towards your AI practice?

Yes [ ] No [ ]

27. If yes, what kind of support did you receive?
    a) Credit [ ]
    b) AI equipment [ ]
    c) Training [ ]
    d) Semen supply [ ]
    e) Supply of other consumables [ ]

Other (Please specify)…….

28. Are there any NGOs supporting AI services in Nyeri County?

Yes [ ] No [ ]

29. If yes,
    a. please list the NGOs supporting AI services

……

……

……

……

.

b. What kind of support do the NGO's provide?

a) Credit [ ]
b) AI equipment [ ]
c) Training [ ]
d) Semen supply [ ]
e) Supply of other consumables [ ]

Other (Please specify)…….

30. To what extent has external financial or material support helped improve your business?

Very High	High	Moderate	Low	Very Low
[ ]	[ ]	[ ]	[ ]	[ ]

Part 5: Technology Application

31. What percentage of farmers has applied the following technologies in your work area?

	None	1 – 25%	26-50%	51 – 75%	Over 75%
Sex selected semen	[ ]	[ ]	[ ]	[ ]	[ ]
Oestrus synchronization	[ ]	[ ]	[ ]	[ ]	[ ]
Embryo Transfer	[ ]	[ ]	[ ]	[ ]	[ ]

32. To what extent do you use the following channels to communicate with farmers on AI?

	Never	Rarely	Only When Needed	Frequently	Very Frequently
a) Internet	[ ]	[ ]	[ ]	[ ]	[ ]
b) Mobile phones	[ ]	[ ]	[ ]	[ ]	[ ]
c) Landline phones	[ ]	[ ]	[ ]	[ ]	[ ]
d) Hand Delivered Notes	[ ]	[ ]	[ ]	[ ]	[ ]
e) Oral Messages through intermediary	[ ]	[ ]	[ ]	[ ]	[ ]
f) Message Points e.g. kiosks	[ ]	[ ]	[ ]	[ ]	[ ]
g) Physically seeking the service	[ ]	[ ]	[ ]	[ ]	[ ]

provider

33. Is there a database that you can refer to in order to find current information on artificial insemination? Yes [ ] No [ ]

34. If Yes, Is the databank centrally placed or scattered?

Central [ ] Scattered [ ]

35. Who is responsible for creating and maintaining the databank?

Government	Private Practitioners	Suppliers	Farmers	Cooperative Societies
[ ]	[ ]	[ ]	[ ]	[ ]

Others (Please specify)……..…….

Part 6: Organization of Service Provider

36. What is the legal status of your AI practice?

Cooperative [ ] Private Provider [ ] Government Veterinarian [ ]

Farmer Self Help Group [ ] Other (Please specify)……

If cooperative or self-help group, please proceed to question 36, otherwise go to question 37

37. How many farmers are members of the cooperative/self-help group? [.....]

38. How many inseminations did you perform in the last year for the following?

a. Members [.....]
b. Non Members [.....]

39. Are the costs of AI for members different from costs to non-members?

Yes [ ] No [ ]

40. Please suggest two ways in which AI service can be improved.

a. …….
b. …….

Thank You for your time

APPENDIX 3: QUESTIONNAIRE FOR FARMERS

Instruction

Please fill the questionnaire as honestly and objectively as possible by ticking in the appropriate brackets or by filling in the blank spaces.

Part 1: Biodata

1. What is your gender? Male [ ] Female [ ]

2. What is your age in years?
   18-30 [ ] 31-40 [ ] 41-50 [ ] 51-60 [ ] Above 60 [ ]

3. What is your highest level of education?
   a) Illiterate [ ]
   b) Did not Complete Primary School [ ]
   c) Completed Primary School [ ]
   d) Completed Secondary School [ ]
   e) Completed Tertiary Institution [ ]
   f) Completed University [ ]
   g) Post-Graduate Qualification [ ]

4. How many years have you practiced dairy farming?
   0 – 2 years [ ] 3 – 5 Years [ ] 6 – 10 years [ ] Over 10 years [ ]

5. What is your monthly level of income in KShs?
   0 – 10,000 [ ] 10,000 – 20,000[ ] 20,000 – 50000[ ]
   50,000 – 100,000[ ] Over 100,000 [ ]

6. How many heads of cattle do you have?
   Bull Calves [.....] Heifer Calves [.....] Cows [.....] Bulls [.....]

7. What method do you use for breeding your cattle (Please tick)?
   Bulls [ ] Artificial Insemination [ ] None [ ] Both [ ]

8. If you use AI, what type of semen do you use?

   Local [ ] Imported [ ] Both [ ]

If your answer in question 7 is artificial insemination or both, please proceed to question 9, otherwise terminate the questionnaire.

Part 2: Monitoring and Evaluation

9. To what extent do you agree that you keep accurate records on the following?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a) Milk Production	[ ]	[ ]	[ ]	[ ]	[ ]
b) Artificial insemination	[ ]	[ ]	[ ]	[ ]	[ ]
c) Fertility diseases in cattle	[ ]	[ ]	[ ]	[ ]	[ ]
d) Income from dairying	[ ]	[ ]	[ ]	[ ]	[ ]
e) Expenditure on dairy cattle	[ ]	[ ]	[ ]	[ ]	[ ]

10. How often do you communicate with your AI service provider about your dairy enterprise?

    a) Every week [ ]
    b) Every two weeks [ ]
    c) Every month [ ]
    d) Every Three months [ ]
    e) Every six months [ ]
    f) Only when he is needed [ ]
    g) Never [ ]

11. How often do you communicate with the veterinary officer service provider about your dairy enterprise?

    a) Every week [ ]
    b) Every two weeks [ ]
    c) Every month [ ]
    d) Every Three months [ ]
    a) Every six months [ ]
    b) Only when he is needed [ ]
    c) Never [ ]

12. What method do you use to provide information to the veterinary officer?

a) Written Reports [ ] b) Verbally [ ]

13. Do you provide the following information to the Veterinary Department?

a) Number of Inseminations done	Yes [ ]	No [ ]
b) Specific bull semen used	Yes [ ]	No [ ]
c) Number of successful conceptions	Yes [ ]	No [ ]
d) Number of offspring born	Yes [ ]	No [ ]
e) Number of offspring surviving the first year	Yes [ ]	No [ ]

14. What other information do you provide to AI Service Providers? .....

Part 3: Quality of Artificial Insemination Services

15. What is the calving interval in your farm?

Under 19 Months [ ] 19 – 24 months [ ] 25 – 30 months [ ] over 30 months [ ]

16. How do you rate the following about artificial insemination services? (Please tick the appropriate box)

	Deplorable	Poor	Fair	Good	Excellent
a) Conception rates	[ ]	[ ]	[ ]	[ ]	[ ]
b) Response time to farmer's call	[ ]	[ ]	[ ]	[ ]	[ ]
c) Breeds are true to type	[ ]	[ ]	[ ]	[ ]	[ ]
d) Semen Storage	[ ]	[ ]	[ ]	[ ]	[ ]
e) Calving Interval	[ ]	[ ]	[ ]	[ ]	[ ]
f) Milk Production	[ ]	[ ]	[ ]	[ ]	[ ]
g) AI meets your expectations	[ ]	[ ]	[ ]	[ ]	[ ]
h) AI services are complete	[ ]	[ ]	[ ]	[ ]	[ ]
i) AI Guarantees conception	[ ]	[ ]	[ ]	[ ]	[ ]
j) AI gives confidence to farmer	[ ]	[ ]	[ ]	[ ]	[ ]
k) Cows are safely handled	[ ]	[ ]	[ ]	[ ]	[ ]
l) Services are convenient	[ ]	[ ]	[ ]	[ ]	[ ]
m) AI uses the right equipment	[ ]	[ ]	[ ]	[ ]	[ ]
n) Inseminator is Clean	[ ]	[ ]	[ ]	[ ]	[ ]

o) Inseminator is skilled	[ ]	[ ]	[ ]	[ ]	[ ]
p) Treats you with courtesy	[ ]	[ ]	[ ]	[ ]	[ ]
q) Gives clear communication	[ ]	[ ]	[ ]	[ ]	[ ]
r) Can solve incidental problems	[ ]	[ ]	[ ]	[ ]	[ ]
s) Gives timely communication	[ ]	[ ]	[ ]	[ ]	[ ]

Part 4: Capacity Building

17. Please rank the frequency with which you receive the following services from AI stakeholders

	Very Frequent	Frequent	Only when needed	Rarely available	Never
a) Veterinary Disease Treatment	[ ]	[ ]	[ ]	[ ]	[ ]
b) Artificial Insemination	[ ]	[ ]	[ ]	[ ]	[ ]
c) Dairy cattle information	[ ]	[ ]	[ ]	[ ]	[ ]
d) Input Supply	[ ]	[ ]	[ ]	[ ]	[ ]
e) Experience sharing	[ ]	[ ]	[ ]	[ ]	[ ]
f) Breeding Information	[ ]	[ ]	[ ]	[ ]	[ ]

18. How many times have you received training in cattle breeding from the following in the last 12 months?

	None	1 – 2	3 - 4	5 - 6	7 - 8	9 – 10	Over 10 times
Government	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Cooperative Societies	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Farmer Groups	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Semen Suppliers	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
AI Providers	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

19. Do you have a written farm plan for the current year?

Yes [ ] No [ ]

20. What is your most significant source of information on artificial insemination?

Extension	Tours	Farmer Discussions	Internet	Experiences
[ ]	[ ]	[ ]	[ ]	[ ]

21. Have you received Government support on the following?

	Yes	No
Credit	[ ]	[ ]
Semen supply	[ ]	[ ]

Other (Please specify)…….

22. Have you received any assistance in form of AI equipment?

Yes [ ] No [ ]

23. Which is your main farm input supplier?

a) Cooperative Societies [ ]

b) Self Help Groups [ ]

c) Agrovet shops [ ]

Other (Please specify) …….

]

24. Are you aware of any rules governing AI services in Kenya?

Yes [ ] No [ ]

Part 5: Technology Application

25. How frequently do you obtain information on artificial insemination from these channels?

	Never	Rarely	Often	Frequently	Very Frequently
a) Radio	[ ]	[ ]	[ ]	[ ]	[ ]
b) Television	[ ]	[ ]	[ ]	[ ]	[ ]
c) Mobile Phone	[ ]	[ ]	[ ]	[ ]	[ ]
d) Landline phone	[ ]	[ ]	[ ]	[ ]	[ ]
e) Internet	[ ]	[ ]	[ ]	[ ]	[ ]

26. How frequently do you communicate with the AI service provider using the following methods:

	Very Frequently	Frequently	Often	Rarely	Very Rarely
a) Email	[ ]	[ ]	[ ]	[ ]	[ ]
b) Mobile phones	[ ]	[ ]	[ ]	[ ]	[ ]
c) Landline phones	[ ]	[ ]	[ ]	[ ]	[ ]
d) Hand Delivered Notes	[ ]	[ ]	[ ]	[ ]	[ ]
e) Oral Messages through intermediary	[ ]	[ ]	[ ]	[ ]	[ ]
f) Message Points e.g. kiosks	[ ]	[ ]	[ ]	[ ]	[ ]
g) Physically seeking the service provider	[ ]	[ ]	[ ]	[ ]	[ ]

27. Have you used the following methods of breeding?

a) Embryo Transfer Yes [ ] No [ ]

b) Oestrus Synchronization Yes [ ] No [ ]

c) Sexed Semen Yes [ ] No [ ]

Part 6: Organization of Service Provider

28. What is the legal status of your AI service provider(s)?

Cooperative [ ] Private Provider [ ] Government Veterinarian [ ]

Farmer Self Help Group [ ] Other (Please specify)……

29. Are you a member of a milk marketing Self Help Group or cooperative that provides AI services?

Yes [ ] No [ ]

30. Are you a member of the cooperative or Self Help Group providing the service?

Yes [ ] No [ ]

31. If you are a member of a cooperative of self-help group, are your costs of AI for members different from costs to non-members?

Yes [ ] No[ ]

Conclusion

32. Please suggest two ways in which AI services can be improved

a. ……

b. ……

Thank You for Taking Your Time

APPENDIX 4: INTERVIEW GUIDE FOR VETERINARY OFFICERS

Instruction

Please answer the questions as honestly as possible, giving explanations where possible.

1. What is your age in years?
2. Which is your highest professional qualification?
3. How many years have you worked for the Veterinary Department?
4. What are the roles of the roles of different stakeholders in monitoring and evaluating the AI industry?
5. What is your opinion on the adequacy of resources dedicated for collection and dissemination of information in AI?
6. Which methods are used to collect and disseminate information on AI in your work area?
7. Which technology is used in gathering and disseminating information on AI?
8. What is the average calving interval in your Sub-County?
9. How do farmers deal with unsuccessful inseminations?
10. Which are the common reproductive diseases in your Sub-County?
11. Which post-qualification trainings have you received on overseeing AI services?
12. Which refresher courses are AI service providers in your work area required to undertake regularly?
13. How do you deal with people providing artificial insemination services without relevant qualifications?
14. Do you provide refresher courses to AI service providers?
15. Which assistance other than training do AI service providers get?
16. To what extent is the use of sex-selected semen prevalent in your sub-County?
17. To what extent is oestrus synchronization practiced by farmers in your sub-County?
18. How is ICT applied in artificial insemination?
19. Which arrangements has your department put in place in order to make technologies in AI available to farmers?
20. Which policies guide the AI service industry?

Thank You.

APPENDIX 5: GENDER DISSAGREGATED QUALIFICATION AND EXPERIENCE

Crosstabulation of Gender * AI Service Provider's Experience (Years)

		AI Experience (Years)					Total
		0 - 5	6 - 10	11 - 15	21 - 25	Above 25	
Gender	Male	12	21	7	5	2	47
	Female	3	0	7	0	0	10
Total		**15**	**21**	**14**	**5**	**2**	**57**

Crosstabulation of Gender * Highest Qualification of Service Provider

		Highest Qualification			Total
		Certificate	Diploma	Degree Related to AI	
Gender	Male	39	1	7	47
	Female	10	0	0	10
Total		**49**	**1**	**7**	**57**

APPENDIX 6: QUALITY RATINGS BY AI PROVIDERS

	N	Minimum	Maximum	Mean	Standard Deviation
Conception Rates	56	1	3	1.71	0.530
Response Time	57	1	4	1.91	0.714
Breed True to Type	57	1	3	1.96	0.778
Semen Storage	57	1	3	1.86	0.766
Calving Interval	55	1	4	2.45	0.835
Milk Production	57	1	3	2.19	0.789
Meeting Farmer expectations	57	1	3	1.98	0.612
Service Timeliness	57	1	3	1.81	0.743
Service Completeness	57	1	3	1.70	0.566
Courtesy to Farmers	57	1	3	1.77	0.535
Consistency of service effectiveness	57	1	3	1.91	0.763
Access of Service	57	1	3	2.16	0.774
Convenience of Service	57	1	3	2.28	0.726
Guaranteed Conception	54	1	4	2.37	0.760
Solving Other Problems	57	1	3	1.95	0.742
Understanding Farmer Needs	57	1	3	2.05	0.718
Providing Extra Services	57	1	4	1.91	0.892
Right Equipment	57	1	3	1.68	0.506
Valid N (listwise)	51				

APPENDIX 7: QUALITY RATING BY FARMERS

	N	Minimum	Maximum	Mean	Standard Deviation
Conception Rates	175	1	5	2.66	0.741
Response time	174	1	4	2.46	0.858
Breed True Type	172	1	5	2.65	0.953
Semen Storage	163	1	5	2.51	0.884
Calving Interval	170	1	5	2.81	0.802
Milk Production	170	1	4	2.64	0.718
Meeting Expectations	174	1	5	2.64	0.839
Service Completeness	173	1	5	2.54	0.811
Conception Guarantee	169	1	5	2.96	0.830
Giving Farmer Confidence	177	1	5	2.51	0.880
Safe Handling	175	1	5	2.26	0.816
Service Convenience	172	1	4	2.44	0.811
Right Equipment	175	1	5	2.25	0.818
Inseminator Cleanliness	175	1	5	2.10	0.807
Inseminator Skill	173	1	5	2.17	0.843
Inseminator Courtesy	174	1	5	2.15	0.867
Inseminator’s Communication	171	1	5	2.27	0.908
Solving Incidental Problems	172	1	5	2.51	0.921
Communication Time	175	1	5	2.54	0.975
Valid N (listwise)	138				

APPENDIX 8: PAPERS PUBLISHED FROM THIS STUDY

1. **Mirara A, Maitho T. and Okoth U. (2016).** Monitoring Role of ICT in Quality of Artificial Insemination Services in Nyeri County, Kenya. *The International Journal of Science and Technoledge 4(11).* 70-74
2. **Mirara A, Maitho T. and Okoth U. (2017).** Legal Setup and Performance of Post-Privatization Artificial Insemination Service Providers in Nyeri County, Kenya. *International Journal of Livestock Research 7(1).* DOI http://dx.doi.org/10.5455/ijlr.20161222032217**.**

Abstracts of Published Papers

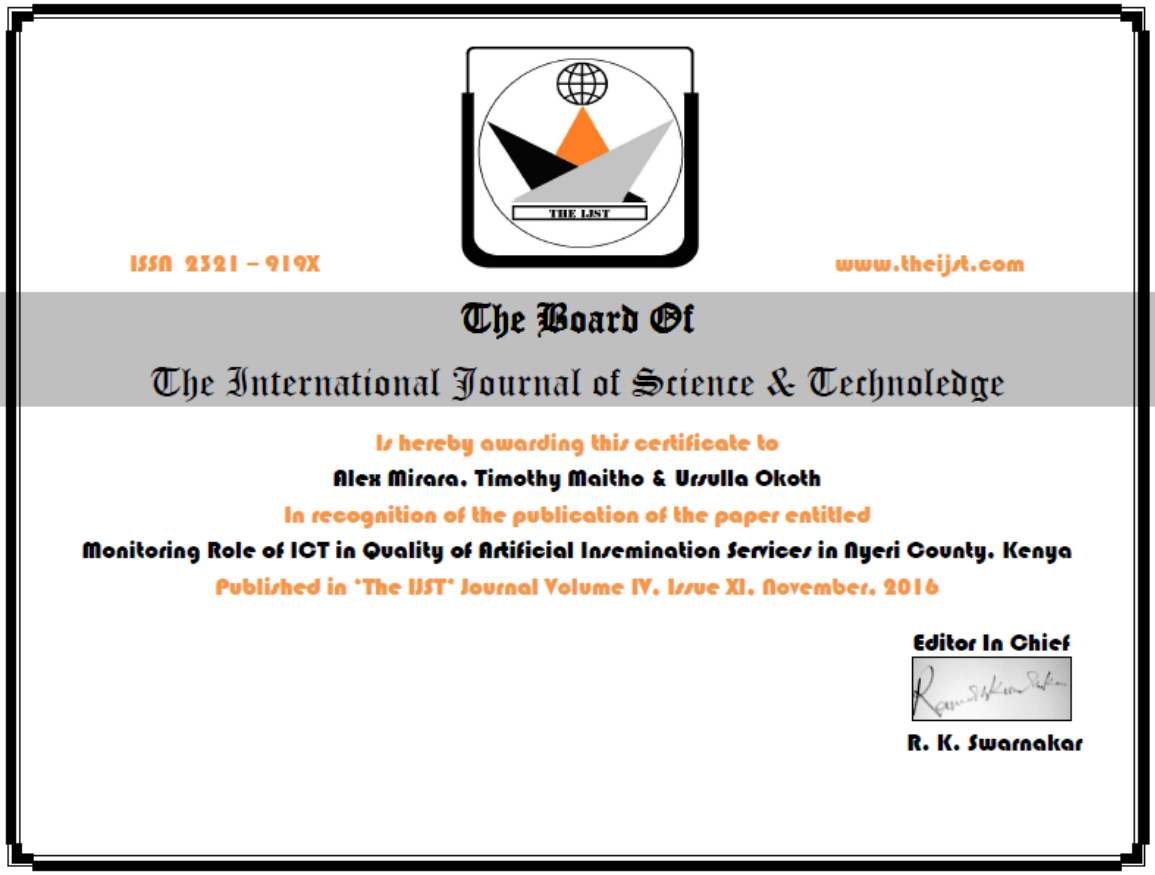
1. Monitoring Role of ICT in Quality of Artificial Insemination Services in Nyeri County, Kenya

Abstract:
Privatization of artificial insemination (AI) services led to a situation where government control of monitoring and evaluation of the services was drastically reduced. The privatization was also concomitant with the introduction and rapid growth of information and communication technology (ICT). However, the use of ICT in rural farming areas has been documented to be low. This study investigated whether the usage of ICT in monitoring artificial insemination services has an influence on the quality of the services. A cross sectional survey was carried out involving 188 farmers and 57 AI service providers. The study found that verbal communication through mobile telephones was the most commonly used technology for communicating AI related information. It was further found that use of the internet was very low among the rural farmers. This was attributed to the fact that most of the farmers were above 60 years of age and had not embraced the application of computers in their activities. The study further found that the application of ICT has a significant positive influence on quality of AI services. It was therefore recommended that there is a need for extension service providers to invest more in ICT related extension.

2. Legal Setup and Performance of Post-Privatization Artificial Insemination Service Providers in Nyeri County, Kenya

Abstract
This study investigated the differences between the various legal entities of organizations which provide the privatized artificial insemination services in Nyeri County, Kenya. The findings were that 89.5% of the service providers were operating as private entities, 7.0% were in Cooperative societies while 3.5% were operating as farmers' self-help groups. All the artificial insemination practitioners used motorcycles for transport and stored semen in liquid nitrogen tanks. Government support to the service providers was only in form of training which was received by 21% of the participants. Non-governmental organizations also provided training to 17.5% of the respondents. However, these non-governmental organizations provided financial credit to 3.5% as well as equipment support to 3.5% of the service providers. It was concluded that private artificial insemination service providers have a potential of performing better than Cooperative societies or self-help groups despite the benefits of farmers having a jointly owned service.

Acceptance Certificate for the First Paper



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Is hereby awarding this certificate to

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In recognition of the publication of the paper entitled

Monitoring Role of ICT in Quality of Artificial Insemination Services in Nyeri County, Kenya

Published in 'The IJST' Journal Volume IV, Issue XI, November, 2016

Editor In Chief

R. K. Swarnakar

Acceptance Letter for Second Paper

International Journal of Livestock Research

December 22, 2016

Dear Dr. Alex Mirara, Timothy Maitho, Ursulla Achieng Okoth

I am pleased to inform you that your manuscript titled as "Legal Setup and Performance of Post-Privatization Artificial Insemination Service Providers in Nyeri County, Kenya" (Manuscript Number: IJLR-2016-10-144 was accepted for publication in the International Journal of Livestock Research. You could check your possible publication date at your author page.

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Sincerely yours,
Editorial Board

APPENDIX 9: DECALARATION OF ORIGINALITY

UNIVERSITY OF NAIROBI

Declaration of Originality Form

This form must be completed and signed for all works submitted to the University for examination.

Name of Student MATHU, ALEX MIRARA

Registration Number L83/81021/2011

College EDUCATION AND EXTERNAL STUDIES

~~Faculty~~/School/~~Institute~~ OPEN AND DISTANCE LEARNING

Department EXTRA-MURAL STUDIES

Course Name PhD. PROJECT PLANNING

Title of the work

Influence of Post-Privatization Management Practices and Monitoring and Evaluation Strategies on Quality of Artificial Insemination Services in Cattle in Nyeri County, Kenya.

DECLARATION

1. I understand what Plagiarism is and I am aware of the University's policy in this regard
2. I declare that this Thesis (Thesis, project, essay, assignment, paper, report, etc) is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work, or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.
3. I have not sought or used the services of any professional agencies to produce this work
4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own work
5. I understand that any false claim in respect of this work shall result in disciplinary action, in accordance with University Plagiarism Policy.

Signature _____

Date 29th May, 2017

APPENDIX 10: PLAGIARISM REPORT BY TURNITIN®

turnitin Turnitin Originality Report

INFLUENCE OF POST-PRIVATIZATION MANAGEMENT PRACTICES AND MONITORING AND EVALUATION STRATEGIES ONQUALITY OF ARTIFICIAL INSEMINATION SERVICESIN CATTLE IN NYERI COUNTY, KENYA by Alex Mirara

From projects (Information Resources)

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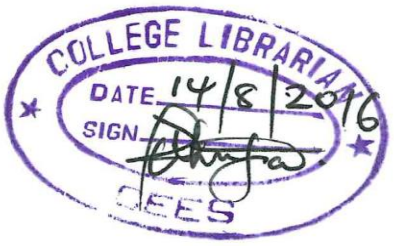

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https://www.ehow.com/about_5052929_history-artificial-insemination-cattle.html
2

< 1% match (Internet from 16-Feb-2015)

http://www.livestockkenya.com/index.php/cattle/212-choosing-between-artificial-insemination-and-the-bull
3

< 1% match (publications)

Regional Conference on Science Technology and Social Sciences (RCSTSS 2014), 2016.
4

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http://www.ncsconline.org/D_ICM/programs/cedp/papers/Research_Papers_2009/Patterson_ServiceExcellenceGA.pdf

APPENDIX 11: NACOSTI RESEARCH AUTHORIZATION

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/15/72626/8778**

Date: **2nd December, 2015**

Alex Mirara Methu
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Influence of Post-Privatization Management Practices and Monitoring and Evaluation strategies on quality of Artificial Insemination Services in cattle in Nyeri County, Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Nyeri County** for a period ending **24th November, 2016.**

You are advised to report to **the County Commissioner and the County Director of Education, Nyeri County** before embarking on the research project.

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

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

Copy to:

The County Commissioner
Nyeri County.

The County Director of Education
Nyeri County.

APPENDIX 12: RESEARCH IDENTIFICATION DOCUMENT

THIS IS TO CERTIFY THAT:
MR. ALEX MIRARA METHU
of UNIVERSITY OF NAIROBI, 0-10140
Kimathi Way,has been permitted to
conduct research in *Nyeri County*

on the topic: *INFLUENCE OF POST-PRIVATIZATION MANAGEMENT PRACTICES AND MONITORING AND EVALUATION STRATEGIES ON QUALITY OF ARTIFICIAL INSEMINATION SERVICES IN CATTLE IN NYERI COUNTY, KENYA*

for the period ending:
24th November,2016

.....
Applicant's Signature

Permit No : NACOSTI/P/15/72626/8778
Date Of Issue : 2nd December,2015
Fee Recieved :ksh 2000

.....
for Director General
National Commission for Science, Technology & Innovation

CONDITIONS

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

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No. A 7391

CONDITIONS: see back page

APPENDIX 13: COUNTY COMMISSIONER'S AUTHORIZATION

OFFICE OF THE PRESIDENT

MINISTRY OF INTERIOR AND CO-ORDINATION OF NATIONAL GOVERNMENT

Telephone: 061 2030619/20
Fax: 061 2032089
E-mail: mkoakati@yahoo.com

When replying please quote

COUNTY COMMISSIONER
NYERI COUNTY
P.O. Box 33-10100
NYERI

REF: ADM. 1/57 Vol. IV/56 **7th December, 2015**

Alex Mirara Methu
University of Nairobi
P.O. Box. 30197-00100
NAIROBI

RE: RESEARCH AUTHORIZATION

This is to inform you that you have been authorized to carry out research on 'Influence of Post-Privatization Management practices and Monitoring and Evaluation strategies on quality of Artificial insemination Services in cattle in Nyeri County, Kenya.'

The research period ends on 24th November 2016.

F. MWANGI
FOR: COUNTY COMMISSIONER
NYERI COUNTY.

APPENDIX 14: COUNTY EDUCATION OFFICER'S AUTHORIZATION

MINISTRY OF EDUCATION SCIENCE & TECHNOLOGY
STATE DEPARTMENT OF EDUCATION

E-Mail –centralpde@gmail.com
Telephone: Nyeri (061) 2030619
When replying please quote

OFFICE OF THE COUNTY
DIRECTOR OF EDUCATION
P.O. Box 80 - 10100,
NYERI

CDE/NYI/GEN/23/VOL. II/38

7th December, 2015

All Sub-County Directors of Education,
NYERI COUNTY

RESEARCH AUTHORIZATION

Reference is made to Secretary National Commission on Science, Technology and Innovation letter Ref. NACOSTI/P/15/72626/877 of 2nd December, 2015 on the above subject.

Please note that Mr. Alex Mirara Methu of University of Nairobi has been authorized to carry out research on ***"Influence of Post-Privatization Management Practices and Monitoring and Evaluation Strategies on quality of Artificial Insemination Services in Cattle in Nyeri County".*** He has been authorized to undertake the research for a period ending 24th November, 2016.

Kindly accord him the necessary assistance.

KABORA I. MWANGI
FOR: COUNTY DIRECTOR OF EDUCATION
NYERI COUNTY

CC

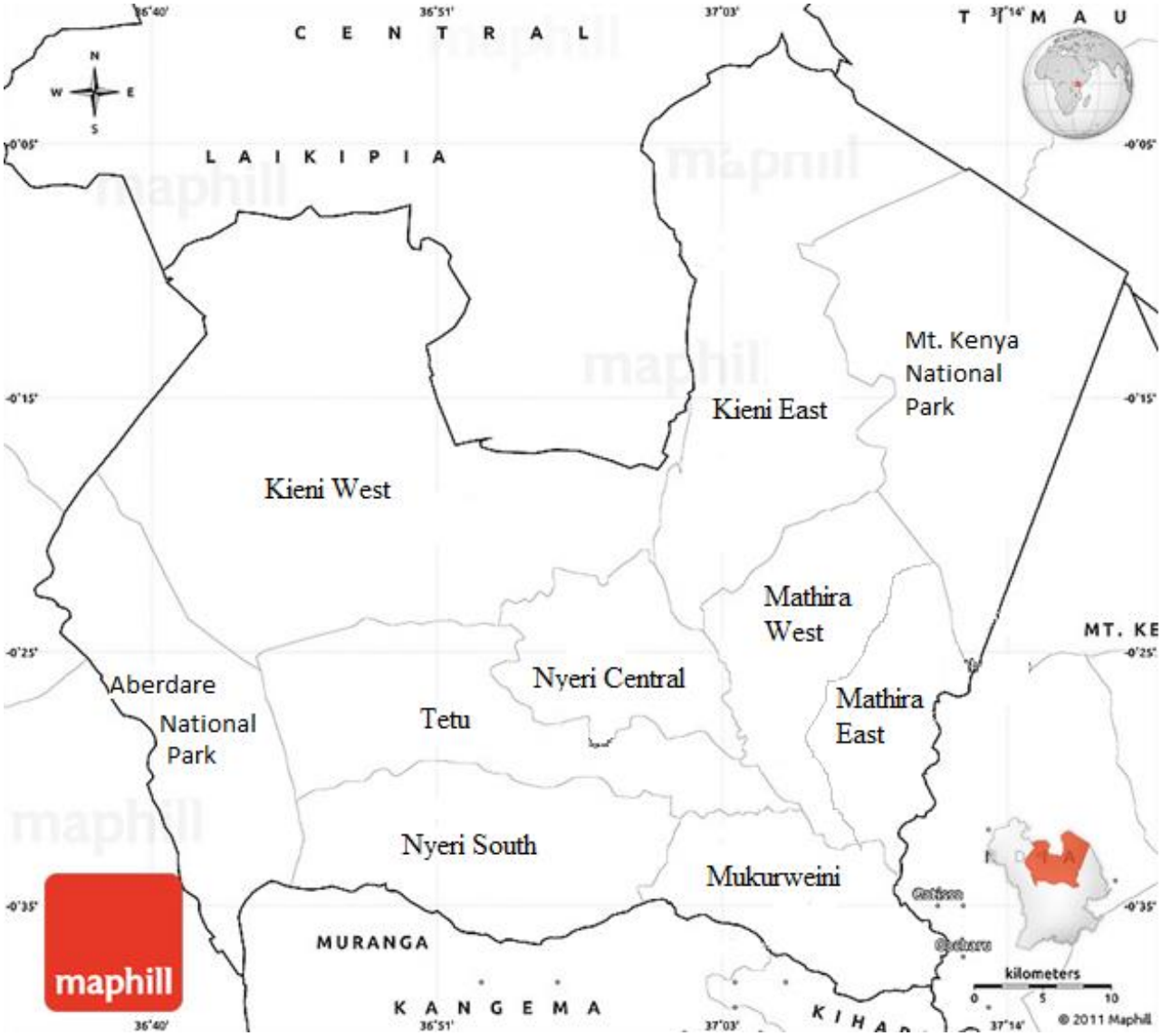
Mr. Alex Mirara Methu,
University of NAIROBI,
P. O. Box 30197-00100,
NAIROBI.

National Commission for Science,
Technology and Innovation
P. O. Box 30623 – 00100
NAIROBI.

APPENDIX 15: LOCATION OF NYERI COUNTY IN KENYA

Source: NCG (2013).

APPENDIX 16: MAP OF NYERI COUNTY



Source: Adopted from Maphill (2011).