

**ANALYSIS OF THE SOCIO-ECONOMIC CONTRIBUTION OF DONKEY
OWNERSHIP AND USE TO HOUSEHOLD LIVELIHOODS IN KIAMBU COUNTY,
KENYA**

DAVIES BARASA MWASAME

A56/83706/2015

A THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE AWARD OF THE
DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL AND APPLIED ECONOMICS

DEPARTMENT OF AGRICULTURAL ECONOMICS
FACULTY OF AGRICULTURE
UNIVERSITY OF NAIROBI

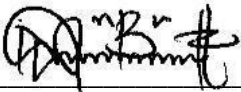
2020

Declaration

This thesis is my original work and has not been presented to any other institution for any award.

Davies Barasa Mwasame

A56/83706/2015

Signature:  _____ Date 19th June 2020

This thesis has been submitted with our approval as University supervisors.

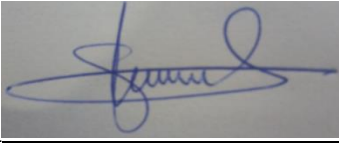
1. Dr. David Jakinda Otieno

Department of Agricultural Economics, University of Nairobi

Signature:  _____ Date: 19th June 2020

2. Dr. Hillary Thadiaz Nyang'anga

Department of Agricultural Economics, University of Nairobi

Signature:  _____ Date: 19th June 2020

UNIVERSITY OF NAIROBI

Declaration of Originality Form

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

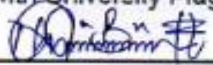
Name of Student DAVID BARASA MNASAME
Registration Number ASG/83706/2015
College AGRICULTURE & VET. SCIENCE
Faculty/School/Institute AGRICULTURE
Department AGRICULTURAL ECONOMICS
Course Name AGRICULTURE & APPLIED ECONOMICS

Title of the work

ANALYSIS OF THE SOCIO-ECONOMIC CONTRIBUTION OF DONKEY OWNERSHIP AND USE TO HOUSEHOLD IN KIAMBU COUNTY, KENYA

DECLARATION

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

Signature 

Date 17th June 2020.

Dedication

I dedicate this thesis to my beloved wife Branice Barasa and son Kibali Barasa for their love, moral support and encouragement throughout the study.

Acknowledgement

First, I thank God for life and strength that were limitless throughout my study. This work would not be done if He had not favored me this much. My gratitude also goes to my parents Francis Wekesa and Sara Odinga for the encouragement and support during my course.

Secondly, I thank my supervisors Dr. David Jakinda Otieno and Dr. Hillary Nyang'anga for their academic mentorship since the formative stages of this study. To my peers Chris Mutsami, Deborah Muricho and Dennis Olumeh, I am grateful for your input in my work.

Finally, I wish to thank the African Economic Research Consortium (AERC) for funding my course work and data collection. I also wish to extend my regards to Kenya Network for Draft Animals Technology (KENDAT) for facilitating my access to donkey owners' groups in Kiambu County for purposes of the field survey.

Abstract

Donkeys play an important role in household livelihoods, especially among rural and peri-urban households. However, donkeys continue to face numerous challenges, including; disease, injuries and mistreatment. This is attributed to a lack of attention from policy makers and livestock programs. Empirical literature on the contribution and livelihood linkages of donkey use is a potential pathway to inform policy. This study sought to quantify and document the contribution of donkeys on household livelihoods using the sustainable livelihood approach (SLA) in Kiambu County.

Multi-stage sampling method was used to select 134 donkey owners and 121 non-owners who were interviewed through a questionnaire-based survey. Economic returns from ownership and use of donkeys were assessed using gross margin analysis. A multiple regression model was then applied to assess the effect of donkey welfare indicators and household socio-economic factors on annual donkey returns. A Tobit model was estimated to analyze the effect of donkey use on household female labor time.

The findings showed that donkey ownership was a profitable venture; with an average return on investment of Kshs 6 per shilling invested. Donkey welfare factors such as frequency of veterinary care and the number of donkey's working hours were found to significantly influence the economic returns. The results also showed that donkey ownership significantly reduces the amount of time female persons spend on household chores. The study concludes that, donkey welfare is inextricably linked with welfare of their users, while lack of attention to donkey welfare negatively affect the welfare of donkey users. The study, therefore, recommends the need to enhance donkey welfare at all levels including policy and livestock program priorities. Finally, donkey promotional programs should focus on female-headed households for maximum contribution.

Key words: Donkeys, women, livelihood, Kenya.

Table of Contents

Declaration.....	i
Dedication.....	ii
Acknowledgement	iv
Abstract.....	v
List of Figures.....	viii
List of Tables	ix
List of Acronyms	x
CHAPTER ONE.....	1
1. 0 INTRODUCTION	1
1.1 Background of the Study	1
1.2 Statement of the Research Problem	4
1.3 Objectives of the Study.....	5
1.4 Research Hypotheses	5
1.5 Justification of the Study	5
1.6 Study Area	7
1.7 Organization of the Thesis	8
CHAPTER TWO	9
2.0 LITERATURE REVIEW	9
2.1 History of Donkeys and their Role in Human Livelihoods.....	9
2.2 Profitability of Animal Power.....	10
2.3 Linkages between Working Animals and Household Livelihoods.....	10
2.4 Conceptual Framework.....	12
CHAPTER THREE	14
3.0 CHARACTERIZATION OF DONKEY OWNERSHIP AND USE IN KIAMBU COUNTY	14
3.1 Abstract.....	14
3.2 Introduction.....	15
3.2. Sampling and Data Collection	15
3.3 Data Handling and Analysis	17
3.4 Characteristics of Donkey Owners and Non-owners	17
3.5 Role of Donkeys	20
3.6. Diagnostic Tests.....	21
CHAPTER FOUR.....	23
4.0 QUANTIFYING THE ECONOMIC CONTRIBUTION OF DONKEYS TO HOUSEHOLD LIVELIHOODS	23
4.1 Abstract.....	23
4.2 Introduction and Research Issue	24
4.3 Analysis of Returns from Donkey Ownership and Use	25

4.4 Factors Influencing Gross Margins to Donkey Ownership and Use.....	25
4.5 Economic Returns from the Use of Donkeys.....	28
4.6 Determinants of Gross Margins to Donkey Use	31
CHAPTER FIVE	34
5.0 EFFECT OF DONKEY OWNERSHIP ON HOUSEHOLD FEMALE LABOUR TIME ALLOCATION.....	34
5.1 Abstract.....	34
5.2 Introduction.....	35
5.3 Theoretical Framework.....	36
5.4 Empirical Model	38
5.5 Justification of Variables in the Tobit model.....	39
5.6 Effect of Donkey Ownership on Female Labor Time Allocation.....	42
CHAPTER SIX.....	44
6.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....	44
6.1 Summary	44
6.2 Conclusion	45
6.3. Recommendations.....	45
REFERENCES	47
APPENDIX I: SURVEY QUESTIONNAIRE	53
APPENDIX II: Correlation Matrix.....	67
APPENDIX III: Test for Multicollinearity	69
APPENDIX IV: Test for normality	70
APPENDIX V: Durbin Wu Hausman Test.....	71

List of Figures

Figure 1: World population trend of donkeys.....	3
Figure 2: Donkey population trend post export ban in Africa.....	4
Figure 3: Map of Kiambu County and study sites.....	8
Figure 4: The allocation of income from donkeys in household needs.....	12
Figure 5: Potential role of donkeys in livelihood improvement.....	13
Figure 6: Household ranking of donkey roles.....	20
Figure 7: Percentage income contribution from donkey related activities in Kiambu County. ...	30
Figure 8: Annual gross margins disaggregated by mode of donkey use.....	31

List of Tables

Table 1: Differences in means of characteristics of donkey owners and non-owners.....	19
Table 2: Explanatory variables and expected signs	28
Table 3: Annual Gross Margin Analysis for Donkey Ownership and Use.....	29
Table 4: Factors Influencing Gross Margins From Donkey Use in Kiambu County	32
Table 5: Definition of variables included in the Tobit model.....	41
Table 6: Tobit model estimates of effect of donkey ownership on household female labor time	42

List of Acronyms

ADP	Animal Draft Power
AGRA	Alliance for a Green Revolution in Africa
CBA	Cost Benefit Analysis
DDO	Donkey Development Organization
DFID	Department for International Development (UK)
DSK	Donkey Sanctuary Kenya
FAO	Food and Agriculture Organization of the United Nations
HLP	High Level Panel
HP	<i>Heshimu Punda</i>
KENDAT	Kenya Network for Draft Animals Technology
KNBS	Kenya National Bureau of Statistics
KSPCA	Kenya Society for Protection and Care for Animals
SDGs	Sustainable Development Goals
SLA	Sustainable Livelihood Approach
UN	United Nations
UNICEF	United Nations Children Fund
WHO	World Health Organization

CHAPTER ONE

1. 0 INTRODUCTION

1.1 Background of the Study

Working animals are important in farm and non-farm households especially in most developing economies. They perform a significant role in provision of farm power (draft animals), labor saving, income generation, and food; donkeys are a case in point. They are beasts of burden as referred to in the majority of developing countries; at least 90% of their use is the provision of draft power or as pack animals (Eli-Jones et al., 2005). In Africa, donkey owners have reported significant livelihood improvement due to donkey use (Valette, 2015). For instance, farmers in Kiambu reported that owning donkeys enabled them to afford school fees, healthcare and access food. In Ethiopia, Curran and Smith (2005) reported that use of donkeys had a positive contribution to female-headed peri-urban households; respondents reported that they bought more superior food (*tef*) compared to when they did not have a donkey.

Further, farmers still face challenges of accessing markets due to poor roads particularly in Sub-Saharan Africa. In such instances, donkey use could play a significant role in ameliorating these problems. In Tanzania, Sieber (2004) opined that donkey use is, in fact, comparable to road development, as they provide a cheap option for market access. Drudgery among women is also an important setback to women's healthy living, especially in developing countries. In Africa, most women are unable to respond to economic incentives due to their role as household laborers including childcare. Donkey use is an apt intervention to stop this burdening reality as they can considerably reduce the workload of women. Studies have reported that donkeys are more beneficial to women compared to other working animals such as oxen because they are calm, hence easy to handle by both women and children (Mutua, 2004). Decreasing land sizes and scarce labor especially in rural areas due to youth out-migration provides an opportunity for donkey use. In peri-urban Kenya, mainly youthful individuals use donkeys as a business to transport merchandise (Valette, 2015).

Donkeys also provide synergies to nutrient cycles, marketing and farming systems. They facilitate transportation of harvested produce; livestock feed, market products and water. In

Kenya, rice farmers in Mwea have greatly benefited from donkeys by using them to move seedlings to the waterlogged farms, which could otherwise not be accessed by motorized implements (FAO/Brooke, 2011). It is therefore evident that use of donkeys is a livelihood strategy for households especially women and the youth. Mburu et al. (2012) noted that the use of working animals contributes to increased farm intensification and productivity, which translates to increased income and improved livelihood. Chang et al. (2011) reported that donkey use contributes to household livelihood in five-fold; financial capital, physical capital, natural capital, human capital and social asset. Financial and social capital form a significant aspect of donkey role among households in Kenya (Kendagor and Njoroge, 2014). Donkeys contribute to the financial capital of households through generation of additional income. In this case donkeys generate income through savings by performing household work, and earning through transportation of other peoples' goods. Donkeys also contribute to household social capital through reducing drudgery especially among women. Other social contributions include stronger ties with community members through lending donkeys and participation in ceremonies (Curran and Smith, 2005).

Further, the global donkey population has been increasing in the past decade (Figure 1). However, donkey population recorded a sharp decline in 2016 and could worsen further if no action is taken. The decline is attributable to increased demand for donkey products such as hides and meat specifically in China (FAOSTAT, 2019). This justifies the need for policy makers to take deliberate steps in abating the trend.

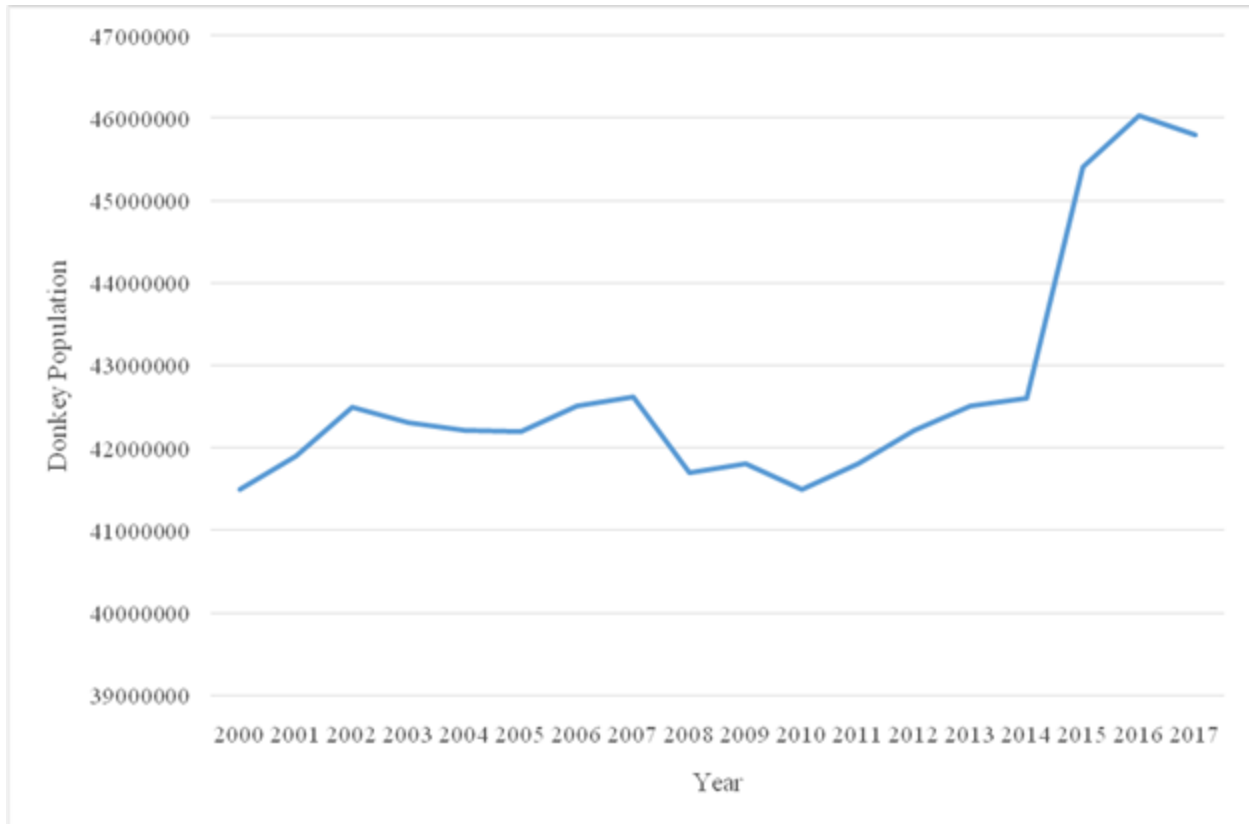


Figure 1: World population trend of donkeys

Source: FAOSTAT (2019).

In Africa; Ethiopia, Niger, and Tanzania are among the nine countries that have imposed an export ban on live donkeys and related products; and this has resulted to an upward trend in donkey population in their countries despite the global decline (see Figure 2).

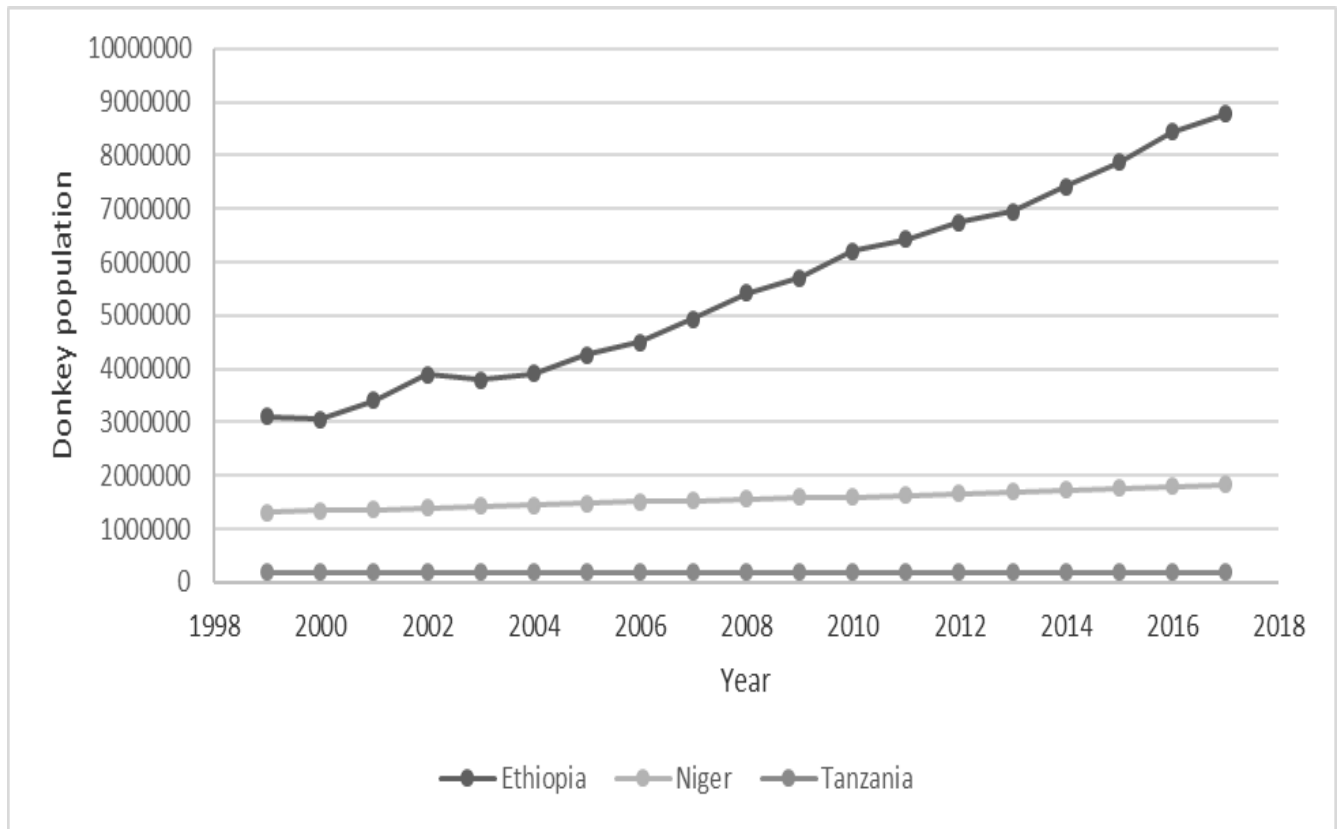


Figure 2: Donkey population trend post export ban in Africa

Source: FAOSTAT (2019).

Kenya still lags behind in taking steps towards protection and use of donkeys. This is despite the role of non-state actors such as Kenya Network of Draft Animal Technology (KENDAT), Donkey Sanctuary Kenya (DSK) and Kenya Society for Protection and Care for Animals (KSPCA) that have demonstrated efforts towards donkey use and protection. The expansion of such initiatives to national level is imperative for a significant effect on donkey welfare.

1.2 Statement of the Research Problem

Donkey use is a major source of livelihood for many households in the world. In Kenya, over seven million people are estimated to benefit directly from working donkeys (Valette, 2015). In most communities, donkeys are regarded as low-status animals due to their low prices. Some farmers indicate that buying a new donkey was cheaper than the cost of their veterinary care (Kendagor and Njoroge, 2014). This has seen donkeys being mistreated and poorly handled. It is estimated that a third of working donkeys in Kenya are in poor health conditions arising from

human abuse, mistreatment and malnutrition (KENDAT, 2019). Valette (2015) affirms that most working donkeys are in poor health and working conditions. This is attributed to lack of policy on donkey protection and veterinary care provision.

Recognition of the role of donkeys by policymakers is an important step towards promoting donkey welfare. However, donkey use has been neglected and sidelined in policy debates as the donkey sub-sector remains conspicuously missing from livestock policy documents. In Kenya, the lack of proper knowledge, negative attitude and poor practices towards donkeys have left donkeys wounded and miserable (Valette, 2015). Improper handling, overworking and negative myths are among the main issues facing donkeys. Limited statistical evidence on the value of donkeys is reported as a major drawback to their protection (Behnke and Muthami, 2011; Van Dijk et al., 2014). Hence, the need to address this gap through research to create evidence-based debate on promotion of donkey use and protection. The current study thus, informs the debate on the protection of working donkeys by providing evidence on the economic and non-economic value of donkeys to human livelihood. Specifically, the study focused on the income contribution of donkeys and its effect on female labor time allocation.

1.3 Objectives of the Study

The overall objective of the study was to assess the socio-economic contribution of donkey use on livelihoods of donkey owners in Kiambu County, Kenya. The specific objectives were to:

1. Characterize donkey ownership and use.
2. Assess the factors influencing the gross margins from donkey use.
3. Assess the effect of donkey ownership on household female labor time allocation.

1.4 Research Hypotheses

1. That donkey use has negative gross margins.
2. That donkey welfare factors taken singly do not influence gross margins from donkey use.
3. That donkey ownership has no effect on household female labor time allocation.

1.5 Justification of the Study

Understanding whether donkey use generates positive gross margins provides empirical evidence on the income contribution of donkeys as an appropriate livelihood strategy and offers useful

insights to support the promotion of donkeys as a convenient source of farm power. This is in line with section 3.7 of the Kenya National Agricultural Mechanization Policy 2015, which states that "*National and County governments shall create awareness on the use of appropriate mechanization technologies.....*". Existing policies continue to view donkeys as non-conventional livestock; this negative perception reduces donkey visibility and importance (see Republic of Kenya, 2019a). The study therefore provides evidence on the significant role of donkeys to livelihoods and thus, draws the attention of policy makers on the need to re-think the place of donkeys in development.

Sims and Kienzle (2016) reported that farm mechanization is a significant determinant of achieving the United Nations Development Goals (UN SDGs) 1 and 2. These goals seek to end poverty and hunger, which is a pre-requisite for increased labor and land productivity. According to the Kiambu County Integrated Development Plan 2013-2017, the key challenges for agricultural development include decreasing labor force and diminishing land sizes (Republic of Kenya, 2015a). Although the County does not prioritize agricultural mechanization *per se*, decreasing land sizes is a setback to tractor-based farm power. Information on the returns on the use of donkeys is important to rethink a solution for declining farm labor.

According to the National Gender and equality, Policy and Sessional Paper number 2 of 2006, gender equality is emphasized (Republic of Kenya, 2011). The policy provides a framework from which all levels of government can operationalize gender mainstreaming in planning and programming. The study here contributes to the policy by providing insights into the role of donkey in engendering equality. Understanding the effect of donkey ownership and use on female labor time allocation provides a basis for promoting donkey use as a women empowerment program. In addition, the findings of the study support target number 5.4 of the UN SDGs (UN Women, 2016), which aims to achieve gender equality and empowerment for all women and girls.

The literature on working animals is limited. Most studies have focused on oxen and draft power (Valette, 2015). Behnke and Muthami (2011) opined that the lack of empirical insights on the economic value of donkeys and other animals is a setback to policy interventions. The study here

therefore, offers empirical evidence of the costs and returns on donkey ownership and their effect on household livelihood outcomes.

1.6 Study Area

This study focused on Kiambu County (Figure 3). The County has a population of at least 1.8 million people with over 50% in urban areas (Republic of Kenya, 2015a). Agriculture accounts for 17.4 % of County income and the main economic activity for over 70% of the population in the region. Small land sizes are a major constraint to agricultural production with each household having an average of 0.36ha being the household average (Republic of Kenya, 2015a). The area is peri-urban in nature, where donkey activities are generally more commercial compared to other parts of the country. In addition, the County has relatively higher proportion of well-managed donkeys compared to other parts of the country according to Vallete (2015). This would increase accuracy in calculation of returns from donkey-use, hence the choice of the study area. Three sub-counties were purposively selected; Kikuyu, Limuru and Lari, which were actively engaged in donkey-use and welfare promotion by KENDAT.

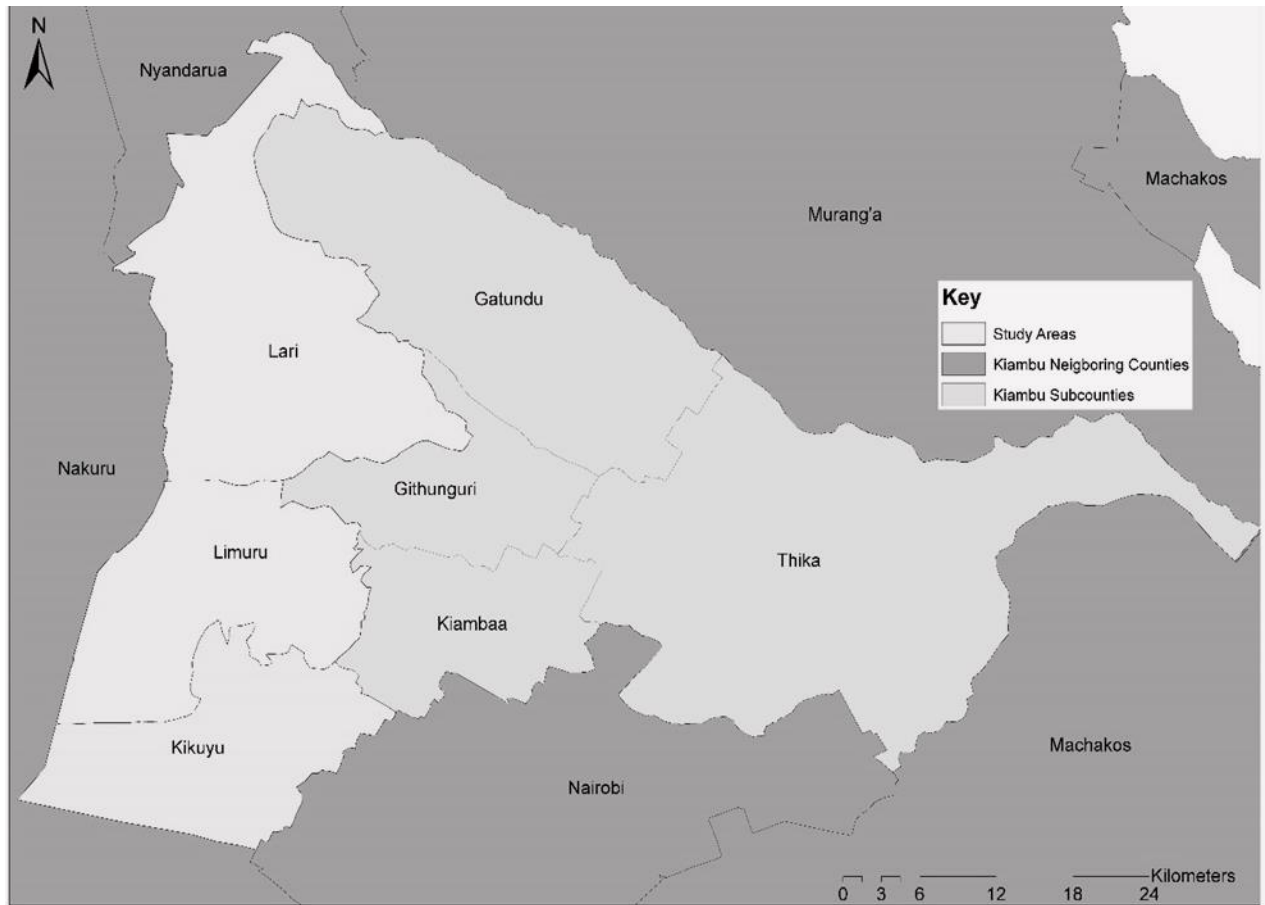


Figure 3: Map of Kiambu County and study sites

Source: Edited from google maps (2019).

1.7 Organization of the Thesis

This thesis is organized in six chapters. The first chapter provides a general introduction of the study, the research problem, objectives, hypothesis and justification. In chapter two, relevant literature is reviewed and explains the conceptual framework. Sampling procedure, data collection methods, descriptive statistics and diagnostics are presented in chapter three. Results and discussions of objective two and three are presented in chapter four and five, respectively using paper format. Finally, chapter six provides a summary of the thesis, key conclusions and recommendations.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 History of Donkeys and their Role in Human Livelihoods

Early literature on donkeys by Epstein (1971) indicates that they can be traced back to the 4th millennium from the Atlas Mountains to the Red Sea and the present-day northern Kenya. Donkeys are not conventional sources of food to majority of the households who domesticate them; instead, they were majorly kept as draft animals. However, records on the working of donkeys in the early age are scarce; this is attributed to the lowly status of donkeys as perceived in traditional society. Despite their perceived low status, the contribution of donkeys to human life led to their gradual spread to most parts of the world including Southern Africa and West Africa (Blench, 2004). For instance, in West Africa, donkey use became popular during Nigeria's economic recession in the 1980s. The recession led to unprofitable use of motorized machines for farm transportation (Starkey, 1995). It is also clear that the ability of donkeys to survive in harsh conditions contributed to their spread across Africa. This is evident as farmers reported using donkeys when their oxen died due to persistent droughts (Mutua, 2004).

In Kenya, donkeys are traditionally used for transportation of farm produce and other household chores. Their use for tillage has recently gained popularity due to harsh conditions that do not favor oxen (KENDAT, 2015). The small size of donkeys makes them less preferred over oxen, which have higher energy power (Mutua, 2004). However, the prevalence of changes in agricultural systems, declining grazing fields and prevalence of disease have proved unfavorable to large animals such as oxen, thereby creating an opportunity for donkeys (Fernando and Starkey, 2004). The situation continues to be even worse as human population increases and droughts continue to intensify. It is estimated that over 7 million people in Kenya directly benefit from working donkeys (KENDAT, 2015). The major bottleneck on the history of the donkey is the lack of empirical studies to quantify their contribution, particularly in Kenya. This has significantly contributed to the lack of effective policies targeting donkeys. For example, livestock policies have mostly focused on dairy, beef and minimally on working animals. Further, most countries have neglected the role of working animals in the calculation of gross domestic product (GDP) (Behnke and Muthami, 2011) and this omission leads to

underestimation of the national GDP as well as lack of recognition of working animals in policy formulation.

2.2 Profitability of Animal Power

The literature on the profitability of donkeys is scarce, as most studies have focused on Oxen and Camels. Such studies include Ariaga-Jordan et al. (2005), Umar (2010), Teweldmehidin and Conroy (2010). However, there are studies that focused on the general contribution of donkeys to household livelihoods. For example, a study conducted in Ethiopia showed that donkeys are profitable as they increase household savings (Curran and Smith, 2005). Admassu and Shiferaw (2011) also estimated the annual net return from working equines and found that on average, a household receives a net annual return of USD330. Avornyo et al. (2015) also found that it was profitable to own a donkey in Ghana; a household with a single donkey was found to fetch a net earning of up to USD217 per annum.

While the farmers know donkey profitability, there remains a critical lack of recognition at higher levels. Valette (2014) suggests that there is a need to increase empirical evidence on the contribution of donkeys in order to stimulate the debate on donkey visibility and therefore welfare. For instance, the amount of income that a donkey can fetch for a household in Kenya remains unclear.

2.3 Linkages between Working Animals and Household Livelihoods

It is acknowledged that animal power is a significant contributor to household livelihood particularly in less developed countries (FAO/Brooke, 2011). Valette (2015) used the Department for International Development (DFID) sustainable livelihood framework to illustrate the importance of working animals. The contribution included uses such as fetching water, lending to neighbors in times of need, access to health care, draft services and selling in case of emergency.

Chang et al. (2011) identified the role of working animals (donkeys) in five dimensions of household livelihood assets. Donkeys can be used as physical capital assets used to increase the productivity of other productive assets such as providing farm manure, farm tillage and intensification of crop-livestock productivity. Admassu and Shiferaw (2011) also argue that ownership of donkeys confers social status. In Ethiopia, donkey ownership contributes up to

14% of family income, which is more than what other livestock provide. In Guatemala, loss of a donkey would, therefore, lead to a 57% loss of household's productive assets (Chang et al., 2011). Donkey ownership was also viewed as a natural capital by maintaining other natural assets such as manure and fetching water and livestock feeds for other livestock (FAO, 2011).

In Africa, Ethiopia provides a strong linkage between donkeys and human livelihoods. Martin-Curan and Smith (2005) reported that donkey owners in Ethiopia had better livelihood outcomes compared to those who did not own a donkey. On average, donkey owners who use the donkey, earn up to USD 2,272 per annum. Casual laborers and donkey owners who hire laborers earn approximately USD 1,389 and USD640 per annum, respectively (Valette, 2015). Women in developing countries have also reported positive results in the use of donkeys (FAO, 2014).

In Kenya, Kendagor and Njoroge (2014) reported that marginalized group used donkeys to recover from uncertainty, become self-sufficient, provide for their children and themselves, restore dignity and hope. However, women reported high incidences of donkey deaths due to injuries and disease, which is attributed to lack of policy intervention to equip women with the ability to care and improve donkey welfare. Figure 4 shows the allocation of income generated from donkeys to various household needs. For marginalized groups in Kenya, donkey use is a major income generating activity that provides food and other major household needs.

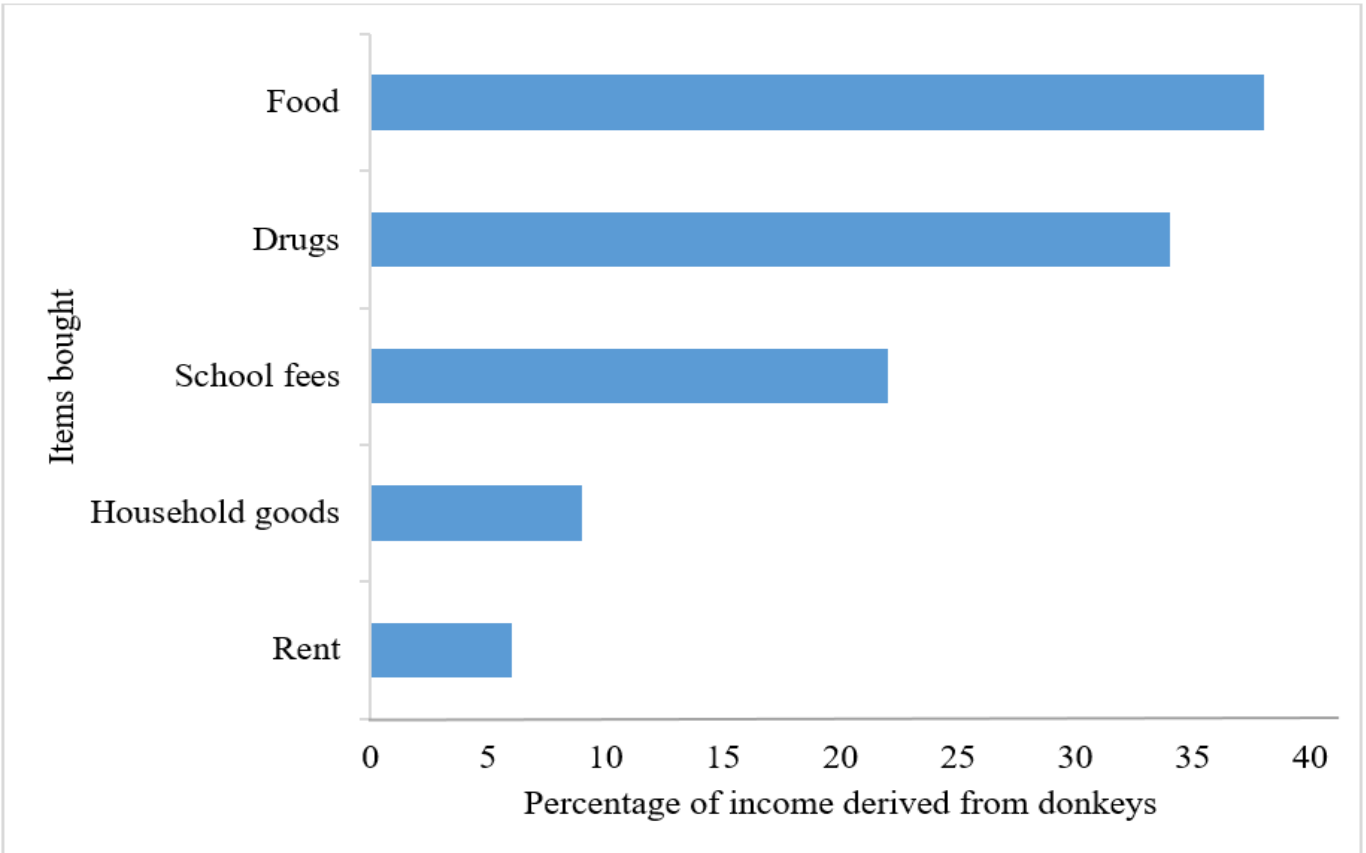


Figure 4: The allocation of income from donkeys in household needs

Source: Kendagor and Njoroge (2014).

Qualitative information suggests existence of linkages between donkey ownership and female labor use (see Curran and Smith 2005). Further, the FAO (2014) reported that 40% of donkey owners ranked reduction of female labor time as the most important role of donkeys in Ethiopia. This implies that donkey use is a potential labor-saving strategy for women. The United Nations High level panel of experts (UN HLPE) reported that use of donkeys is a potential strategy to achieve gender equality through redistribution of unpaid female work (UN-HLPE, 2016). However, there still exists a gap in literature, as most studies do not quantify the amount of time saved by donkeys.

2.4 Conceptual Framework

This study is anchored on the sustainable livelihood approach (SLA) proposed by Krantz (2001). The approach assumes that a livelihood comprises the capabilities, assets and activities needed to

earn a living (Figure 5). It lays emphasis on the asset base, the confronting vulnerability context and institutional structures limiting or facilitating the improvement of livelihoods over time. This approach provides a framework within which poverty reducing factors can be identified and appraised. The approach has previously been used in other studies to show how ownership of working animals is a potential pathway out of poverty (see for example, Curran and Smith 2005; Mburu et al., 2012; Selamawit, 2014).

In this study, it is assumed that households choose to use donkeys when faced with certain vulnerability processes such as drought, limited land sizes and unemployment. Donkeys are also used as intervening strategies to complement the existing ones such as livestock and crop production. Donkey use is then expected to improve household livelihood outcomes such as increased income, reduce workload for women and increase production efficiency. Ultimately, linkages between household socio-economic factors and donkey-use as a livelihood strategy were assessed.

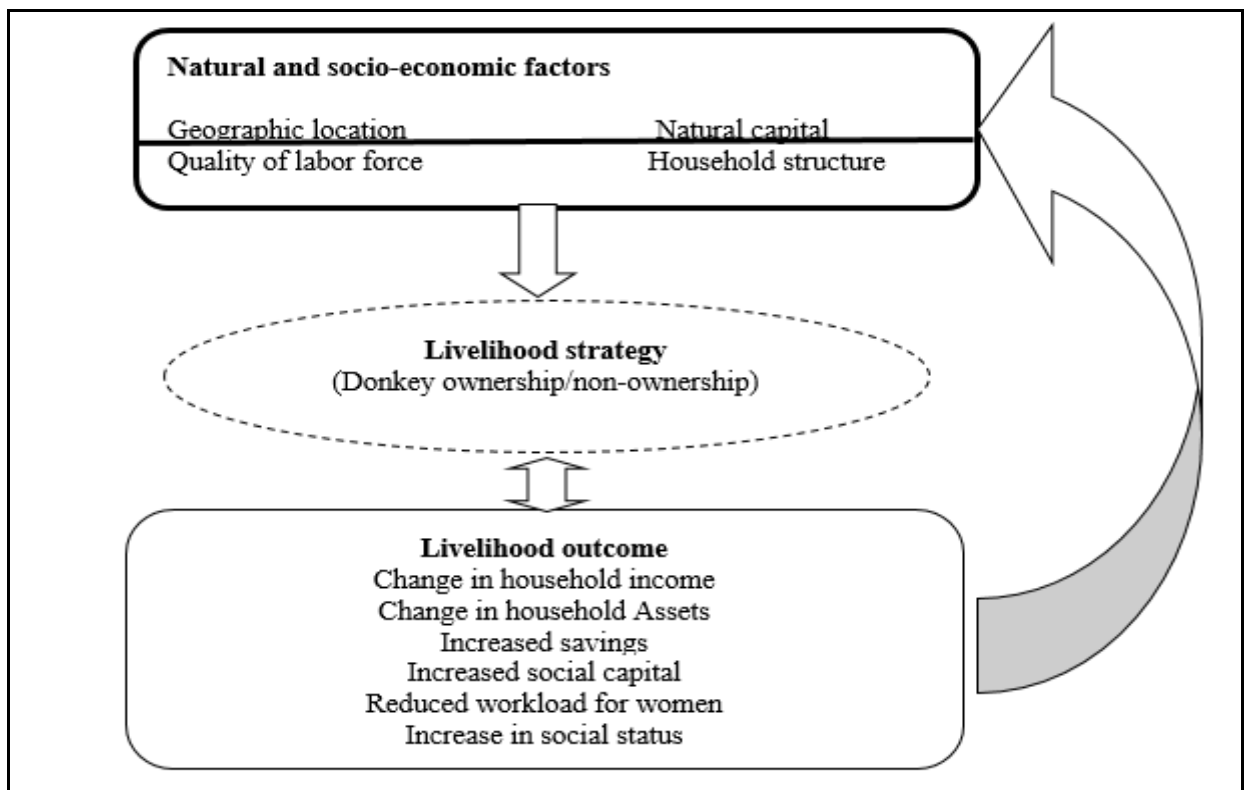


Figure 5: Potential role of donkeys in livelihood improvement

Source: Adapted from Peng et al. (2017).

CHAPTER THREE

3.0 CHARACTERIZATION OF DONKEY OWNERSHIP AND USE IN KIAMBU COUNTY

3.1 Abstract

Demand for donkey products is increasingly attracting attention from policy makers. Licensing of donkey slaughter houses and export of donkey products are among key steps made towards the donkey sub-sector in Kenya. Such efforts pose a threat to donkey population and welfare if implemented in without proper understanding of the role of donkeys and potential impact of such policies to donkey users. Understanding of socio-economic characteristics of donkey users is an important step towards profiling of donkey ownership and use. This chapter sought to characterize donkey owners and non-owners in Kiambu County and identify the main role of donkeys in the study area. Data was collected through a household survey questionnaire. Face-to-face interviews were conducted on 131 donkey owners and 121 non-owners, drawn from Kikuyu, Lari and Limuru sub-counties. Descriptive analysis was used to compare means and frequencies of different socio-economic characteristics.

Results have shown significant differences between donkey owners and non-owners. Education, household income, age of household head and household size were found to be significantly different between donkey owners and non-owners. Notably, donkey owners had a weaker profile with less education, lower income, larger household sizes with more elderly household heads. Fetching water and transportation of animal feeds were the main donkey roles as nearly 80% of donkey owners ranked fetching water as the most important donkey activity.

Keywords: donkey, household characteristics, Kiambu.

3.2 Introduction

The donkey is a herbivore originally reared in North East of Africa. The utilization of donkeys socially, economically and culturally varies widely depending on location and communities in which the donkey lives and works. In Kenya, donkeys are traditionally owned as a source of draft power for domestic and commercial purposes (KALRO, 2019). Donkeys are recognized for fetching water, firewood, transportation of animal feeds and household transport needs. The geographical location, economic status, cultural and social status of communities influence how they use donkeys. The draft national livestock policy identifies the donkey among the non-conventional or emerging livestock that have recently been recognized in the country as an alternative farming activity (Republic of Kenya, 2019b).

In the recent past, due to the realization of the potential contribution of donkey on human livelihood, efforts have been made towards promoting the donkey sector. In 1999, the donkey was gazetted as a food animal in Kenya. Further, donkey slaughter houses were exclusively licensed for export products. These efforts were intended to improve the commercial value of donkeys and increase job opportunities. However, an increase in demand without structured interventions to protect donkey population and welfare is likely to disrupt community livelihoods. There is limited attention on donkey research and development (FAO, 2014). There remains a dearth of knowledge on the mode of donkey ownership and usage in Kenya. Understanding socio-economic status of donkey users and donkey use situation is an important step in mapping the role of donkeys. This chapter provides socio-economic characteristics of donkey owners and non-owners.

3.2. Sampling and Data Collection

Most donkey owners especially in Africa use them for income generation and homestead activities. In Ethiopia, it was reported that 82% of donkey owners used them for both income generation and homestead activities, while 14% used donkeys exclusively for homestead activities (FAO, 2014). Following this, the current study assumed that all donkey owners keep them for a livelihood outcome (gain). Sampling was based on donkey ownership; two

populations were therefore sampled- donkey owners and non-owners. Cochran (1963) formula was applied to determine the sample size for each of the two categories as follows;

$$n_0 = \frac{z^2 pq}{e^2} \quad (1)$$

where; n_0 is the estimated sample size, e is the margin of error, p is the percentage of the population owning donkeys and q is equal $1-p$. Because the exact proportion of donkey owners was unknown at the time of the study. The study assumed that only 20% of the population own donkeys. The assumption was because there are only 1.8 million donkeys against 12 million households in Kenya (Kenya National Bureau of Statistics KNBS, 2009). This implies that only 15% of households in Kenya own donkeys, however according to Brooke (2015) Kiambu is expected to have a higher proportion compared to the national average due to the intensity of donkey use. A margin of error is required to range from 0.1 to 0.01 for a representative sample (Cochran, 1963). In this study a margin of error of 0.06 was selected with a z -value of 1.88; this margin of error was selected based on the low number of donkey owners as well as their remote location making it difficult to access and replace in case of non-response.

$$n_0 = \frac{0.2 * 0.8 * 1.88^2}{0.06^2} = 157.08 \text{ respondents} \quad (2)$$

This gave a sample size of 157 respondents for each category and 314 for the total sample. Other related studies such as Curran and Smith (2005), Admassu, and Shiferaw (2010) used similar sample sizes with a variation between 200 and 300 respondents.

Multi-stage sampling was used to select donkey owners and non-owners. Due to the scattered nature of donkey owners, KENDAT officials were consulted to assist in identifying them. In the first stage, donkey owners groups in Limuru and Kikuyu were purposively selected as peri-urban donkey users, while donkey owner groups in Lari were selected as rural donkey users. Lari sub-County does not have a classified urban centre according to the Republic of Kenya (2015a). Additionally, the sub-County has the largest land holding per household in Kiambu creating a more rural agricultural view compared to Limuru and Kikuyu.

In the second stage, systematic random sampling was undertaken on a sampling frame obtained from KENDAT to obtain 157 respondents for donkey owners. For each donkey owner, one non-

owner was selected in the same study area. However, due to inaccessibility of some areas especially Lari, only 81% of the target sample was achieved. Therefore, 57 and 77 donkey owners were interviewed from rural and peri-urban areas, respectively. For non-owners 41 respondents were interviewed from rural and 80 from peri-urban areas.

Two hundred and fifty five (255) respondents were interviewed using a semi-structured questionnaire. The questionnaire (Appendix I) comprised information on household characteristics, donkey ownership and use status and other livelihood outcomes. The questionnaires were pre-tested one week before the main survey to provide insights on possible adjustments required. Six trained enumerators were deployed to assist in implementing the face-to-face interviews. Household heads, their spouses or adult members of the household with knowledge of donkey ownership and management were interviewed. The data was collected in April 2018.

3.3 Data Handling and Analysis

The data was entered and analyzed using Microsoft excel and STATA 14. Microsoft excel was used in calculation of gross margins to donkeys. STATA 14 was used to estimate the linear regression model and the Tobit model. Results were presented in tables, charts and graphs.

3.4 Characteristics of Donkey Owners and Non-owners

The results in Table 1 show the differences between donkey owners and non-owners. The results show that there was a significant difference in means for age. In particular, age was higher among owners compared to non-owners. This is explained by the fact that as individuals grow older household labor supply decreases, hence requiring labor-augmenting strategies to accomplish household activities. This is consistent with results of Curran and Smith (2005) who reported that the majority of the women who owned donkeys were older than non-owners in Ethiopia.

Years of completed formal schooling was higher among non-owners. Consistent with the findings of Admassu and Shiferaw (2011) in Ethiopia, the results show that donkey owners in Kiambu had an average of 8 years of schooling, which was 2 years less than the non-owners. Avorny et al. (2015) reported a much lower level of education for donkey owners in Ghana, with owners having 5 years less than non-owners. This may be attributed to the suggestion by

Geiger and Hovorka (2015) that household heads who were more educated perceive donkey-use as a backward and traditional livelihood source meant for the uneducated.

The number of hours female members work in the household was significantly different between non-owners and owners. Specifically, results show that female working hours were fewer among donkey owners. This implies that when a household owns a donkey, women are relieved of certain household chores allowing them to venture in other non-household activities such as formal employment and participation in social activities. Household labor saving technologies are expected to free up more time for women compared to men (Cooke and Bishop-Sambrook, 2016). Brooke (2019) reported that households with donkeys offer women an opportunity to save some time to engage in other development activities outside household chores. The finding here also corroborates that of Curran and Smith (2005) that in Ethiopia women who owned donkeys had more time to do other things besides household chores.

Donkey owners had higher household size compared to non-owners. The result can be because the majority of the households used household members to work with the donkey; hence a lower household size meant lack of household labor to work with the donkey. The results showed that only 21% of the households hired laborers to work with their donkeys.

The study shows that only 9% of the donkey owners had formal employment compared to 19% for non-owners. This corroborates earlier observations that wealthier households are less likely to own a donkey compared to poorer ones. Admassu and Shiferaw (2011) reported a similar observation in Ethiopia, where the majority of wealthier households did not prefer using donkeys. This implies that households with limited income sources were more likely to own a donkey. The percentage of owners who were married was higher compared to non-owners. Specifically, 78% of donkey owners were married and 67% for non-owners. This conforms with the observations by Avornyo et al. (2015) that many people seek to diversify their income sources after marriage so as to offset new expenditure that come with increasing the household size.

Table 1: Differences in means of characteristics of donkey owners and non-owners

Variable	Donkey owners		Donkey non-owners		Mean Diff.	t-ratios
	Mean	Std. Dev	Mean	Std. Dev.		
Household size (number)	3.985	1.798	3.529	1.713	0.456	2.069**
Distance to the nearest murram road (Kms)	0.457	0.626	0.413	0.636	0.043	0.522
Distance to the nearest tarmac road (Kms)	1.408	1.478	1.299	1.589	0.108	0.537
Age of household head	46.450	15.035	41.385	11.950	5.065	2.905***
Level of education in completed years	7.927	3.241	9.757	3.281	-1.829	-4.294***
Household annual income (Kshs)	210,245.00	228,761.100	239,120.30	346,073.70	-28,875.30	-0.727
Number of females' housework hours per day	2.580	1.988	3.446	2.229	-0.866	-3.561***
Gender of household head (1= Male, 0 = female)	0.851	0.358	0.752	0.434	0.099	1.990**
Access to credit (1 = Yes, 0 = no)	0.106	0.309	0.110	0.314	-0.004	-0.104
Household saving (1 = Yes, 0 = no)	0.455	0.516	0.432	0.501	0.022	0.354
Formal employment (1 = Yes, 0 = no)	0.090	12.042	0.190	0.394	-0.100	-2.321**
Household adult female members falling sick within 3 months (1=Yes, 0 = no)	0.106	0.309	0.124	0.331	-0.018	-1.945*
Marital status of household head (1 = married, 0 = otherwise)	0.786	0.412	0.678	0.469	0.109	1.956*
Group membership (1 = Yes, 0 = no)	0.109	0.312	0.137	0.345	-0.028	-0.674
Household market access (1 = Yes, 0 = no)	0.403	0.492	0.397	0.491	0.006	0.102

Statistical significance levels: ***1%; **5%; *10%.

Source: Survey Data (2018).

3.5 Role of Donkeys

Results in Figure 6 show that donkeys were mostly used for fetching water, transporting farm produce and animal feeds. Three-quarter of the households ranked fetching water as their most important activity. This is attributable to the peri-urban nature of Kiambu where donkey owners use them to supply water to households and hotels in urban centers.

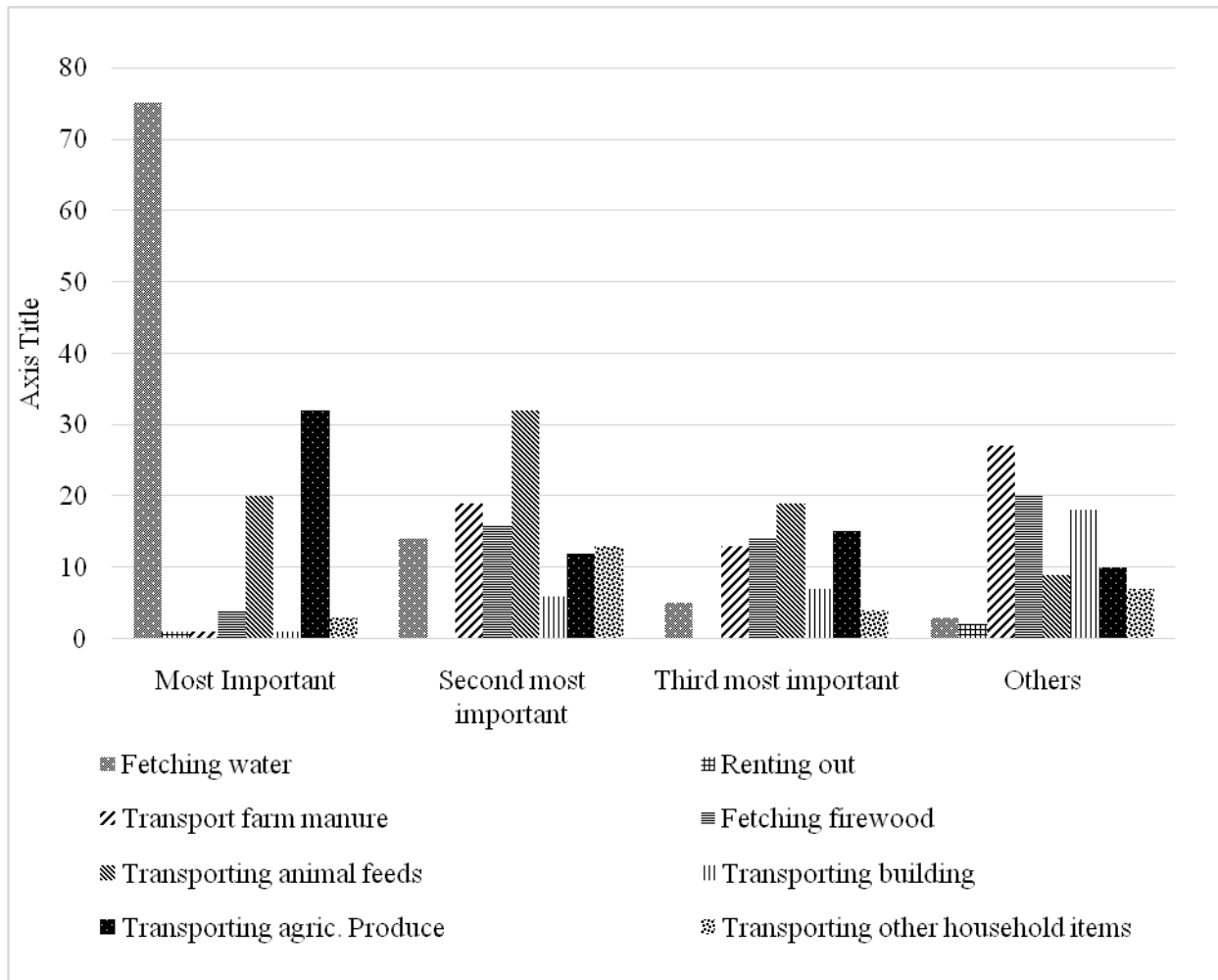


Figure 6: Household ranking of donkey roles

Source: Survey Data (2018).

Transporting animal feeds, farm produce and farm manure were also ranked highly. This is because the majority of the households in Kiambu participate in crop farming and dairy production. Transportation of milk, cabbages, Irish potatoes, napier grass, and farm manure were therefore essential donkey activities. Renting out was the least ranked because of the increased

incidence of theft occasioned by high demand for donkey products. This implied that donkey owners were not willing to rent out their donkeys in fear of theft or mistreatment. Plowing was not reported as one of the donkey activities. In general, use of draft animal power for plowing was not observed in the study area, this is associated with the small land sizes making possible to work with hand tools. Additionally, a lack of appropriate technology to harness donkey power in plowing is also a potential setback to its adoption.

3.6. Diagnostic Tests

This sub-section presents results of diagnostic test done for the regression models estimated in chapter four and five.

3.6.1 Multicollinearity

For the multiple linear regression and Tobit models, test of correlation between explanatory variables was done. Results showed that the correlation between explanatory variables was less than 30% for all variables (see Appendix II). Further, a variance Inflation factor (VIF) was used to establish the presence of multicollinearity;

$$VIF_i = 1 / (1 - R_i^2) \quad (3)$$

The VIF values that exceed 10 imply presence of multicollinearity (Gujarati and Porter, 2009). Results did not show presence of multicollinearity (Appendix III).

3.6.2 Normality Tests

One of the assumptions of linear models is that the error term should be normally distributed. Graphical method was used to assess normality of the error term. Results showed that the error term for the overall regression was normally distributed use of OLS was therefore supported (Appendix IV).

3.6.3 Durbin Wu Hausman test

This procedure is used to test for the presence of endogeneity in the data. This problem occurs when the explanatory variety is correlated with the error term.

$$\hat{e} = \alpha + \beta_i X_i \quad (4)$$

where, \hat{e} is the predicted residuals from the regression equation, X_i is a vector of explanatory variables used in the original regression equation, β_i is the estimated coefficient which is hypothesized to be zero. If the β_i is significantly different from zero, it is concluded that endogeneity exists in the data and hence the estimators are biased. In this study, all coefficients were found to be insignificant, it was therefore concluded that there was no endogeneity in the data and use of OLS was supported (see Appendix V).

CHAPTER FOUR

4.0 QUANTIFYING THE ECONOMIC CONTRIBUTION OF DONKEYS TO HOUSEHOLD LIVELIHOODS

4.1 Abstract

There is limited empirical evidence on quantitative economic' contribution of donkeys to livelihoods. This leads to an undervaluation of their importance and could potentially result in their mistreatment and/or lack of interest in improving their welfare. In order to address the aforementioned gap, this study used a sustainable livelihood approach to evaluate the contribution of donkeys to household livelihoods and drivers of returns from donkeys. Primary data was collected through a survey of 134 donkey owners in Kiambu County in Kenya. Farm budgeting technique was applied to determine donkey gross margins while a multiple linear regression model was estimated to identify the drivers of gross margins from donkey use. Results showed that on average, donkey-use contributes up to 36.4% of annual household income for donkey owners. Donkey-specific attributes and household characteristics had significant effects on the gross margins. It was concluded that donkey-use is a potential income diversification strategy. Hence, the marginalized and resource-constrained people can considerably improve their economic status using their donkeys for provision of economic services.

Keywords: Donkey, economic returns, livelihoods, Kenya.

4.2 Introduction and Research Issue

Working animals such as donkeys play a significant role in provision of farm power (draft animals), income generation and food. Due to their resilience to difficult working environments in developing countries, donkeys are often referred to as the “beasts of burden” . At least 90% of their use in Africa is in the provision of draft power (Eli-Jones et al., 2005). Indeed; many donkey owners in the continent have reported significant livelihood improvements due to donkey use (Valette 2015). For instance, Kendagor and Njoroge (2014) reported that marginalized groups in Kenya used donkeys to recover from uncertainties and become food self-sufficient. However, women reported that more often their donkeys die due to injuries and diseases, which was attributed to negative attitude and behavior among donkey users. Equipping donkey users with the ability to care for and improve donkey welfare is an important intervention. However, there is need for a holistic policy approach to mitigate against negative attitude and behavior especially among donkey users. In livestock policy and programs, donkey use and protection is often understated (see Republic of Kenya, 2015b). Donkey-use has been neglected in policy debates, hence the donkey sub-sector remains conspicuously missing from livestock policy documents. The FAO (2014) noted that unavailability of empirical evidence on the value of donkeys is a setback to donkey visibility and inclusion in policy debates.

Empirical evidence on contribution of donkeys to household livelihood in Kenya is scarce. Specifically, the amount of household income attributable to ownership and donkey use is unknown. Past studies such as Kendagor and Njoroge (2014) and Mutua (2004) focused on qualitative assessments. The studies provide important insights on the role of donkeys; however, such findings are not sufficient in influencing policy due to limited quantitative information. The role of donkeys is further understated as the contribution of working animals is often omitted in the calculation of GDP. This study therefore, provides empirical evidence on the economic value of donkeys to household livelihood in Kiambu County. Determinants of income from donkeys were also assessed. The findings provide insights on relationship between household socio-economic factors and donkey income. Donkey users and policy makers at different government levels are expected to benefit from these insights. Understanding the value of donkeys to household livelihood is essential for provision of proper care. On the other hand, policy makers will be able to make evidence-based policies.

4.3 Analysis of Returns from Donkey Ownership and Use

Farm budgeting technique was used to estimate gross margins of donkey ownership. The profit equation, which allows for measurement of all variable costs and their deduction from total revenue, was applied. This follows the formulation by Admassu and Shiferaw (2011). In order to get closer to a true measure of donkey profit, fixed costs would need to be accounted for. But, since the fixed costs components do not vary as much as the variable cost components the current analysis did not include the fixed costs.

The following variable costs were included in the calculation: donkey feeding costs, donkey labor costs and veterinary care. The revenue generated was calculated based on the direct and measurable benefits from the use of donkeys. All transport services done in the household using a donkey for household use, business merchandise and lending were considered as revenue. For household donkey-user, the value of moving goods using alternative sources of power was estimated. Ariaga-Jordan et al. (2005), and Teweldmehidin and Conroy (2010) used a similar approach to quantify the economic importance of work-bulls among smallholder farming systems in Mexico and Namibia, respectively. Equation 5 shows how gross margins were calculated in this study.

$$\text{Gross margins (GM)} = \text{Total revenue (TR)} - \text{Total Variable cost (TVC)} \quad (5)$$

To obtain the income contribution, the ratio of gross margins to total household income was calculated as shown in equation 6.

$$\text{Income ratio} = \frac{\text{Gross margins}}{\text{Total household income}} \quad (6)$$

4.4 Factors Influencing Gross Margins to Donkey Ownership and Use

Socio-economic factors and donkey welfare factors are expected to influence gross margins from use of donkeys. The welfare of donkeys is expected to positively influence gross margins. For instance, Igwe et al. (2013) reported that the cost of medication had a positive influence on net returns from pig farming. This is plausible as animal health and physical strength affects its productivity. Donkey welfare indicators such as working hours, number of donkeys per load, and frequency of veterinary care are important proxies to donkey welfare.

Donkey usage has been found to significantly influence gross margins. Curran and Smith (2005) found that donkey use was more profitable to households that used them for gathering and selling of firewood compared to those who used them to carry goods for other people. Admassu and Shiferaw (2011) also noted that households earned more if they used the donkey by themselves instead of hiring out. In both cases, donkeys are more beneficial when used for business purposes. It is therefore expected that donkeys that are used for business merchandize would attract higher returns compared to household use.

Household characteristics are essential to determining donkey net returns. This is because a household head is responsible for coordination of household activities. Factors such as age, education level, employment status and gender define how a household engages in economic activities. For instance, Kanyua et al. (2015) reported that female-headed households in Kenya realized low income from agricultural production compared to their male counterparts. This is because females engaged more in food crop production unlike male-headed households, who participated more in cash crops that had higher returns. In Ethiopia, donkeys were considered friendly, hence adopted more by female-headed households (Curran and Smith, 2005). Females are therefore likely to protect the donkey better than male counterparts are, hence positive effect on gross margins.

Age defines the level of experience of the household head. Kanyua (2015) stated that an increase in age increases the level of efficiency due to more experience. There is limited evidence on the effect of age on returns from working animals. Younger donkey owners are expected to earn higher returns from donkeys due to the ability to multi-task with lesser cost on hired labor. This is contrary to the a priori expectation, since the older the person the more hired labor will be required to work the donkey.

Olujeny (2008) reported that higher level of education increases the chances of adopting modern technology. Educated donkey owners will therefore be expected to provide prompt veterinary care as well as proper animal husbandry, hence higher returns. Employment on the other hand provides additional income for farmers. However, there are conflicting findings on the role of non-farm income on farm production. Kanyua et al. (2015) found a negative effect of

off-farm income on crop farming. On the other hand, Chikwama (2010) reported that when there is no surplus labor, an increase in non-farm income decreases the agricultural income as individuals invest away from agriculture. Admassu and Shiferaw (2011) reported that wealthier individuals were less likely to engage their donkeys in business-oriented tasks; this might negatively affect gross margins.

Sieber (2004) found that donkeys were more useful to individuals far off from motorable roads. It is therefore expected that individuals in remote areas would obtain higher returns due to the multiple need for donkeys. However, In Ethiopia, Curran and Smith (2005) found that it was more profitable to own a donkey in the peri-urban areas due to the high demand for firewood that required donkeys to transport. This shows mixed results on the effect of locality and distance to the market in influencing returns from donkeys. Intuitively, the cost of transport is expected to be higher in urban areas as compared to rural areas the distance to markets would therefore negatively affect returns to donkey use. To capture this variation, locality was included in the regression model as a binary variable. It is expected that donkey activities in Lari differ significantly from those in Kikuyu and Limuru due to the nature of household activities.

Factors influencing gross margin were estimated as a linear function of household-specific characteristics and donkey-specific characteristics. The following equation was therefore estimated using multiple linear regression model;

$$\begin{aligned}
 \ln \pi = & \beta_0 + \beta_1 \ln Age + \beta_2 Donkey_sicksigns + \beta_3 Donkey\ usage + \beta_4 Veterinary\ care \\
 & + \beta_5 \ln Working\ hours + \beta_6 \ln Level\ of\ education + \beta_7 \ln Distance \\
 & + \beta_8 Gender
 \end{aligned}
 \tag{7}$$

where π , is a continuous variable showing household annual gross margin from donkey-use, β_1 - β_8 is the coefficient for the explanatory variable hypothesized to be non-zero. Table 2 shows summary of explanatory variables included in the multiple linear regression model.

Table 2: Explanatory variables and expected signs

Variable name	Measurement	Expected sign
Donkey ownership	1= Owning, 0 = Not owning	-
Donkey usage	1 = Multiple user, 0 = single user	+
Veterinary care provision	1= Yes, 0 = No	+
Donkey working hours per day	Number of hours per day	+/-
Age of household head	Number of years	+/-
Education level (years of schooling)	1= Primary, 2 = Post-primary	+
Whether or not the donkey showed signs of sickness in the last three months	1 = Yes, 0 = No	+/-
Gender	1 = Male, 0 = Female	-
Distance to the nearest market	Kilometers	-

4.5 Economic Returns from the Use of Donkeys

Donkey-use was found to have positive annual returns. As shown in Table 3, on average a donkey owner is estimated to earn an annual income of Kshs 360,000 (1USD\$ = Kshs 100) from donkey activities. This is 40% more than what Vallete (2015) reported for rice farmers in Kenya. This result shows that the income from donkey-use accounts for up to 36% of household income. Other studies have shown household income contribution of donkeys in the range of 14% and 19% and 14% (See Admassu and Shiferaw, 2011; Avornyo et al., 2015). The variation is explained by differences in the extent to which donkeys are used in various areas. For instance, Brooke (2019) found that resource-poor women generate up to 87% of their gross annual income from use of donkeys for transportation. In Kiambu for example, the maximum contribution ratio was 75%, which was observed among households that use their donkeys for multiple activities; both household and business merchandise.

Further, a one sample *t-test* was applied to test the hypothesis that net return from donkeys is not positive. The result led to the rejection of the null hypothesis at 95% confidence level, which implies that net return from donkey use is significantly different from zero and positive in nature (Table 3).

Table 3: Annual gross margin analysis for donkey ownership and use

Description		Units (Kshs)
Average revenue per household (TR)	TR	420593.71
Average total variable cost (TVC)	Veterinary services	821.81
	Feeding	18911.34
	Labor cost for working animal	11940.50
	TVC	32,120.65
Average Gross margins (GM)	GM	388,473.06
Income ratio (Annual Gross margin/total household income)	0.36	
Test of significance using one sample t-test at 95% confidence level. $H_0: NR=0$	<i>t-value = 11.822</i> <i>p-value = 0.000</i>	

Source: Survey Data (2018).

Figure 7 shows the percentage income derived from various activities. Fetching water had the highest contribution while renting out had the least.

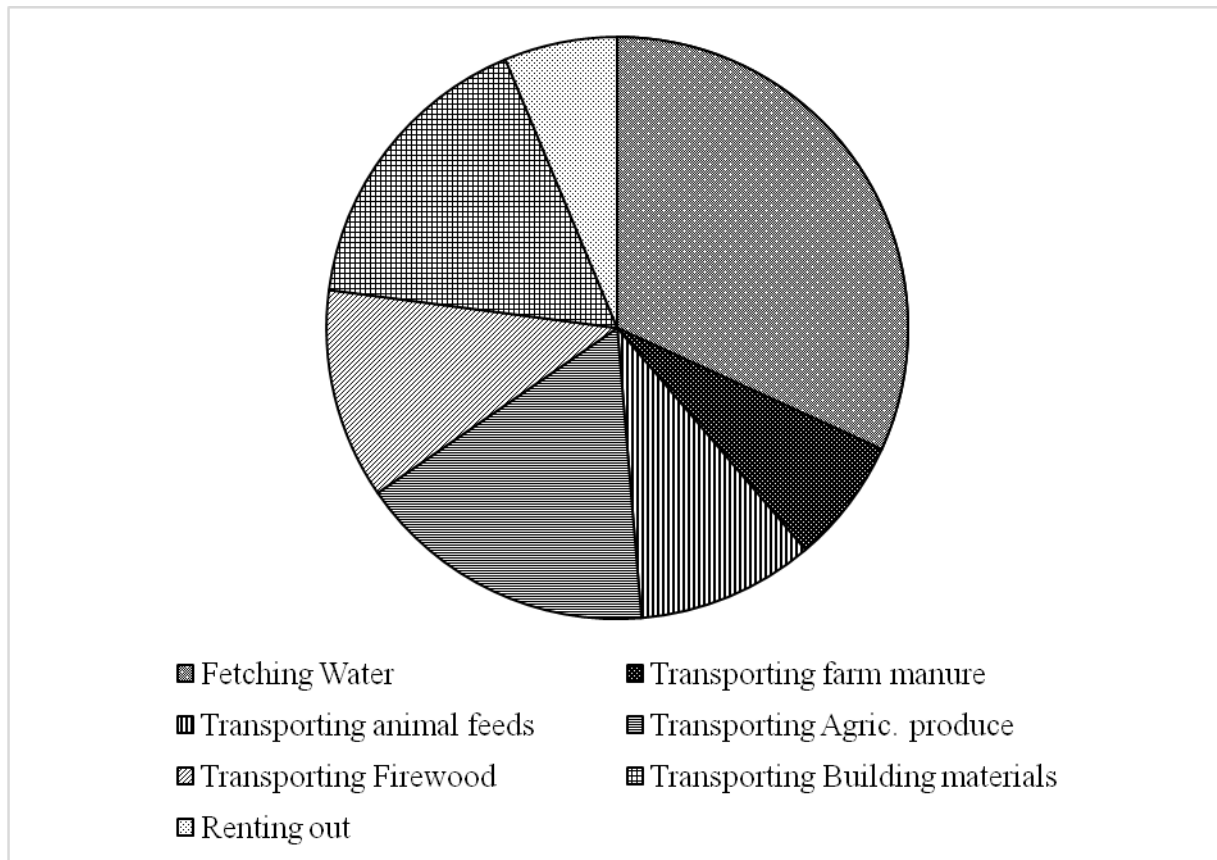


Figure 7: Percentage income contribution from donkey related activities in Kiambu County

Source: Survey Data (2018).

However, using donkeys in multiple commercial activities yielded higher returns compared to own household use as shown in Figure 8. The findings augment Admassu and Shiferaw (2011), who reported that donkey owners who used their donkeys exclusively for own household activities earned lower returns compared to those who used their donkeys for multiple activities.

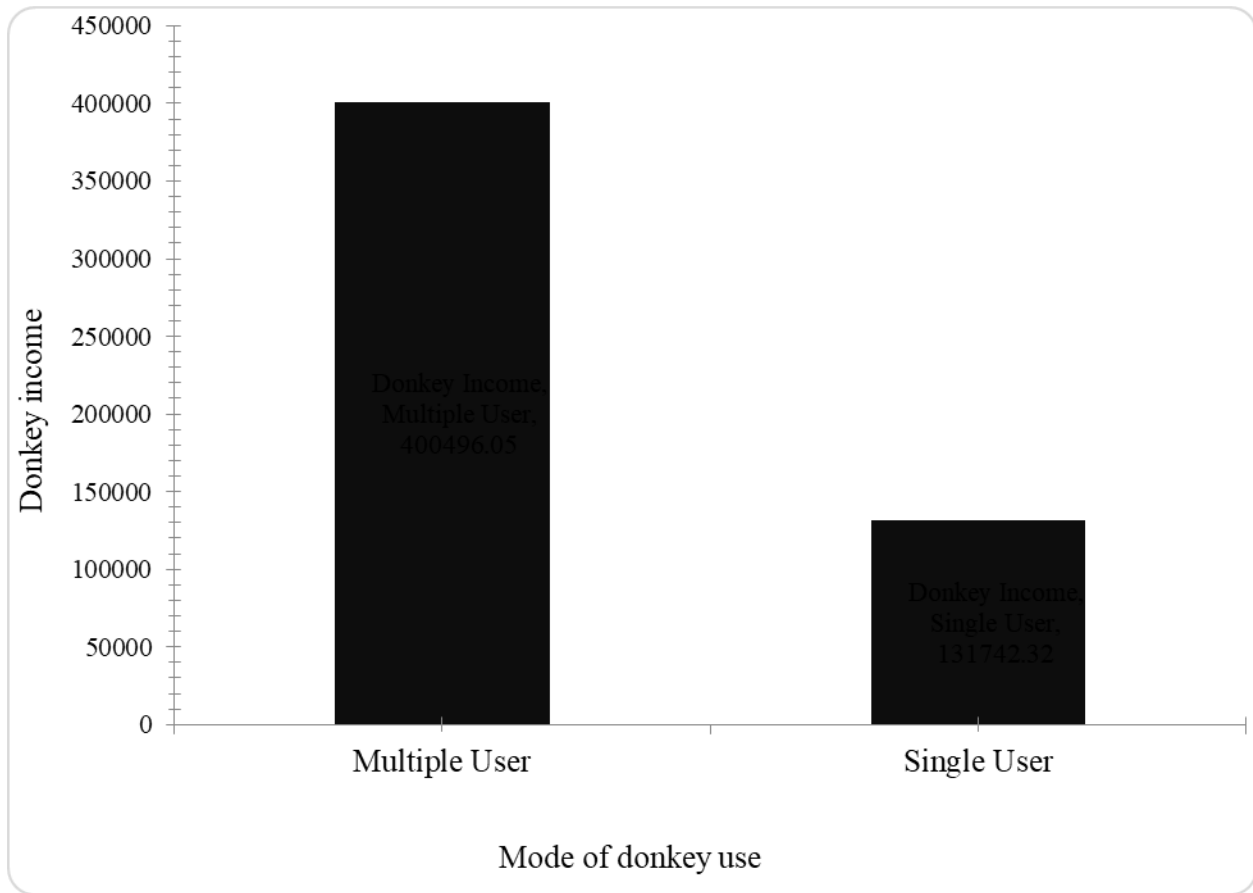


Figure 8: Annual gross margins disaggregated by mode of donkey use

Source: Survey Data (2018).

4.6 Determinants of Gross Margins to Donkey Use

The results in Table 4 show the factors influencing returns from donkey use. The following factors had a significant influence on the dependent variable; donkey-usage, veterinary care, donkey working hours per day, education level, gender and age of household head. The results show that over 40% of the variations in returns are jointly explained by these factors.

The number of activities in which households use their donkeys was positively significant. Households who use their donkeys for multiple activities (own household activities and business merchandise) received higher returns compared to those who used their donkeys for own household activities only (single user). Intuitively, it is expected that doing more activities generate higher returns than doing less.

Table 4: Factors influencing gross margins from donkey use in Kiambu County

Variables	Coefficient	Robust Std. Err.	t-ratio
Age of household head (years)	-.456	0.238	-1.92*
Education of household head (1= post-primary 0 = completed primary)	.540	0.261	2.07**
Distance to the market (km)	-.046	0.088	-0.52
Donkey working hours	.410	0.241	1.70*
Donkey usage type (1= multiple user, 0 = single user)	1.269	0.294	4.31***
Gender (1 = male)	-.601	0.359	-1.67*
Veterinary care (1= yes)	.756	0.328	2.30**
Whether or not the donkey showed signs of sickness in 3 months (1= yes)	-.202	0.253	-0.80
Constant	10.564	0.471	22.41***

Multiple regression results

Dependent variable is the gross margin; n =135 (donkey owners); $R^2=0.4105$; Prob> F = 0.000

Statistical significance levels:***1%;**5%; *10%.

Source: Survey Data (2018).

Provision of veterinary care positively influences returns. This is because healthy donkeys have the ability to work for longer hours and carry more load. This corroborates the finding by Pearson et al. (2001) that working animals operate at optimal potential when they are in good health. Bekele et al. (2014) also reported that infected donkeys worked for 4 to 8 hours, while un-infected ones worked for 8 to 12 hours. It is therefore, implicit that donkey welfare is inextricably linked with human livelihoods (Geiger and Hovornka, 2015). The number of hours a donkey works per day had a positive influence on the annual net return from donkey use. Donkey gender was not included in the estimation, since donkey owners and users did not care about it provided the donkey was adult and able to work.

Age of the household head negatively influences annual returns from donkeys at 10% significance. This is counter-intuitive as results in Table 1 showed that the majority of donkey owners were elderly. It was therefore anticipated that the elderly had more experience and hence

reap the highest benefit. However, the result can be explained by the number of activities the elderly are likely to engage their donkeys in. The elderly unlike the young are not able to participate in merchandise activities with the donkey. Admassu and Shiferaw (2011) also found a similar result; they argue that older donkey-users are not able to perform most of the business-oriented activities that require moving longer distances hence the negative influence.

Having formal education had a positive influence on returns from donkeys at 5% significance. Specifically, individuals who had gone beyond primary level of education earned more donkey income compared to those whose highest level of education was primary. Households with higher level of education showed higher level of income, this implied the ability to acquire veterinary services compared to the least educated. Previous studies have shown that wealthier households had higher returns from donkey-use compared to the resource-poor (see for instance, Admassu and Shiferaw 2011). This is due to the ability of wealthier households to provide prompt veterinary care as well as make optimal use of donkeys in their enterprises.

Gender had a negative relationship with income from donkey use, this implies that females generate lower returns from donkeys, which is attributable to the time available for women to work with the donkey. Grassi et al. (2015) found that women had more household responsibilities compared to men. In this case, to achieve higher donkey returns individuals would need to engage in multiple activities, which include business merchandize. Typically, women would balance between working with the donkey and other household chores such as cooking and childcare. The constant in the model was also significant. This means that there are other important variables that significantly influence returns from donkeys. Distance to the nearest market was found not to influence the returns. This could be because owners would do more donkey activities due to shorter distances to the market, which compensates for higher prices charged for those leaving far from the market.

The findings of this study lead to the rejection of the null hypothesis, that donkey welfare factors do not have a significant influence on returns. Veterinary care provision and donkey working hours were individually significant at 95% confidence level. The alternative hypothesis is therefore accepted.

CHAPTER FIVE

5.0 EFFECT OF DONKEY OWNERSHIP ON HOUSEHOLD FEMALE LABOUR TIME ALLOCATION

5.1 Abstract

Women play an important role in satisfying household labor requirements. Studies have shown that women are more responsible for household tasks compared to men. Tasks such as fetching firewood, fetching water, transporting animal feeds, farm manure and farm produce are often carried out by female members of the household. This reality undermines the welfare of women. They spend most of their time performing housework leading to physical weakness as well as limited time to rest and participate in other economic opportunities. This suggests the need to provide labor saving technologies and practices to relieve women of the household labor burden. Donkey use is a potential strategy.

This study assessed the effect of donkey ownership on household female labor allocation. Data was obtained from 134 donkey owners and 121 non-owners in Kiambu County. The agricultural household model was used to model female labor time allocation to housework. Further, a Tobit model was applied to assess the effect of donkey ownership on household female labor time. The findings show that donkey ownership significantly influenced the amount of time a female spends on household activities. Donkey owning households saved up to 50% of the female labor time. Other factors such as household size, participation in crop farming and distance to the market significantly influenced household female labor time. Strategies to promote donkey ownership such as grants towards donkey acquisition, credit schemes and veterinary care support should be enhanced. In particular, facilitation mechanisms that enhance access by female-headed households should be explored.

Keywords: Donkeys, women, labor time allocation, Kenya.

5.2 Introduction

Women play an important role in household labor requirements. Most studies have reported that women are responsible for more household tasks than men (see Ilahi and Grimard, 2000; UN HLPE, 2016). In recent times, the situation remains the same despite the argument for gender equality. A survey of 45 countries revealed that 76% of households consider household roles such as fetching water and firewood as the primary responsibility of women (WHO/UNICEF, 2010). This situation is not likely to change especially in societies, which are less egalitarian in nature. According to Ilahi and Grimard (2000), household labor time is allocated based on the power of each spouse. Women are considered less powerful especially in Africa.

In Malawi, women were found to work for a total of 39 hours per week compared to 27 hours for their male counterparts (Ferrant et al., 2014). Household labor work accounted for 23 to 24 hours of female time including 8 hours per week for fetching water and firewood. On the other hand, men spent 70% of their time on salaried work and leisure. This implies that women are overburdened with repetitive work that does not earn them any direct income. This trend limits the ability of women to compete for other economic pursuits. In Uganda, Grassi et al. (2015) reported that female-headed households lost their livestock due to lack of capital to afford veterinary care. This reality undermines the welfare of women. They spend most of their time performing housework leading to physical weakness as well as limited time to rest and participate in other gainful economic opportunities. Therefore, reducing women burden at household level is an important step to women empowerment and gender equality.

Past studies have focused on recommending alternative labor-saving technologies and practices to reduce the burden of work on women. In particular, use of donkey power has been proposed as a potential strategy to relieve women of the household transport needs (see Grassi et al., 2015; Cooke and Bishop-Sambrook, 2016). Donkeys help women fulfill various household chores. Lighter housework for females implies they can travel and respond to economic incentives as well as build their social networks. The UN High Level Panel of Experts on gender argued that there is need to redistribute unpaid work especially housework to lessen the burden (UN-HLPE, 2016). Insights on the role of donkeys in reducing female housework is an important step to promoting gender equality. Empirical evidence of the contribution of donkeys to women's lives

remains scarce and often overlooked. The aim of this chapter was to provide empirical evidence on the effect of donkey use on household female labor allocation.

5.3 Theoretical Framework

A female household member makes a decision whether to use her own labor to work on household chores or to hire paid laborers. The female member is a producer and a consumer of resources including labor. Women therefore seek to maximize total utility by allocating available work time to housework activities and out-of-household activities. If engaging in housework activities improves, the total utility then housework will be pursued and optimal time allocated. If on the other hand, housework does not improve total utility then no time will be allocated at all. Intuitively, it is expected that the decision to pursue housework will be followed by the extent of participation in housework. However, according to Khandker (1988) the decision to participate and number of hours are determined jointly.

The agricultural household model (AHM) was applied to analyze this decision. The model is adapted from Benjamin and Guyomard (1994), and has been used by Matshe and Young (2005) to model off-farm labor allocation decisions in Zimbabwe. The model provides a theoretical basis for understanding household labor supply. It posits that a household seeks to maximize utility from consumption of goods (own-produced, purchased and leisure) subject to a budget constraint. The utility is a function of the female person's number of off-farm hours, household work hours and total household income. It also depends on household characteristics and female-specific characteristics such as level of education and age of individual female members.

The utility maximization problem is to maximize total utility;

$$\text{Max } U(Y, L_h, L_{of}, E, H) \quad (7)$$

Subject to:

$$T_i \geq L_h + L_{of}, L_h \geq 0, \quad (8)$$

$$L_{of} \geq 0, L_e \geq 0, Y \geq 0 \quad (9)$$

$$Y \leq \pi(p, v, L_{of}, H, E, A) + w_h L_h + B \quad (10)$$

where; Y is the household total income, T_i is the total time available to the household female member, L_h is the female household work hours, L_{of} is the female off-farm hours, E individual-specific characteristics and household characteristics, H . $\pi(p, v, L_{of}, H, E, A)$ is the restricted profit function, which depends on p and v , the output and input prices, respectively. It also depends on female household work, L_h and related wage rate (reservation wage rate, w_h), E individual-specific characteristics and household attributes H . Lastly, it depends on household fixed inputs (A) and exogenous income such as remittances, (B).

A Lagrangian function can be derived from the optimization problem and solution of the first order conditions yields the following equation:

$$L = U(Y, L_h, L_{of}, E, H) + \lambda_1 \sum_{i=1}^n (T_i - L_h - L_{of}) + \lambda_2 [Y - \pi(p, v, L_{of}, E, H, A) - (w_h L_h + B)] \quad (11)$$

where, λ_1 and λ_2 are Lagrange multipliers for time and income constraints respectively. An optimum allocation of household labor time can be derived by taking the first order derivative of Equation 12 as follows;

$$-\frac{\partial U / \partial L_{of}}{\partial U / \partial Y} = \partial \pi / \partial L_{of} \quad (12)$$

And

$$-\frac{\partial U / \partial L_h}{\partial U / \partial Y} - \frac{\mu}{\partial L_h} = w_h \quad (13)$$

where μ is the Lagrange multiplier associated with the positivity constraint of household work hours. In Equation 13, the marginal rate of substitution of female off-farm hours for income should be equated to the shadow price of that labor, w_m if the member does not work in the

household. In Equation 14, the marginal rate of substitution of household work hours for income should be equated to the household reservation wage rate (w_h). If the marginal rate of substitution of household work for income is greater than household reservation wage rate, then the member does not work in the household.

5.4 Empirical Model

The empirical model depends on the distribution of the dependent variable. The dependent variable is the number of hours a female adult spends on household chores per day. Tobit, double hurdle and Heckman selection models have been used in modeling such kind of decisions. Double hurdle and Heckman selection models are used in a two-step decision making; i) a female's decision to participate in household chores, ii) a female's decision on the number of hours spent on household chores per day. The models are suitable when the factors determining the first decision are different from the factors determining the second decision. However, in this study, it is assumed that since women are traditionally the main players in household activities it is unrealistic to study factors influencing their participation. For policy, it is therefore more reasonable to study the factors influencing time allocation.

Similar advancements were first made by Khandker (1988) in studying rural women time allocation in Bangladesh. The findings showed that women household labor time is strictly positive. The findings are attributable to the fact that household chores such as childcare and cooking are included. However, the study here focused on time spent doing household activities that would otherwise be done by donkeys. In particular; fetching water, firewood, transportation of farm manure/fertilizer, farm produce and animal feeds were defined as household work. Therefore, women were likely to have zero and non-zero values based on existing exogenous variables leading to a corner solution. On this basis, a lower limit Tobit model was preferred since it assumes the zeroes to be corner solutions. This method has previously been applied by Guthiga et al. (2004) to assess the effect of animal traction on household labor allocation.

The Tobit model expresses the observed variable y , in terms of an underlying latent variable y^* , where;

$$y^* = \beta_0 + X\beta + \mu; \mu|x \sim Normal(0, \sigma^2) \quad (14)$$

$$y = \max(0, y^*) \quad (15)$$

In this study, y is the number of hours a female member works on housework per day. The X is a vector of explanatory variables included in the model, β is the coefficient of explanatory variable, which is obtained by maximizing the log-likelihood.

Equation 16, implies that the observed variable, y equals y^* if $y^* \geq 0$, but $y = 0$ if $y^* < 0$.

Because y^* is normally distributed, y takes a continuous distribution strictly over positive values.

In particular, the density of y given x equals the density of y^* given x for positive values.

The following Tobit model was estimated;

$$T_i = \beta_0 + \beta_1 D_1 + \beta_i X_i + \mu_i \quad (16)$$

where, T_i the female labor time allocated to household chores per day, X_i a vector of explanatory

variables which include; household and, individual characteristics, and household fixed inputs. A dummy variable $D_1 D_1 = 1$ if the household owns a donkey and $D_1 = 0$ otherwise. This variable

is useful to assess the effect of donkey ownership on female household labor time allocation.

5.5 Justification of Variables in the Tobit model

5.5.1 Female Labor Time

The dependent variable in this study is female labor time. This was measured in terms of the average number of hours a female member spends on household activities in which a donkey could be a perfect substitute. The activities captured included; fetching firewood, fetching water, transporting animal feeds, carrying farm produce, transporting manure and transporting farm produce to the market. The respondents were required to approximate the total number of hours spent on housework per day. Data was collected from both donkey-owning households and non-owning ones.

5.5.2 Donkey Ownership

This is a dummy variable used to establish the effect of donkey ownership on female labor time. Those who owned a donkey were expected to spend less time in housework, while those who did not own would spend more time doing similar activities. It was also expected that the number of

donkeys owned would influence female labor time differently. However, nearly 95% of donkey-owners in the sample owned only one donkey hence limiting the plausibility of estimating the effect of number of donkeys in the household.

5.5.3 Other Regressors

Past studies have shown that household and women-specific variables influence female household labor time allocation differently. Household income is an important variable in influencing female household labor time (Ilahi, 2000). However, income is an inherently endogenous variable, the higher the income the more likely an individual will spend less time on housework. On the other hand, more time spent in off-work, *ceteris paribus* would result in higher incomes. In this case, use of income on the right hand side of the equation creates a confounding problem. Use of other proxy variables have been recommended in past studies such as Ilahi (2000), and Ilahi and Grimard (1999). This study used household asset as a proxy for household income as proposed by Ilahi (2000). An increase in household assets confers an income effect on household time allocation. This implies that ownership of household assets (productive and non-productive assets) reduces an individual's time allocation to housework by increasing time spent on income generating activities.

Distance to the market, was used to capture the level of integration of the local farm economy and hence demand for labor. Provision of basic services such as water and energy is poor in Kenya. Consequently, individuals have to allocate time to acquire these goods. In most cases, the burden falls on women to acquire these good from either open sources or market. The longer the distance to such amenities the more time spent on housework. A study by Kumar and Hotchkiss (1988) revealed that individuals who lived far from the forest spent more time doing housework in rural Nepal. In this study, distance to markets implied higher access to these essential goods, hence reduced time spent on housework.

Off-farm employment was used to measure the level of human capital development. Human development is an outcome of education; individuals with more education tend to work more because every hour of their labor fetches more, hence less time spent on housework (Ilahi, 2000). Notably, human capital acquired through education yields returns through employment. Inclusion of formal employment and education is not econometrically plausible (Ilahi and

Grimard, 1999). In this study, formal employment was therefore used as a proxy for human development. Females with formal employment are expected to spend less time on housework.

Crop and dairy farming were included to capture household demand for labor. Specifically, in Kiambu transportation services such as transportation of animal feeds and vegetables to the market was sharply divided across gender. Participation in crop and dairy farming implied higher demand for labor specifically female labor, hence time allocation. Household size and age were also included in the model. Household size was used to measure the amount of household essential goods required, for instance higher household size implies increased demand for water, firewood and other amenities. This burden of acquiring the goods is expected to fall on females hence more time spent on housework. Age of female members was also important, intuitively elderly individuals work less compared to younger once. Number of children was not included in the model since childcare was not considered as part of housework in this study. Table 5 presents a summary of the variables included in the model and the expected signs.

Table 5: Definition of variables included in the Tobit model

Variable Name	Variable description and measurements	Expected sign
Household size	Number of individuals living in the household	+
Asset value	The financial value of household assets owned (Kshs)	-
Distance to nearest market	The distance in kilometers from the household to the nearest market (Km)	+
Livestock rearing	Whether or not the household participates in livestock production (1 = Yes, 0 = no)	+
Crop farming	Whether or not the household participates in crop production (1 = Yes, 0 = no)	+
Female formal employment	Whether or not the female member is employed (1 = Yes, 0 = no)	-
Age	Age of the female household head (measured in complete years)	-/+

5.6 Effect of Donkey Ownership on Female Labor Time Allocation

Table 6 presents the results of the Tobit model on the effect of donkey ownership on household female labor time allocation.

Table 6: Tobit model estimates of effect of donkey ownership on household female labor time

Variable	Coefficient	Std. Error	t-value
Number of household members	0.651	0.140	4.64***
Donkey ownership (1 = Yes, 0 = no)	-1.514	0.489	-3.09***
Distance to nearest market (Km)	0.712	0.339	2.10**
Age of female head (Years)	0.029	0.019	1.48
Asset value (Kshs)	-2.210	1.780	-1.24
Crop farming (1 = Yes, 0 = no)	1.188	0.490	2.42**
Livestock rearing (1 = Yes, 0 = no)	-0.017	0.500	-0.03
Female formal employment (1 = Yes, 0 = no)	0.792	0.552	1.43
Constant	-3.367	1.024	-3.29***
Log likelihood	-345.608		
Pseudo R²	0.363		

Dependent variable is female household work hours; Prob> chi2=0.000;
 Statistical significance levels:***1%;**5%; *10%.
 Source: Survey Data (2018).

The results showed that donkey ownership had a negative but significant effect on household female labor time. This implies that owning a donkey reduces the amount of time a female adult spends on housework. This finding corroborates that of Grassi et al. (2015) who observed that use of working animals is a potential intervention to reduce household female labor time. This is because the majority of the donkey activities would otherwise be performed by females. The

result also agrees with the proposition by Khandker (1988) that ownership of household productive assets such as livestock provide an income effect. This effect increases the marginal product of women labor, hence, prefer working outside the household by substituting their labor with hired labor.

Guthiga et al. (2004) observed that ownership of working animals increase marginal productivity of owners. This explains the finding that donkey ownership reduced the amount of time females spent on a particular activity. The study hypothesized that donkey ownership does not have a significant effect on female household labor time. The *p*-value of 0.002 shows that donkey ownership was significant at 99% confidence interval (Table 6). This is sufficient to reject the null hypothesis. The alternative is hence, accepted. Household size was statistically significant at 1%. This indicates that an increase in household size increases the number of female labor time in the household. This could mean an expanded demand for services such as demand for more water, more firewood and more food to be produced. Female adults would then require more time to satisfy the increased demand.

Distance to the nearest market was significant at 5%. A unit increase in distance to the nearest market increases the female household labor time by nearly 71%. Intuitively, an increase in distance implies longer distances to be covered by women to access services such as transportation of farm produce shopping. Participation in crop farming positively influences female household labor time, this supports the finding by Guthiga et al. (2004) that participation in crop farming had a similar effect on the amount of female time allocated to housework. This implies that participation in crop production increases the demand for labor such as transporting of farm manure, and produce from the farm and to the market.

CHAPTER SIX

6.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

This study assessed the contribution of donkey use to household livelihood in Kiambu County. The specific objectives were to: assess the returns due to donkey ownership and use; and the factors influencing those returns and to assess the effect of donkey ownership on household female labor time allocation. The sustainable livelihood approach was used to conceptualize the contribution of donkeys. A linear regression model was used to assess the factors influencing donkey returns while a censored Tobit model was applied to determine the effect of donkey ownership on female household labor time allocation.

The results showed significant socio-economic differences between donkey owners and non-owners. In particular; age, gender, formal employment and education level of household heads differed significantly between the two groups. Household size was also significantly different, with donkey owners having higher sizes. Distance to the nearest tarmac road was not significant. However, donkey owners were found to be slightly further from tarmac compared to non-owners. This is attributable to the lack of access to interior regions by motorable machines, hence the need for alternative means of transport.

Further, it was also found that donkey ownership and use was a profitable economic activity in the study area. The annual gross margin from donkey use was approximately USD 3,880, which is significantly different from zero, hence rejecting the null hypothesis, that donkey ownership was not profitable. Returns from donkey use were specifically higher for households who used their donkeys for multiple activities, which included both own household activities and business. Donkey-specific attributes were found to significantly influence returns. Specifically, the number of hours a donkey worked and the frequency of receiving veterinary care had a positive influence. The findings led to the rejection of the null hypothesis that, donkey welfare factors do not affect returns to donkey use. Other socio-economic factors such as age of household head and formal employment were also found to significantly influence returns.

Finally, donkey ownership showed a negative influence on the number of hours female members work in the household implying a reduction in the time spent by women doing household chores.

Other variables found to influence female household labor time included household size, distance to the nearest market and participation in crop farming. At 99% confidence interval, the null hypothesis that donkey ownership has no effect on household female labor time allocation was rejected.

6.2 Conclusion

Quantifying economic contribution of donkey-use to household livelihood is an imperative step in promoting action towards enhancing donkey use and protection. The study has shown that donkey ownership is a profitable livelihood strategy in Kiambu County. Therefore, promoting donkey use and welfare protection is a potential pathway out of poverty through income diversification.

This study shows that donkey welfare and returns are inextricably linked. Factors such as the number of hours a donkey works, provision of veterinary care and number of activities performed using donkeys were found to be important determinants of gross margins donkey. The management and care of donkeys is therefore imperative for owners to realize optimal returns.

The study also found that donkey ownership and use significantly influences female household labor time allocation. Owning a donkey reduces the time spent on housework such as fetching water, fetching firewood, transporting agricultural produce and transporting manure. This implies that donkey ownership is not only a capital asset but also a social asset. It provides resting time for women as well as the opportunity to respond to economic incentives. This would subsequently reduce drudgery and provide more time for other social activities such as childcare and leisure. Therefore, owing to the significant contribution of donkeys to household income, donkey use is a key contributor to rural economies.

6.3. Recommendations

Policy makers at the County and national levels should prioritize donkeys in development programs. Specifically, donkey promotional programs should target less educated individuals from hard-to-reach areas. Further, County governments should promote of donkey ownership in remote areas to cushion households from short-run effects of poor road network. Additionally,

donors and other development agencies should enhance accessibility of veterinary services to donkey owners to improve donkey productivity.

Policies affecting donkeys should be holistic to ensure all donkey aspects including welfare and use are properly addressed. In particular, policies legalizing the slaughter of donkeys ought to be revisited to protect donkeys from extinction. Essentially, donkeys have longer gestation periods compared to most ruminants. There is therefore a need for an all-inclusive policy to include donkey aspects such as donkey breeding and protection. A lack of attention on these issues implies that households are likely to lose a significant proportion of their livelihood because of a reduction in the donkey population.

Additionally, national and County governments should include the contribution of working animals especially donkeys in accounting for GDP. This will improve visibility and a paradigm shift on donkey use and welfare. State and non-state actors and other organizations should promote donkey use among women to reduce the existing inequality. In particular, marginalized women should be targeted to ensure higher adoption for maximum benefits.

Considering that donkey use varies per location and region, further research on the holistic contribution of donkey use should focus on comparison of donkey uses in different agro-ecological areas, livelihood options and socio-economic profiles.

REFERENCES

- Admassu, B. and Shiferaw, Y. (2011). Donkeys, horses and mules: their contribution to people's livelihoods in Ethiopia. The Brooke, London.
- Arriaga-Jordán, C., Pedraza-Fuentes, A., Velázquez-Beltrán, L., Nava-Bernal, E. and Chávez-Mejía, M. (2005). Economic contribution of draft animals to Mazahua smallholder Campesino farming systems in the highlands of Central Mexico. *Tropical Animal health and Production*, 37(7): 589-597.
- Avornyo, F., Teye, G., Bukari, D. and Salifu, S. (2015). Contribution of donkeys to household food security: a case study in the Bawku Municipality of the Upper East Region of Ghana. *Ghana Journal of Science, Technology and Development* 3(1): 15-24.
- Behnke, R. and Muthami, D. (2011). The contribution of livestock to the Kenyan economy. *IGAD Livestock Policy Initiative. Working Paper*, 03-11(2): 1-62.
- Bekele, M., Leggese, G., Teshome, W., Nahom, W., Anteneh, K. and Tewodros, T. (2014). Socioeconomic impact of epizootic lymphangitis in cart mules in Bahir Dar City, North West Ethiopia. In *Seventh International Colloquium on Working Equids*, Ed: J. Wade, World Horse Welfare, Norfolk, UK (pp. 10-15).
- Benjamin, C. and Guyomard, H. (1994). Off-farm work decisions of French agricultural households. In: Caillavet, F., Guyomard, H., Lifran, R. (Eds.), *Development in Agricultural Economics: Agricultural Household Modelling and Family Economics*. Elsevier, Amsterdam (pp 65-86).
- Blench, R. (2004). The history and spread of donkeys in Africa. In: Starkey P. and Fielding D. (eds), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ATNESA)*. ACP-EU Technical Centre for Agricultural and Rural Cooperation (CTA). Wageningen, The Netherlands. p244.
- Chang, C., Sapón, M. and Rodríguez, D. (2010). Economic valuation of the impact of the working equine in the Peten and Chimaltenango communities in Guatemala. In Wade J. (Ed.), *Learning from Others. Proceedings of the 6th International Colloquium on Working Equids*. India Habitat Centre, New Delhi, India.

- Chikwama, C. (2010). The role of rural off-farm employment in agricultural development among farm households in low-income countries: Evidence from Zimbabwe. *African Journal of Agricultural and Resource Economics*, 4(1):311
- Cooke, J. and Bishop-Sambrook, C. (2016) Reducing rural women's domestic workload through labour-saving technologies and practices toolkit, Rome: IFAD.
- Curran, M. and Smith, D.(2005). The impact of donkey ownership on the livelihoods of female peri-urban dwellers in Ethiopia. *Tropical Animal Health and Production*, 37(1): 67-86.
- Ellis-Jones, J., O'Neill, D., Riches, C. and Sims, B. (2005). Farming systems: Future challenges for the use of draft animals in agricultural development with emphasis on Sub-Saharan Africa. *Annals of Arid Zone*44(3/4):277.
- Epstein, H. (1971). The origin of the domestic animals of Africa. Africana Publishing Corporation, New York, USA.
- Ferrant G., Pesando L. and Nowacka K., (2014) Unpaid Care Work: The missing link in the analysis of gender gaps in labour outcomes, Paris: OECD Development Centre.
- Food and Agriculture Organization of the United Nations and Brooke (2011). Electronic consultation on the role, impact and welfare of working (traction and transport) animals, 1–28 February. Available at: http://www.fao.org/fileadmin/user_upload/animalwelfare/FAO-The%20Brooke%20working%20animals%20e-consultation%20report.pdf (accessed on 12 September 2018).
- Food and Agriculture Organization of the United Nations (2014). The role, impact and welfare of working (traction and transport) animals. Animal Production and Health Report. No. 5. Rome, Italy.
- Fernando, P. and Starkey, P. (2004). Donkeys and development: socio-economic aspects of donkey use in Africa. In: Starkey P. and Fielding D. (eds), Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ATNESA). ACP-EU Technical Centre for Agricultural and Rural Cooperation (CTA). Wageningen, The Netherlands. Pp31–44.
- FAOSTAT (2019). Available at: <http://www.fao.org/faostat/en/#data/QA/visualize> (Accessed 02 March 2019).

- Garuma, S., Sisay, A., Lemma, T., Lamecha, F. and Jemal, E. (2007). Study on Gender distribution of ownership of animal drawn Carts and its effect on Women life in AdamiTullu and Dugda Bora Districts. In T. Degefa and F. Feyissa (Eds.), *The role of Agricultural Universities/Colleges in Transforming Animal Agriculture in Education, Research and Development in Ethiopia: Challenges and Opportunities*. Proceedings of the 13th annual conference of the Ethiopian Society of Animal Production (ESAP). Addis Ababa, Ethiopia.
- Geiger, M. and Hovorka, A. (2015). Animal performativity: Exploring the lives of donkeys in Botswana. *Environment and Planning D: Society and Space*, 33(6): 1098-1117.
- Grassi F., Landberg J. and Huyer S. (2015) *Running out of time, the reduction of women's work burden in agricultural production*, Rome: FAO.
- Gujarati, D. and Porter, D. (2004). *Basic econometrics* (ed.) McGraw-Hill. Irwin business.
- Guthiga, P., Karugia, J., and Nyikal, R. (2007). Does use of draft animal power increase economic efficiency of smallholder farms in Kenya? *Renewable Agriculture and Food Systems*, 22(4):290–296.
- Igwe, K., Ifekaonwu, A., Amao, S. and Igwe, C. (2013). Determinants of output among pig farmers in Abia State, Nigeria. *Journal of Biology, Agriculture and Healthcare*, 3(17): 121-126.
- Ilahi, N. and Grimard F. (2000). Public infrastructure and private costs: water supply and Time allocation of women in rural Pakistan. *Economic Development and cultural change*, 49(1): 45-75.
- Ilahi, N. (2000). *The Intra-household Allocation of Time and Tasks: What Have We Learnt from the Empirical Literature?* Policy research report on gender and development (*working paper series No. 13*). Retrieved from the World Bank website: <http://documents.worldbank.org>.
- Kanyua, M., Waluse, G. and Wairimu, W. (2015). Factors influencing profitability of diversified cash crop farming among smallholder tea farmers in Gatanga District, Kenya. *Journal of Economics and Sustainable Development*, ISSN, 2222-1700.

- Kendagor, M. and Njoroge, P. (2014). The contribution of donkeys to the livelihoods of the marginalized population in Kenya. In Wade J. (Ed.), *How do we demonstrate the importance of working animals to human livelihoods? Proceedings of the 7th International Colloquium on Working Equids*, 1-3 July, Royal Holloway, University of London.
- KENDAT (2018). Animal Welfare: Heshimu Punda Programme. Retrieved from: <http://www.kendat.org/our-causes-3/animal-welfare-2/>. (Accessed 12 September 2018)
- Kenya National Bureau of Statistics (2009). The Kenya population and housing census report. Retrieved from: www.knbs.or.ke. (Accessed 12 April, 2018)
- Khandker S. (1988), "Determinants of Women's Time Allocation in Rural Bangladesh," *Economic Development and Cultural Change*. 37 (1): 111-126.
- Krantz, L. (2001). The sustainable livelihood approach to poverty reduction. Swedish International Development Agency (SIDA): Division for Policy and Socio-Economic Analysis. Stockholm-Sweden.
- Matshe, I. and Young, T. (2004). Off- farm labour allocation decisions in small- scale rural households in Zimbabwe. *Agricultural Economics*, 30(3): 175-186.
- Mburu, S., Zaibet, L., Fall, A. and Ndiwa, N. (2012). The role of working animals in the livelihoods of rural communities in West Africa. *Livestock Research for Rural Development*. 24(10):56.
- Mutua, J. (2004). Some challenges to the use of donkeys in Kenya. In P. Starkey and D. Fielding (Eds.), *Donkeys, people and development. A resource book of the Animal Traction Network for Eastern and Southern Africa (ATNESA)*. ACP-EU Technical Centre for Agricultural and Rural Cooperation (CTA). Wageningen, the Netherlands.
- Olujenyo, F. (2008). The determinants of agricultural production and profitability in Akoko Land, Ondo-State, Nigeria. *Journal of Social Sciences*, 4(1): 37-41.
- Pearson, R., Nengomasha, E. and Krecek, R. (1999). The challenges in using donkeys for work in Africa. In P. Starkey and D. Fielding (Eds.), *Meeting the Challenges of Animal Traction. A resource book of the Animal Traction Network for Eastern and Southern Africa (ATNESA)* (pp190-198).
- Peng, W., Zheng, H., Robinson, B., Li, C. and Wang, F. (2017). Household Livelihood Strategy

- Choices, Impact Factors, and Environmental Consequences in Miyun Reservoir Watershed, China. *Sustainability*, 9(2), 175-179.
- Republic of Kenya (2011). National gender and equality commission Act No. 2 of 2011. National council for law reporting. Accessed at: www.kenyalaw.org. (Accessed August, 2019).
- Republic of Kenya (2015a). Integrated development plan 2013-2017: County government of Kiambu. Available at: <http://www.kiambu.go.ke/images/docs/public-notice-and-announcements/2013201720150303-KIAMBU-CIDP.pdf>. (Accessed 5 July 2018).
- Republic of Kenya (2015b). Kenya Veterinary Policy. Available at: <http://www.kilimo.go.ke/wp-content/uploads/2015/06/Draft-Veterinary-Policy.pdf>. (Accessed February 2017)
- Republic of Kenya (2019a). Kenya agricultural mechanization policy. Available at: <http://www.kilimo.go.ke/wp-content/uploads/2015/05/Agriculture-Mechanization-Policy.pdf>. (Accessed August 2019)
- Republic of Kenya (2019b). Kenya agricultural mechanization policy. Available at: <http://www.kilimo.go.ke/wp-content/uploads/national-livestock-policy.pdf>. (Accessed August 2019)
- Selamawit, T. (2014). The Impact of Camel Transportation on the Livelihood of Pastoralists in Berahle Woreda, Regional State of Ethiopia (Unpublished Doctoral dissertation), Mekelle University.
- Sieber, N. (2004). The Economic Impact of Pack Donkeys in Makete, Tanzania. In Starkey P and Fielding D (Eds.), *Donkeys, People and Development: A Resource Book for the Animal Traction Network of East and Southern Africa*. Wageningen: The Netherlands.
- Simalenga, T., Belete, A., Mzeleni, N. and Jongisa, L. (2000). Profitability of using animal traction under smallholder farming conditions in Eastern Cape, South Africa. In P. Kaumbutho, R. Pearson R, and T. Simalenga (Eds.), *Empowering Farmers with Animal Traction*. ATNESA. Mpumalanga: South Africa.
- Sims, B. and Kienzle, J. (2016). Making Mechanization Accessible to Smallholder Farmers in Sub-Saharan Africa. *Environments*, 3(2): 11.
- Starkey, P. and Starkey, M. (1995). Regional and world trends in donkey populations. In Starkey P and Fielding D (eds.), *Donkeys, People and Development: A Resource Book for the Animal Traction Network of East and Southern Africa*. Wageningen: The Netherlands.

- Teweldmehidin, M. and Conroy, A. (2010). The Economic Importance of Draft Oxen on Small Farms in Namibia's Eastern Caprivi Region. *African Journal of Agricultural Research*. 5(9): 928-934.
- The Brooke (2019). Invisible livestock: Benefits, threats and solutions. Available at https://www.thebrooke.org/sites/default/files/Advocacy-and-policy/Invisible-livestock-2019_0.pdf. (Accessed on 11 June 2019)
- Umar, A. (2010). Economic Evaluation of investment in Animal Traction a Case Study of Katsina State, Nigeria. In Y. Kishida (Ed.), *Agricultural Mechanization in Asia, Africa and Latin America*, Farm Machinery Industrial Research Corporation: Japan
- UN HLPE (2016). Leave No One Behind, a call to action for gender equality and women's economic empowerment, Report of the UN Secretary-General's High-Level Panel on Women's Economic Empowerment, New York: UNHLP.
- UN Women (2016). Progress of the World's Women 2015-2016, transforming economies, realizing rights, New York: UN Women.
- Valette, D. (2014). Invisible Helpers: Women's views on the contributions of working donkeys, horses and mules to their lives Available at: <https://www.thebrooke.org/sites/default/files/Advocacy-and-policy/Invisible-Helpers.pdf>. (Accessed 2 January, 2017).
- Valette, D. (2015). Invisible Workers: The Economic Contributions of Working Donkeys, Horses and Mules to Livelihoods. Available at: <https://www.thebrooke.org/sites/default/files/Advocacy-and-policy/Invisible-workers-report.pdf>. (Accessed 2 January, 2017).
- WHO (World Health Organization)/UNICEF (United Nations Children's Fund) (2010). Progress on sanitation and drinking-water: 2010 update. Report by the Joint Monitoring Programme (JMP) for Water Supply and Sanitation. Geneva, Switzerland.

APPENDIX I: SURVEY QUESTIONNAIRE



UNIVERSITY OF NAIROBI

Contribution of donkeys to livelihood of households

Household Survey Questionnaire, 2018

Researcher

Davies Barasa Mwasame

Purpose of this Survey

The reason for conducting this field survey is to obtain statistical evidence on the contribution of donkeys to livelihood of households. The information obtained will be used to guide policy on ways of promoting and protecting donkeys as a source of human livelihood. All the information you will provide together with other 244 respondents in this study will be kept confidential to the researcher and anonymity shall be maintained throughout the study. Your voluntary participation in answering questions on this subject is highly appreciated.

In this survey, household head, spouse or older family members above 18 years old, familiar with and involved in decision-making on household livelihood activities will be interviewed. The survey will take approximately one hour to complete all questions, I therefore request for your permission to start now.

START TIME _____

SECTION A: GENERAL INFORMATION (Household and site identification)

A01. Household ID _____ **A02.** Enumerator's ID _____

A03. Name of household head _____ (Optional)
First name Last name

A04: Telephone number of respondent _____ **A05.Treatment** (1) Owner
(2) Non-Owner

A06: Respondents Name _____ (skip if same to household head)
First Name Last Name

	Question	Response	
A07	Date of interview	_____ (dd-mm-yyyy)	
A08	Sub-County	_____	Code _ _
A09	Ward	_____	Code _ _
A010	Village	_____	Code _ _
A11	Distance nearest Murram road (motorable)	Kilometers	_ _ (Approximate)
A12	Distance to nearest Tarmac	Kilometers	_ _ (Approximate)

SECTION B: HOUSEHOLD CHARACTERISTICS

HH member identification [Record at least 1 name]	Relation to HH head [Use Codes A below] 1= HH head 2=Husband/wife 3=Child 4=Grandchild 5=Brother/sister 6=Servant 7=Other relatives	Gender: 1= Male 0=Female	Age (yrs)	Is [name] currently in school? 1=Yes 0=NO	Educational Level (Years of Schooling)	Marital status 1= Single 2=Married 3= Divorced 4=Separated 5=Widowed	Did you undertake any salaried work in 2016? (if above 18yrs old) :1=Yes 0=No	If yes, How many months did you work?	Amount earned per month
	B01A	B01B	B01C	B01D	B01E	B01F	B01G	B01H	B01I
1.									

B01. How many members live in your household? _____ (proceed to table B below)

SECTION C: Profitability of Donkeys (For donkey owners only - Treatment)

C01. Do you own a donkey at present? (1) Yes (0) No

C02. Which year did you acquire the donkey _____?

C03. What are the costs that you incurred in purchase and use of maintenance of donkeys in the last one year? (fill the table C03 below)

What are the costs incurred	C03A. Do you have any of these items? 1=Yes 0=No	C03B.H ow many items do you own? (count)	C03C. How did you acquire these items? (see codes below)	C03D. What is the purchase price? (if not Purchased what is the current market price) (KES)	C03E. If hire how much do you pay per month? (KES)	C03F.If you were to sell these items, ow much would charge? (KES)	C03G. Did you incur any veterina ry costs in 2016? 1=Yes 0=No	C03H. If yes, how much did it cost you in 2016 (KES)	C03I. What is the cost of feeding your donkey per month	C03J. Do hire a laborer to work with your donkey 1=Yes 0=No	C03K. If yes, How much do you pay the laborer per month (KES)
1. Donkey											
2. Pull cart	__										
3. Plough	__										
4. Accessories (e.g. Chains, bolts, strap)	__										
5. Other donkey accompaniments (specify)_____	__										

Code C03B: 1. Purchase 2. Rent 3. Inherited 4. Gift (given freely)

C04. How many hours does your donkey work per day (average) _____hours

C05. What are the main roles that donkeys play in your household? (Fill in table C05 below for donkey owners)

	C05A. Do you use your donkey(s) in any of these roles? 1=Yes 0=No	C05B. How many donkeys do you use for each activity?	C05C. Rank the three most important roles of your donkey	C05D. Who performs these activities in your household? (See codes)	C05E. If NO in C04A, what methods do you use to perform these activities? (see codes below)	C05F. How often do you do these activities?	C05H. How much do you earn from this activities per month?	C05I. How much would/do you pay for these activities if you were to hire other forms of labor? (KES/month)
1. Transporting goods for other people (Business)	<input type="checkbox"/>							
2. Renting out	<input type="checkbox"/>							
3. Ploughing	<input type="checkbox"/>							
4. Fetching water	<input type="checkbox"/>							
5. Fetching firewood	<input type="checkbox"/>							
6. Transporting animal feeds	<input type="checkbox"/>							
7. Transporting building materials	<input type="checkbox"/>							
8. Transporting agric. Products to the market	<input type="checkbox"/>							
9. Transporting farm manure/fertilizer	<input type="checkbox"/>							

Code C05D
 1=Paid workers
 2=Male household head
 3=Female household head
 4=Children
 5= Both men and Women

Code C05E
 1=Bicycle 4=Ox-cart
 2=Human 5=Hired donkey
 3=motorbike 6=Vehicle

Code C05F
 1=once a week
 2=daily
 3=twice a week
 4=once a month
 5=Never

C06 Do you perform any of the following activities in your household? (**For those who do not own a donkeys**)

Household roles	C06A. Do you perform any of the following activities in your household? 1=Yes 0=No	C06B. How often do you do these activities? (See codes)	C06C. How much do you carry per week? (estimate in Kgs)	C06D Who performs these activities in your household? (see codes)	C06E. Which mode do you use for these activities?	C06F. How much does this mode cost you per month? (If not household labor)
1. Fetching water	__					
2. Transporting building material	__					
2. Fetching firewood	__					
3. Transporting animal feeds	__					
4. Transporting agric. Products to the market	__					
5. Transporting farm manure/fertilizer						

Code C06B
 1=once a week
 2=daily
 3=twice a week
 4=once a month
 5=Rarely

Code C06D
 1= Paid workers
 2=Male household head
 3=Female household head
 4=Children

Code C06E
 1=Bicycle
 2=Human
 3=motorbike
 4=Ox-cart
 5=Hired donkey
 6=Vehicle

SECTION D: HOUSEHOLD INCOME

D01. Household Crop Income

	Three main crops		D01A	D01B	D01C
1	Did you grow during 2016? 1=Yes 0=No	Long rains	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Short rains	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Did you sell during 2014 1=Yes 0=No	Long rain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Short rain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Total value (KES)	Long rains			
		Short rains			

D02. Household Business Income

Business	D02A. DO you own any of this business? 1=Yes 0=No	D02B. Total value at present	D02C. Monthly income (Kshs)	D02D. When did you start (year)
1. Retail Shop				
2. Transport services using donkeys				
3. Tailoring				
4. Trading grains (vegetables, fruit vendors included)				
5. Hairdressing				
6. livestock trading				
7. Selling soft drinks				

D03. Other Household Income sources

Sources	D03A. Earned from source? 1=Yes 0=No	D03B. Quantity (units)	D03C. Price/ unit	D03D.Total income (Kshs)
1. Milk	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2. Egg s	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3. Manure/compost	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
4. Other livestock product (specify.....)	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
5. Rented out land	<input type="checkbox"/>			<input type="text"/>
6. Rented out donkeys	<input type="checkbox"/>			<input type="text"/>
7. Regular employment income	<input type="checkbox"/>			<input type="text"/>
8. Pension income	<input type="checkbox"/>			<input type="text"/>
9. Casual employment income	<input type="checkbox"/>			<input type="text"/>
10. Remittances	<input type="checkbox"/>			<input type="text"/>
11. Sale of trees/timber/firewood, etc	<input type="checkbox"/>			<input type="text"/>
12. Sale of charcoal, bricks, stones, sand, etc)	<input type="checkbox"/>			<input type="text"/>
13. Fishing/fisheries	<input type="checkbox"/>			<input type="text"/>
14. Bee keeping	<input type="checkbox"/>			<input type="text"/>
15. Other (specify)_____	<input type="checkbox"/>			<input type="text"/>

SECTION E: HOUSEHOLD ASSETS

E01: Livestock Assets

What livestock do you own in your household (fill table E01 below)

Livestock type	E01A. Current stock (number)	E01B. Current value of stock (KES)	E01C. Did you sell any in 2016? 1=Yes 0=No	E01D. If sold, how much money did you get? (KES)
1. Bulls	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
2. Cows	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
3. Heifers	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
4. Calves	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
5. Oxen	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
6. Goats	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
7. Sheep	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
8. Donkeys	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
9. Pigs	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
10. Chicken	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
11. Ducks /Turkey	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
14. Rabbit	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _
15. Other (specify___)	_ _	_ _ _ _ _ _ _	_	_ _ _ _ _ _ _

E02: Physical Assets

Do you own any of the following assets (Fill table E02 below)

Asset name	E02A. Number currently owned	E02B. Year bought/built	E02C. Current value (KES)
1. Ox-plough	□□□	□□□□□□	□□□□□□□□
2. Ox-cart/pulling cart	□□□	□□□□□□	□□□□□□□□
3. Chemical Sprayer/pump	□□□	□□□□□□	□□□□□□□□
4. Wheel barrow	□□□	□□□□□□	□□□□□□□□
5. Bicycle	□□□	□□□□□□	□□□□□□□□
6. Motorcycle	□□□	□□□□□□	□□□□□□□□
9. Radio/radio cassette	□□□	□□□□□□	□□□□□□□□
10. Mobile phone	□□□	□□□□□□	□□□□□□□□
11. Television (TV)	□□□	□□□□□□	□□□□□□□□
12. Water pump	□□□	□□□□□□	□□□□□□□□
13. Generator	□□□	□□□□□□	□□□□□□□□
14. Machete	□□□	□□□□□□	□□□□□□□□
15. Hoe	□□□	□□□□□□	□□□□□□□□
16. Refrigerator	□□□	□□□□□□	□□□□□□□□
17. Sofa	□□□	□□□□□□	□□□□□□□□
18. Car	□□□	□□□□□□	□□□□□□□□
19. Other.....	□□□	□□□□□□	□□□□□□□□

E03: Household Amenities

What is the status of your living house, toilet and source of water (fill table E03 below)

	Question	Response
E03A	What is the walling material of your main house? 1=Earth 2=Stone 3=Bricks 4= unburned brick 5=Cemented earth 6=Other (specify)_____	_
E03B	What type of floor does your main house have? 1=Earth 2=Cement 3=Smearred earth/dung 4=Other (specify)_____	_
E03C	What is the roofing material of your house? 1=Grass/straw 2=Iron sheets 3=Tiles 4=Other (specify)_____	_
E03D	What is your main source of drinking water 1=Stream/spring 2=Well 3=Tap 4=Storage tank 5=rainwater 6=Borehole 7=Other (specify)_____	_
E03E	What kind of toilet do you have? [<i>If more than 1, ask for the main toilet used</i>] 1= Pit latrine 2=Flush 3=Bush 4= Other (specify _____)	_
E03F	What is your main means of transport 1=Bicycle 2=Public transport 3=Motorbike 4=Own vehicle 5=Donkey 6. Others (specify)_____	_

E04: Household Saving and Access to credit

E04A. Have you received credit in the last one year? (1) Yes (2) No

E04B. If yes, how much did you receive? _____ (KES)

E04C. Have you made any saving in the last 12 months? (1) Yes (2) No

E04D. If yes How much have you saved for the last twelve months? _____(KES)

Do you belong to any of the following groups at present (Fill table **E04** below)

Social/savings group	E04E. Do you belong to any of these groups at present? 1=Yes 0=No	E04F. Which year did you join?	E04G. Have you made any savings in the last 12 months? 1=Yes 0=No	E04H. If yes, how often do you save? 1=weekly 2=Daily 3=Monthly 4=Annualy	E04I. How much do you save for a given interval?	E04J. How much have you saved for the last 12 months
1. Sacco						
2. farmer group						
3. Micro-finance						
4. Table banking						
5. Funeral and burial scheme						
6.Banks						
7.Others (specify)						

E05. Subjective Impact assessment

	Since owning a donkey state your current livelihood status 1= Strongly agree 2= Agree 3= Neutral 4= Disagree 5=Strongly disagree	Compared to your non-donkey owning neighbors, state your current livelihood status 1= Strongly agree 2= Agree 3= Neutral 4= Disagree 5=Strongly disagree
1. More children go to school		
2. Able to afford household food requirement		
3. More time for women to take care of their children		
4. Stronger social ties with community members		
5. Improved soil fertility		
6. More timely performance of farming operations/household chores		

E06. What motivates you to use donkeys (you can tick more than one)

- 1) Other alternatives are expensive
- 2) Other alternatives cannot reach remote areas
- 3) No alternative
- 4) Donkeys are free

End of Interview. Thank you for participating.

END TIME _____

APPENDIX II: Correlation Matrix

Correlation matrix for OLS regression model

	Age_Cat	Educ_lvl	In_distmkt	In_Donkhrs	donkey_use	Gender	C02P_Vet_care	C02N_Donk_sick
Age_Cat	1.000							
Educ_lvl	0.156	1.000						
In_distmkt	-0.061	-0.081	1.000					
In_Donkhrs	-0.061	-0.098	-0.185	1.000				
donkey_use	-0.217	-0.193	-0.118	0.292	1.000			
Gender	0.180	-0.110	0.001	-0.068	-0.102	1.000		
C02P_Vet_care	-0.063	-0.126	0.082	0.162	0.104	-0.116	1.000	
C02N_Donk_Sick	-0.007	0.040	0.163	0.105	0.053	-0.084	0.291	1.000

Correlation Matrix for Tobit model

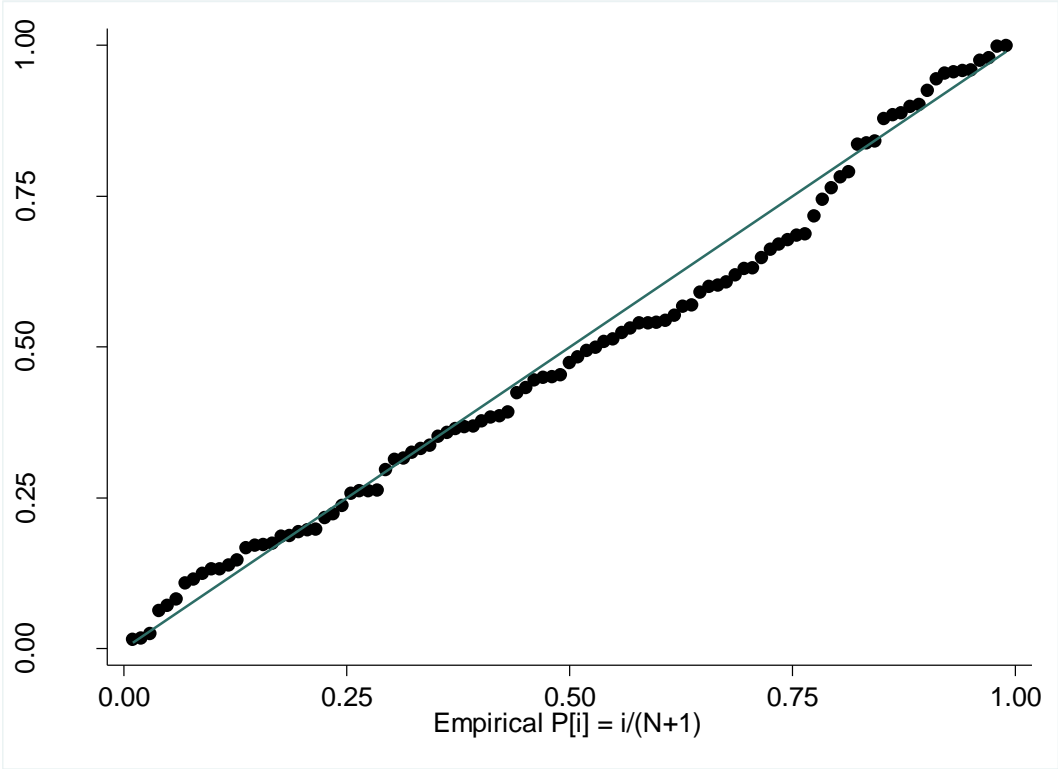
	Hhld_size	Donkey_own	Distance_mkt	Female_Age	Asset value	Crop_farming	Lvstck_rearing	Female_emp
Hhld_size	1.000							
Donkey_own	0.095	1.000						
Distance_mkt	0.091	0.084	1.000					
Female_Age	0.157	0.186	0.018	1.000				
Asset Value	0.403	0.120	0.151	0.092	1.000			
Crop_farming	0.015	0.076	0.074	-0.045	0.004	1.000		
Lvstck_rearing	-0.001	0.227	0.059	0.128	0.052	0.206	1.000	
Female_emp	-0.035	-0.094	-0.010	0.014	-0.008	-0.088	0.064	1.000

APPENDIX III: Test for Multicollinearity

Multiple Linear Regression model

Variable	VIF	1/VIF
Donkey Usage	1.39	0.720
Donkey working hours	1.32	0.754
Veterinary care provision	1.22	0.819
Education level of household head	1.19	0.842
Whether or not the donkey fell sick in 3 months	1.19	0.844
Gender	1.15	0.868
Distance to the nearest market	1.13	0.885
Age of household head in years	1.12	0.896
Mean VIF	1.21	

APPENDIX IV: Test for normality



APPENDIX V: Durbin Wu Hausman Test

Error	Coefficient.	Std. Err.	t
donkey_use	-0.0000192	4716.396	0.000
A013_Dist_tarmac	0.0000666	1286.478	0.000
Gender	1.80E-04	5843.378	0.000
B01C_Age_mem1_1	-2.69E-06	141.2389	0.000
B01E_Educlvl_mem1_1	-3.67E-06	629.9578	0.000
B01K_SLR_Wrkmem1_1	0.0001737	7038.237	0.000
C02V_Work_hours_1	-0.0000169	873.9933	0.000
C02P_Vet_care_1	0.0000286	4997.614	0.000
Locality	-1.14E-04	4320.58	0.000
Hhldinc_monthly	-3.72E-09	0.0767487	0.000
_cons	0.0002329	10532.25	0.000