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Role Played by Bicycles in Rural Employment Diversification in Laikipia County, Kenya

Fredrick M. Karema
University of Nairobi,
Department of Geography and Environmental Studies,
P.O. Box 425-10400, Nanyuki, Kenya

Evaristus M. Irandu
University of Nairobi
Department of Geography and Environmental Studies
Box 5207-00200, Nairobi, Kenya

Paul N. Mbatia
Multi-Media University
P.O. Box 52702- 00200, Nairobi, Kenya

Abstract:- This paper investigates the use of bicycles and their possible effects on promotion of non-farm production activities focusing on employment diversification in Laikipia County, Kenya. A questionnaire survey was used to interview 384 respondents from the area of study. Data was analyzed using both descriptive and inferential statistics. Data was randomly selected from the individuals from a complete list of the population. Stratified samples from the population were used for primary data collection. The population was further divided into strata with similar characteristic and participants were selected within the strata. The strata in this case were 15 administrative wards within which proportionate sampling were carried out. The paper is based on the premise that, there is no significant difference between bicycle use and non-farm activities engagement in Laikipia County. The study found out that key non-farm activities which were developed due to bicycle ridership generated productive engagement. A correlation between the respondents' income and occupation had a significant correlation of 0.421. A conclusion was therefore, drawn that income and economic activities significantly determined the distance travelled in Laikipia County. Another striking result from the study showed that occupation and level of education had a significant positive correlation of 0.449. This denotes that level of education and occupation significantly determined the distance travelled by walking and cycling in Laikipia County. The study recommended that the County Government should develop infrastructure to facilitate cycling such as bicycle lanes and offer loan facilities to bicycle operators to access credit in order to purchase new bicycles to increase ridership. The study emphasized on the need to ensure appropriateness of the non motorized transport technologies adopted in Laikipia County. Reducing prices of spare-parts by the government was the key solution of overcoming bicycle operators' challenges mentioned by respondents in Laikipia County.

Keywords:- *Bicycle Lane, Non-Farm Employment, Non Motorized Transport, Intermediate Means of Transport, Mobility, Mobility Indicator.*

I. INTRODUCTION

Laikipia County is classified as arid and semi-arid area (ASAL) and it is often adversely affected by climate hazards such as droughts thereby putting the lives and livelihoods of households in jeopardy. Rainfall is unpredictable in Laikipia County, while droughts have become more frequent.. During the rainy season, rural communities are often completely cut off from the major roads, rail lines, and other public transport services. This results in poor access to economic, social activities and opportunities in major market centres (HLAGST, 2016). Rural access is the main driver in enabling the rural poor to escape from poverty. It reduces over social exclusion by linking their wares to markets and connecting rural areas to market towns. Sampled non-farming activities from Laikipia County include handicrafts, construction, repair, transport, community service in the designated rural areas.

Debates about rural development attach increasing importance to the rural non-farm sector. Traditionally, rural households in developing countries have been viewed as though they were exclusively dependent on agriculture. However, there is overwhelming evidence to the effect that many rural households can have highly varied and often multiple sources of income (Lanjouw and Shariff (2002). This is so because rural households can, and do participate in a wide range of non-agricultural activities, such as wage employment and self-employment in commerce, manufacturing and transport services among others alongside the traditional rural activities of farming and agricultural labour. Such non-farm incomes can and do contribute significantly to total incomes of farming households in developing countries such as Kenya. .

Amongst policymakers and researchers, there is considerable interest in understanding the contribution of non-farm activities to economic growth and development of rural areas. In particular, it is intriguing to establish whether there is any, specific role it can play in alleviating rural poverty. There is growing fear in many parts of the developing world that rapid growth in agriculture during the next few decades may be untenable, and in the absence of other alternative livelihoods it may be difficult to maintain and/or raise rural living standards. This may lead to rising rural poverty and trigger more rural-urban influx

(Lanjouw and Shariff (2002). Whether and how the rural non-farm activities can be promoted so as to cushion any adverse effects from any decline in the agricultural sector is a subject of keen interest. This is the motivation of this paper. The paper is intended to bridge existing knowledge gap on the role of non- farm activities in promoting rural employment with specific reference to bicycle transportation.

Non-farming activities can be classified into three broad categories, namely, regular employment, self-employment and casual employment. Culturally, socially and environmentally, Kenya is at a crossroads (Fletcher 1999). It has tended to pursue the same car-based, land-use and transportation model that has failed to deliver social cohesion in Europe and the USA (Fletcher 1999)., Therefore, it is important to consider other transportation models to minimize automobile dependency, which is characterized by high levels of per capita automobile travel, automobile-oriented land-use patterns, and other transport alternatives. There is need to explore the physical and socio-cultural barriers preventing women from benefiting from cycling infrastructure and provide appropriate gender-sensitive ways to encourage its use.

II. LITERATURE REVIEW

According to World Bank report (2005), Non-Motorized Transport is usually ignored and not planned for in Sub-Saharan Africa. For instance, fresh construction and improvement of roads does not offer actual infrastructure like overpasses for open non-motorized transport operators. Consequently, cars and other motorized modes are favoured hence, disadvantaging the poor. Lisa (1996) pointed out that sound policy options for several transportation problems are triggered by inadequate and relevant data. About 98 per cent of the people who use public transport in Scandinavian cities start their journey on foot or on bike. In rural districts, 90 per cent walk or cycle part of the way. To promote public transport use, there is need to improve the state for pedestrians and cyclists and also guide them on how to make a choice. About 63 per cent of Copenhagen's cycle since it is easy, fast and convenient. There is need to integrate schemes that are well thought out. Cycling is believed to have significant potential in providing affordable, cheap and efficient transport in the world. Despite the fact that in Brazil cycling possession levels are high, this potential has not been realized. The size of cities makes cycling inappropriate for entire trips; however integration of cycling into public transport, when analyzed and planned, may contribute immensely in raising the modal share of bicycles (Carvalho de Souza, 2011).

According to (Jobanputra, 2013; Masaoe, 2013), about 62% of the accidents of young people of 15 and 44 years old in Africa occur on roads. The vulnerable categories have poor mobility. This contributes to their remote access to health-care, education and economic opportunities. Poor access to these opportunities leads to inadequate affordability and use of the existing Non- motorized transport facilities. It is hard to evaluate pedestrian mobility at country level because walking is used for short trips which are not registered by national travel surveys and therefore, significance of walking is not highly rated. Seven European countries survey data indicate that 12-30% of the entire trips especially Great Britain is done by walking. Average length of trips is about 1 km in Great Britain to 2.8 km in Finland. Comparison of average trip length is impossible as it varies from country to country. For example, in Great Britain all trip lengths are included, while in Denmark trips less than 300 metres are not included and 300-1500 metres are termed as 1 km.

The 1970s oil crisis led to a deeper understanding of the oil dependent countries in Western Europe. In the Netherlands, about 3,300 people died in traffic in 1972 (Van den Bergh, 1997). The government saw the need of change and bike paths were separated from other modes of transport in the city centers. The cyclists were given back the rights to the streets as it was initially. This led to boosting of biking culture in Netherlands.

- *Theoretical Consideration*

Theoretical framework is the 'blueprint' for a research which consists of theoretical principles, constructs, concepts, and tenants of a theory (Grant & Osanloo, 2014). It is based on an existing theory in a field of inquiry that is related to the hypothesis of a study. It serves as the foundation upon which a research is constructed. Theory building is termed as "the resolute progression or recurring cycle by which coherent images, and representations of practical or skilled phenomena are generated, verified, and refined" (Lynham, 2000b, p. 161). Good theory building includes: outcome and progression knowledge which is capable of explaining and predicting knowledge; for example, insight understanding of meaning and working principles (Dubin, 1976). Chapin (1974) provided a framework on how societal constraints and inherent individual motivations interact to shape activity involvement patterns. However, the framework ignored the spatial context and failed to address the relationship between activities and travel.

III. MATERIALS AND METHODS

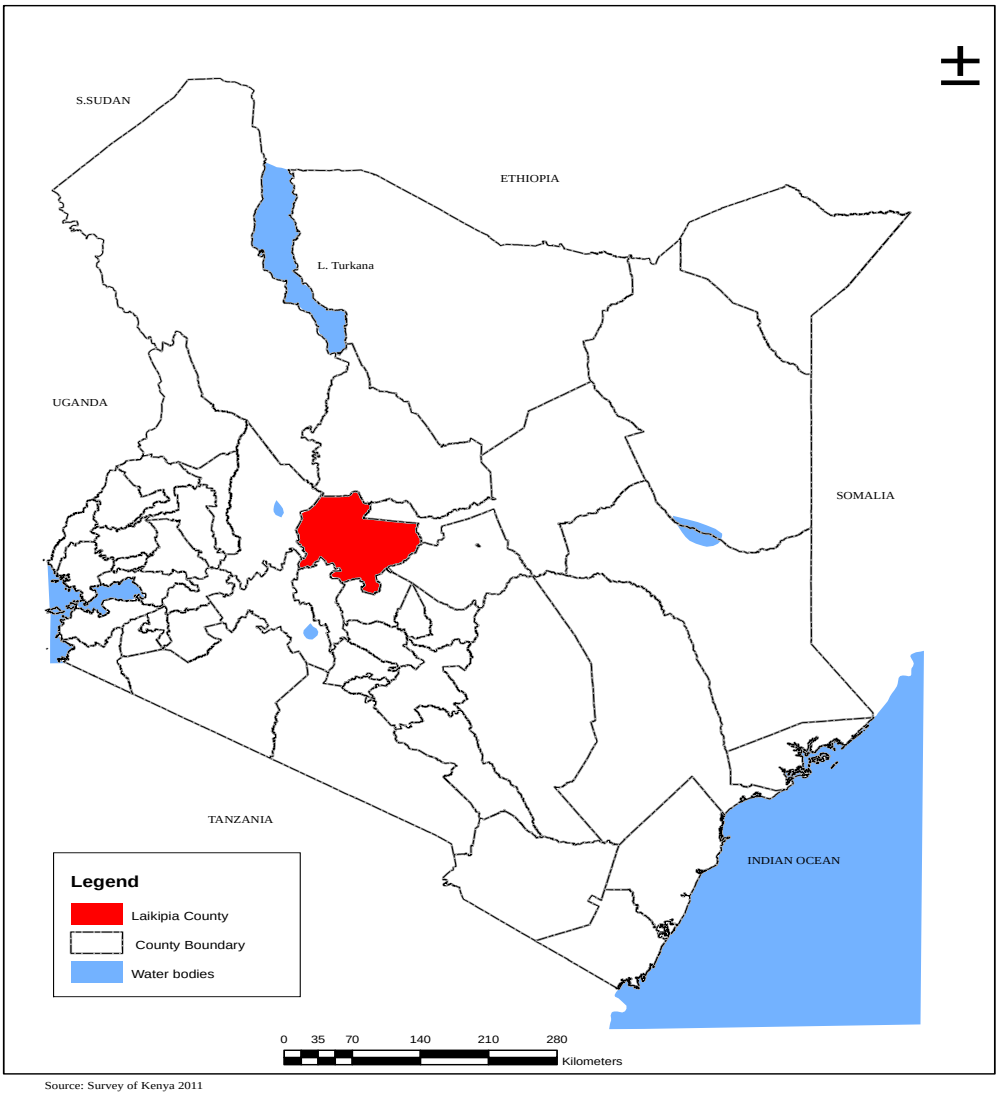
- *Study Location*

Laikipia County consists of three administrative sub-counties: Laikipia East, Laikipia North, and Laikipia West. Laikipia County is located in Rift Valley. The name Laikipia means '***treeless plain'*** in Maasai language an apt description of the county, which is a vast plain where both wildlife and domestic animals roam freely on the rangelands of Laikipia. It shares boundaries to the North with Samburu County, in the North East there is Isiolo County, in the East there is Meru County, in the South East is Nyeri County, in the South West there is Nyandarua County and Nakuru County while in the West there is Baringo County. It lies within latitudes 0^{o} 18" and 0^{o} 51" North and within longitude 36^{0} 11" and 37^{0} 24' East. It is the 15^{th} largest county in Kenya and occupies an area of 9,462 km^2 of land. It experiences an average of 400mm and

750mm annually. Its annual mean temperature ranges between 16^0C and 26^0C. Laikipia County is mainly a plateau bordered by the Aberdares to the south, Mt. Kenya massifs to the southeast and by the Great Rift Valley to the west (GoK, 2014a). In the year 2009 census, Laikipia County had a total population of 399,227 persons (GoK, 2009a). The projected total population was at 479,072 in 2015 and likely to be 479,072 by 2017 (KNBS, 2014).

The county is served by two district hospitals, Nanyuki Referral and Teaching Hospital and Nyahururu General Hospital. Other healthcare facilities include 56 dispensaries, 8 health centers, 9 medical clinics and 2 nursing homes. The county has 350 primary schools and 91 secondary schools. The county has 15 wards, 51 locations and 96 sub-locations. Laikipia East sub-county is in the east, in the north is Laikipia North, in the south-east is Laikipia Central and in the west of the county is Laikipia West.

The available industrial activities are found in Nanyuki and Nyahururu towns within Laikipia County. The industries mainly concentrate on leather, milk, meat and food processing. The only meat processor is in Rumuruti and is known as Ngare Narok Meat Industry. The county has two bakeries, four main flour mills, milk cooling depot and saw milling firms. The county has seven *Jua kali* associations offering employment to about 255 artisans. Petroleum products are stored and distributed in the county at a low scale. Honey harvesting and processing of wax is done within the county especially, in Rumuruti, Lariak, Marmanet, and Mukogodo forests. The county's road network is not well developed and therefore, majority of transport activities mentioned in the study are carried out by use of NMT.



Source: Survey of Kenya 2011

Fig 1:- Map of Laikipia County in Kenyan Map

➢ *Research Design*

According to (Labaree, 2009), research design is the overall strategy chosen and integrated into the study in a logical and coherent manner while addressing the research problem. The new approach to rural transport was identified by (1) the introduction of the household as the unit of analysis rather than a focus on the region or the country, (2) the movement of rural people and their goods

to meet their domestic, economic and social needs, by any means, along paths, tracks and roads (Dawson and Barwell, 1993).

➢ *Sampling*

Sampling was done by random selection of individuals from a complete list of the population. Population was stratified into strata based on appropriate characteristic, for example, age, level of education, and income, then selecting the participants within the clusters or strata (Singleton and Straits, 2010: 151). The total number of households in Laikipia County was 103,114 (KNBS, 2013).

The stakeholders that were interviewed comprise of non-motorized transport users, key informants, and non-motorized transport operators. Stakeholders had knowledge, wisdom and insight information that guided the study. They provided a broader scope of the interviewees' opinions on the topic which revealed a hidden concern from specific questions in the questionnaires.

➢ *Sample Size*

The population of the stakeholders was unknown. Therefore, the sample size was derived by computing the minimum sample size required for accuracy in estimating proportions by considering the standard normal deviation set at 95% confidence level (1.96), percentage picking a choice or response (50% = 0.5) and the confidence interval (0.05 = ±5) (Ishmael Mensah, 2014). The formula is:

$$n = \frac{z^2 (p)(1-p)}{c^2} \quad \text{(Ishmael Mensah, 2014)}$$

Where:z = standard normal deviation set at 95% confidence level,
p = percentage picking a choice
c = confidence interval
Application of the formula to determine the sample size:

$$n = \frac{z^2 (p)(1-p)}{c^2} = \frac{1.96^2 (0.5)(1-0.5)}{0.05^2} = \frac{0.9604}{0.05^2} = 384.16$$

Stratified random sampling was done and a total of 384 non-motorized transport stakeholders were selected. The target population was divided into 15 strata of administration classification. The sample for each stratum was extracted from the sample frame. Within the stratum simple random sampling was performed for non-motorized transport operators (Ruth *et.al*.,2005). According to Hamilton *et al*., (2005) the agenda of gendered mobility was achieved by providing door-to-door demand-responsive services. In order to ensure gender representation in the study, door-to-door interview of households within the study area was done.

➢ *Data Collection Procedures*

Stratified samples from the population were used for primary data collection. The population was further divided into strata with similar characteristic and participants were selected within the strata (Singleton and Straits, 2010: 151). Interviewing key informants, focus group discussions and performing pedestrian questionnaires in Laikipia County was conducted. Proportionate sampling for the county was done. A total of 384 households were interviewed as indicated in Table 1. Out of a total of 384 households, purposive sampling for key participants was done. Secondary data was sourced from the review of peer refereed journals, published and unpublished materials.

Sub-County	Wards	Population	Target Population	Sample size
Laikipia East Sub-county	Ngobit	23,978	26	
	Tigithi	27,062	30	
	Thingithu	20,836	23	
	Nanyuki	28,485	31	
	Umande	16,201	18	
	Total	116,562	128	128
Laikipia West Sub-county	Igwamiti	66,466	51	
	Marmanet	42,422	33	
	Githiga	27,958	22	
	Salama	23,824	18	
	Rumuruti-Township	21,265	16	
	Ol-Moran	17,556	14	
	Total	199,491	154	154
Laikipia North Sub-County	Sosian	25,848	33	
	Mukogondo West	23,362	30	
	Segera	15,911	21	
	Mukogondo East	13,702	18	
	Total	78,823	102	102
	Total sample size			**384**

Table 1:- Distribution of Households' Sample Size within the Sub-counties in Laikipia County
Source: Kenya Population and Housing Census (2009)

➢ *Data Analysis*

Data coding was done using categories of responses which was assigned values, classified and then recorded. Descriptive statistics and inferential statistics were carried out using Statistical Package for Social Sciences (SPSS) and EXCEL programmes to generate mean scores, frequencies, percentages, Chi-square and correlations.

➢ *Socio-Economic Characteristics of the Respondents*

This focuses on the demographic and socio-economic attributes that indicate how travel distances vary with the individuals' characteristics such as age, gender, occupation, income and level of education. This helps us to understand their relationships with median distance travelled. A total of 30 variables were generated by the help of SPSS programme version 20. Data validation was done with assistance of each variable's level of measurement.

Km		NMT used in Laikipia							
	Walking (O)	Expected (E)	(O-E)	$\sum(O-E)^2/E$	Cycling (O)	Expected (E)	(O-E)	$(O-E)^2/E$	Total
1-10	149	148	1	0.007	151	151.6	0.6	0.002	300
11-20	33	33.7	-0.7	-0.015	35	34.4	0.6	0.01	68
>20	8	7.9	0.1	0.001	8	8.1	0.1	0.001	16
Total	190			**-0.007**	194			**0.013**	384

Table 2:- Chi-square (X^2) Contingency Table of Walking and Cycling Distance Travelled in Laikipia County.
Source: Fieldwork (2018)

Calculated X^2 at 2 degrees of freedom = 0.006

Critical X^2 at 2 degrees of freedom at 0.05 significance level = 5.99

Therefore, the Calculated X^2 is smaller than the Critical X^2

There was no adequate evidence to reject the null hypothesis that cycling was independent of distance travelled in Laikipia County. Therefore, the hypothesis was adopted. A conclusion was drawn that, cycling was not determined by the distance travelled in Laikipia.

IV. RESULTS AND DISCUSSION

➢ *Characteristics of Cycling Commuters in Laikipia County*

Table 3 shows the distribution of age categories of bicycle operators. The table indicates that there were 8 categories of bicycle operators. The highest age category was that of 31-40 years with a percentage of 19.8. The second age category of the bicycle operators interviewed was that of 15-20 years with a percentage of 17.1. The third age categories were those of 21-25, 26-30 and 41-50 years with similar percentages of 16.2 each. The rest of the categories were insignificant.

Age of respondent		
Age Category	Frequency	Percent
15-20	19	17.1
21-25	18	16.2
26-30	18	16.2
31-40	22	19.8
41-50	18	16.2
50-55	8	7.2
56-60	4	3.6
>60	4	3.6

Table 3:- Distribution of Age Categories of Bicycle Operators
Source: Fieldwork (2018)

The age of bicycle operators was classified into 8 age categories and a bar chart was drawn using Excel programme for a quick comparison (Figure 2). Majority of the respondents interviewed fell in three age categories. The highest age category was 15-20 years with a frequency of 13, followed by the age category of 31-40 years with a frequency of 6 and the third highest age category was 41-50 years with a frequency of 5. This indicates that cycling and mobility depends on individual's age. This implies that the higher the age the lower the tendency of cycling and hence lower mobility rate. The trend line indicates a negative trend of relationship of age and frequency of cycling. According to the respondents interviewed cycling women in Laikipia County were found to fall on the age category of 26-30, 50-55 and 56-60 with a frequency of 1 each.

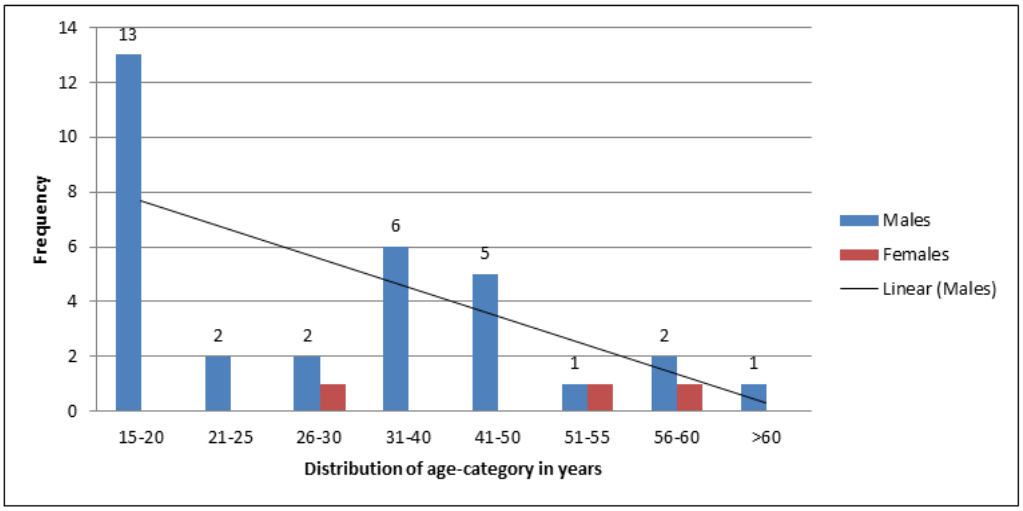


Fig 2:- A Trend Line Graph of Age Category of Bicycle Operators by Gender in Laikipia County
Source: Fieldwork (2018)

➢ *Mobility and Accessibility to Economic and Social Opportunities in Laikipia County*

Accessibility is a measure of development in the sense that it links people to economic and social opportunities (Rodrigue, Comtois, & Slack, 2017). The study explored the benefits of cycling in Laikipia County through a survey questionnaire. Respondents were asked whether there were any activities resulting from bicycle operation in Laikipia County. Those who were affirmative to the question had a percentage of 85.7 and those who were not aware of the activities resulting from NMT operation had 14.3 percent.

The study found out that several economic activities had sprung up from bicycle operation in Laikipia County (Table 4). Some of the economic activities cited by the respondents were:- Repair workshops accounted for 36.7 percent; sale of spare parts, roadside petrol, food, drinks, clothes and hawking accounted for 28.4 percent; bicycle race, cycling for charity and donation of bicycles to schools accounted for 11.7 percent; leisure parks, ambulance and fetching water accounted for 8.3 percent; and, cycling to the work place and school accounted for 6.6 percent.

Activities	Responses	
	Frequency	Percent
Sale of spare parts, roadside petrol, food, drinks, clothes and hawking	17	28.4
Repair workshops	22	36.7
Cycling to the work place and school	4	6.6
Leisure parks, ambulance and fetching water	5	8.3
Bicycle race, cycling for charity and donation of bicycles to schools	7	11.7
N/A	5	8.3

Table 4:- Activities Resulting from Bicycle Operation in Laikipia County
Source: Fieldwork (2018)

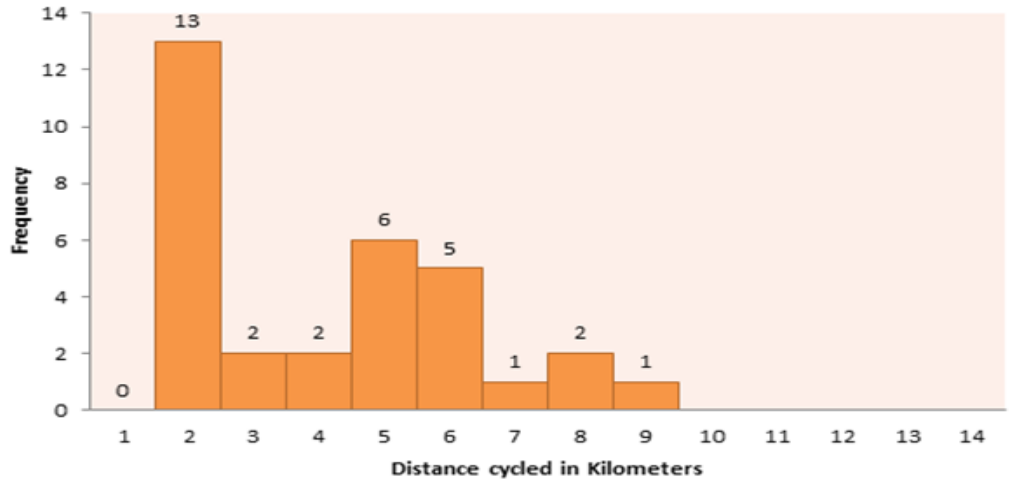


Fig 3:- Frequency of Distance Cycled in Kilometers in Laikipia County
Source: Field work (2018)

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Figure 3 indicates that from the first 2 kilometers commuters' cycling tendency is high. As the distance increases from 3 kilometers onwards cycling commuters' frequency decreases steadily as distance increases. This implies that as distance increases, the frequency of cycling decreases.

Leisure activities take a larger share within short distances which is done mainly by walking. But work trips which are greater than 1 kilometer distances have a large share.

➢ *Distribution of Age Categories of Bicycle Operators*

Figure 4 shows the distribution of age categories of bicycle operators. The bar graph indicates that there were 8 categories of bicycle operators. The highest age category was that of 15-20 years with a frequency of 13. The second age category of the bicycle operators interviewed was that of 31-40 years with a frequency of 6. The third age category was that of 41-50 with a frequency of 5. The rest of the categories were insignificant.

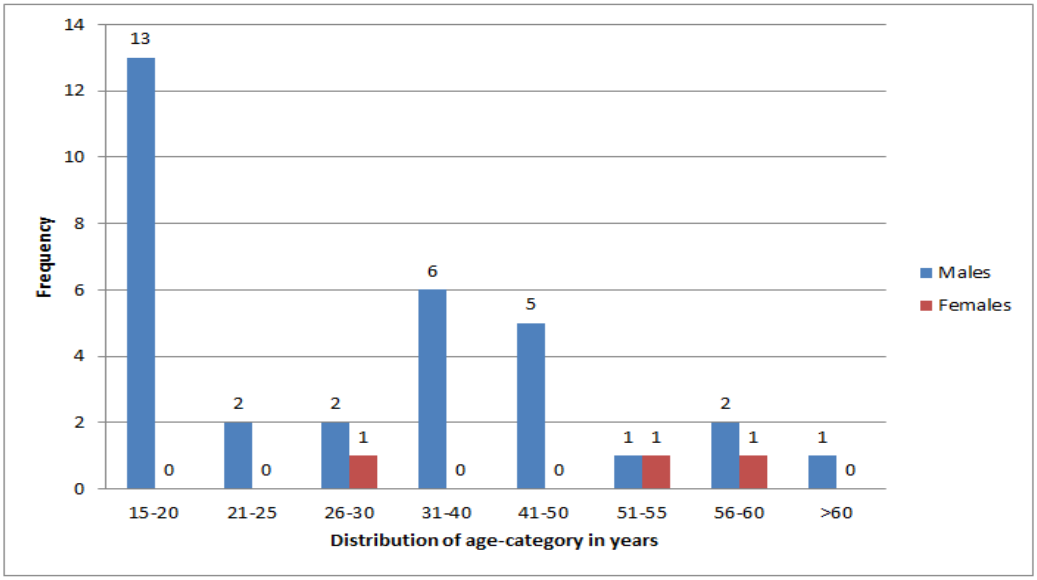

Fig 4:- Frequency of Age Categories of Bicycle Operators
Source: Fieldwork (2018)

➢ *Categories of Daily Income for Bicycle Operators in Laikipia County*

Daily income for the bicycle operators in Laikipia County were split into 6 classes (Figure 5.3). The classes were: Kenya shillings 100-500, 501-1000, 1001-1500, 1501-2000, 2001-2500 and 2501 and above. Majority of bicycle operators in Laikipia County had a frequency of 156 and was found to lie in the category of Kshs.100-500 which translates to 80 percent of the bicycle operators interviewed. The second highest category of the daily income in Kenya shillings. was Kenya shillings 501-1000 whose percentage was 16 percent of the bicycle operators interviewed. The rest of the categories were insignificant.

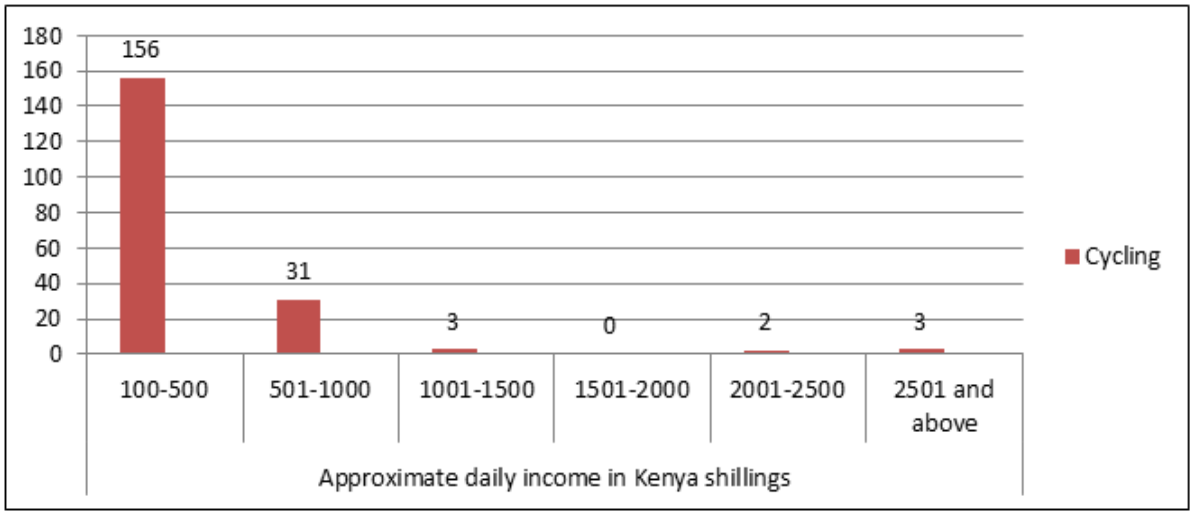

Fig 5:- Approximate Daily Income Categories of Bicycle Operators in Laikipia County
Source: Fieldwork (2018)

Fig 6:- Fuel Wood being Transported using a Bicycle
Source: Fieldwork (2018)

Gender roles define the rights, obligations, responsibilities, behaviour, the society sets for the two sexes. Gender stratification implies the social ranking, where men inhabit higher statuses than women. Amongst the duties defined for both sexes in rural family set-up, fetching firewood and water were mainly done by women and children. But due to the introduction of bicycles in the study area, such duties are being carried out by both men and women.

V. CONCLUSION AND POLICY RECOMMENDATIONS

Many rural families find farming insufficient as a means of survival and therefore, livelihood diversity originates from rural poverty interaction (Ellis, 1999). Future rural policies need to be aware of the rural poverty interaction in order to have sustainable solutions for the poor. Bicycles in Laikipia County play a key role in distribution of water, firewood and food stuff from suppliers. Bicycles are used as ambulances and other transport services since the roads are weather roads and impassable during rainy seasons. The study found out that 80 percent of bicycle operators in Laikipia County derived their livelihood from the activity. Bicycle operators' range of earnings was about Kshs.100-500 daily.

The study recommended that: County Government should construct bicycle lanes and offer loan facilities to bicycle operators. The study emphasized on the need to interrogate the non motorized transport technologies adopted in Laikipia County. Reducing prices of spare-parts by the government was suggested by the respondents as a key solution to bicycle operators' challenges in Laikipia County. Theft and vandalism for bicycles were identified as main distractions for cycling. Key solutions suggested by the respondents as a measure of curbing theft and vandalism were; safe parking for bicycles, insurance provision, police surveillance, and use of GIS applications.

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