

**INFLUENCE OF DAIRY FARMING PRACTICES ON HOUSEHOLDS
INCOME IN KENYA: A CASE OF DAIRY COMMERCIALIZATION
PROGRAMME IN BUNGOMA COUNTY.**

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**A Research Project Submitted in Partial Fulfilment of the Requirements for the Award
of the Degree of Masters of Arts in Project Planning and Management of the University
of Nairobi.**

2017

DECLARATION

This research project report is my original work and has never been submitted for a degree award in any university

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DEDICATION

I dedicate this work to my husband Sam Opot and Children John, Aliciah, Georgina and Christina. Whose support and encouragement has been inspiring towards my advancement in Education.

ACKNOWLEDGEMENT

My appreciation goes to the University of Nairobi, for giving me an opportunity to advance my career. My deep gratitude goes to my supervisor Dr. Stephen Okello and Mr Joseph Awino who believed in my capability to undertake this research. I strongly believe that his constructive criticisms, recommendations and suggestions made this study a reality. I wish to acknowledge all my lecturers in the Department of Extra Mural Studies for sharpening my knowledge on Project Planning and Management issues in class sessions. I am also sincerely grateful to Elder J.Egessa, for his insight in Dairy production in Kenya, drawn from his vast experience, Dr Michael Kipyego and P.K Ochieng of the Smallholder Dairy commercialization programme for providing me with the relevant documentation and information of the Smallholders commercialization programme. In addition, I wish to acknowledge Mr. Solomon the librarian for encouraging me, guiding and enabling me to get the resources I needed from the library.

Lastly, I wish to acknowledge my fellow student Dorcas of Master of Arts in Project Planning and Management, University of Nairobi, Kisumu Campus, September 2015 intake, Weekend class for encouraging me and believing in my ability to strive and pursue the study against all odds. You are truly a friend.

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ABBREVIATIONS AND ACRONYMS

AI	Artificial insemination
BD	Bangladesh
COMESA	Common Market for Eastern and Southern Africa
DFP	Dairy Farming Practices
DM	Downy Mildew
DMB	Dairy Marketing Board
EADD	East Africa Dairy Development
ECM	Energy –corrected Milk
EU	European Union
FAO	Food and Agriculture Organization
FSMS	Food Safety Management System
GDP	Gross Domestic Product
GoB	Government of Bihar
GOK	Government of Kenya
IFAD	International Fund for Agriculture Development
ILRI	International Livestock Research Institute
IRR	Improving Resilience and Reducing Dependency
KBLO	Kenya Breeders Livestock Organisation
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MoLD	Ministry of Livestock &Development
NRC	National Research Council
SADS	Sustainable Agriculture Development
SCDP	Smallholder Commercialisation Dairy programme
SDP	Smallholder Dairy Project
SPSS	Statistical Package for Social Sciences
TOT	Trainer of trainees

ABSTRACT

The dairy subsector is important in attaining the development goal of vision 2030. It is dominated by smallholders who produce over 80% of the domestic milk and sale raw milk directly to consumers, not only do poor smallholder dairy farmers earn steady incomes from milk, the dairy sector also creates demand for wage labour in the farm and creation of mobile milk traders. Kenya's dairy sector has the potential to generate growth and employment opportunities, which benefits the poorest of the rural and urban populations despite the growth in dairy farming over the years, there is a lot of imbalance in income as compared to dairy production in inputs which is costly and labour intensive. Majority of farmers still fail to understand the connection between dairy productivity in terms of income and farming practices. Without careful analysis of the patterns of benefits reaped from good farming practices, we cannot accept at the face value that dairy farming can be both fulfilling and satisfying. The purpose of this study was to determine the influence of dairy farming practices on income in Bungoma County. The study sought to establish the extent to which milk production, animal husbandry, technology and feeding management influences household income. Descriptive survey design involving both quantitative and qualitative method of data collection was used, primary data was collected from target population of 2740 of which 335 was the determined sample size determined from Krejcie and Morgan table. Data collected was analysed using SPSS for mean, frequency and percentages. The findings were milk production, animal husbandry, technology; feed management to a very great extent influenced the improvement of household income. The study concluded that the breed of the animal and nutrition is essential in turn influence the level of milk produced, animal health, housing and welfare to a very great extent influence the improvement of household income and the use of suitable and well maintenance of milking and storage equipment, and adoption of a good mating system will enhance the standards when handling the cows were aspects of production that influence improvement of household income. The study recommended that the project or ministry of livestock devise strategies on how to reach the dairy farmers who desire to expand in dairy farming but are frequently faced with challenges ranging from financial, knowledge and skills towards growth and profit.

CHAPTER ONE

1.1 Background to the Study

Livestock is essential to the economies of many creating nations. For low salary makers, livestock animals can fill in as a crucial wellspring of sustenance, store of riches, give draft influence and natural compost for trim creation and a methods for transport. Utilization of livestock animals items in creating nations is developing quickly. (Otto, Torsten, Arndt and Juliane 2017). The Israeli dairy industry is a result of more than 60 years of R & D in the field of precise nutrition (daily ration design), fertility management, veterinary services and dedicated dairy farmers. There is high milk consumption in Israel of 175 litres per capita annually. Average milk production per cow has increased from 4,000 litres annually in the 1950's to more than 12,000 litres in 2006. The genetic improvement of the herds of Israeli Holstein Friesian cows is constantly enhanced by the use of frozen semen from 200 selected bulls.

Dairy industry in New Zealand demonstrates how industrial restructuring, state regulations, and transnational corporations shape patterns of economic globalization. The development of the New Zealand dairy export market was closely linked to New Zealand's position, first as a colony of Britain, and subsequently as a member of the British Commonwealth. Le Heron, Lewis, Hayward, Tamasy, and Stringer,(2010),the New Zealand Dairy Board became the world's largest dedicated dairy marketing network (Le Heron,2010). Most of the former countries are located in the Mediterranean and Near East, the Indian subcontinent, the savannah regions of West Africa, the highlands of East Africa and parts of South and Central America. Countries without a long tradition of dairy production are in Southeast Asia (including China) and tropical regions with high ambient temperatures and/or humidity. (Faye and Konuspayeva, 2012.)

In Africa milk producing animals have been domesticated for thousands of years. Initially, they were part of the subsistence farming that nomads engaged in. As the community moved about the country, their animals accompanied them. Protecting and feeding the animals were a big part of the symbiotic relationship between the animals and the herders, Indigenous gatherings like the Maasai, Borani, Fulani and Tuareg have a solid notable dairy convention. They share numerous traditions and see drain as a result of congruity that is offered allowed

to relatives, companions and guests (SADS, 2009). Because of populace development, arrive deficiency and expanding enthusiasm for creation and utilization, advertise arranged dairy frameworks are currently advancing, with the utilization of high performing reviewed creatures and additionally higher sources of info. A few worldwide bodies (Heifer Project International, Land O'Lakes, Send a Cow, and so on.) have created techniques to advance drain generation in African nations. (Muriuki 2003). These bodies as a rule have two fundamental goals: Improving on drain utilization particularly by poor families (sustenance change) and expanding on cultivate comes back from dairy cultivating (wage age and neediness mitigation). In this manner, it is imperative to perceive how dairying has advanced in Africa all in all and in singular African nations too. The dairy sector is very important in its contribution to the economies of both the developed and the developing countries of the world. with competitive management systems and high uptake of technology and big capital outlay while in the developing countries it is largely by small scale farmers with minimum management and technical skills, limited access to capital and low access to information. (Muriithi Huka and Njati. 2010).

In Tunisia the government has adopted different agricultural development projects to enhance animal productivity and to improve the livelihood of the living rural population by supporting farmers and providing them with necessary livestock services. Services consisted mainly in providing producers with dual purpose pure breed animals, encouraging the production of cultivated forages, enhancing farmer skills, improving feeding and reproductive management practices and upgrading the animals' genetic potential through the use of artificial insemination and cross breeding programs. (Salem, Khemiri 2008).

The dairy sector of Zimbabwe has been predominately large scale originated from white settlers with high producing (> 5000 kg/lactation) pure exotic cows and their crosses, and produces then 98 % of marketed milk for the nation. The smallholder dairy sector, initiated in 1983, has limited resources to justify large-scale commercial milk production. Milk is produced for home consumption with surplus sold locally through milk collection centers. This sector contributes only 1-2 % of marketed national milk production. (Ngongoni, Mapiye, Mwale and Mupeta 2006.)

In Kenya, the dairy business is the single biggest rural sub-area, bigger than even tea (Muriuki, 2003). It contributes 14 percent of agricultural GDP and 3.5 percent of total GDP (GOK, 2008). Although Kenya's dairy sector has a significant contribution to the national

economy, food security, and household incomes, the industry faces variously specialized, monetary and institutional issues in milk generation, handling, and marketing. TechnoServe (2008). These constraints affect the ability of the sector to participate and compete in the domestic and regional markets (Wambugu, Kirimi and Opiyo 2011). Milk production in Kenya is predominantly by small scale farmers, who own one to three animals, and produce about 80 percent of the milk in the nation. According to the Kenya dairy master plan over 1.8 million households are involved in milk based enterprises but in spite of this great role, the sector experiences low productivity, low profitability and slow enterprise growth (GOK, 2010). However Kenya's dairy sector has the potential to generate growth and employment opportunities. The general objective of SDCP is to build the wage of the poor country families that depend generously on creation and exchange of dairy items for their occupations. (Sdcp-2017). The Smallholder Dairy Commercialisation Programme (SDCP) was developed through a process of negotiation between the GOK and IFAD which led to the approval of IFAD's first Country Strategic Opportunities Paper (COSOP) for the country in 2002. A loan arrangement between the GOK and IFAD was signed on 25th January 2006 for the execution of the Programme (SDCP) under the Ministry of Livestock Development. The programme is implemented in 9 Counties namely Kisii, , Uasin Gishu, Nandi North, Bomet, Nyamira, , Lugari, Trans Nzoia and Bungoma. (Sdcp-2016).

1.2 Statement of the Problem:

The growth in real income of household in agricultural trade liberalisation was the most important policy reform because of households' critical dependence on Dairy farming in terms of both income and consumption.(Krueger 2010). The growth observed through increased number of farmers taking dairy farming as a business, to enable them to meet their basic needs ranging from food, clothing, health and social needs.

Income for the household has really improved over the years with the farmers embracing different agribusiness opportunities. It is, however, observed that the farmers have not realized the optimal production of the same, and are thus operating below peak (Muriuki, 2002). It is, therefore, important to acknowledge that good dairy farming principles are vital to maximise profits through production, this will translated to increase income and factors such us in a milk production, animal's husbandry, Technology, the quality and safety of her milk are key though dependent on the quality and administration of the encourage and water.

Creature welfare has been an essential worry as it manages the prosperity of the animal. When all is said in done, customers see high animal farming norms as a marker that nourishment is protected, solid and of high caliber. To meet these worries, it is critical that agriculturists deliver milk that is clean and gainful. Despite the growth in dairy farming over the years, farmers are yet to adopt modern technologies at the same time there is a lot of imbalance experienced in different areas based on the approach from different farmers. Majority of farmers still fail to understand the connection between dairy income and farming practices. Without careful analysis of the patterns of benefits that can be reaped from good farming practices, we cannot accept at the face value that dairy farming can be both fulfilling and satisfying (Muchirii, 2007).

One of the major problems among the farmers is the choice of feeds they give their dairy animals. Some of the feeds do not have the right nutrients capable of boosting milk quantity and quality. Most of the farmers do not extend any meaningful consideration to the type of feeds and they deal with the same feeds all year round. This is coupled by ignorance on animal health where farmers take a lot of time or ignore administration of healthcare to the animals even after changes in weather (MoLD, 2007).

Present day milk handling and equipments are vital and all dairy ranchers, milk brokers, milk bearers and transporters, dairy item and nourishment producers, merchants and retailers ought to be a piece of an incorporated sustenance security and quality affirmation administration framework (Ngigi, 2003). Great cultivating rehearses support the promoting of protected, quality-guaranteed milk based items. It was from this understanding the analyst drew out the part of dairy ranchers which is fundamentally to guarantee that great agricultural practices, hygienic and animal husbandry hones are utilized at the homestead level.

The study therefore, sought to determine the influence of good dairy farming practices on improvement of households income as it will give a better comprehensive understanding in order to suggest some commendable dairy farming practices.

1.3 Purpose of the Study

The purpose of the study was to determine the influence of good dairy farming practices on improvement of rural household income with reference to SDCP project in Bungoma County, Kenya.

1.4 Objectives of the Study

The study was guided by the followings objectives:

- i. To determine the extent to which milk production influence households income in Bungoma County, Kenya
- ii. To explore the extent to which animal husbandry influences households income in Bungoma County, Kenya.
- iii. To determine how technology influences households income in Bungoma County, Kenya.
- iv. To assess the how Feeding management influences households income in Bungoma county, Kenya

1.5 Research Question

The study seek to answer the following Research questions

- i. How do milk production in dairy farming influences households income?
- ii. How does animal husbandry in dairy farming influences households income?
- iii. How does technology in dairy farming influences households income?
- iv. How does feeding management in dairy farming influences households income?

1.6 Significance of the Study

The research study will help the programme to access the impact of the project in terms of the challenges faced by dairy farmers to achieve optimal income, it will help in monitoring the efficiency of the programmes in reference to skill development, milk value chain and entrepreneurship. The study will document best practices in smallholder dairy farming that can replicated across the entire project area. The study would also seek to reveal the gap which would be important for the implementing organisation to know the extent which project has impacted on the livelihoods of the community at large. The study would be a source of experience to me and a prerequisite in order to fulfil the requirement for the award of the degree of Masters in project planning and management.

1.7 Basic Assumption of the study

That all the targeted respondents were farmers who were practicing dairy farming either small scale or large scale as at the time of data collection. At the same time the study assumed that enumerator were from the locality and were able to translate the questions accurately.

1.8 Limitation of the study

This study anticipated minimal limitation as data collection was subjected to respondents who were dairy farmers in the SDCP project, Fear was limitation however to avoid this, data instrument will be restricted to questionnaire of which the respondents will remain anonymous.

1.9 Delimitations of the study

The study was conducted in Tongaren constituency in Bungoma County, in Dairy commercialization areas (DCA) of the SDCP. The study was conducted on households Practicing Dairy farming and focusing on key areas of Milk productivity, animal husbandry practices, technology and feeding management

1.10 Definition of Significant Term:

Dairy farming: Refers to a class of agriculture of long-term production of milk, which is processed either at the farm or at the dairy plants.

Dairy farming practices: Refers to the implementation of effective and responsible management of human resources, ensuring farm tasks are carried out safely and competently and management of the enterprise to ensure its financial viability

Households income: Earnings realised from the dairy practice, In terms of better food, improved nutrition, better clothing, declining mortality and illiteracy rates, of all people sharing a place of residence

Milk production: Most milk is obtained from dairy cattle and is widely used by humans, The composition and quantity of milk varies with the species, breed, feed, and condition of the animal.

Animal Husbandry: It includes day-to-day care, selective breeding, and the raising of livestock

Technology: These new automated technologies that have the potential to change the way we manage cows. i.e catch cows in heat with limited human observation, Being able to identify sick cow sooner will improve treatment success resulting in reduced disease losses, increased longevity, and improved animal well-being.

Feeding Management: Involves feed procurement, safe storage, optimum diet preparation, timely distribution and correct feeding are management decisions that strongly influence the dairy production performance.

1.11 Organization of the Study

The research study was organized into five Chapters, Chapter one presented the background information about the area being studied, statement of the problem, purpose of the study, the Key objectives of the study, research questions, the significance of the study, basic assumption of the study, limitation of the study, delimitations which set the boundaries of the study, as well as definition of significant terms. On the other hand, chapter two reviewed the literature based on the objectives of the study. It further looked at the conceptual framework and finally the summary. Chapter three covered the research methodology of the study. The chapter describes the research design, target population, sampling procedure, tools and techniques of data collection, pre-testing, data analysis, ethical considerations and finally the operational definition of variables. Chapter four presents data analysis and findings, presentations interpretations and discussion in line with the study objectives, Chapter five presents the conclusion based on the findings, and recommendations of the study gives possible suggestions for further improvement or further studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter literature was based on the following thematic concerns as per the study objectives. It has covered an overview of on the dairy farming project, milk productivity as a factors influencing household income, Animal Husbandry practices influence on household income, quality of heifers as a factor influencing household income and milk marketing as a factor influencing household income. The chapter further covered the theoretic framework, the conceptual framework as well as the summary of literature review.

2.2 Concept of Dairy farming Practices

Good Agricultural Practice for dairy farmers is about implementing sound practices on dairy farms – collectively called Good Dairy Farming Practice. These practices must guarantee that the milk and milk items delivered are sheltered and appropriate for their expected utilize, and also that the dairy farm enterprise is viable into the future, from the economic, social and environmental perspectives. Most importantly, dairy farmers are in the business of producing food for human consumption so they should be certain about the security and nature of the milk they produce. Good dairy farming practice underpins the production of milk that satisfies the highest expectations of the food industry and consumers (FAO) so implementing good dairy farming practice is good risk management for the short and long term future of the dairy farming enterprise. Dairying is considered a “treasure” of the Indian economy, particularly for rural systems.

Dairy farm income refers to the income coming from the profit and loss account for the dairy enterprise of these farms only. (Otto Garcia et al 2017). The global standard setting the requirements for an effective Food Safety Management System (FSMS). ISO 22000 works throughout the food and beverage chain, to ensure that both are safe at the time of human consumption. (ISO 22000:2005). The World Bank (1996) cited by Minja (2007) states that basically small scale dairy production is important in achieving food security in increased food production that adds directly to household nutrition, indirectly through increased cash income that can be used to purchase foods of plant origin, as well as other household items, and through generation of employment. In a study by Komor and Borah (2015), they affirmed that the nature and functioning of traditional form of dairying as a source of income and a symbol of status, pride and prosperity.

2.3 Milk production and household income

Milk is one of most produced and valuable agricultural commodities worldwide. In 2013, with a total production of 770 billion litres valued at USD 328 billion, milk ranked third by production tonnage and was the top agricultural commodity in value terms the world over. Milk contributes 27% to the global value added of livestock and 10% to that of agriculture. (FAO: ROME 2011). Approximately 150 million family units around the world are occupied with milk production . In most producing nations, milk is delivered by smallholders, and milk generation adds to family unit occupations, nourishment security and sustenance.milk gives generally brisk comes back to little scale makers and is an essential wellspring of money salary. World bank (2015)

World milk production is projected to increase by 177 million tonnes by 2025, at an average growth rate of 1.8% per annum in the next 10 years. Over the same period, per capita consumption of dairy products is projected to increase by 0.8% and 1.7% per year in developing countries, and between 0.5% and 1.1% in developed economies.(Ibidemn 2009). According to a report by FAO (2008) global milk production is estimated to expand by 2.2% to 693 million tons in 2008 and by another 2.5 % to almost 710 million tons in 2009, afar slower pace than in recent years. Milk production varies with the breed type, age, stage of lactation, nutritional status in late pregnancy and water availability (McDonald et al., 2002). High milk yield of satisfactory composition is the most important aspect in ensuring high economic returns in the dairy industry. Haile et al. (2002) found out that cross bred cows in Ethiopian Boran with Holtein Friesian had milk potential of not exceeding 10 litres per cow per day.

Europe is currently the world's largest milk producer with 2013 production totalling more than 140 billion litres. More than 93% of this milk is produced by 14 countries with the top nine countries, Denmark. France, Germany, Ireland, Italy, the Netherlands, Poland, Spain and the United Kingdom accounting for over 80% of total EU milk production. In a study Otto Garcia et al (2017) they noted that German dairy farms enjoy the highest dairy returns at about 40 US\$ / 100 kg ECM. the returns include high beef prices and generous direct payments, they further noted that this leaves farmers with a loss of about 20 US\$/ 100 kg ECM for the small farm and a loss of about 2 US\$/ 100 kg ECM for the large farms.

In study by Trung,(2013) he noted that in Vietnam,70% of the total population are in the rural area and plays an important role in economic development. The great results of economic development in the rural area have led to more wealthy consumers who demand higher quality food products. Moreover, rural consumers who are more educated are now more conscious about health and wellness issues related to food choices and diet (Phuong and Marcus, 2013). In fact, food industry has significantly transformed to meet the increasing needs and preferences of the consumers (Hoang 2009). Regarding milk consumption, it is important to find the association between personal and environmental factors with intention to consume milk and therefore enterprises involving milk business will have helpful decisions and strategic planning for expanding their business. (Thuy and Duong, 2013). The livestock industry is charged with providing sufficient animal products to meet the market demand while it needs to improve the environmental perspective of animal production (Capper and Bauman 2013).

According to Rahman and Parvin (2009) in a study on livestock production in Bangladesh they noted that currently there is rapid socio-economic and production system changes that raise the question on the ability to maintain the current milk production to meet the growing demand for the welfare of consumers. They further noted, climate change projections indicate an increased likelihood of droughts and uneven distribution of rainfall leading to increasing phenomenon of water scarcity and temporal as well as spatial availability. Therefore, the water problem in Bangladesh is an alarming issue owing to growing demands, climate change and increasing conflict between current practice and alternative options for water use (Chowdhury 2010). Decreased water availability, thus, is a risk factor to food security (Rahman and Parvin 2009) and this would heavily affect the livelihoods of farmers and hamper the development of the country (Karim et al 2010).

In a study by Machange(2010) in Tanzania he noted, there are many advantages that small scale dairy farming brings to a community, but the most measurable is its impact on the income. He further observed that income from milk sales helped some smallholder families acquire additional land, improve their houses (and cattle sheds), finance small-scale businesses, send their children to secondary school, and expand their dairy business. Income obtained as a result of milk sales has significantly contributed to household assets. In a study conducted in Kagera Region by Lwelamira et al. (2010) showed that dairy farming households had significantly higher average annual income and were relatively better off in

terms of value of assets owned compared to their counterparts. Majority of the respondents used their own capital to start dairy farming. Machanga (2010).

According to Balikowa(2011) he reported that Uganda Milk production dominated by smallholder producers who own over 90% of

the national herd and produce over 90 of the milk in the country. The average herd size in Uganda 6.9 per cattle owning household. He further noted that there is About 64.8% of the milk produced in the country is marketed, leaving only 35.2% at the farm. The milk which remains on farm is either consumed by the family, fed to calves, offered as gift, processed into traditional dairy products for home consumption or wasted due to spoilage. About 5.8% of the farm produce is wasted.

Smallholder dairy is a farming system promotes regular monetary earnings to people who normally access cash once a season after the sole harvested crops. The regular monthly monetary earnings from the sale of milk and milk products have favorable effects on the cash flow charts of rural households and improve the lifestyles of the rural people especially it empowers women and youth. National livestock census report (MAAIF/UBOS 2009).

Concentrates are fed to supply energy and protein for increased milk production. In addition to the limited availability, the high cost of concentrates and the declining milk to concentrate price ratio makes it difficult to feed adequate concentrates regularly resulting in low productivity. (Walshe et al 2009). The declining milk price to concentrate price ratio may be used as a guide to choose feeds and the optimum quantity of concentrate to be fed in a given situation.(IRRD 2008).

Milk production in Kenya is predominantly by small scale farmers, who own one to Three animals, and produce about 80 percent of the milk in the country. According to the Kenya dairy master plan over 1.8 million households are involved in milk based enterprises but in spite of this great role, the sector experiences low productivity, low profitability and slow enterprise growth (GOK, 2010). Dairy production in Kenya is divided into small scale and large scale with the small scale farming being the most popular as it constitutes 70-80% of the total dairy subsector (Ngigi, 2003; Karanja 2004; IFAD, 2006).

In study by Kamau (2013) he noted that the Kenya dairy policy change of 2004, which incorporated small-scale milk producers and traders into the milk value chain and liberalized informal milk markets that has led to an increase in the amount of marketed milk, number of licensed milk vendors and a boost in demand for milk, this has leading to benefit for Kenyan milk producers, vendors and consumers. As a result of this policy change, milk production was targeted to increase to increase to 4.2 and 5 billion litres by 2010 and 2014, respectively (Kenya Dairy Board, 2006). On-farm milk production has remained low due to poor animal husbandry, low quality feeds, inadequate feeding, a declining genetic base, animal diseases, effects of climate change, diminishing land sizes in high potential areas among others. Primary marketing also faces infrastructure bottlenecks caused by poor road networks and lack of cooling and storage facilities (National dairy development policy 2013)

2.4 Animal husbandry and households income

Animal husbandry combines the art and science of raising animals by blending time-honoured practices and modern scientific knowledge into a system that provides for animal well-being and provides for safe and efficient management and handling of animals. animal husbandry hones territory from dehorning dairy cattle to anticipate damage to group mates and homestead hands to techniques for lodging domesticated animals, giving sufficient nourishment, formulating reproducing methodologies, and overseeing pets that live in the family unit. Crabtree (2010) noted that one of the major constraints for this low productivity could well be attributed to the low level of knowledge and adoption of scientific practices among dairy farmers. In this connection, dairy farming is a major economic activity. Important and relevant scientific practices were identified on: feeding, breeding, management, health care, clean milk production and marketing.(Vekariya, Kumar, Chaudhari, and Jivani 2017).

Animal Husbandry can provide good opportunity, particularly for the small and marginal farmers and the landless to improve their economy. Livestock development is a labour intensive activity which demands very close attention throughout the year. This will be a boon for the small farmers and landless who are mostly unemployed or under-employed. Thus, animal husbandry can be promoted as a major economic activity in non-irrigated regions in the country. (Hegde 2009).

Animal husbandry and dairy is the main subsidiary income generating activity for the rural poor of Bihar. It is an important source of income and employment for millions of landless poor in the state (Planning Commission, 2008). Smallholder dairying plays an important role in the socioeconomic development of Bihar. About 80% of the total milk produced in Bihar is from landless poor, agricultural labourers and small and marginal farmers (ILRI, 2014).

The Government of Bihar (GoB) recognises this challenge and it is implementing several programs related to breed improvement, animal health and milk marketing to strengthen the dairy sector in the state. The Department of Animal Husbandry is the single largest agency providing livestock health services to farmers in the state. Over the last few years, the government has organised several vaccination camps to protect animals against infectious disease.(ILRI DISCUSSION PAPER 33). Animal Husbandry is making a significant contribution to the national economy and socio-economic development in the country. The impacts of unmanaged grazing animals have been substantial through the course of human history. The modern principles for proper management of grazing lands developed during this century in response to destructive impacts of unmanaged grazing throughout the world. (The Jodarna 2010)

In a study of rural India, Hegde (2009) reported that, the present breedable bovine population under an organised breeding programme is 113.61 million, which includes 12.62 million crossbred, 51.13 million indigenous cattle and 50.28 million buffaloes. India also tops in milk production, with 100 million tons/year he further noted that the value of output contributed by livestock in 2003-04 was Rs.164,509 crores, of which Rs.110,085 crores (66.92%) was from milk and the rest from meat. Livestock also provides gainful employment all-round the year to over 16 million people, of which 70% are women. Milk production accounts for 5.86% of the GDP while the total contribution from Animal Husbandry is 9.33%.

In Bangladesh animal husbandry are mutually dependent in the country's mixed-farming system, with livestock performing multiple functions, including the provision of food, nutrition, income, savings, draught power, manure, transport and other social and cultural functions. With livestock, people who are poor and landless can still access common property resources, such as roadsides, open grazing areas and water bodies.(Karim Huque , Hussain Ali and Hussain 2010) Cattle are by far the most important farm animals; smallholders possess the majority of them, and they are directly linked to family income, nutrition and

welfare. While animal husbandry is a part of mixed farming, the system of production is not well integrated, and maximum value is not always gained from the inputs and outputs. There is scope for basic improvements that can lead to greater integration and productivity. (Gaufichon Prioul and Bachelier 2010).

In a review of Africa dairy sectors by Sultana ,Uddin and Peters (2016)they reported that the role of small scale dairy cattle farming in improving their life styles, and its importance and integral component of culture and hope, farming systems and contributes greatly to agricultural and rural development in South Africa (Bembrigde 2008). In nomadic and semi-nomadic societies, livestock rearing is the main production activity and the source of most, if not all, economic output. Livestock also contributes a large proportion of the income of farmers with the small-landholdings, which are by far the most common type of farms in the African continent. Mabe, Antwi and Oladele(2010.) The recognition of the role-played by communities is fundamental to rural development. Communities work in animal husbandry is significant and in general, women are more involved livestock production, especially small ruminants. They tend to be heavily involved in all parts of livestock production, with the exception of herding and marketing, which require absence from home, they also perform duties such as fodder gathering, collecting dung for fertilizer and fuel, cleaning stalls and milking in large animal systems (Oladele and Monkhei 2008).

In a study by Salem and Khemiri (2008) they noted that production system used in Tunisia is quite different from production systems practiced in other parts of the country. It is characterized by nutritional deficiencies, health and reproductive problems and relatively little production. he further noted the farmers lack basic cattle management techniques as they are usually ill livestock disease outbreaks are common in parts of the country, like Karamoja, where farmers lack the inputs, infrastructure and veterinary support needed.(FAO Uganda) through vaccination campaigns, equipping community animal health workers with tools, drugs and skills, and strengthening local disease surveillance. Animal vaccination against major diseases is limited to free programs provided by the government. Furthermore, the permanent presence of bulls among the cows is, in many cases, responsible for the even distribution of calving throughout the year, including unfavorable periods. In addition, animals are usually confined in small simple shelters which do not meet the minimum

housing requirements in terms of space, cow comfort and heat stress protection.(FAO/UGANDA- 2011).

According to the sessional paper no.5 (2013) it notes that efficient and reliable animal health services are crucial to a vibrant dairy industry. Dairy animal productivity and profitability are dependent on effective disease control thus Kenya inherited a system of disease control, which was based on availability of veterinary services. Among diseases that hinder dairy industry development include Bovine PleuroPneumonia (CBPP), East Coast Fever (ECF), Foot and Mouth Disease (FMD) and Trypanosomiasis.

2.5 Technology and households income

Without modern processing technologies, most dairy products are highly perishable. The absence of these technologies suggests that the spatial development of dairy markets will be very limited, even without particularly severe infrastructural bottlenecks. Paul,Gogoi,Sarma, and Baroowa,(2014) While other dairy-based products like butter/ghee are less perishable, pasteurisation processes generally render these products less nutritious than milk (FAO, 2013) The role of innovation attributes and limited validation in farmer's field may be another reason for the poor uptake of dairy innovations. Thirunavukkarasu and Narmatha (2016). According to Rachmilevitz it is question of adoption. "It's a conservative marketplace, people tend to think it's a mechanical thing. You grow cows, you milk them, everyone is happy. However, you discover over the years that technology has a very significant impact on this business, and when it becomes tougher to make money, the adoption rate goes higher."

Automation technology is changing the way we produce milk, and the benefits are far-reaching: improved profitability, milk quality, lifestyle and animal welfare. It can also provide us with information about the cow that we have not had before, to support decision-making.in Dairy farming and dairy industry these new automated technologies have the potential to change the way we manage cows. We will now be able to understand each cow's condition in a way that we previously might have only dreamed of. Hoddinott, Headey and Dereje(2015). The potential to catch cows in heat with limited human observation or pharmaceutical intervention is the most exciting prospect economically. Being able to catch sick and lame cows sooner will improve treatment success resulting in reduced disease losses, increased longevity, and improved animal well-being. Bewley (2014.) M.L.) Collar is the same technology used in the popular fitness-tracking device – are effective non -invasive

tools for tracking the health of dairy cows The device, which holds a two-inch tag, provides continuous monitoring of movements and rumination, two activities that occur in a natural rhythm in healthy cows. To monitor these behaviours, you would have to have a person checking the cows at least once a day. Technology has provided a means to do that automatically. Stangaferro et al (2013).

Technology and increased access to data are enabling dairy farmers to make smarter day-to-day decisions to improve cow health, production and on-farm efficiencies. Precision dairy farming is the general name given to this technology that measures and analyzes histological, behavioural and production indicators in individual animals. Notably automated calf feeders provide nutrition for calves several times a day, Milk yield recording systems provide individual animal data, automated milking systems reduce the labour required to milk cows.

In New Zealand the Economic pressures, technological innovations, demographic shifts, consumer expectations, and an evolving regulatory framework have all contributed to the push for changes in the global dairy industry, these changes have had, and will likely continue to have, profound effects on the health and welfare of dairy cows and on management practices and systems for dairy herds.(Barkema 2015), He further examined the key changes taking place in the dairy industry in North America, Europe, Australia, and New Zealand, the implications of which are relevant for the dairy industry in most developed and developing nations. He further observed that increased adoption of new technologies will enable farmers to have access to rich data sources that can aid in further improving animal health and welfare. Because the potential is still largely unrealized, more training of dairy farmers, their employees, and their advisors is necessary.(Barkema,2015).

In a study accessing on how technology has gained ground in Pa-kistan by Ishaq, Li Cui, Rasheed, Ahmad, and Abdullah, (2016)They reported that the consumers prefer to consume loose raw milk due to its freshness and taste. So majority of consumers buy raw milk from traditional milk collectors and boiled it at home. They further reported although modern dairy industry ensure milk quality through processing and pasteurization methods but not preferred due to taste and high price. Owing to consumer preferences and lack of cost efficient dairy technology, almost 95% of milk is marketed through informal milk marketing chains remaining 5% is processed by dairy industry and marketed through formal marketing chains.

Chatikobo, Manzi, Kagarama, Rwemarika, and Umunezero (2009). On their review of Israel, they noted that the Israeli dairy industry is a result of more than 60 years of R & D in the field of precise nutrition (daily ration design), fertility management, veterinary services and dedicated dairy farmers. They also noted there is a high productivity due to adoption of technology especially of the genetic improvement of the herds of Israeli Holstein Friesian cows is constantly enhanced by the use of frozen semen from 200 selected bulls. Because of the harsh climatic conditions experienced in the Israeli desert, the dairy researchers had to solve the problem of the decrease of milk productivity in the summer months, by successful developing of cooling methods to reduce the body temperature in cows, thus allowing reasonable milk production in hot climates.

According to Arluke and Sanders, (2006). In a study of newzealand dairy industry, they noted that since the 1990s streamlining of the milk production process, characterized by a continuous flow and a growing automation of systems. Such as the milking robot has taken over from the milking machine, so that milk can now be produced 24 hours a day. Human work in this context amounts to surveillance and maintenance of the machines. The risk of machine failure is a major source of worry and constant stress for farmers (Porcher and Schmitt 2012).

In Denmark dealing with the relative significance of different supporters of development is that of whether mechanical or institutional advancement is of prime significance. While the typical translation of the An expression in a standard neoclassical development display is as innovation, others have as of late stressed a more imperative part for establishments (Acemoglu et al 2005).

According to the Henriksen ,Lampe, and Sharp (2009).they noted that the development and accomplishment of Danish creameries toward the finish of the nineteenth century is outstanding and is thought to be one of the essential drivers of the achievement of the Danish economy amid this period. The Two advancements considered as the fundamental supporters of this achievement was innovative, and institutional, They additionally noticed the creation of the programmed cream separator in 1878 took into account margarine generation on a bigger scale than had been conceivable under past advances. Specifically, it took into account the extraction of more cream from the (entire) drain; and for the prompt division of cream from drain which had been transported over longer separations, without first requiring a timeframe for the cream to isolate independent from anyone else, and for the extraction of

more drain from the cream. Henriksen et al (2009). The innovation immediately supplanted prior advances in all dairies. The cooperative movement rose as an effective approach to use this innovation. By taking care of a portion of the motivator issues engaged with the administration of a creamery subject to numerous small suppliers, cooperatives took into consideration the effective utilization of the innovation, O'Rourke, (2007) Advancement in the Danish dairy industry The way toward creating spread is basically a two-organize process: the primary concerns delivering the drain and the second removing the cream from the drain keeping in mind the end goal to make margarine. We focus here on the second stage, at which the primary developments in innovation and institutional structures happened. All things considered, we can make certain that expanded specialized effectiveness in the second-phase of creation (more spread out of a similar measure of drain) spared a wide range of assets (cows, milkmaids, arrive for field and grain and work for developing it) in the principal arrange. In examinations of firm level proficiency, a division is normally made amongst specialized and allocate /cost productivity

In a study conducted in Egypt, Gamasa the authors noted how technology would help identify diseases and control on modern dairy farm in several household cows and buffaloes in Dakahlia Governorate, Egypt. Eight hundred seventy-two quarter milk samples of 218 dairy cattle and buffaloes with clinical and subclinical mastitis were investigated they noted that bacteria were identified using matrix-assisted laser desorption/ionization time-of-flight mass spectrometry, However, a small number of different isolates of *S. aureus* were found in household cattle and buffaloes harbouring infectious disease that can be harmful to human being. Hence the use of the technology is good as bacteria identification is key in dairy farm, El-Ashker, Maged et al (2015)

In Africa the increasing mobile penetration in most households is offering unique opportunities for researchers to use mobile-based information systems to make data collection and analysis easier and more efficient across the continent. According the East Africa Dairy Development (EADD),2015) a regional project that is helping farmers boost milk and dairy production in Kenya, Tanzania and Uganda, smallholder dairy farmers who are part of the project's dairy hubs are set to benefit from an innovative and interactive mobile-based system that allows them to effectively record farm events and have access to information and services that help them enhance the productivity of their livestock. EADD (2015). Today, despite tremendous technological advances in genetics (e.g., cloning),

physiological manipulations (e.g., artificial insemination) and nutritional provisions (e.g., high quality harvested forages), there are still only a few domesticated species used in animal agriculture, and traditional animal husbandry practices are still universally applied.(Acemoglu et al 2005).

Artificial insemination (AI) has become one of the most important bio-technologies ever devised for improvement of reproductive performance of farm animals. Today, it is the main tool for dissemination of outstanding germplasm, control of venereal diseases and cost-effective dairy farming however, of the many constraints facing dairy development in Rwanda, low genetic merit of indigenous cattle is understood to be the most important. As a result, since 1996, the government of Rwanda vigorously pursued genetic upgrading of indigenous stock through crossbreeding with exotic germplasm in order to enhance milk production. In order to rapidly achieve this objective, artificial insemination (AI) was accepted as the primary breeding method. Although both number of inseminations and milk production has improved to some extent, the overall pregnancy rate following AI has been very low, around 50%. Clearly, there is a need to undertake a comprehensive assessment of fertility and to identify various factors affecting the success of AI. Chatikobo P. et al (2009). Extensive grazing management systems where cows are given very little supplementary feeding may affect reproductive performance of cows subjected to artificial insemination. These systems do not generally guarantee enough feed for the cows unless a comprehensive supplementary programme supports it, and, the mixing of cows from different herds and different disease status promotes spreading of diseases. As reported by Obese, and Domecq et al(2009), lack of supplementary.

Ojango, Wasike, Enahoro and Okeyo (2016) noted developing countries under The dairy esteem chain has been organized for improvement under the CGIAR look into program on Livestock and Fish in Tanzania (East Africa), India (South Asia) and Nicaragua (Latin America), while ILRI is associated with inquire about on dairy advancement in Kenya. Dairy Cows and disease prevention and vaccination procedures. Amongst other subjects of interest are the raising of calves, management of herds and the preparation and conservation of fodder and other topics in connection with Dairy high technology ,(ILRI DISCUSSION PAPER 33). In the above countries a large number of smallholder farmers operating mixed crop–livestock production systems play a significant role in dairy production. and reproductive technologies. Only in Kenya is there a national organization conducting livestock recording

and monitoring productivity, however, the proportion of the dairy cattle population enrolled in the recording system is small (<2.5 percent). In all the countries, enhanced and adequately planned use of breeding and reproductive technologies, complemented with the relevant infrastructure, is needed to sustainably increase dairy productivity.(Ojango et al 2016).

2.6 Feeding Management and household income

Dairy feeding framework is one that conveys the required supplements to each bovine at the right time (phase of lactation) to keep up most extreme drain creation. FAO(2011).No one system is correct for all dairy producers. The feeding system selected must consider delivery of forages, grain, protein and minerals, either individually or in various combinations.(university of Minnesota). Feeding costs are a high proportion of the total production costs on dairy farms. Other production costs continue to increase while the price of milk has been in swift decline. (Johnson 2013).

When the economics of milking production are being considered, maximizing performance does not always equate to optimizing profitability. In many situations, available feed resources are not suitable for maximizing milk production. (FAO -2011).The most cost-effective feeding programmes can be implemented when feed consumption is maximized. Maximized feed consumption minimizes the cost of providing required nutrients because higher levels of forages and by-product feeds can be incorporated into the ration. When feed consumption is maximized there is more flexibility in the type of feeds that can be used in formulating the ration. (Rudstro 2009). Kellems(2012-FAO) noted that the ideal dairy feeding programme is one that optimizes the use of available feed resources, so that profitability associated with milk production can be maximized. He further classified forage as feeds high in fiber and low in digestible nutrients, and include whole plants of corn, small grains (such as oats, barley, or wheat), legumes, and grasses. He also noted that forages are the primary source of fiber required by the cow to maintain rumen digestion and function as well as to stimulate rumen microbial growth, rumination, and saliva production. Forages are usually a more economical source of nutrients than grains, protein supplements, or mineral-vitamin premixes.(University of Minnesota).

According to Gupta (2009) in a study of dairy feeding in India, he reported that the quality of forage has a dramatic effect on feed consumption in that feeding the highest-quality forage will maximize feed consumption and nutrient intake and minimize dietary nutrient densities,

ration cost and the quantities of concentrates that need to be incorporated into a ration. The feeding of roughages containing high fibre and low digestible energy levels is the primary cause of many dairy farms' failure to realize maximum dry matter intake. Higher forage levels also help to maintain a more stable and healthier rumen and reduce the animal's consumption of grain, which can then be put to other uses, including human consumption. (Kellems FAO-2012).

Buckley (2009) of Moorepark Research Center in County Cork, Ireland, studied the effect of forage mass and pasture allowance on the performance of dairy cows they reported high forage mass was defined by a 31-day interval between grazing with 35% more forage mass than low mass with a 21-day grazing interval and high pasture allowance was 44 lb of pasture forage per head and the low allowance was 35 lb per head. They noted actual consumption ranged from 87 to 97% of available forage, they further noted milk yield per acre for the year was highest for the low pasture allowance because more of the forage grown was utilized and was less mature when it was grazed. As the season progressed, forage quantity and quality began to favour the more closely grazed pastures. There was little difference in production per cow. Rainfall in Cork is greater than rainfall in Minnesota, where our pasture management in drought conditions must emphasize avoiding overgrazing in order to maintain a healthy forage stand. (University of Minnesota).

In Israel Precision Dairy Feed System has been adopted as an important nutritional aspect related to dairy feed efficiency that which promotes great nutrient utilization and allows nutrient requirements to be met more precisely. Feeding high concentrate, high energy diets as opposed to traditional high forage diets has also been an area of recent study in the dairy industry.. (Diop, Mazouz, 2010) Scientists in Ireland, France and New Zealand have been studying the effect of number of hours of grazing that cows are allowed each day. The prevailing view until recently has been that cows should be allowed as many grazing hours as possible. But there may be seasonal foul weather (Minnesota in October 2009) that places pastures at risk or use of feedlot supplementation when pasture is limited, which reduces hours of grazing time. UGA scientists are studying the effects of forage sorghum as a dietary supplement for dairy cows. Forage sorghum has multiple benefits that make it an attractive option: It's drought tolerant, can be harvested twice in the same growing season in the southern part of the state and supports equal milk production to those cows fed corn, Bernard concludes. (Thompson C.2016).

Frelich, Šlachta, Střeleček, and Lososová, (2011) examined the benefit of dairy farms in Denmark in connection to the kind of feeding framework (seasonal pasture vs. permanent housing). They revealed benefit related more to the quantity of subsidies, the territory of arable land, the quantity of animals and to the milk and plant production than to the area of meadows and pastures. Although a better cow performance was achieved on farms with confined herds, the profit per agricultural area and profit rate did not differ significantly between the two feeding strategies between the two nourishing techniques ($P > 0.05$). The benefit was 3,259 and 3,655 CZK/ha all things considered and the benefit rate 7.9% and 5.6% by and large on ranches with fed crown ranches with kept groups, separately. A bringing down of information costs and a more compelling usage of meadows may additionally upgrade gainfulness. (Frelich, et al 2011). Hagiya, Yamaguchi, Hayasaka, Yamazaki, Osawa, Abe, Nakagawa, Kawahara and Suzuki (2014) examined the effects of housing type \times feeding system on Holstein milk yield in Japan, using 305-day milk yield records for 382,269 cows in Japan calving between 2008 and 2012. Milk yield records were analyzed in first-, second-, and third-lactation subsets. There were three barn-type traits (tie-stall (TS), free-stall (FS), and grazing (GZ)). Studies have shown that when these ingredients were stored in sheds and added to the mixer with a loader, mixing errors and losses to wind, birds and spoilage were very high. (Hagiya et al 2014). Both lower losses and more accurate inclusion in the TMR more than pay for the increased handling time and labour of bulk bins for these feeds. (B. Lang 2012).

Bihar has shortage of 9.93 million tonnes of dry fodder, 23.47 million tonnes of green fodder and 5.48 million tonnes of concentrates (GoB, 2012a). Chronic feed deficit is the major constraint to animal production in Bihar. Most of the dairy farmers are smallholders having one or two local-breed milch animals, which are raised on crop residues and natural pastures with under-employed family labour. Feeding grains, oil cakes and green nutritious fodder are generally restricted to some crossbred cattle (Singh et al, 2013). Paddy and wheat straw are the major fodders that account for about 95% of the total marketed fodder in Bihar (Singh et al, 2013).

In Africa, Common grazing lands are limited and many of them are overgrazed. Only about 2% of the land area in the state is allocated to green fodder crops (Singh RKP, 2013). The proportion of green fodder in total livestock feed is close to 10%. About 55% of green fodders are cultivated (Singh et al, 2013). Presently hardly 3-4% of the area is under cultivation of forage crops, in selected pockets where dairy husbandry is prospering as an

important source of income. The small-scale dairying was followed as small-scale intensive, extensive and traditional farming systems Uddin N., Uddin B., Al Mamun, Hassan. and Hasan Khan and Anim (2010) reported that the traditional farming systems in Africa were maintained mainly keeping local cows of which majority of the farmers do not provide concentrates and depend on natural grass, they reported further that forages for dairy animals are usually natural pastures from communal lands, river banks and road sides; and crop residues i.e. straws. Animal are also supplemented with concentrates such as maize crush, wheat bran, rice polish. The average milk production in traditional farming system is around 400 kg/cow/year.(Uddin et al. 2010).

In Tunisia Natural pastures and forest rangelands constitute the major feed resources for animals. Cattle supplementation with concentrate feeds is an exception, Moreover, the contribution of natural resources to animal feeding varies between years as it largely dependent upon seasonal rainfall. The role of cultivated forages is small. In 1996, it did not exceed 15% of the total farm size. Furthermore, produced forages have low nutritive values due to their high fiber and low crude protein contents. This has a direct effect on the cows' productive and reproductive performances. The labor is mainly of family type where most of the times women are taking care of the cows.(Salem and Khemiri 2008).

In Malawi a study by Tebug (2012) noted that livestock under zero-grazing, each animal was fed individually from concrete troughs twice a day at 08.00 and 15.00 hours. Each time concentrate was first fed after which chopped Napier grass was fed to appetite; the amount offered was weighed using a spring balance of a 50 ± 0.5 kg capacity. Little concentrate was also fed at milking. Refusals were weighed every afternoon and morning and samples accumulated over a week or 5 days. he also noted that in the semi-zero-grazing and grazing treatments animals were individually fed from half-cut drums or basins. He further stated that feeding of fodder was once a day either in the morning or afternoon; the rest of the time, the animals grazed.

In Kenya, there are differences in the range of feeds offered to animals at farm level during the wet season. These differences are often environmentally determined so that farmers do not necessarily feed sufficient amounts of the types of feeds that would produce maximum performance in their animals in accordance with feeding standards. As a fodder, Napier grass has been popularized by the extension service (SCDP -2015) and this explains its use in zero-grazing and semi-zero-grazing systems. In a study in bomet county Kenya by Egessa Joseph

(2015) Evaluating feeding system. He noted the feeding of other fodders has developed over time through farmers own observations and exchange of ideas with each other. Cabbage was, for example, fed because it grew well in the area, was cherished by cows, was fed by other farmers in the neighbourhood and was believed to increase milk yield. His observation, showed that many small holders, fed cabbage at least during milking. The farmers are, however, possibly unaware of the effects of feeding large quantities of brassicas. The farmers also fed potatoes and molasses as sources of readily available carbohydrates in addition to the wide range of concentrates offered. (Bayemi 2005). Mixing of concentrates was a common feature of the farms practicing semi-zero-grazing. For some farmers the practice developed in an attempt to cut down costs by combining cheaper concentrates with expensive ones.(Muriuki, Wanjohi and Njuguna, 2010). Feeds used in Kenya have been reported to be of low quality and in some cases contaminated with aflatoxins which have been found in milk. A study by the university of Nairobi on the prevalence of contaminants in dairy feeds in Nairobi peri urban (Mwangi, 2007) concluded that 50% of commonly used feeds - maize germ, cotton seed meal, wheat bran were contaminated with aflatoxins and pose serious implications on livestock and human health.

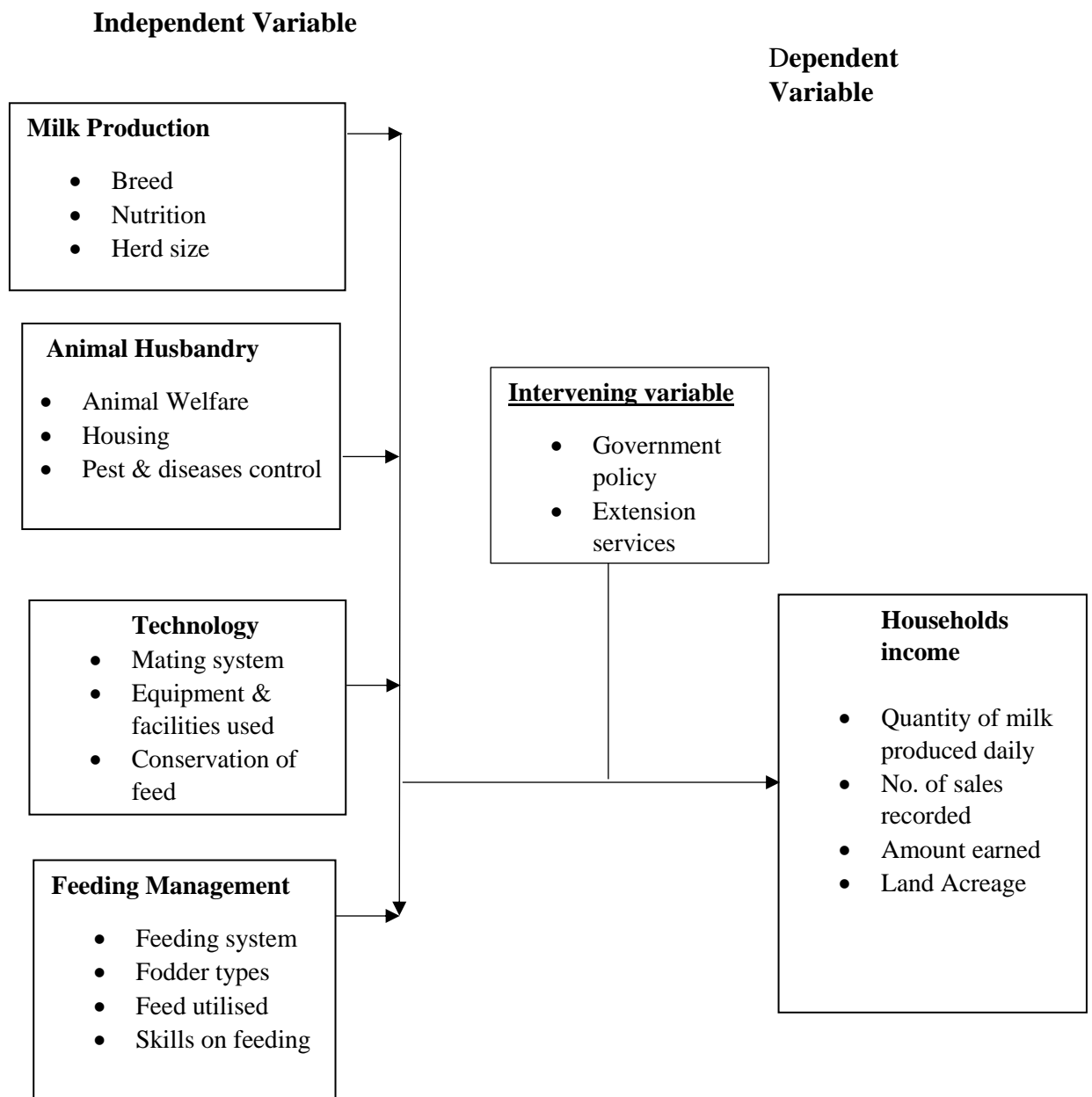
2.7 Theoretical Framework.

In this study neo classical theory of production will be used, Classical economists such as Malthus and Ricardo attributed the successive diminishment of output to the decreasing quality of the inputs. The theory of unavoidable losses (law of diminishing returns)expresses that in every single profitable process, including a greater amount of one factor of creation, while holding all others consistent ("ceteris paribus"), will sooner or later yield bring down incremental per-unit retu (Samuelson, Paul A 2001). This theory connects to the literature, the design of the study the instruments for data collection and data analysis process.the theory of unavoidable losses (law of diminishing returns)does not suggest that including even more a factor will diminish the aggregate creation, a condition known as negative returns, however in truth this is normal.For example in a dairy farm where there is increase labour and high cost of input yet the farm experience low milk production as a result of inefficiency in management.

Figure 2.1 Conceptual framework

Introduction

Milk production look into aspects such as Breed of animal, Nutrition, and herd size in relation to improving household income; Animal husbandry will look in to parameters such as Welfare, housing, pest and diseases in relation to improvement household income. Technology in mating systems, Equipment and facilities, feed conservation methods in relation to improved household income and how feeding management such as type of feeding, fodder type and feed utilised in relation to household income.



2.9 2.10 Knowledge Gap

Table 2.1: Knowledge Gap

Author	Title	Finding	Methodology	Knowledge gap
Talukder D.	Assessing Determinants of Income of Rural Households in Bangladesh	While the share of agriculture income was a positive determinant of household income in both years, the magnitude of its influence was very significant	Descriptive survey. Random sampling Interviews and questionnaires Quintiles Regression	Done in Bangladesh The study looked in Rice production not dairy farm practices
Ingrid Henriksen, Markus Lampe, and Paul Sharp	The Role of Technology and Institutions for Growth: Danish Creameries in the late Nineteenth Century	This growth in productivity might be due to technological progress, the breeding of cows which could produce a higher fat content in their milk due to innovations	stochastic frontier model Descriptive statistics. production function theory diminishing returns to scale	Study done in Denmark. The study did not look into technology and institutions And not dairy farming practices
Uddin M. N et al., (2012)	Small Scale Dairy Farming for Livelihoods of Rural Farmers: Constraint and Prospect in Bangladesh	Smallholder dairy production was found to be an important and have the potential to poverty alleviation, food security, improved family nutrition and income	Descriptive survey Design, Interviewing, Questionnaire, Observations, Excel-2000 and STATA/IC-11.0	further study on intervention for disease prevention improved dairy animals supply and awareness, which my study on good dairy farming practice could address
Muriuki K.M et al	Factors Influencing Growth of Dairy Farming Business in Imenti South District of Meru County, Kenya	The study finds big potential to use modern approaches to extension encompassing information communication technology (ICT) reading and writing	descriptive survey design, stratified proportionate random sampling Correlation Analysis Questionnaire	Study done in Imenti south District, Kenya and not in Bungoma. The study did not look at Dairy farming practices
Bayemi et al (2005)	Appraisal of Dairy Farms in the North West Province of Cameroon. Livestock Research for Rural Development	The aim of crossbreeding is to upgrade for better milk production and at the same time retaining the adaptability of the	Descriptive survey design Questionnaires Regression	The Study conducted in Cameroon not Kenya. The st

		animals in changing environmental conditions		
Muriuki, Wanjohi & Njuguna (2010)	Improving Livelihoods in the Smallholder: Dairy Sector in Kenya Evaluation stall	modern dairy farms use “free stall” housing designed to maximize cow comfort, and that allows cows to eat and sleep and have the milking parlor on its own place.	Descriptive survey design Questionnaire and interview Regression model	The study did not take place in Bungoma. The study did not focus on Dairy farming practice
Chatikobo P. et al (2009).	Benchmark study on husbandry factors affecting reproductive performance of smallholder dairy cows subjected to artificial insemination (AI	Extensive grazing management systems where cows are given very little supplementary feeding may affect reproductive performance of cows subjected to artificial insemination	Descriptive survey design. Questionnaires and interviews Correlation analysis	Study conducted in Rwanda The study did not focus on dairy farming practices

2.10 Summary of Literature

The study focused on the relationship between dairy practices and how production can be maximised to improve on income. The social aspects of dairy farming and administration at the homestead level. Dairy agriculturists' creation frameworks overall should have the capacity to join benefit with the duty of securing human wellbeing, creature wellbeing, creature welfare and the earth. This examination will give singular dairy ranchers proactive direction on how these destinations can be accomplished on their homesteads. The practices that are proposed have been drawn from best practice rules and existing confirmation plots the world over, thus singular practices will differ in their relevance to different dairying locales. The underlying factor however is the level of knowledge and technological advancement by individual farmers as well as the ability and proactivity of the agricultural extension officers to disseminate the same. This is important since some farmers may ignore practices as they may deem them not relevant to them and hence achieving results at a below optimal level. Most of the literature reviewed in this chapter is from developed countries whose strategic approach and financial footing is different from that of Kenya. There is therefore a gap on the influence of dairy farming practices on improvement in rural

household in Kenya. The study sought to fill the gap by establishing how Milk production, Animal husbandry, Technology and Feeding management influence improvement in household income in Bungoma County, Kenya.

CHAPTER THREE

RESEARCH AND METHODOLOGY

3.1 Introduction

This chapter describes the methodology that was used in conducting the study in order to get information aimed at meeting the research objectives and answering the research questions. The chapter was discussed under the following headings; Research design, target population, sample size, sample selection, research instruments, data collections procedure, data analysis and ethical consideration.

3.2 Research Design

The research design adopted for the study was descriptive survey this design is appropriate of the study as it will show the correlation between variables (Kothari, 2004) as is intention of the study. Descriptive survey is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals and this being a one time study. According to Orodho (2004) descriptive survey design allows researchers to gather information, summarize, present and interpret for the purpose of clarification. The study was aimed at collecting information from respondents on the influence of dairy farming practices to household income.

3.3 Target population

According to Kisilu and Tromp (2006), a population is a group of individuals, objects or items from which samples are taken for measurement, it is an entire group of persons or elements that have at least one thing in common. The target population for the study was 2740 individual dairy farmers who belong to dairy groups in dairy commercialization areas supported by Smallholder dairy commercialization programme. in Bungoma County, A part from this 5 key informant; 1 official from ministry of livestock and 4 officials from smallholder commercialization project to make a total 2745 .

Table3.1: Target population

COUNTY	DCA Blocks	Dairy Groups	Members
Bungoma	Nabingenge	22	472
Bungoma	Milima	23	462
Bungoma	Maliki	22	375
Bungoma	Makuyuni	20	532
Bungoma	Ndalul	23	469
Bungoma	Bukembe	20	430
	Total	130	2740

3.4 Sampling procedure and Sample Size

The sample and the sampling procedure to be use to obtain the study sample of the population.

3.4.1 Sample Size

The targeted population of the household within the project area as provided in the project Documents was 2,740 In the study, the sample size from the population was determined based on Krejcie and Morgan (1970) table. From the table, a formula is given, that a sample size when drawn randomly from a finite population is that the sample is within +or -0.05 of the population proportional with 95% level of confidence. Therefore my sample for the study will be 338 in addition to 5 key informants who are to be interviewed.

3.4.2 The Sampling Procedure

The target population was 2760 from six DCA,s, The study grouped the population into strata comprising of the Dairy commercialization areas (DCA). Questionnaires were administered using Stratified proportionate random sampling technique was used to select the sample. Where frequency, mean and percentage to determine 338 respondents of the study.

3.5 Data collection Instruments

This study used both primary and secondary data. For primary data, a questionnaire with closed and open ended questions will be used to obtain the data from the respondents. The questionnaire will provided enough spaces to record additional responses to the research question by the respondents. To gather data, the researcher used pre-designed questionnaires to capture information useful in meeting the stated objectives as well as answering the research questions. An interview schedule was used to gather data from key informants. Secondary data was manually extracted from the Smallholder dairy commercialization records.

3.5.1 Pilot Testing

Nachmias and Niachmias (1996) Pilot testing is an important step in the research process because it reveals vague questions and unclear instructions in the instruments. To ensure consistency of questions in the research instrument, a pilot testing was conducted by the researcher in an area with similar project, the instruments were administered to 30 Dairy farmers who are members Nadafa Cooperative in Naitiri Bungoma County, and Respondents were randomly selected. The selected participants were asked questions and if they were able to interpret each question and answer it was coded 1 and where the question appeared to be ambiguous it was coded 2 for corrections to be done on the instrument. Data was excluded from the final analysis as it was meant to improve the instrument.

3.5.2 Validity of the instruments

Validity as noted by Kothari, (2004) is the degree to which the results obtained from analysis of the data actually represents the phenomenon under study. Validity was ensured by having objective questions included in the questionnaire. This was achieved through pre-testing the instrument to be used to identify and change any ambiguous, awkward, or offensive questions and techniques as emphasized by Cooper and Schindler, (2003).

The administered instruments were analysed and a generalized position of the respondents in the study to be valid the researcher made sure that the instruments addressed the information sought by the research objectives.

3.5.3 Reliability of the instruments

Reliability on the other hand refers to a measure of degree to which research instruments yield consistent results. (Mugenda & Mugenda, 2003) Reliability. Thus to measure the reliability, the researcher employed test-retest where 30 respondents were given questionnaire, that is 10% of the sample size. The test was repeated a week later to the same respondents, thus results generated were same, and reliable.

3.6 Data Collection Procedures

Data collection exercise will commence on approval of the study from University of Nairobi, and research permit obtained from the national council of science and technology so as to make of the study conform to the set standards, training of the 7 research assistant in order to standardize the data collection exercise. The physical location of the respondents was established for ease of delivery of the questionnaire. For illiterate respondents, a guided interview was done.

3.7 Data Analysis Technique

Data obtained from the field was coded, and analysed using a statistical package for social sciences (SPSS V. 21) to generate required information. Qualitative data from the open ended questions will be analysed thematically by content analysis and the findings presented in prose. In order to effectively analyse the primary quantitative data, descriptive statistics including percentages, frequencies, mean, standard deviation and was used. Presentation of quantitative data will done using frequency tables. Correlation will be conducted to show the relationship between the dependent and independent variables.

3.8 Ethical considerations

The Study described the purpose of the study, the possible benefits and the contact person in case of query, appropriate consent to participate in research was sought from all respondents and total confidentiality was assured and information they gave was used for research purposes. The research assistant maintained high standard of professional behaviour in line with the national regulations and organisation policies that are practiced by the University of Nairobi.

3.9 Operationalization of the variables

The following is the variables operationalization

3.9 Operationalizing study variables

Table 3.2 Operationalizing study variables

Objective	Variable	Indicators	Measurement scale	Data collection method	Type of Analysis
To determine the extent to which milk production influence households income in Bungoma county, Kenya	<u>Independent Variable</u> Milk Production <ul style="list-style-type: none"> • Breed • Nutrition • Herd size 	<ul style="list-style-type: none"> • No.Crosses, local and pure • Commercial/own farm • No. of animals Quantity of milk,butter fat 	Ordinal Nominal ordinal	Questionnaires	Frequency percentages mean Standard deviation
To explore the extent to which animal husbandry influences households income in Bungoma County, Kenya.	Animal Husbandry <ul style="list-style-type: none"> • Animal Welfare • Housing • Pest & diseases control 	<ul style="list-style-type: none"> • No. of feeding and drinking points. • Shade.(dry, clean) • Dip/sprayer pumps. • No. of vets visits 	ordinal ordinal nominal	Questionnaires	Frequency percentages Standard deviation
To determine the role of technology in influences households income in Bungoma County, Kenya	Technology <ul style="list-style-type: none"> • Mating system • Equipment & facilities • Conservation of feed 	<ul style="list-style-type: none"> • AI/bull, • Milking facilities, coolers, separators milkcan • No of training 	Ordinal ordinal ordinal	Questionnaires	Frequency percentages standard deviation
To access the extent to which Feeding systems influences households income in Bungoma county, Kenya	Feeding Management <ul style="list-style-type: none"> • Feeding system • Fodder types • Feed utilised • Knowledge of feed 	<ul style="list-style-type: none"> • Zero grazing, semi zero grazing, free range. • Wet/dry • Kilos/sacks/wheelbarrow s. No.training 	ordinal nominal	Questionnaires	Frequency percentages standard deviation
	<u>Dependent variable</u> Improved household income <ul style="list-style-type: none"> • daily litre of milk • Amount earned • No of sales • Land acreage 	<ul style="list-style-type: none"> • Number of litres. • Cash recorded • Sour milk, cream, ghee, milk sold • Titledeed/leasehold 	interval	Questionnaires	Frequency percentages standard deviation

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION INTERPRETATION AND DISCUSSION

4.0 Introduction

This chapter analyses, present, interpret and discuss the study on the influence of dairy farming practices on improvement of household income in Bungoma County. The chapter also provides questionnaire response rate, and result analysis on each objective

4.1 Questionnaire Response Rate

Table 4. 1: Response Rate

	Frequency	Percentage
Returned	270	79.9
Not Returned	68	20.1
Total	338	100.0

The study targeted 338 respondents out of which 270 questionnaires were filled and returned giving a response rate of 79.8%. This response rate was good and representative and conforms to Mugenda and Mugenda (1999) stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent.

Standard error sample proportion

4.2 Demographic Information

4.2.1 Distribution of Respondents by Gender The study sought to find out the gender composition of the respondents. The findings are presented in table 4.2.

Table 4. 2: Gender Composition

	Frequency	Percentage
Male	95	35.2
Female	175	64.8
Total	270	100.0

From the findings, it was evident that majority of the respondents were female as shown by 175(64.8%), 95(35.2%) of respondents were male.

4.2.2 Distribution of the length of time practiced in Dairy Farming

The study also sought to determine the length of time the respondents have practiced dairy farming. The findings are presented in table 4.3

Table 4.3: Length of Time Practices in Dairy Farming

	Frequency	Percentage
1 to 5 years	102	37.8
6 to 10 years	63	23.3
11 to 15 years	42	15.6
16 to 20 years	26	9.6
21 years and above	37	13.7
Total	270	100.0

From the findings, the majority of the respondents indicated that they had practices dairy farming for a period of 1to 5 years as shown by 37.8%.23.3% of the respondents had practices dairy farming for a period of 6 to 10 years. 15.6% of the respondents had practices dairy farming for a period of 11 to 15years 13.7% had practiced farming for a period of 21 years and above followed closely by 9.6% of the respondents had practiced dairy farming for a period of 16 to 20 years.

Table 4.4 Level of Education

Response	Frequency	percentage
Primary	105	38.9
Secondary	92	34.1
Tertiary	73	27.0
Total	270	100

Table 4.4 shows that 105 (38.9%) have Primary level of education as expressed, 92(34.1%) of the respondents had Secondary level of education and 72(27%)had Tertiary level of

education. This implies that the respondents are able to acquire skills that will enable them to propel the growth of the dairy business. The respondents also revealed that the average farm size is 2 acres and that an average of 3 cows were owned by the respondents in the farm. It was also evident that the amount of milk produced by a farm per day was an average of 20 litres.

4.3 Influence of milk production on improvement of household income

This objective was to establish the extent to which milk production in dairy farming influences household income.

Table 4.5 Extent to which milk production in dairy farming influences household income

Response	Frequency	Percentage	(cm f)
Very great extent	200	74.1	74.1
Great extent	40	14.8	88.9
Moderate extent	9	3.3	92.2
Low extent	11	4.1	96.3
Very low extent	10	3.7	100
Total	270	100	
Mean	1.49		
Std. deviation	1.005		
Variance	1.009		

The results in table 4.5 shows 200 (74.12%) of the respondent indicated that milk production in dairy farming to great extent influenced household income, 40(14.8%) expressed that milk production to a great extent influence of household income which has been expressed by a mean score of 1.49 and Standard deviation of 1.005 this means that the respondents have positively identified dairy farming as a means of in improving of household income. Komor and Borah (2015) affirmed that dairying farming is a source of income and prosperity.

Table 4.6.1: shows level of Agreement on cow breed in of Milk production

Response	Frequency	Percentage	(cm f)
Strongly Agree	162	60.0	60.0
Agree	60	22.2	82.2
Neutral	28	10.4	92.6
Disagree	12	4.4	97.0
Strongly Disagree	8	3.0	100
Total	270	100	
Mean	1.68		
Std. deviation	1.025		
Variance	1.051		

The results from table 4.6.1, out of 270 respondents 162(60%) Strongly agreed that the breed matters when it comes to milk production. As expressed with a mean score of 1.68 and standard deviation of 1.025. This is consistent with Arimi et al, (2012) arguments breed selection is critical to enable modern, high-producing dairy cows to meet their genetic potential for milk production. 8(3%) of the respondents strongly disagree, 28(10.4%) of the respondents were neutral in most cases as their cows were either in-calf or dry.

Table 4.6.2 shows the level of agreement on quality assurance on feed on influence of milk production

Response	Frequency	Percentage	(cm f)
Strongly Agree	90	33.3	33.3
Agree	86	31.9	65.2
Neutral	57	21.9	86.3
Disagree	12	4.4	90.7
Strongly Disagree	25	3.0	100
Total	270	100	
Mean	2.24		
Std. deviation	1.225		
Variance	1.501		

From the above table 90 (33.3%) respondents strongly agreed, this indicates that they access quality feeds from feed suppliers 57(21.1%) were neutral most of who do not supplement the feed and rely mainly on home grown feeds and rations. As expressed with a mean of 2.24 and a standard deviation of 1.225 this shows that there is a shift in that not all access quality feeds in terms of balanced nutrition, minerals and rations. Muriuki (2012) argument that dairy farmers use professional animal nutritionists to develop scientifically formulated, balanced, and nutritious diets to support milk production,

Table 4.6.3 shows the level of agreement herd size influence of milk production

Response	Frequency	Percentage	(cm f)
Strongly Agree	44	16.3	16.3
Agree	69	25.6	41.9
Neutral	27	10.0	51.9
Disagree	42	15.6	67.4
Strongly Disagree	88	32.6	100
Total	270	100	
Mean	3.23		
Std. deviation	1.525		
Variance	2.324		

From the response in table 4.6.3, the respondents indicated that herd size can only be significant if there is recorded increased in milk production, as expressed with a mean of 3.23 and a variance of 2.324 this means the respondents strongly disagreed owing to the fact one cow can produce as much as 3 cows combined depending on the breed, nutrition and welfare. Otto *et al* (2017) notes that the genetic improvement of herds in Israel Holstein cows has seen improved milk production per cow.

Table 4.6.4 Shows the level of Agreement based on various statements regarding milk production

	Mean	Standard Deviation
Animal breed matters when it comes		
Milk production	1.68	1.025
Quality assurance on feeds	2.24	1.225
Herd size on milk	3.23	1.525
Average	2.38	1.258

The aggregate score in table 4.6.4 showing the mean = 2.38 and S.Dev=1.258 is a clear indication that most of the respondents were in agreement that milk production influence household income among small scale Dairy farmers.

4.4 Animal husbandry

The study sought to establish if the respondents were practicing good animal husbandry on their farms, the researcher was guided by the indicators of which he would draw a conclusion. The table below indicate there responses of

Table 4.7 shows awareness of good animal husbandry practices

Response	Frequency	Percentage	(cm f)
Very great extent	180	66.7	66.7
Great extent	52	19.3	85.9
Moderate extent	28	10.4	96.3
Low extent	6	2.2	98.5
Very low extent	4	1.5	100
Total	270	100	
Mean	1.53		
Std. deviation	.878		
Variance	.771		

From table 4.7 the respondents indicated that animal husbandry practices to a very great extent influences that level of household income, as expressed by a mean of 1.53 and standard deviation of .878 this means that the farmers are aware of health care, preventing injuries, housing structures and farm management. This is backed up by Omore et al, (2013) who argues that dairy farmers depend on healthy cows for their livelihood

Table 4.8.1: Level of agreement that animals are free from disease and hunger

Response	Frequency	Percentage	(cm f)
Strongly Agree	120	44.4	44.4
Agree	106	39.3	83.7
Neutral	16	5.9	89.6
Disagree	16	5.9	95.6
Strongly Disagree	12	4.4	100
Total	270	100	
Mean	1.87		
Std. deviation	1.062		
Variance	1.127		

The results from the above table 4.8.1, out of 270 respondents who participated, 120(44.4%) strongly agree and this is further expressed by a mean of 1.87 and variance of 1.127. it therefore means that the animals were free from disease and hunger as they had adequate feeding and watering points, thus animals welfare was great, they further employed biosecurity measure to reduce disease morbidity the variance arose as a result strongly disagree which means they had detected illness on their flock as some were not feeding properly and not active. Crabtress (2010) noted that one of major constrains in dairy farming is lack of knowledge and adoption of scientific practises.

Table 4.8.2: Level of agreement that animals protected from extreme weather conditions

Response	Frequency	Percentage	(cm f)
Strongly Agree	69	25.6	25.6
Agree	111	41.1	66.7
Neutral	24	8.9	75.6
Disagree	42	15.6	91.1
Strongly Disagree	24	8.9	100
Total	270	100	
Mean	2.41		
Std. deviation	1.266		
Variance	1.604		

From the above table the respondents indicated that animals were protected from weather changes as expressed by a mean of 2.41 and standard deviation of 1.266 which means there is a great variability of the scores in the distribution, only few farmers had adequately provided proper housing, others had their animals under trees which provided shade where they would feed and rest on, from the findings 24(8.9%) were neutral, since others had collapsed, burnt down and feared for disease morbidity. According to Muriuki, Wanjohi and Njuguna (2010), recognizing that proper animal care including provision with comfortable living conditions leads to the production of high quality milk hence increased household income

Table 4.8.3: Level of agreement on following correct treatment procedure when animal is sick

Response	Frequency	Percentage	(cm f)
Strongly Agree	142	52.6	52.6
Agree	91	33.7	86.3
Neutral	19	7.0	93.3
Disagree	11	4.1	97.4
Strongly Disagree	7	2.6	100
Total	270	100	
Mean	1.70		
Std. deviation	.953		
Variance	.908		

The results from the table 4.8.3 out of 270 respondents 140(52.6%) strongly agreed to have follow correct treatment procedure when animal are sick as expressed by a mean score of 1.70 and a standard deviation of .953 these denotes less variability in the distribution since a number of them are able to detect animal disease early and were aware of mechanisms to control infections. Bebe et al, (2013) views that animals should be observed regularly and to help in early detection and correctly diagnose the diseases.

Table 4.8.4 Shows the level of Agreement based on various statements regarding Animal husbandry

	Mean	Standard Deviation
Animals are free disease and hunger	1.87	0.879
Animals are protected from extreme weather	2.41	1.266
Follow correct treatment procedure	1.70	0.953
Average	1.99	1.033

The aggregate score in table 4.8.4 showing the mean = 1.99 and S.Dev=1.033 is a clear indication that most of the respondents were in agreement that Animal husbandry influences household income among small scale Dairy farmers.

4.5 Technology

The study sought to deduce whether technology adoption influence improvements in the household income. The researcher wanted to know if the respondents are aware of technologies in Dairy farming and have at least adopted one

Table 4.9 Shows awareness on technology adoption

Response	Frequency	Percentage	(cm f)
Very great extent	95	35.2	35.2
Great extent	70	25.9	61.1
Moderate extent	60	22.2	61.1
Low extent	23	8.5	91.9
Very low extent	22	8.1	100
Total	270	100	
Mean	2.29		
Std. deviation	1.254		
Variance	1.573		

Table 4.9 shows that out of 270 respondents 95(35.2%) to a very great extent were aware of technology and at least adopted one, with a mean of 2.29 and standard deviation of 1.254, this denotes there is smaller deviation denoting less variability, while 22 (8.1%) scored to a very low extent this means there was lack of knowledge of what they could adopted at the same time the cost a factor. As noted by Stangaferro *et al* (2013) technology increased access to data and change the way we produce milk thus improve profitability and efficiency at the farm level.

Table 4.9.1: Level of agreement that bull is the preferred mating system

Response	Frequency	Percentage	(cm f)
Strongly Agree	87	32.2	32.2
Agree	57	21.1	53.3
Neutral	20	7.4	60.7
Disagree	69	25.6	86.3
Strongly Disagree	37	13.7	100
Total	270	100	
Mean	2.67		
Std. deviation	1.485		
Variance	2.202		

Table 4.9.1 shows that out of 270 respondents, 87(32.2%) of the respondents preferred bull for reproduction as expressed by a mean of 2.67 and standard deviation of 1.485 this denotes there is variability in the choice of mating system since the respondents acknowledged that trait of the animal at the same time if the cow was on heat it would be readily be served by a bull. 37(13.7%) of the respondents strongly disagree that bull was not their preferred mating system which means they had knowledge of Artificial insemination and had adopted it despite the costs associated with it. Chatikobo P. *et al* (2009) notes that although pregnancy following AI has been very low it is one of the most important bio technologies ever devised.

Table 4.9.2: Level of agreement on using of suitable milking and storage equipment

Response	Frequency	Percentage	(cm f)
Very Great Extent	104	38.5	38.5
Great Extent	48	17.8	56.3
Moderate Extent	70	25.9	82.2
Low Extent	21	7.8	90.0
Very low Extent	27	10	100
Total	270	100	
Mean	2.33		
Std. deviation	1.324		
Variance	1.753		

Table 4.9.2 shows that out of 270 respondents 104(38.5%) agreed to a very great extent had suitable equipment for milking and storage, as expressed by a mean of 2.33 and a standard deviation of 1.324 which denotes less variability of the scores and a positive distribution. part the respondents were neutral of which their cows were in calf or dry. Milking is an important activity on the dairy farm, as it ensures that consumers demand high standards of milk quality are met, thus to minimize microbial, chemical and physical contamination. Ndungu M.(2014)

Table 4.9.3: Level of agreement on testing mastitis using strip cup

Response	Frequency	Percentage	(cm f)
Strongly Agree	36	13.3	13.3
Agree	26	9.6	23.0
Neutral	49	18.1	41.1
Disagree	36	13.3	54.4
Strongly Disagree	123	45.6	100
Total	270	100	
Mean	3.68		
Std. deviation	1.459		
Variance	2.129		

The results from table 4.9.3, shows the respondents strongly disagree meaning they do not use the strip cup for testing mastitis, this has been expressed with a mean of 3.68 and standard deviation of 1.459. The distribution is negatively skewed as most of the respondents were not aware of the danger of mastitis and hence didn't invest on a strip cup. Mosnier and Wiek (2010) view that it is important to ensure good milking techniques since incorrect techniques can result in a higher mastitis risk and injury to the cow which translate to lower level of milk production or even contamination of milk.

Table 4.9.4: Level of agreement on having skills on feed production and conservation

Response	Frequency	Percentage	(cm f)
Strongly Agree	88	32.6	32.6
Agree	113	41.9	74.4
Neutral	26	9.6	84.1
Disagree	32	11.9	95.9
Strongly Disagree	11	4.1	100
Total	270	100	
Mean	2.13		
Std. deviation	1.118		
Variance	1.251		

Table 4.9.4 shows that, out of 270 respondents 113(41.9%) agreed which is an indication that they have acquired knowledge and skills on feed production and conservation thus expressed

by a mean of 2.13 and a standard deviation of 1.118, From this findings it is clear that a number of the respondents have not had an opportunity for such training or skills on feed production and conservation of which would impact in the overall milk production hence increased income

Table 4.9.5 Shows the level of agreement on various statements influence technology

	Mean	Standard Deviation
Preferred bull for mating	2.67	1.485
Use of suitable milking equipment	2.33	1.324
Testing mastitis using strip cup	3.68	1.459
Have skills on feed conservation	2.13	1.118
Average	2.70	1.346

The aggregate score in table 4.9.5 showing the mean = 2.70 and S.Dev =1.346 is a clear indication that most of the respondents were in agreement that Technology influences household income among small scale Dairy farmers. However there is need to continue to impart information on use of strip cup.

4.6 Feeding management

The objective was to assess the how feeding management in dairy practice influences improvements of household income.

Table 4.10 shows awareness on good feeding management practice

Response	Frequency	Percentage	(cm f)
Very great extent	165	61.1	61.1
Great extent	89	33.0	94.1
Moderate extent	10	3.7	97.3
Low extent	6	2.2	100
Very low extent	0	0	100
Total	270	100	
Mean	1.53		
Std. deviation	.861		
Variance	.741		

Table 4.10 show that out of 270 respondents 165(61.1%) to a very great extent agreed that they were aware of the importance of feeding management as expressed with a mean of 1.53 standard deviation of .861. from the findings it there is less variability in the distribution it is clear that feeding is an integral part of dairy farming that cannot be over looked as noted by FAO(2011) that feeding should deliver nutrients to each cow at correct measurement to maintain maximum milk production.

Table 4.10.1: Level of agreement on type of animals feeding system

Response	Frequency	Percentage	(cm f)
Zero grazing	61	22.6	22.6
Semi zero grazing	72	26.7	49.3
Free range	64	23.7	73.0
Stalls	27	10.0	83.0
Seasonal pasture	46	17.0	100
Total	270	100	
Mean	2.86		
Std. deviation	1.441		
Variance	2.077		

The findings in Table 4.10.1 indicates that 72(26.7%) of the 270 respondents agreed with a mean of 2.86 and standard deviation of 1.441 indicating that Semi-zero grazing was the most adopted way of feeding the dairy cows hence having direct influence on household income. it was observed during data collection there was plenty of maize harvest which is consistent with the findings by Thomspson C.(2016) who noted in his findings that improved feed availability and quality will be a key strategy to realize the largest proportion of the needed animal productivity levels

Table 4.10.2: Responses on nature of forage given to dairy Animals

Response	Frequency	Percentage	(cm f)
Maize Stovers	98	36.3	36.3
Green fodder	58	21.5	57.8
Own/supplements	68	25.2	83.0
Hay	22	8.1	91.0
Silage	24	8.9	100
Total	270	100	
Mean	2.32		
Std. deviation	1.283		
Variance	1.645		

Table 4.10.2 shows that out of 270 respondents, 98(36.3%) of the respondents indicated that they were feeding their animals with maize stovers as it was observed during data collection, as expressed with a mean of 2.32 and standard deviation of 1.283. from the findings we note both wet and dry forage was given to the animals of which is consistent with the findings by Hasan and Anim (2010) on adoption of natural pastures, crop residues such as wheat bran, straws and rice polish consumed for improvement of milk hence increase household income. the finding further supported the fact that the respondents 68(25.2%) produced their own feed hence great variability in the distribution.

Table 4.10.3: Level of agreement on measuring the daily ration

Response	Frequency	Percentage	(cm f)
Very great extent	89	33.0	33.0
Great extent	56	20.7	53.7
Moderate extent	44	16.7	70.0
Low extent	52	19.3	89.3
Very low extent	29	10.3	100
Total	270	100	
Mean	2.54		
Std. deviation	1.394		
Variance	1.944		

Table 4.10.3 shows out of 270 respondents, 89(33%) to a very great extent had methods in place to measure the feed intake as expresses with a mean of 2.54 and standard deviation of 1.394 which denotes a positive distribution in consistent with the study by Diop Mazouz (2010) measurement on high energy diets and high concentrates with precision as opposed to tradition forage diets on improvement of milk production hence increase income. objective in formulating rations is to provide animals with a consumable quantity of feed stuffs that will supply all required nutrients in adequate or greater amounts and do so in a cost effective way.

Table 4.10.4 Shows the level of agreement on various statements on feeding management

	Mean	Standard Deviation
Animals feeding freely	2.86	1.441
Production of own feeds	2.32	1.283
Measuring of daily rations	2.54	1.394
Average	2.57	1.372

The aggregate score in table 4.10.4 showing the mean = 2.57 and S.Dev=1.372 is a clear indication that most of the respondents were in agreement that Feeding management influences household income among small scale Dairy farmers.

4.7 Cross cutting issues

The study sought to examine the extent of culture influence dairy farming practice

Table 4.11: Extent to which Cultural practice influences Dairy farming

Response	Frequency	Percentage	(cm f)
Very great extent	83	30.7	30.7
Great extent	76	28.1	58.9
Moderate extent	40	14.8	73.7
Low extent	42	15.6	89.3
Very low extent	29	10.7	100
Total	270	100	
Mean	2.47		
Std. deviation	1.351		
Variance	1.856		

Table 4.11 shows that out of 270 respondents, 83(30.7%) to a very greater extent still employed cultural ways in their farms, as expressed by a mean of 2.47 and standard deviation of 1.351, further finding note that 29 (10.7%) of the respondents to a very low extent meaning they had adopted modern technological ways of dairy practice thus recorded high yield in produce and increased income as noted by Millers S. (2016) People live and work in cultures that we have spent most of our lives on applying various culture, Animal husbandry practices has been passed down through the ages,

Table 4.12: Extent to which visits from extensions officers influence dairy farming

Response	Frequency	Percentage	(cm f)
Very great extent	106	39.3	39.3
Great extent	48	17.8	57.0
Moderate extent	75	27.8	84.8
Low extent	24	8.9	93.7
Very low extent	17	6.3	100
Total	270	100	
Mean	2.25		
Std. deviation	1.239		
Variance	1.535		

The findings in Table 4.12 indicates that 106(39.3%) of the respondents agreed with a mean of 2.25 and standard deviation of 1.239 indicating that extension education had a direct influence on the adoption of the Dairy practice. It is imperative that the extension officers visit and sensitise farmers on best practice to enable them improve on the household income. (Sessional paper no.5,2013)

Table 4.13 Shows the level of agreement on various statements on crosscutting issues

	Mean	Standard Deviation
Culture	2.47	1.351
Extension Services	2.25	1.239
Average	2.36	1.295

The aggregate score in table 4.10.4 showing the mean = 2.36 and S.Dev=1.295 is a clear indication that most of the respondents were in agreement that cross cutting issues influences household income among small scale Dairy farmers.

Table : 4.14 Quantity of milk produced in litres (daily)

Litres	Frequency	Percentage
0	37	13.8
1 - 5	28	10.4
6 -10	64	23.7
11 - 15	76	28.1
16 - 20	38	14
Above 21	27	10
Total	270	100.0

Table 4.14 shows out of 270 respondents, 37(13.8%) of the respondents reported no milk production, 28(10.4%) made a daily sale of 1 and 5 litres, 64(23.7%) Sold 6 to10 litres of milk on daily basis,76(28.1% of the respondents sold between 11 to15 on average and 38(14%) of the respondents sold between16 to 20 litres, and 27(10%) of the respondents so above 21 litres. From this table it is evident that high milk production was recorded in farms that had scaled up there operations, where us others were affected by factors such as animal breed, incalf animals, diseases such as mastitis hence reducing productivity of the animals. As noted by N.G Hedge (2013) that without inclusion of breeds, complete fodder, and animal well being, the growing demand of milk for the growing population may not be met.

Table: 4.15 Milk Sales in Ksh

Ksh	Frequency	Percentage
0	37	13.7
25 - 35	104	38.5
35 - 40	129	47.8
Total	270	100.0

Table 4.15 summarized the frequency of milk price ranges. Out of 270 respondents 37(13.7%) Dairy animals were either in the dry or in-calf thus no milk to be sold, 104(38.5%) sold milk between 25-35 shillings, while 129(47.8%) of the respondents sold milk between 35-40 shillings. The milk prices were seen to be relatively equal in all the area under the study regions though more farmers reported to be getting a higher price for their produce than others this can be attributed to the milk marketing scheme where farmers who sell to consumers directly fetch higher prices than those who sell to middlemen. Kamau J. (2013) note in his findings that milk like any other commodity is subjected to the rule of

supply and demand where during dry season prices go up as supply is low. On the other hand during rainy season the prices go down due to increased production from farmers.

Table : 4.16 Land owned by farmers

Size of land (acre)	Frequency	Percentage
1 - 5	72	26.7
6 -10	75	27.8
11 - 15	64	23.7
16 - 20	21	7.8
Above 21	38	14
Total	270	100.0

The target population was a highly concentrated milk region and it was a scheme with good and favourable climate for dairy production. Out of 270 respondents 38(14%) had over 21 acres of land, thus a lot of farming activity was evident such as crop farming, Semi zero grazing system was practiced at the same time fodder farming was also practised, its important to note that land usage affects production more that the size of land.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Chapter five presents the summary of the findings of the study, Conclusion drawn from the findings and recommendation focused on addressing the objectives of the study and contribution to the study of knowledge and suggestion for further research based on issues raised in this study.

5.2 Summary of Findings

The study sought entailed four objectives notably Milk production, Animal husbandry, Technology and feeding management of dairy animals on improvement of household income in Bungoma County. The study found out Dairy farming was dominated by Female 175(64.8%) while men were at 95(35.2%), the study found out that the numbers of years farmers have practiced below 5 years was 37.8% was the majority, from 6 to 10 year was 23.3% from 11-15 years was 15.6%, from 16-20 was 9.6and above 21years 13.7%. The study found out that illiteracy level was hindered improvement of household income where 38.9% were primary level, 34.1% were secondary level and 27% were tertiary level.

5.2.1 Influence Milk production on of households income

The study found out how milk production influenced improvement of household income the researcher found that the respondents who were aware of aspects such as animal breed, nutrition and herd size affect milk production, from the findings it was evident that the respondents agreed to a very great extent that milk production influenced household income as expressed with a mean of 1.49, this was as best practices were employed thus ensure they maximized milk production. Regarding the herd size, it was evident that the respondents to some degree disagreed as expressed with a mean of 3.23 the findings denotes that the herd size is not as important as breed and nutrition in milk production.

5.2.2 Influence of Animal Husbandry on improvement of household income

The study sought to deduce that animal husbandry to a very great extent influenced household income as expressed with a mean of 1.53 meaning they were aware and practiced it. Aspects which were strongly agreed as factors influencing animal health and subsequent level of milk production include detecting animal diseases early which the respondents were aware as expressed with a mean of 1.87, following correct treatment procedures whenever the animal is sick as a way of ensuring their animal health as expressed with a mean of 2.41

denotes aspect that the respondents agreed, and protection of animals from extreme weather expressed with a mean of 1.70 of respondents agreed to be practicing.

5.2.3 Influence of Technology on improvement of household income

The findings as expressed by a mean of 2.29 denotes that the respondents were aware of dairy technologies with a slight deviation of 1.254 signifying that some respondents were not aware. Hence technology to a moderate extent influenced improvements of household income. Various factors regarding technology which were strongly agreed upon as aspects that also influenced the improvements of household income include mating system, artificial insemination, preferred the bull, as expressed with a mean of 2.67, 2.33 a used of suitable milking and storage equipment, harvesting milk under hygienic conditions to prevent physical and microbiological contamination, Mastitis testing was reported at a mean of 3.68 which denote the respondents to lower extent hence chances of infection are high thus impacting on household income. with a mean of 2.13 the respondents agreed to having skills on feed production and conservation

5.2.4 Influence of Feeding management on improvement of household income

The study established that feeding management to a great extent influence improvement on household income. Freedom from hunger, freedom from thirst, to a very great extent influence milk production. As expressed with a mean of 1.53 this denotes that the respondents were aware of good feeding practices which was to a very great extent, from the findings the respondents employed various feeding systems, semi zero grazing was to the most preferred as agreed among the respondents at 77(26.7%) the distribution of various feeding methods among the respondent also varied though with a minimal variance of .861 The respondents agreed with a mean of 2.54 ration measurement.

5.2.5 Cross cutting issues

The study further deduced that to a great extent, cross cutting issues in dairy farming influence household income. It became clear that cultural practices and extension services was to a moderate extent influenced Dairy farming practice as expressed with an aggregate mean of 2.36 and deviation of 1.295 respectively

5.3 Conclusions

The study concludes that for households income to be successful, Dairy farming practices needs to be adhered to more so on milk production, The breed of animal and feeding animals on good quality feeds, influence the level of milk production.

The study further deduced that animal husbandry to a very great extent influence the level of improvement of household income. It was clear that detecting animal diseases early, preventing spread of disease among animals, ensuring there are mechanisms to prevent transmission of zoonosis and following correct treatment procedures whenever the animal is sick were aspects if ignored lead to deterioration of animal health and influenced level of milk production.

On the topic of technology this study concludes that technology to a moderate extent influence improvement of household income. in reproduction, it was clear that a number of farmers still preferred the bull as opposed to AI, practicing good milking routines and ensuring high cleanliness standards when handling the cows were aspects of animal hygiene that influence the level of milk production not all farmers used suitable and well maintenance of milking and storage equipment, hence exposing milk to contamination thus losses.

The study further deduced that Feeding management to a great extent influenced improvement of household income. The study also deduced that various feeding methods were employed by the farmers to ensure the animals were free from hunger and thirst, most farmers gave rations depending of the nutritional requirement and weather, majority of farmers used sacks for ration measurement proper feeding to a very great extent influence milk production.

The study further concludes that cross cutting issues of dairy animals influence household income, Extension officers visits to Dairy farms is key in promoting high standards of bio-security which in turn minimises diseases morbidity and increased production and Cultural practices are still practiced and these had affected the production in dairy farms and loses in terms of disease wiping out the flock.

5.5 Recommendations

This study made the following recommendations based on the findings

5.5.1 Milk production:

Though the project has recorded increase quantity of milk delivered to milk collection centres there is need for improved milk quality thus the study recommends that there should be increased availability of good quality heifer by among farmers and work in collaboration with KLBO to increase the number of dairy cows registered as this will enhance improvements of income for the household.

5.5.2 Animal husbandry

Despite farmer being aware of good animal husbandry practices including calf rearing, housing, hygienic milking practices, record keeping etc. this study found out that farmers are yet to adopt practices that prevent introduction and spread of animal diseases by maintaining good hygiene and biosecurity standards thus the study recommends farmer be empowered with basic knowledge about animal health and herd health and extensions officers to continue to provide farmers training beyond the project life.

5.5.3 Technologies

The study found out there is low uptake of technologies among farmers, thus the study recommends that the farmer groups will be categorised depending on ability to pay for the various types of breeding programmes. Farmers will be encouraged to use bull, AI, sexed and or embryo transfer according to their ability, Increase adoption of technologies that improve milk productivity such as Total Maxed Ration (TMR), Pulverize, Chaff cutter, and access to equipment for ration making by farmers will be enhanced through linking them to suppliers of such equipment

5.5.4 Feeding management

The study recommends increased acreage of land under fodder establishment and quantity conserved for dry season, conservation of fodder and production of quality homemade concentrates, silage, hay and fodder crops like luceana should be promoted.

5.5.5 Extension services

From the findings the number of extension officers available as opposed to farmers was low, therefore the study recommend that the project conduct ToTs for lead farmers and link each farmer group to lead farmer, the farmers will be given general training on extension service and then asked to pick right people amongst themselves who will be given more training identified as lead former. The lead farmer will be the link between the rest of the farmers and the project as well as extension service providers.

5.6 Suggestions for Further Studies

(i) Further study should be conducted on the influence of dairy farming practices on improvement of household income in other counties in Kenya so as to allow for generalization of the findings. (ii) Another study should be done to determine the influence of emerging trends in agribusiness on improvement of household income. (iii) A similar study should also be done on other farming practices such as poultry farming.

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Yuval Rachmilevitz, CEO of Israel's AFIMILK

APPENDICES

Appendix I: Research Authorization Letter from UON



**UNIVERSITY OF NAIROBI
OPEN, DISTANCE AND e-LEARNING
SCHOOL OF OPEN DISTANCE LEARNING**

Our Ref.: UON/CEES/KSM/1/16

University Of Nairobi Plaza
Oginga Odinga Street
P.O. Box 825,
KISUMU. Kenya

Telephone: Kisumu 057-2021534


RE: WERE MARY - REG NO: L50/82579/2015

This is to inform you that the above named **Mary Were** is a student at the University of Nairobi, Open, Distance and e-learning centre, School of Open and Distance learning, Kisumu Campus, pursuing **Masters in Project Planning and Management**.

Mary has completed her course work and examinations successfully and she is now undertaking his Research Project which is a pre-requisite for the course. The Project is entitled: **"Influence of Dairy Farming Practice in Improving Household Income; A Case Study of Small Holder Dairy Commercialization Project in Bungoma, Kenya"** The purpose of this letter therefore is to request you to allow the student to access the data or information he may need for purpose of this study. The data is required for his academic purposes only and not for any other reasons.

We would appreciate any assistance that may be given to enable her carry out the study.

Yours faithfully,


Dr. Stephen Okelo, PhD
COORDINATOR ODeL
KISUMU CAMPUS



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Appendix II: Research Authorization Letter from NACOSTI



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
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P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/17/27978/18466**

Date: **3rd August, 2017**

Mary Akoth Were
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *“Influence of dairy farming practices on improvement of household income in Kenya: A case study of smallholder dairy commercialization programme in Bungoma County,”* I am pleased to inform you that you have been authorized to undertake research in **Bungoma County** for the period ending **3rd August, 2018.**

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

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

**GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO**

Copy to:

The County Commissioner
Bungoma County.

The County Director of Education
Bungoma County.

Appendix III: Research Permit

THIS IS TO CERTIFY THAT:
MISS. MARY AKOTH WERE
of UNIVERSITY OF NAIROBI, 1671-40100
KISUMU, has been permitted to conduct
research in Bungoma County

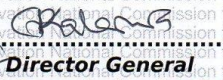
Permit No : NACOSTI/P/17/27978/18466
Date Of Issue : 3rd August,2017
Fee Received :Ksh 1000

on the topic: INFLUENCE OF DAIRY
FARMING PRACTICES ON IMPROVEMENT
OF HOUSEHOLD INCOME IN KENYA: A
CASE STUDY OF SMALLHOLDER DAIRY
COMMERCIALIZATION PROGRAMME IN
BUNGOMA COUNTY

for the period ending:
3rd August,2018



Applicant's
Signature


Director General
National Commission for Science,
Technology & Innovation

CONDITIONS

1. The License is valid for the proposed research, research site specified period.
2. Both the Licence and any rights thereunder are non-transferable.
3. Upon request of the Commission, the Licensee shall submit a progress report.
4. The Licensee shall report to the County Director of Education and County Governor in the area of research before commencement of the research.
5. Excavation, filming and collection of specimens are subject to further permissions from relevant Government agencies.
6. This Licence does not give authority to transfer research materials.
7. The Licensee shall submit two (2) hard copies and upload a soft copy of their final report.
8. The Commission reserves the right to modify the conditions of this Licence including its cancellation without prior notice.



REPUBLIC OF KENYA



National Commission for Science,
Technology and Innovation

RESEARCH CLEARANCE
PERMIT

Serial No.A 15260

CONDITIONS: see back page

Appendix IV: Research Questionnaire

Kindly answer the following questions by writing a brief answer or ticking in the boxes provided.

PART A: BACKGROUND INFORMATION

A1) Please indicate your gender. Male [1] Female [2]

A2) How long have you practiced dairy farming ?

1 to 5 years [1] 6 to 10years [2] 11 to 15 years [3] 16 to 20 years [4]

21 years and above [5]

A3) Household head level of education Primary (1) Secondary (2) Tertiary (3)

8A4) Farm size (acres).....

A5) At what price do you sell your milk?.....

A6) How many litres of milk are produced on your farm per day.....

PART B: Milk production

B7) Does milk production in dairy farming influences improvements in household income?

[1] Yes [2] No

B8) What is your level of agreement on the following statements?

	1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly disagree
B8a) The breeds matters when is comes to milk production					
B8b) There is quality assurance from the feed supplier					
B8c) I believe that the herd size influence milk yield					

Part C: Animal Husbandry

C9) Do you practice good animal husbandry on your farm on day to day basis?

Yes [1] No [2]

C10) What is your level of agreement on the following statements?

	1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly disagree
C10a) Animals are free from disease and hunger					
C10c) Animals are protected from extreme weather conditions					
C10d) I follow correct treatment procedures whenever the animal is sick					

PART D : Technology

D11). Are you aware of any technology in dairy farming that influences improvements of household income? Yes [1] No [2]

D12) What is your level of agreement on the following statements?

	1 Strongly agree	2 Agree	3 Neutral	4 Disagree	5 Strongly disagree
D12a) Bull is the preferred mating system					
D12b) I believe I use suitable equipment for milking and storage					
D12c) I test for mastitis with a strip cup					
D12d) I have skills on feed production and conservation					

PART E: Feed Management

E13) Are you aware that proper feeding of Dairy Animals influences improvements of household income? Yes [1] No [2]

E14) What is your level of agreement on the following statements?

	5 Very great extent	4 Great extent	3 Moderate extent	2 Low extent	1 Very low extent
E14a) Livestock feed freely in their own					
E14b) I produce my own feeds					
E14c) I measure the daily ration for the animals					

E15) To what extent do the following influence income in your dairy farming project

	5 Very great extent	4 Great extent	3 Moderate extent	2 Low extent	1 Very low extent
E15a) Cultural practices					
E15b) Visits from extension officers					

THANK YOU FOR PARTICIPATING

Appendix V: Questionnaire for the key informants

1. Gender Male[] Female[]

2. What is your role in the SCDP project?
Government officer[] Project officer [] Community leader []

3. Do Dairy farmers in this area produce enough milk Yes[] No[]

4. If no what plans do you have in place to ensure that milk production from the farmers is above average.....

5. In your own opinion are farmers employing skills that they have acquired to improve earnings at the household levels
.....

6. What control measures do you have in place to control livestock diseases.....

7. How accessible are animal feed and health services in this locality
.....

8. What type of feeds is mostly used in your locality.....

9. What are the challenges associated with this project?
.....

10. What are the gains recorded from this project?.....

THANK-YOU FOR PARTICIPATING