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Mobility patterns and their impact on urban-rural linkages in small and intermediate towns in Kenya: a focus on the milk value chain

Jackson Kago

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Université Bordeaux Montaigne

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THÈSE DE DOCTORAT EN «Géographie Humaine»

**Mobility patterns and their impact on
urban-rural linkages in small and
intermediate towns in Kenya**

A focus on the milk value chain

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Mobility patterns and their impact on urban-rural linkages in small and intermediate towns in Kenya

A focus on the milk value chain

**Dissertation submitted at Université Bordeaux
Montaigne**

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*In fulfilment of the requirements of the degree of
Doctor of Philosophy (PhD) in Human Geography*

Date: December 2022

Declaration.

**This dissertation is my original work and has not been presented at any other university
for examination**

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Date

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Kenyatta University, Kenya

Date

December 2022

Dedication

To my wife Maggie,
children – Kelly and Joel
and
dad and mum.

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Abstract

Urban and rural areas are inter-connected through physical, economic, environmental and social linkages, and their boundaries are blurred. The interaction between the two areas is dependent on sustainable mobility that is anchored on resilient infrastructure. However, this interconnection is affected by barriers of mobility that limit effective interaction between the two areas leading to among others under-development especially in rural areas, food loss, high cost of production, decreased investments, and isolation of some areas. In particular, milk production is dependent on efficient mobility because milk is perishable. Infrastructure that is not well integrated to ensure mobility and accessibility may not reliably improve livelihoods in rural areas.

The research investigated mobility patterns between urban and rural areas and its implications on urban-rural linkages with a focus on the milk value chain. It covered issues of the patterns, motives, benefits, barriers and challenges faced during mobility. The research area was a transect between Ruiru town to Uplands village centre. It made use of qualitative techniques to assess both the usability and operational aspects of mobility by interviewing various actors and stakeholders along the dairy value chain.

The research shows patterns of mobility directed towards the locations where goods and services are sourced mostly in the urban centres and the flow of goods and services from the urban centres to the rural areas. This flow of goods between urban and rural areas creates a convergence and divergence in urban centres, making them focal points for human activities in rural areas and enhancing rural-urban linkages. The connecting road networks in turn act as the arteries or conduits that form connections and facilitate the flow of goods and services. The study also reveals the existence of a symbiotic relationship between urban and rural areas, whereby rural areas provide the raw material – milk, while the urban areas provide goods and services and undertake the processing of the raw materials. These rural-urban interactions that are anchored on mobility leads to a robust dairy value chain and a milk industry cluster particularly in Githunguri town which emerges as a ‘milk town’. The findings show that the milk value chain exhibits itself in the rural-urban space leading to the shaping of the territory from the village, market to urban centres.

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Glossary

<i>Askari</i>	Police
<i>Boda boda</i>	A bicycle or motorbike used as a taxi
<i>Chapati</i>	A kind of unleavened bread that resembles a pancake
<i>Chochoro</i>	Hidden routes
<i>Githigi</i>	Twig
<i>Igata</i>	Sodium Bicarbonate/ Magadi soda/ baking soda
<i>Kamiitu</i>	Place of thieves
<i>Karima</i>	Hill
<i>Machicha</i>	Brewers spent grain, a by-product of beer processing
<i>Mama</i>	Mother [of]
<i>Mandazi</i>	A kind of deep-fried bread
<i>Matatu</i>	A private owned mini-bus used as a taxi
<i>Mheshimiwa</i>	Honourable
<i>Mzee</i>	Old
M-Pesa	Mobile phone-based payment system operated by Safaricom Ltd
<i>Panya</i>	Rat
<i>Shamba</i>	Farm
<i>Weru</i>	Dry land

Exchange rate of the Kenyan shilling in 2019: 1US\$ = KSh. 106

Acronyms

ABS TCM	African Breeders Services Total Cattle Management Ltd
AC	Agri-based Cluster
AKEFEMA	Association of Kenya Feed Manufacturers
AI	Artificial Insemination
BAHLITA	Bar Hotel and Liquor Traders Association
CBD	Central Business District
CAK	Communication Authority of Kenya
CAP	Chapter
CBK	Central Bank of Kenya
CBR	Central Bank Rate
CIDP	County Integrated Development Plan
DFID	Department for International Development (United Kingdom)
EABL	East African Breweries Limited
ESIA	Environmental and Social Impact Assessment
FCS	Farmers Cooperative Society
GDP	Gross Domestic Product
GIKAKI	Githunguri Kagwe Kiambu Sacco
GMO	Genetically Modified Organism
GSV	Google Street View
ICRAF	World Agroforestry Centre
ICT	Information and communication technologies
IG	Inspector General

IIED	International Institute for Environment and Development
ILRI	International Livestock Research Institute
KARI	Kenya Agricultural Research Institute
KDB	Kenya Dairy Board
KEBS	Kenya Bureau of Standards
KENHA	Kenya National Highways Authority
KERRA	Kenya Rural Roads Authority
KRA	Kenya Revenue Authority
KRB	Kenya Roads Board
KURA	Kenya Urban Roads Authority
LRRD	Livestock Research for Rural Development
Ltd	Limited
M-PESA	Mobile phone-based money transfer service
MLHUD	Ministry of Land, Housing and Urban Development
NACOSTI	National Commission for Science, Technology and Innovation
NARUGI	Nairobi Ruiru Githunguri Sacco
NERC	National Emergency Response Committee
NKCC	New Kenya Cooperative Creameries
NLC	National Land Commission
NTSA	National Transport and Safety Authority
OCS	Officer Commanding Station
OECD	Organisation for Economic Co-operation and Development
PERAK	Pubs, Entertainment, and Restaurants Association of Kenya

PD&F	[Uplands] Premium Dairies & Foods Ltd (<i>Pascha</i>)
PSVS	Public Service Vehicles
SACCOs	Savings and Credit Co-Operatives
SMS	Short Message System
UHT	Ultra Heat Treated

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1 Introduction

Mobility is crucial for rural and urban development because it creates the link between production, exchange of goods and services, and consumption. Without it, people would not be able to sustain their livelihoods. To perceive how important mobility is, one can visualize a scenario where there was absolutely no mobility. Kwan & Schwanen (2016, p. 243) writes that mobility is “*endemic to life, society, and space.*” Mobility studies are broad, covering a wide range of disciplinary studies as illustrated by Sheller & Urry (2006, p. 207) to include “*anthropology, cultural studies, geography, migration studies, science and technology studies, tourism and transport studies, and sociology.*” Within Geography, Kwan & Schwanen (2016, p. 243) further asserts that mobility encompasses the geographic concepts of “*space, place, network, scale and territory.*”

The access to and between urban centres and the rural hinterland has an impact on how development takes place within the region. Lack of access inhibits mobility and reduces linkages which in turn slows development in regions that are inaccessible (Pinho & Silva, 2016). Mobility is associated with the act of ‘moving’. People move to survive; they move in search of food, money, water for themselves and their animals and essentially to sustain their livelihoods. All the more reason why UN-Habitat (2013) views mobility from a human rights perspective.

“Mobility is not only a matter of developing transport infrastructure and services, but also of overcoming the social, economic, political and physical constraints to movement. These constraints are influenced by factors such as: class, gender relations, poverty, physical disabilities, affordability, etc. Mobility is thus about granting access to opportunities and empowering people to fully exercise their human rights.” (UN-Habitat, 2013, p. 3)

The right to ‘freedom of movement’ enshrined in the Kenyan constitution reinforces the importance of this phenomenon to the lives of people. Mobility from a human rights perspective is seen as a bridge that allows populations to freely access sources of livelihood and socio-economic opportunities. Barriers to mobility create socio-spatial inequalities that include discrimination against disadvantaged groups. The barriers arise out of among others institutional, technical, political or social factors (UN-Habitat, 2013).

1.1 Background to the study

Milk production in Kenya

Agriculture, forestry and fishing directly contributed to 31.5 per cent of Kenya's GDP in the year 2018 out of which 4.4 per cent was specifically from animal production (Kenya National Bureau of Statistics, 2018). Kenya produced 5.275 billion litres of milk in 2016, out of which 55 per cent of it - 648.2 million litres was marketed (Kenya Dairy Board, n.d.; Kenya National Bureau of Statistics, 2018). 45 per cent of milk produced is either consumed by calves, spoilt or used domestically (Nassiuma & Nyoike, 2014). Out of the marketed milk, 80 per cent of it was sold through informal channels from the farm to neighbours, by milk vendors, and in milk parlours (Karanja, 2003; Muriuki, 2003; Nassiuma & Nyoike, 2014; TechnoServe Kenya, 2008; Tegemeo Institute, 2016). There is no recent data that shows whether these trends have changed but (Alonso et al., 2018) indicates that the trends could still be relevant.

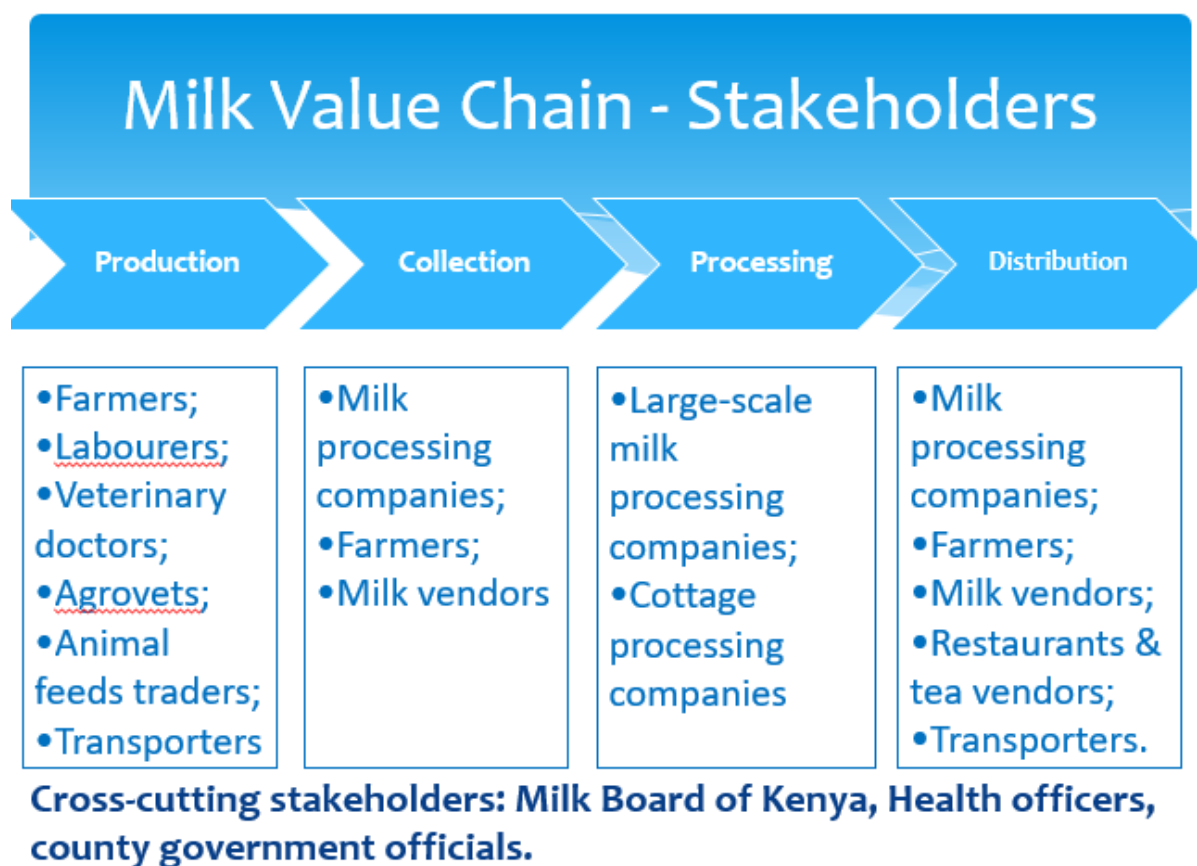
It is estimated that 70-80 per cent of the milk production in Kenya is from smallholders. (FAO, 2011a; Odero-Waitituh, 2017; TechnoServe Kenya, 2008). The smallholders own about 2-5 cows; 3-5 Acres of land; and produce about 5 litres of milk from each cow. The average milk sold by smallholders is 10 litres per day (FAO, 2011a). Kenya has 29 registered milk processing companies and 67 mini dairies (Mwita & Adhiambo, 2022) with varying scales of production, of which four dominate the market: Brookside Dairy Ltd, New Kenya Co-operative Creameries Ltd, Githunguri Dairy FCS Ltd and Spinknit Dairy Ltd. Brookside Dairy Ltd and Githunguri Dairy FCS Ltd are located along the Ruiru to Uplands Transect. The four companies accounted for 86 per cent of the milk produced: New KCC – 32 per cent; Brookside Dairy Ltd - 30 per cent, Githunguri dairy FCS Ltd – 13 per cent and Spinknit Dairy Ltd - 11 per cent (FAO, 2011a). Brookside Dairy Ltd acquired Spinknit Dairy Ltd in February 2010 and Buzeki Dairy Ltd that produced Molo milk in 2013, raising their share market to over 42 per cent (Okoth, 2013). There exists competition among the milk processing companies and also between the formal and informal sectors on the sources of raw milk with the processing companies operating at only 46 per cent of their capacity (Mwita & Adhiambo, 2022). The average price paid by milk processors to farmers has risen from Ksh. 20 in 2007 to Ksh. 35.43 in 2016 (Kenya National Bureau of Statistics, 2017).

The challenges facing the milk value chain include high costs of milk production, seasonality in milk production; poor dairy farming practices including quality of feeding; poor quality control of animal feeds, poor road infrastructure; diseases; and poor animal breeds (Karanja, 2003; TechnoServe Kenya, 2008; Tegemeo Institute, 2016, 2021).

Stakeholders and actors in the dairy value chain

The dairy value chain has a wide range of stakeholders from the production to the distribution of milk (See Figure 1.1). Milk production involves mainly farmers and the suppliers of farm inputs and services including agrovets, veterinary doctors, mechanics, animal feeds sellers, hay sellers, car wash operators, and transporters. The collection of milk involves the farmers, milk processing companies and the milk vendors. While the milk vendors sell raw milk, processing companies undertake value addition before distributing the milk. The scale of the processing companies ranges from large, medium to small scale industries. The milk processing companies are owned collectively by farmers through milk processing cooperatives or by private actors. The distribution of processed milk also involves second-level distributors who sell the milk using pickup vans, motorbikes and bicycles to various outlets. Automated milk dispensers that are commonly referred to as ‘ATMs’ are also available in urban areas and most supermarkets where pasteurized milk is sold.

Figure 1.1: Stakeholders and actors in the dairy value chain



Source: Author

There is also the involvement of government regulators who cut across the value chain. The Kenya Dairy Board (KDB) is the main regulator as defined by the Dairy Industry Act CAP 366

to “to organise, regulate and develop the efficient production, marketing, distribution and supply of dairy produce.” The KDB is under the ministry of agriculture, livestock, fisheries and co-operatives that regulates policies affecting the agriculture sectors. The ministry is also in charge of research and quality control of farm inputs and service providers like veterinary doctors. It additionally regulates the quality of processed products, and has representatives at the county and sub-county levels. It also carries out its mandate through various agencies and directorates. Other government agencies involved are the Kenya Bureau of Standards (KEBS), Kenya Revenue Authority (KRA), Kenya Agricultural Research Institute (KARI), and International Livestock Research Institute (ILRI).

Diversification from coffee production

Until 1989, coffee was the main source of foreign exchange earnings in Kenya. The decline in the sector is mainly attributed to the collapse of the International Coffee Agreement on 04 July 1989 that led to competitive international markets. Other challenges that led to the decline of the sector were: poor management of the cooperative societies, high cost of production¹ with low returns, delayed payment to farmers, climate change and restrictive laws. Earnings decreased since then and coffee was now ranked fourth after tourism, tea and horticulture (Mwangi, 2014). Coffee is produced by both large and small scale producers, with the smallholders being about 800,000 (99.63 per cent), with land parcels less than five acres and producing about 60 per cent of Kenyan coffee. About 3,000 large producers have land parcels of between five to over fifty acres (International Coffee Council, 2019) (see Table 1.1).

Table 1.1: Distribution of coffee producers in Kenya.

Sector	Size of acreage	Number of farmers	Share of total farmers
Small holder affiliated	Varies	800,000	99.63%
Estates holdings distributed as follows			
Small estates	5-20 acres	2,400	0.30%
Medium estates	20-50 acres	500	0.06%
Large estates	Over 50 acres	100	0.01%
Total number of coffee farmers		803,000	100%

Source: (International Coffee Council, 2019)

Yields from individual coffee bushes once estimated at 30 kilograms have dropped to three kilograms (Global Coffee Report, 2011). Coffee production has also declined from an annual

¹ Coffee production requires inputs including labour, fertilizers, transportation, agrochemicals, irrigation, and electricity

average of 1.7 million bags in the 1980s to current levels of less than 1 million bags. Low returns in the coffee sector has led farmers to venture into other agricultural activities. “*Consequently, enterprises such as dairy, horticulture and real estate are now occupying land previously used for coffee production.*” (International Coffee Council, 2019, p. 26). This phenomenon is visible in the coffee-growing areas of the transect. Coffee production along the transect has declined and farmers are inter-cropping coffee with other crops, pruning the branches or completely uprooting it so as to cultivate other crops (See Figure 1.2). In Githunguri sub-county, where small-holder coffee farms are located, diversification from coffee to dairy farming is evident. The staple theory discussed in section 1.6 on the Theoretical and conceptual framework shows how staple produce can ignite the economic development in a region. However, a reliance in exploitation of one staple can make a region prone to stagnation and decline in case of negative effects on the staple. This is referred to as the ‘staple trap’ where a sector does not realise the necessary economic linkages to spur growth (Watkins, 1963). The lack of local processing of coffee may have denied the sector ability to generate strong backward, forward and demand linkages in form of industrialisation and consumption that would have spurred local economic growth in the area even without further exploitation of coffee. The exploitation of the produce in semi-processed form may have benefited regions where the industrial processing of the coffee was taking place at the City of Nairobi making it to emerge as a primate cities depicting a core-periphery relationship.

Figure 1.2: Neglected coffee farm inter-cropped with banana plants and napier grass.



Source: Field survey, 2019

The diversification from coffee production is also evident in the growth of the dairy cooperative societies compared to the coffee cooperatives. Dairy cooperatives in Kiambu County where the transect is located has the highest turnover at Ksh. 8,633,665,036 as compared to the other agricultural sectors like coffee at Ksh. 701,749,767 and pyrethrum at Ksh. 15,299, 696. (See Table 1.2)

Table 1.2: Membership, share capital and turnover of cooperatives in Kiambu County

Type	No.	Membership	Share capital (Kshs)	Turnover (Kshs)
Coffee cooperative societies	21	51,087.	144, 939,150	701,749,767
Dairy cooperative societies	14	63,180	626,264,645	8,633,665,036
Pyrethrum cooperative societies	3	11,868	1,458,325	15,299,696
Urban Saving and Credit Cooperative Societies (SACCOS)	194	47,021	870,434,495	723,068,452
Rural Saving and Credit cooperative societies (SACCOS)	196	231,,382	1,131,713,046	1,613,921,809
Transport Saccos	87	4946	. 82,660,116	120,103,115
Housing cooperative societies	43	49,062	1,511,556,452	3,702,669,387
Total	554	227,164	4,141,426,963	15,510,477,262

Source: (County Government of Kiambu, 2018)

The decline in coffee production in the area has affected both the large scale and small scale farmers. The growing of fodder and maize is evident in the coffee growing areas along the transect. Mboi Kamiti, a group ranch that owned a coffee plantation of over 11,000 acres in Riabai, along the Kwamaiko to Kiambu road is no longer growing coffee. The company collapsed as a result of low returns from coffee sales, debts, leadership wrangles and mismanagement (Weru et al., 2011.) The land has been informally sub-divided and some of the owners are leasing it out for the planting of maize (see Figure 1.3). After harvesting, the maize stalks are sold to the dairy farmers. In the coffee growing areas, there is also increasing conversion of agricultural land to real estate. The flat topography at the lower part of the transect, the close proximity of the area to Nairobi and the presence of Ruiru town, a favourable dormitory town of Nairobi with good access to the city centre through Thika road make Ruiru a favourable location for real estate development.

“Tatu City’, a Kenyan flagship project for Kenya’s Vision 2030 is a private real estate development in Kiambu 24 kilometres from the City of Nairobi. The project is a mixed use development project on a 5,000 acre piece of land previously under

coffee. Within the same locality Migaa Golf Estate which is located 21 kilometres from the City is an upcoming gated residential neighbourhood on a 774 acre piece of land also previously under coffee”.(Bartke et al., 2021, p. 380)

Figure 1.3: Maize plantations at Mboi Kamiti farm, a source of fodder for animals



Source: Field survey, 2019

Small and intermediate towns

The World is witnessing a rapid shift from agricultural activities to an urbanized way of life. 55 per cent of the World’s urban population was living in urban areas in the year 2018 and is expected to rise to 68 per cent by 2050 (United Nations, 2019). Rural areas that depend on agricultural productivity face challenges of climate change, low agricultural yield, market fluctuations, droughts, famines, a drop in human resources and a decline in agricultural employment leading to an increasing migration to urban centres (Llorent-Bedmar et al., 2021; Lyu et al., 2019). Rural areas still lag behind in terms of development and distribution of wealth, with 85 per cent of the rural poor living in rural areas (Alkire et al., 2014). FAO (2017, p. 91) argues that “*urbanisation has a unique role in reshaping the rural landscape. Where rural townships and medium-sized urban centres are better developed, agricultural and non-agricultural jobs tend to be created and poverty declines.*” The report further indicates that rural transformation is driven by the interaction of the two areas driven by the flow of goods and services.

Towns with half a million inhabitants are home to over half of the World's 4.2 billion urban dwellers (United Nations, 2019). Urbanization trends indicate that the population of small and intermediate towns will continue to grow. The expansion of towns into rural areas and the urban periphery and the reclassification of rural villages and small towns to urban annexes are a contributor to urban growth. This expansion is attributed to the growth of periphery settlements and also the suburbanization of people out of the city centre (Cohen, 2006; United Nations, 2019). Projections indicate that between 2018 and 2030, the population in urban centres of between half a million to one million inhabitants is expected to increase by 19 per cent while the population of medium-sized cities with one to five million people will increase by 28 per cent (United Nations, 2019).

Kenya's national spatial structure is characterized by the primacy of cities, with commercial activities being more concentrated in Nairobi and the major cities of Kisumu, Nakuru, and Mombasa. Kenya's decentralization strategies attempted to reduce the primacy of large cities, bridge the rural-urban divide, and create an efficient urban hierarchy with the goal of achieving balanced growth. The Kenyan government in its recognition of the role of small and intermediate towns integrated the growth centre policy into the national development plan of Kenya in the 1970s, and this was first reflected in the national development plan of 1970/74. The policy was aimed at promoting the development of small and medium-sized urban centres with potential for growth and redirecting urban development away from the main cities of Nairobi and Mombasa. The government implemented this policy through the designation of certain settlements as growth centres, as well as concentration of public investment in form of infrastructure services and public sector enterprises. The growth centres would then in turn promote the development of their rural hinterlands through 'spread effects' and absorb rural-urban migrants that would otherwise be attracted to Nairobi city and Mombasa. The increase in the number of small and intermediate towns in Kenya as a result of these policies contributed to a re-distribution of the urban population.

However, the decentralisation policies faced some challenges including: lack of explicit selection criteria which made it difficult to identify urban centres to be included in the bottom-up approaches; political interference and lack of adequate infrastructure investments to steer growth, which was largely blamed on lack of human and financial resources and appropriate institutions (Obudho & Aduwo, 1990). This limited the 'spread effects' to the surrounding region that were supposed to have taken place. The failure of the growth centre strategy is not necessarily about how it was conceptualized, but how it was implemented. Identification of growth centres without provision of adequate prerequisite infrastructure and services limited the success of the policy. 'Spread effects' in the region can be inhibited by lack of adequate

facilities including infrastructure and services in the adjoining small and intermediate towns leading to stagnation in some areas (Evans, 1982).

In addition to challenges of inadequate infrastructure, small and intermediate towns face little recognition from policymakers who view their contribution to national growth as minimal and consequently receive low budgetary allocations compared to large cities. These towns are struggling to manage urbanization, attract investment and meet the demand for housing, land, infrastructure and basic services. They are often poorly managed, have weak communication systems within and between them, struggle to create and retain jobs, and have high levels of unemployment. In addition, they often find it difficult to diversify and strengthen their economies, retain capital and attract investments (Roberts, 2014; Roberts & Hohmann, 2014; Rodriguez, 2014; Sietchiping et al., 2014).

1.2 Problem statement

Urban and rural areas are inter-connected through physical, economic, environmental and social linkages, and their boundaries are blurred. The interaction between the two areas is dependent on sustainable mobility that is anchored on resilient infrastructure. However, this interconnection is affected by barriers of mobility that limit effective interaction between the two areas leading to among others under-development especially in rural areas, food loss, high cost of production, decreased investments, and isolation of some areas. In particular, milk production is dependent on efficient mobility firstly because milk is perishable. Milk production suffers from post-harvest rejection due to inefficiencies in the delivery of milk to the market due to the long distances and also poor road conditions especially during the rainy season. Losses at the farm level are estimated at 6 per cent of the total production (FAO, 2011a; Muriuki, 2003), and could go up to 10 per cent during the rainy season.

Secondly, decreasing land holdings necessitate the need to move in search for fodder in order to sustain the animals. Thirdly, farmers are affected by changing seasons in the course of milk production. While the rainy season is accompanied by an increased supply of forage, poor road conditions hinder access to these feeds. The dry season is more problematic because farmers have to move over longer distances in search of animal feeds which are scarce within the vicinity of their farms during that period. Efficient mobility can break the barrier created by the seasonal effects of milk production by creating links between the areas where fodder is available. TechnoServe Kenya (2008) on their report on the dairy value chain in Kenya emphasized that there is need to reduce seasonality in milk production. Managing efficient production, collection, processing and distribution of milk can lead to cost-cutting and boost

the growth and profitability in the dairy sector. One of the ways this can be done is by facilitating efficiency in the movement of farm inputs, raw and processed milk along the value chain.

Mobility between urban and rural areas can be enhanced through among other interventions provision of infrastructure such as roads, electricity, and communication. The rationale is that transport infrastructure has an impact on the movements of goods, raw materials, and people (Mireri, 2006). However, its implementation should go beyond issues of the physical infrastructure to ensure that the core issues of ensuring mobility and accessibility are adequately considered. While transportation infrastructure is key to development in urban and rural areas, governments and developers often concentrate on physical access and less on the socio-cultural aspects of these developments. As a result, some of the infrastructure may not necessarily achieve the objectives of accessibility that they are often intended to or may be implemented in areas that may not achieve the desired impact.

Small and intermediate towns are important in enhancing urban-rural linkages because they are often more accessible to rural populations and also act as a bridge between rural populations and large cities. Their proximity to the rural population enables them to provide: administrative functions, market for produce, goods and services and non-farm job opportunities for the rural dwellers. However, these small and intermediate towns face among other challenges depreciated and limited road infrastructure, limiting their potential to contribute effectively to regional development.

There is a research gap on the role of mobility between urban and rural areas and its implications on urban-rural linkages. UN-Habitat sees the need for investigation of not only the “*motivations, benefits and challenges of urban-rural mobility; but also the social, economic and environmental implications of the flow of people*” (UN-Habitat, 2017, p. 32). The purpose of this research will be to investigate the implications of mobility on urban-rural linkages. Value chains exhibit themselves in space, hence an investigation of how they function and the inter-relations they create is useful in informing interventions to improve them.

1.3 Research questions and objectives

Research questions

1. What are the mobility patterns along the milk value chain?
2. What are the barriers and adaptations of mobility along the milk value chain?
3. What is the impact of mobility patterns on urban-rural linkages?
4. What is the impact of mobility on rural and urban livelihoods transformation?

Research Objectives

The main objective of this study is to assess the impact of mobility patterns in small and intermediate towns on urban-rural linkages.

The specific objectives of the study are:

1. **Objective 1:** Assess the mobility patterns along the milk value chain.
2. **Objective 2:** Assess the barriers and adaptations of mobility along the milk value chain.
3. **Objective 3:** Assess the impact of the mobility patterns on rural and urban linkages.
4. **Objective 4:** Assess the impact the mobility patterns have on livelihoods

1.4 Justification, significance, assumptions, scope and limitations of the study

Justification of the study

The study highlights the importance of taking into consideration mobility assessments as a key element in the implementation of transport infrastructure. Good infrastructure without mobility may not ignite development. In addition, mobility that does not lead to connectivity may not have an impact on the livelihoods of people. Additionally, by investigating the impact mobility has on livelihoods, the research shows the relations between spatial mobility and social mobility. This research is also in line with the Sustainable Development Goals (SDGs). It discusses the contribution of mobility in facilitating the efficient flow of goods along the milk value chain and the role of urban-rural linkages in boosting the connections between urban and rural areas to facilitate access to inputs and markets. This is in in line with SDG goal two which seeks to “*end hunger, achieve food security and improved nutrition and promote sustainable agriculture.*” The research also contributes to SDG goal nine which seeks to “*build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.*” It discusses the need for enhancing rural road infrastructure to ensure that it is resilient to the seasonal effects of rain. The research additionally discusses the issue of accessibility to affordable means of transport and its implications in ensuring efficient mobility. The issue of rural industrialisation and its contribution to creating non-farm opportunities are also discussed including the contribution of cottage industries. The research additionally contributes to SDG goal 11 which seeks to “*make cities and human settlements inclusive, safe, resilient and sustainable,*” with Target 11.a seeking to “*support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development.*”

The research is also aligned with the ‘New Urban Agenda’ which was adopted by the UN member states in October 2016 whose resolutions include:

“strengthening the role of small and intermediate cities and towns in enhancing food security and nutrition systems; providing access to sustainable, affordable, adequate, resilient and safe housing, infrastructure and services; facilitating effective trade links across the urban–rural continuum; and ensuring that small-scale farmers and fishers are linked to local, subnational, national, regional and global value chains and markets.” (UN-Habitat, 2017, p. 12)

The above UN resolutions highlight the significant contribution of urban-rural linkages and in particular small and intermediate towns in local, regional and national development. The research makes a particular focus on the role of Githunguri ‘milk’ town in supporting the milk value chain from production, collection, processing and distribution.

Significance of the study

This research contributes to knowledge on urban-rural linkages from the perspective of mobility and value chains that will be useful to the policymakers involved in rural and urban development. It additionally contributes to knowledge on the territoriality of the commodity value chains as it is influenced by the *“range of developments in transport, communication and process technologies”* (Coe et al., 2010, p. 97) and reinforces the notion that urban and rural areas are integrated and interlinked, and mobility plays a key role in their integration. It contributes knowledge on transportation planning on overcoming barriers to mobility and enhancing the adaptations to mobility to create sustainable and resilient mobility between urban and rural areas. In particular actors in the agricultural industry will use this knowledge in evaluating various value chains from the perspective of mobility, and finding aspects that need to be enhanced in making these value chains effective. The research will also be beneficial to the county and municipal managers in assisting them to make decisions and prioritise which road projects to implement in various locations from murrum to tarmac roads. The research contributes to knowledge that will be useful in the formulation of plans to guide the development of small and intermediate towns.

Assumptions

Mobility patterns along the milk value chain have an impact on urban-rural linkages.

Scope and limitations of the study

The study focussed on intra-mobility within the three sub-counties along the transect.

1. The study focussed on both public and private transport means of transport.
2. The study was limited to the Ruiru to Uplands transect.
3. The research was limited to the flow of milk along the value chain from its production to distribution.

1.5 Definition of key concepts

Transect

According to Google's English dictionary, it is to "*Cut across or make a transverse section in.*" or "*a straight line or narrow section through an object or natural feature or across the earth's surface, along which observations are made or measurements taken.*" The word has Latin origins of the word "*trans*" which means "*through*" and *secāre* which means "*divided by cutting*" The Cambridge English dictionary defines it as "*to cut across something; to divide something by cutting it*"

Robic (2014, p.1 as cited in Racaud & Bart, 2017) defines it as "*a system for land observation or the representation of a space, along a linear path and following the vertical dimension, aimed at emphasising a superposition, a spatial succession or relations between phenomena.*" Racaud & Bart (2017, pp. 69 & 70) indicate that through a transect, one is able to observe "*level differences, slopes, altitudinal zonation, inclination gradients and altitudinal differences and complementarities*"

Mobility, movement and accessibility

Mobility, movement and accessibility are sometimes used interchangeably. While the meaning of these terms is diffused they still attach different meanings. According to the advanced Oxford learner's dictionary, mobility is "*the ability to move easily from one place, social class, or job to another*" or the "*the ability to move or travel around easily.*" This is different from movement which is the "*an act of moving from one place to another or of moving something from one place to another.*" Accessibility according to the same dictionary is defined as "*how easy something is to reach, enter, use, see, etc.*"

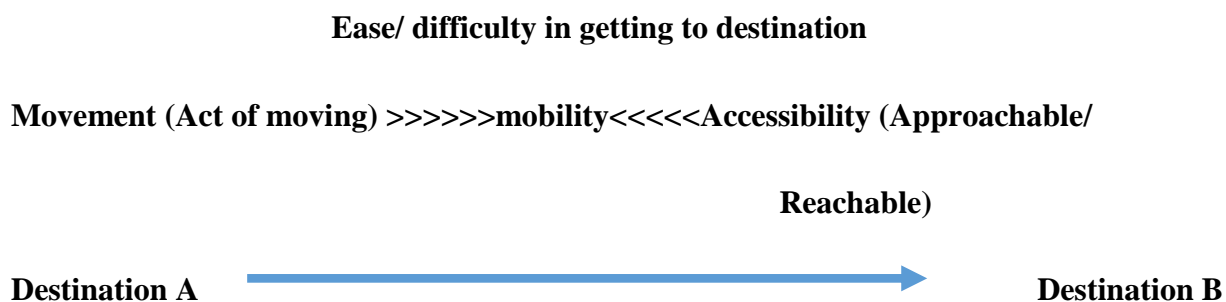
The definition of mobility relates closely to that of accessibility. Cresswell (2010, p. 17) broadens the definition of mobility beyond just movement, he views it as "*the entanglement of movement, representation, and practice.*" He asserts that this definition necessitates a multi-disciplinary, multi-faceted approach to understanding mobility as it attaches different meaning to various disciplines. He looks at the mechanics of mobility in terms of "*motive force, speed,*

rhythm, route, experience and friction” (Cresswell, 2010, p. 18). His model identifies six factors of analysis in identifying the physical movement, representation, meaning and practice of mobility: “*why does a person or thing move?... How fast does a person or thing move?... In what rhythm does a person or thing move?... What route does it take?... How does it feel?... Lastly when does it [mobility] stop?*” (Cresswell, 2010, pp. 22–26). Mobility in population studies is often used to describe migration, social mobility describes the change in the social hierarchy while economic mobility describes the change in the economic status of an individual. One of the conceptualization of mobility that this research utilizes is that mobility is entangled with these three main issues: the physical movement, the social-economic issues associated with that movement, and the actual experience of movement (Cresswell, 2006; Kwan & Schwanen, 2016). Mobility goes beyond the actual functional aspects to encompass social-cultural aspects. Kaufmann et al. (2004, p. 750) develop a theoretical construction that combines spatial and social mobility, which he refers to as ‘motility’ and defines it as:

“The capacity of entities (e.g. goods, information or persons) to be mobile in social and geographic space, or as the way in which entities access and appropriate the capacity for socio-spatial mobility according to their circumstances.”

Kaufmann et al. (2004) break down this concept of ‘motility’ into three components. The first one is accessibility which characterises the availability and constraints in usability; secondly competence that represents the skills and ability to use the options available and lastly appropriation; which signifies behaviour and attitude towards mobility options. Accessibility portrays an impression of a more ‘inward’ movement as compared to mobility which is more ‘outward’. Accessibility is used especially in transport planning to refer to how difficult or easy it is to reach a destination. The words used to define accessibility include ‘easily approached’ or ‘admitting approach’. Rodrigue et al. (2013, p. 322) defines accessibility as “*the measure of the capacity of a location to be reached by, or to reach different, locations*”.

Figure 1.4: A graphic representation of accessibility, movement and mobility



Source: Author.

This describes accessibility as being process-oriented focusing on the barriers and drivers experienced in getting to a destination. Connectivity leads to mobility. Kaufmann et al. (2004) differentiates mobility from accessibility by describing the latter as a component of mobility:

Access refers to the range of possible mobilities according to place, time and other contextual constraints, and may be influenced by networks and dynamics within territories. (Kaufmann et al., 2004, p. 750)

Accessibility is the ultimate goal of mobility and transportation planning, and is viewed as a product of what transportation and mobility seek to achieve – the flow of goods and people (UN-Habitat, 2013).

Small and intermediate Towns

There is no universal definition of intermediate towns across the World, but it is widely accepted that they represent the towns that are in between small towns and big cities in the urban hierarchy. It is also used interchangeably with the term secondary cities or intermediary towns. The size of the population used to define these small and intermediate towns varies across the World due to contextual differences in the population of cities. “UN-Habitat defines a secondary city as an urban area generally with a population of 100,000 to 500,000” (David, 1955, as cited in Roberts & Hohmann, 2014, p.3) while the United Nations (2019) refers to urban centres with a population of between one to five million people as medium-sized cities. Asian cities have a higher limit of the population used to define these cities; for instance, in China, intermediate cities have populations of over five million inhabitants (Roberts, 2014; Roberts & Hohmann, 2014). Roberts (2014) recommends that the definition of secondary cities should take into consideration the integration of population size and functional characteristics of these cities. According to this definition, there would be three categories of these cities:

“Subnational urban centres of administration, manufacturing, agriculture or resource development; Metropolitan clustered secondary cities, which develop on the periphery of metropolitan or urban regions and take the form of new towns, spillover growth centres and linear cities. These could also include migrant and refugee cities; and corridor secondary cities, which develop as growth poles along major transportation corridors” (Roberts, 2014, p. 37).

The Urban Areas and Cities (Amendment) Act, No 3 of 2019 defines the minimum population sizes of various urban centres in Kenya. A city should have a minimum population of 250,000 people; a municipality at least 50,000 people, a town at least 10,000 people and a market centre at least 2,000 people (Government of Kenya, 2019b). Arising from the delineation of urban

areas in Kenya, this study considers urban centres with a population of 10,000-50,000 people as small towns, while municipalities with a population of more than 50,000 people are considered as intermediary towns. Most secondary/ intermediary cities are subnational capital cities responsible for secondary level of government; manufacturing, primary or resource-industry centres or global centres of cultural, natural or advanced-industry significance. They can also be major satellite cities forming a cluster of cities in a metro-region city. These cities are largely driven by population growth and consumption. (Roberts, 2014).

Urban-Rural Linkages²

Urban-rural linkages is a complex concept, and defining it would necessitate breaking it down into components and exploring it from a multi-disciplinary and multi-sectoral approach. It encompasses the factors and indicators that make connections/ linkages between urban and rural areas including spatial flows and production to consumption chains that have close links with urban, peri-urban and rural areas. The linkages constitute the system of interactions that take place between urban, rural, peri-urban and urban areas that cannot be restricted to the rural–urban interface, but may be taking place even in the urban or rural areas. The UN-Habitat defines urban-rural linkages as the:

“Nonlinear, diverse urban-rural interactions and linkages across space within an urban-rural continuum, including flows of people, goods, capital and information but also between sectors and activities such as agriculture, services and manufacturing. In general, they can be defined as a complex web of connections between rural and urban dimensions”(UN-Habitat, 2017, p. vii).

Different researchers and actors have various versions of breaking down the specific categories of urban-rural linkages. (Randinelli & Evans, 1983) identifies the four categories of linkages between settlements and their hinterland consisting of economic links which involve issues of marketing and production; physical links involving issues of transportation; administrative involving issues of government and communication and finally social linkages that encompass interaction and service functions. They applied this approach in the Urban Functions for Rural Development (UFRD) project in Bolivia and viewed these linkages as integral for a well-articulated and integrated region. Through that project, they illustrated how regions would transform progressively to overcome polarization effects through spread effects facilitated by inter-linkages between them. Sietchiping et. al. (2014) and UN-Habitat (2017) breakdown

² More detailed explanation of the urban-rural linkages approach is in the section on theoretical framework

urban–rural linkages in terms of strategic entry points that are viewed as sectors of convergence between urban and rural areas. They are:

“(i) spatial flows of products, services and information/expertise between urban and rural areas; (ii) mobility and migration between urban and rural areas; (iii) food security systems and a “sustainability chain” for all; (iv) rural urbanization: the development of small and intermediate towns; (v) the urban– rural continuum in the face of conflicts and disasters; (vi) reducing environmental impacts in urban-rural convergences; (vii) regional and territorial planning for integrated urban and rural development; (viii) enhancing legislation, governance and capacity; (ix) partnerships between urban and rural areas; and (x) inclusive investment and finance in both urban and rural areas” (UN-Habitat, 2017, p. 18).

Spatial flows

Spatial flows are an important component of urban-rural linkages and in the study of mobility. They answer the question: What is moving? They occur as a result of the interactions between urban and rural areas, and include hidden and visible flows between the two areas. A major component of these flows is the movement of people from rural to urban areas and vice versa. UN-Habitat, (2017) defines the spatial flows as:

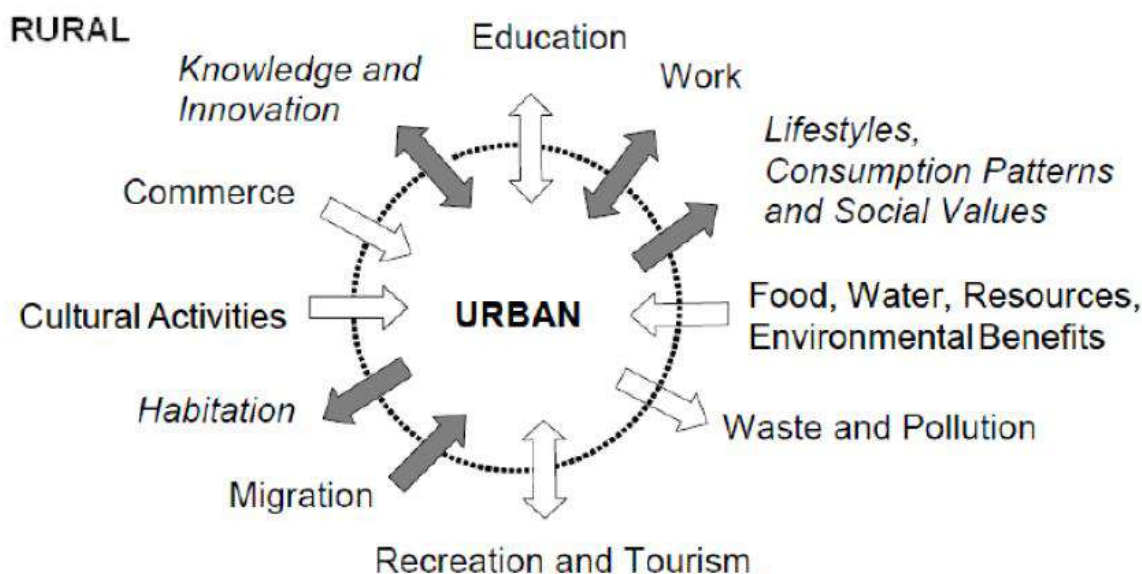
The invisible and visible spatial links between urban and rural areas, creating connectivity, a continuum and a network between them; while marginalizing territorial contiguity. (UN-Habitat, 2017, p. 21)

Flows represent the continuous production to consumption of goods and services that is a major source of linkages between urban and rural areas. Rural areas are actively involved in the production of goods which then flow through distribution channels before they get to consumers if they do not require processing. There is also the flow of raw materials from rural areas to industries (located either in rural or urban areas) and then to consumers located in urban and rural areas. Urban-rural relations also lead to flow of money between urban and rural areas through remittances. Studies have shown that remittances are a major influence on rural transformation and social capital for the rural communities.

Hidden flows are the intangible flows of data, information, and innovations between urban and rural areas that influence rural transformation and socio-cultural change in rural areas. These flows have an influence on rural transformation because of advancements in communication technology and the expansion of electricity connectivity to rural regions. They are also supported by the use of mobile technology and applications including WhatsApp and Facebook

that keep rural and urban communities connected. Farmers can market their produce through mobile applications that make them aware of markets for their produce, even before they harvest it. This has an influence on mobility because farmers do not have to go physically to markets since they can directly get in touch with consumers and middlemen.

Figure 1.5: Flows between urban and rural areas in the tourism industry.



Source: Based on Preston (1975), Stead (2002), adapted by Repp et al. (2012), as cited in Eppler et al. (2015, p.4)

Spatial flows constitute forward and backward linkages between urban and rural areas (Tacoli, 2003). Backward linkages occur when an industry stimulates production in the industries supplying it, and forward linkages occur when the output of the industry stimulates production. For example, the milk industry create backward linkages linked to the supply of animal feeds and veterinary facilities; and the industry also provides forward linkages in the production of cheese and yoghurt.

Patterns

The Oxford Advanced Learner's Dictionary defines a pattern as “*the regular way in which something happens or is done*” or “*a regular arrangement of lines, shapes, colours, etc.*” Jamhuri et al. (2016, p. 1) define a spatial pattern as a “*perceptual structure, placement, or arrangement of objects on earth. It includes the space in between those objects. Patterns may be recognised because of their arrangement, maybe in a line or by a clustering of points.*” Chou (1995, p. 365) define spatial patterns as the “*arrangement of individual entities in space and the geographic relationships among them.*” In this definition, the relationship between the

spatial elements is put into consideration. Chou (1995, p. 365) adds that there are “*complicated spatial processes underlying the distribution of a phenomenon.*” The National Geographic Society (n.d., p. 7) consider patterns and trends among the “*four concepts of geographic thinking,*” and view patterns as the “*characteristics that are similar that repeat within natural or human environment.*” The National Geographic Society emphasises that identification of patterns and trends in space and making inquiries concerning their existence is important in geographical studies.

1.6 Theoretical and conceptual framework

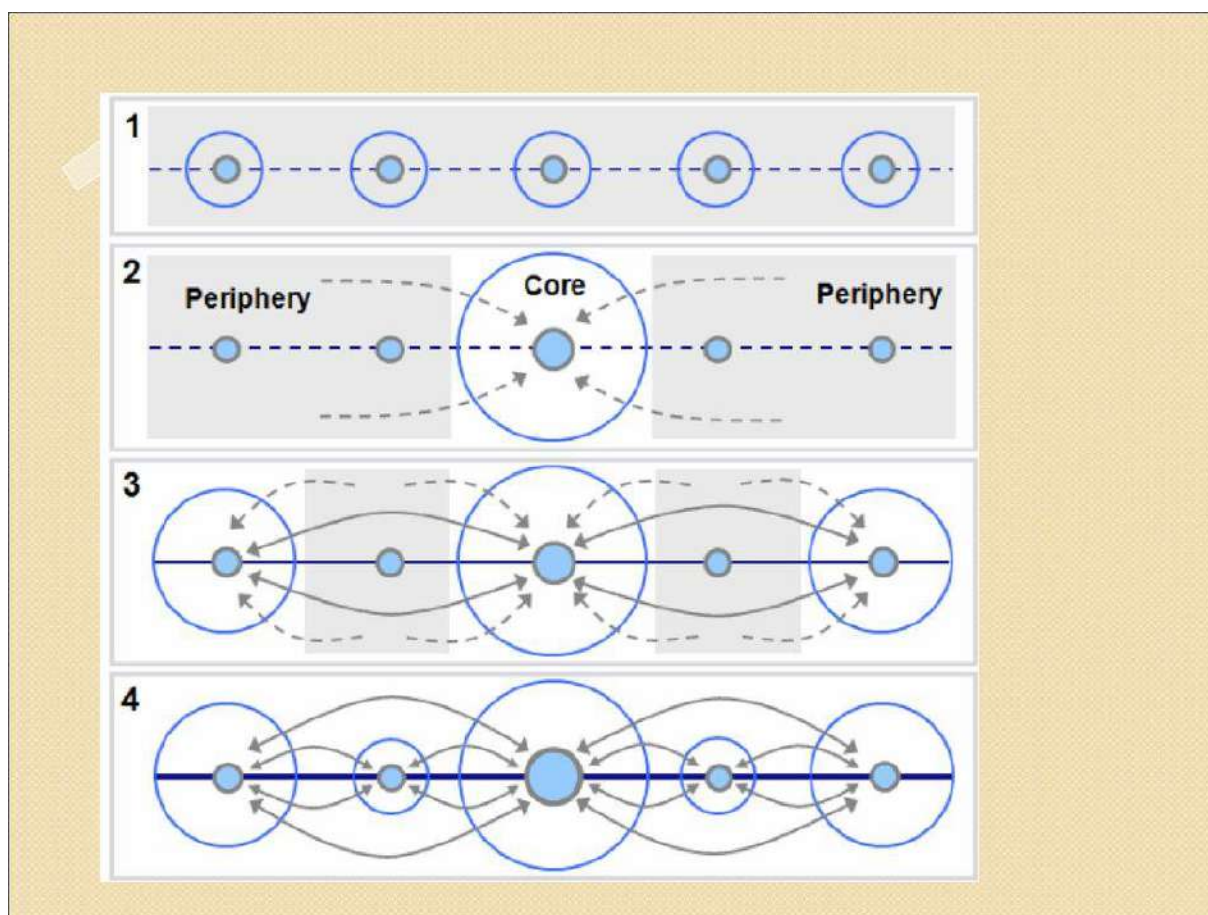
Theoretical Framework

The research utilises the urban-rural linkages approach, the growth pole theory, the core-periphery model, Rostow’s economic growth model and the staple theory in identifying the linkages and connections resulting from the mobilities and spatial flows along the milk value chain and how they exhibit themselves in rural-urban space. The theoretical foundations of urban-rural linkages can be closely linked to “*spread effects*” that were advanced by Myrdal (1957) and the trickle-down effects that Hirschman (1958) referred to in highlighting the urban-rural interactions that were taking place between the two areas. The spread/trickle-down effects are the positive spillover of growth from the major towns to the smaller towns. In the context of urban–rural linkages, this would be the spillover of development from the towns to the rural areas. The linkages that stem from the spread effects are essentially economic linkages. The spread/trickle-down effects advanced by Myrdal (1957) and Hirschman (1958) were explaining the interaction between unbalanced regions that François Perroux advanced through the Growth Pole Theory. Perroux showed the imbalance in development by highlighting the relation between core industries and support industries at the periphery. His view was that as the core industries develop, they would in turn motivate the growth of the periphery industries through economic links. The resultant effect would be the development of emerging growth poles. However, these spread effects to the region can be inhibited by lack of adequate facilities in the adjoining small and intermediate towns, including infrastructure and services, leading to stagnation in some areas (Evans, 1982).

Friedmann (1969) took this further and illustrated how regions would transform progressively to overcome polarization effects through spread effects facilitated by sufficient transport networks to foster inter-linkages between them. In his core-periphery model, he outlines four stages transition of a regions’ urban system from a system of homogenous centres during the pre-industrial stage that transforms to emerging dominant centres at the second stage as

industrialization begins to take place at certain centres. At the second stage, the backwash effects outweigh the spread effects, and growth is oriented towards the emerging cores. He deduces that in the third stage, as a result of mobility, interactions and diffusion and spread effect effects, growth spreads to the other growth centres. Eventually there emerges a balanced spatial system of different hierarchy of towns and cities with different specialization and comparative advantages. This is the case of post-industrialized nations where populations are moving to secondary cities. This study applies the theory in assessing the growth and interaction of the towns along the transect. Like the growth pole theory, the core-periphery model has been criticized as being ‘top-down’ and depending on ‘trickle down’ effects but instead led to centralization of development that perpetuated more unequal spatial structures and primate cities. This type of development leads to “backwash” effects by attracting populations from the periphery to the centre, draining the periphery of its human resource and perpetuating exploitation of raw materials from the periphery (Rondinelli & Ruddle, 1978).

Figure 1.6: Friedmann (1969) theory of core and periphery

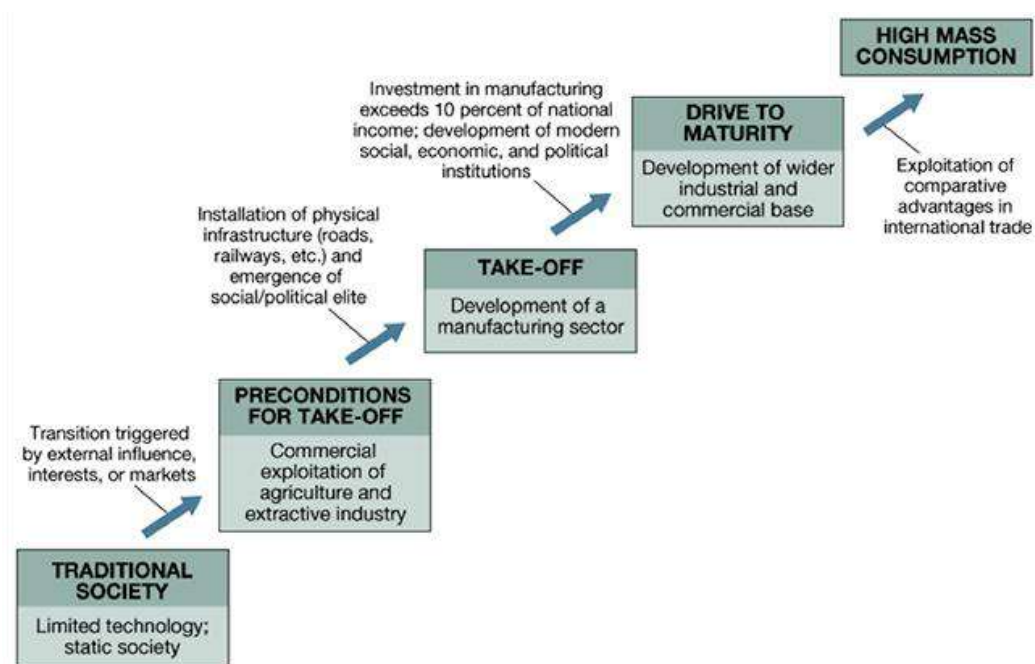


Source: <https://slideplayer.com/>

The research also applies Rostow’s economic growth model in understanding the transition from subsistence to industrialised economies. Rostow (1959) outlines five stages that all nations

must go through to develop from a traditional society, followed by take-off conditions, take-off, drive to maturity, and finally age of high mass consumption.

Figure 1.7: Rostow's economic growth model



Source: <https://www.e-education.psu.edu/>

The study also uses the staple theory to understand the economic linkages created by the milk value chain. The staple theory that was advanced by Harold Innis and W.A Mackintosh in 1923 that postulates that regions' growth is influenced by the exportation of staple produce. Hirschman (2013) argues that spread effects in form of backward, forward, demand, fiscal and consumption linkages can be tied directly to the extraction and exportation of the staple produce of a region. This study analyses these spread effects as they take place along the dairy value chain along the Ruiru to Uplands transect. The resultant spread effects as a result of the exportation activities to the region's economy is the central concept the theory (Watkins, 1963). Hirschman (2013, p. 161) posits that the staple theory offers an opportunity to "discover in detail how "one thing leads to another" through the requirements and influence of the staple, from transportation facilities and settlement patterns to the establishment of new economic activities."

Although the staple theory is intended to analyse the economic effects resulting from exportation of staples to other countries, this study 'localises' the theory in analysis of the dairy value chain as an emerging staple with potential for exportation, but also in recognition of the 'exportation' or trade of the product from one region to another. The study also recognises the slow economic growth along the transect as a result of decline of the coffee, pyrethrum and

bacon industry (as discussed in the background of the study) that were key staples produced along the Ruiru to Uplands transect and the resultant effects on the economy of the area and the need to diversify to other economic sectors like milk production and avoid the ‘staple trap’ where a staple is not able to generate strong backward, forward and demand linkages. North (1955, p. 243) argues that the theory can be applied to “*regions that have grown up within a framework of capitalist institutions and have therefore responded to profit maximizing opportunities, in which factors of production have been relatively mobile.*” The mobility oriented nature of the milk value chain would be an ideal case that focusses on the exploitation of the milk. The study attempts to ‘spatialize’ the staple theory by identifying the spatial impacts of the spread effects along the transect. A proponent of the staple theory Douglass North argues that the location theory can be examined in the context of the growth of staples. He outlines how staples shape the growth of nodes as they become specialised processing and distribution centres, and their growth is driven by subsidiary industries that develop to support production, processing and distribution of staples. He indicates that the growth of the region is driven by the successful exploitation of the staple and its ability to cut costs and gain comparative advantage (North, 1955). The staple theory provides an opportunity to fuse the linkages created along the milk value chain with the growth of urban centres along the transect as a result of forward and backward linkages provides an opportunity to evaluate the inter-regional linkages created by the milk value chain. In addition, the demand linkages created by the rising incomes from milk production and their effect in creating non-farm activities that are not directly linked to the milk value chain and their impacts in transformation of village, market and urban centres are also relevant to the study.

The other approach used is view of urban and rural areas as a continuum rather than a dichotomy. When urban and rural areas are viewed in dichotomy they are seen as two distinct spatial areas with either urban or rural features which is misleading. Traditional approaches to the development of urban and rural areas have tended to focus on either of the two and not how the two function together. This has arisen as a result of sectoral approaches to development in both urban and rural areas that is visible even in the definition of urban and rural areas as distinct geographical zones. It also arises as a result of separate sectoral functions in both urban and rural areas, that see rural areas as agricultural, raw material-oriented and urban areas as production and retail-oriented. FAO (2011b, p. 16) describes this false dichotomy as “*artificial and counter-productive.*” According to (Tacoli, 2003, p. 3):

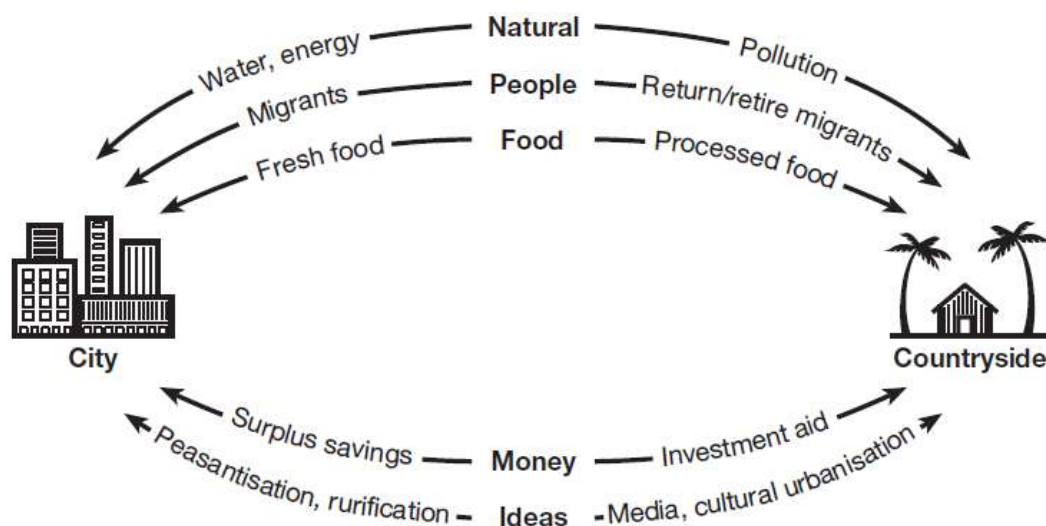
“The notion of a “divide” has become a misleading metaphor, one that oversimplifies and even distorts the realities...The linkages and interactions have become an ever more intensive and important component of livelihoods and

production systems in many areas – forming not so much a bridge over a divide as a complex web of connections in a landscape where much is neither “urban” nor “rural”, but has features of both, especially in the areas around urban centres or along the roads out of such centres (what can be termed the peri-urban interface).”

The imaginary blurred boundaries between urban and rural areas should not be used to create a dichotomy between the two regions. Cresswell (2014, p. 718) asserts that borders can no longer be lines in plans separating territories – “*borders too are on the move.*” OECD, (2013, p. 3) points out that “*the traditional distinction between urban and rural areas is increasingly blurred.*” Urban and rural areas are inter-connected and interact with each other through urban-rural linkages within the context of functional regions beyond the administrative boundaries. Boundaries have become diffused and not easy to delineate, as urban areas show rural characteristics and rural areas show urban characteristics (Chirisa et al., 2014; Ndabeni, 2017; OECD, 2013). Furthermore, rural communities are also gaining urban orientations, while some urban areas like slums have rural orientation. This creates a sense of continuum as opposed to the structural duality between urban and rural areas. Robert Redfield in 1956 advanced the concept of “folk- urban continuum” following ethnographic studies of Tepoztlán and Yucatan villages in Mexico that were inhabited by native Mexican communities. He noted that the rural ‘folk’ had distinct contrasting traits with the urban communities and the two were located in opposite poles. “*Whereas he characterized folk society as isolated, homogeneous, and sacred, he described urban society as mobile, heterogeneous, and secular*” (Wilcox, 2006, p. 62). However, he also noted that there was a transition from rural to urban societies through “*a process of social change or ‘civilization’*” (Wilcox, 2006, p. 62) that was brought about by the interaction between the rural communities leading to peasant communities who traded their goods in urban centres hence the folk to urban continuum (Wilcox, 2006).

The apparent boundaries between urban and social populations may only be separated by geographical differences, but the social orientations are increasingly similar, especially owing to advancements in digital technology and communication. Some of the social characteristics that were associated with urban communities like availability of electricity, use of mobile phones, and possession of television and radio sets are now available to rural communities. Urban and rural areas are intertwined and connected in a functioning system of linkages that sustains the interactions between them. While the strength of the linkages may vary depending on contextual issues, they visibly or invisibly exist. Figure 1.8 below summarizes the interactions between urban and rural areas.

Figure 1.8: Urban rural interactions



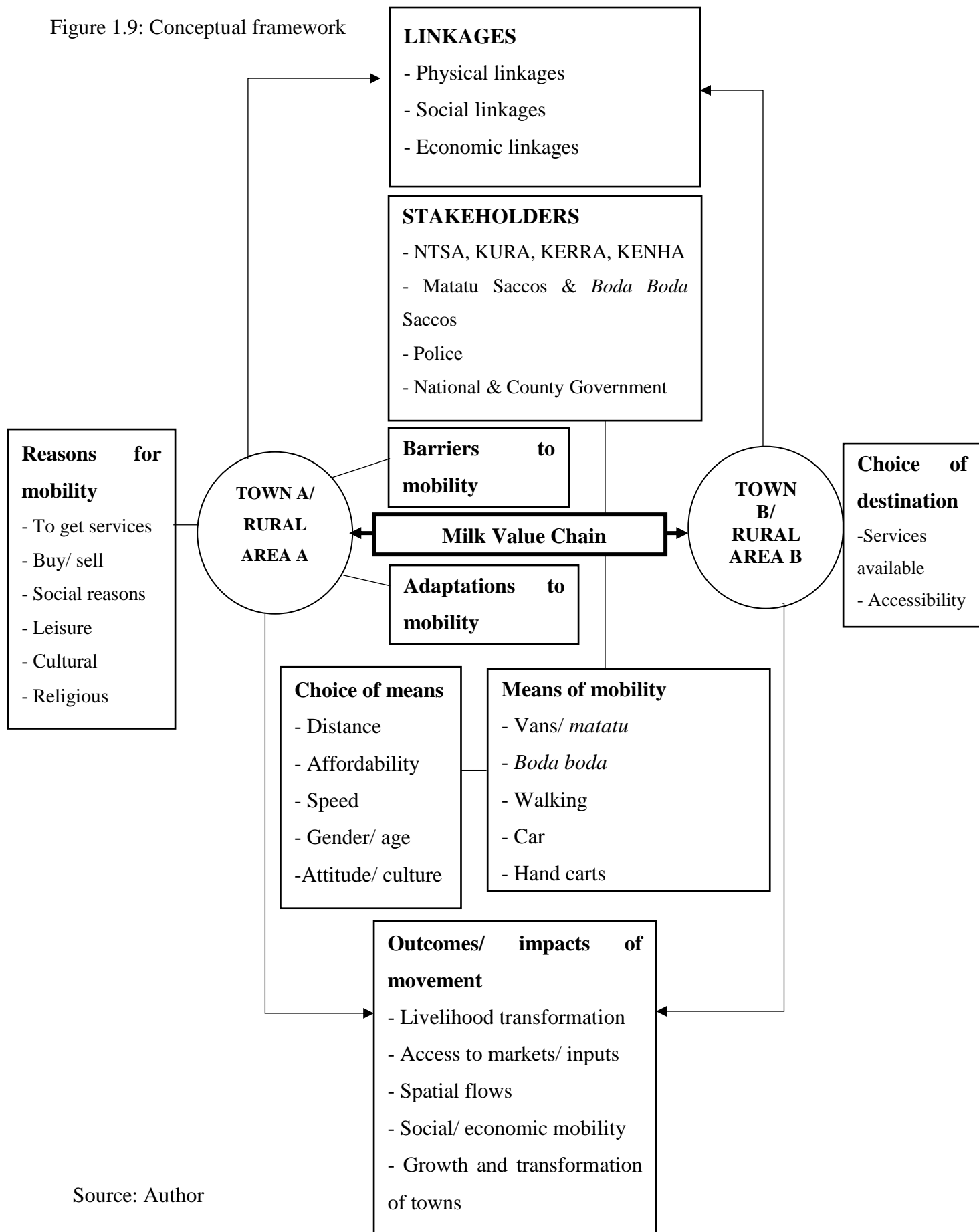
Source: (Lynch, 2005, p. 6).

Conceptual Framework

The conceptual framework builds on Cresswell (2010) and Kaufmann et al. (2004) conceptualization of mobility that looks at both the physical movement and the social issues associated with that movement. The conceptualization of this research looks at the mechanics of mobility, and its outcomes in terms of livelihood and urban-rural linkages associated with it. It views mobility beyond the actual functional aspects to encompass social-cultural aspects, encompassing the physical movement and social issues that determine the experience of the movement.

The conceptual framework is further based on the assumption that mobility has an impact on urban-rural linkages and interactions and spatial flows between towns in the regional setting. It is also based on the assumption that these interactions driven by the milk value chain lead to livelihood transformation and regional development. The concept views spatial mobility as that consisting of geographic movement and spatial flows from one area to another. The success of the urban-rural linkages approach lies in the efficiency of these flows along the milk value chain where urban areas including small and intermediate towns play a big role in facilitating and driving the flows. Mobility contributes to these flows as a facilitator to support rural urban interaction and connectivity. Consequently, for the small and intermediate towns to efficiently play a role, they have to be equipped with the necessary infrastructure and service facilities. Challenges in mobility between urban and rural areas have been propagated by impending barriers to spatial flows. Nevertheless, commuters have adapted ways of overcoming some of those barriers and challenges.

Figure 1.9: Conceptual framework



Source: Author

1.7 Summary

Urban and rural areas are inter-connected through physical, economic, environmental and social linkages, and their boundaries are blurred. The interaction between the two areas is dependent on sustainable mobility that is anchored in resilient infrastructure. However, this interconnection is affected by barriers of mobility that limit effective interaction between the two areas leading to among others under-development especially in rural areas, food loss, high cost of production, decreased investments, and isolation of some areas. In particular, milk production is dependent on efficient mobility because milk is perishable. Milk production suffers from post-harvest rejection due to inefficiencies in the delivery of milk to the market due to the long distances and also poor road conditions especially during the rainy season.

UN-Habitat sees the need for investigation of the “*motivations, benefits and challenges of urban-rural mobility; but also the social, economic and environmental implications of the flow of people*” (UN-Habitat, 2017, p. 32). The purpose of this research will be to investigate the implications of mobility on urban-rural linkages. The main objective of this study is to assess the impact of mobility patterns in small and intermediate towns on urban-rural linkages. The specific objectives of the study are to assess: the mobility patterns along the milk value chain; the barriers and adaptations of mobility along the milk value chain; the impact of the mobility patterns on rural and urban linkages; and the impact the mobility patterns have on livelihoods.

This research contributes to knowledge on urban-rural linkages from the perspective of mobility and value chains that will be useful to the policymakers involved in rural and urban development. It additionally contributes to knowledge on the territoriality of the commodity value chains and reinforces the notion that urban and rural areas are integrated and interlinked, and mobility plays a key role in their integration.

The research utilises the urban-rural linkages approach, the growth pole theory, the core-periphery model, Rostow’s economic growth model and the staple theory in identifying the linkages and connections resulting from the mobilities and spatial flows along the milk value chain and how they exhibit themselves in rural-urban space. The conceptual framework builds on Cresswell (2010) and Kaufmann et al. (2004) conceptualization of mobility that looks at both the physical movement and the social issues associated with that movement.

2 Research Methodology

2.1 Research design

Qualitative techniques were adopted in this research because of its “*inductivist, naturalistic, process-oriented and their roots in constructionist paradigm that examines the what and how of social life*” (Northey et al., 2015, p. 78). The authors add that “*qualitative data are most suitable for answering how questions: how does or how did something come about?*” (Northey et al., 2015, p. 79). Qualitative techniques were used to identify mobility patterns along the transect area in terms of: what is moving? How it is moving? When it is moving? Where it is moving? Investigating the means, frequency, time, rhythm, routes, distances, directions, products and mechanics of this movements. The study examined the change in mobility patterns during the dry and rainy seasons, and during the day and night. It also scrutinized the motives, barriers, challenges, adaptations and enablers to mobility and the resultant cost of these barriers. The enquiries on the patterns of movement builds on Cresswell (2010) interconnected elements of the ‘politics’ of mobility that encompasses the physical movement, representation, meaning and practice of mobility. This in the study was viewed as the mechanics and character of that mobility.

The research focussed on the milk value chain and also on a particular transect. Transects have been used by geographers and planners as a visual tool to undertake spatial analysis. Andres Duany developed a particular one that illustrates the rural-to-urban gradation between nature and dense urban zones (Bohl & Plater-Zyberk, 2006). A transect study was used because of its capacity to make comparisons on the mobility patterns at different locations along the transect which has a rich variation in terms of climatic, topographical, vegetation, and human settlement patterns. The other reason why a transect study was utilized was because the research was about mobility and mobility activities and its impacts were exhibited along the main transect road.

The research utilized both primary and secondary data sources to achieve the study objectives and answer the research questions. The research is based on empirical data collected by the author between 2017 -2021. The study made use of ethnographical techniques through direct observation and interviewing of actors while accompanying them in their daily schedules. This was useful to getting data on how the users experienced mobility in their daily routines in order to establish the character and patterns of mobility. This information was captured by use of photographs and hand written notes. The study also took note of the means of communication, transportation and other forms of technology that facilitated the mobility of the respondents.

2.2 Data sources

The study utilized both primary and secondary data sources. The primary sources included in-depth semi-structured interviews with various stakeholders, participant field observations and focus group discussions. The range of people interviewed were farmers, labourers, agrovets, hay suppliers, restaurant operators, *machicha* transporters, milk processing factories personnel, *matatu* operators, *boda boda* operators; pick up operators, milk bar/ Kiosk operators, milk ‘ATM’ operators, and government officials. The secondary sources of data were from international, national and county government sources; reports and journals undertaken by research institutes like the KDB, IIED, Tegemeo Institute, FAO, UN-Habitat and ILRI among others. Semi-structured interviews were carried out with the farmers, traders and commuters to ascertain their experiences in mobility within the area. Northey et al. (2015, p. 78) point out that “*qualitative researchers use a less structured and non-directive interview to explore a broader range of factors, including the thoughts and feelings of study participants.*” Participant observation including accompanying the farmers and vendors as they undertook activities like the collection of animal feeds, taking milk to the collection centres, delivery of milk by the vendors and the processing of milk by both cottage and large industries. Other qualitative data that were utilized included: social media information, photographs and newspaper articles.

The research additionally utilized open source mapping data from Google maps and *satellite.pro*. Google Street View (GSV) images that were taken between February and May 2018 were also useful in undertaking an exploratory overview to identify the various milk related mobility activities taking place along the transect and the surrounding area. Some of the photos utilized in this thesis report are extracted from GSV. GSV has been applied in research in various disciplines including in geography, archaeology and ecology (Rundle et al., 2011; Vandeviver, 2014).

2.3 Sample size and procedures

The Ruiru – Uplands transect was purposefully selected because it has an existing dominant dairy value chain related activities that are boosted by the presence of four large milk processing factories in the three sub-counties in the area (Lari, Githunguri and Ruiru and also Murera and Theta ward in Juja sub-county that is adjacent to Ruiru to Uplands road): Githunguri Dairy FCS Ltd; Uplands PD&F Ltd; Brookside Dairy Ltd; Palmhouse Dairy Ltd, Canaan Factories Ltd, Elite Dairies Ltd and other small cottage processing factories. The area also has a network of various milk collection points, especially around Githunguri and Lari Constituencies.

The sampling technique ensured that it covered the four main aspects that represented what was taking place along the milk value chain and transect: the setting, actors, events, and processes as illustrated by (Miles & Huberman (1994). The setting was the Ruiru Uplands transect; the actors were the stakeholders in the milk value chain; the events were the mobility-related activities in the dairy value chain and lastly, the process was the sequence of events in the milk value chain. The respondents were selected through purposive and snowball sampling and interviewed to the point of saturation, where there was no more new incoming information. Milk vendors operate in an environment of fear and mistrust due to occasional arrests by government authorities because they sometimes operate without licences, so it took time to build trust with them. The vendors that were interviewed introduced me to the other respondents or helped to build confidence of the other respondents in interacting with me. Adler & Adler (2003) refers to this kind of respondents as reluctant respondents, whose reluctance to be interviewed is driven by their illegal activities, fear of being reported or their membership in secret societies. By being referred by respondents previously interviewed, it was easier for the respondents to openly give information without suspecting me as a government agent. Northey et al. (2015, p. 83) point out that “*gaining entry into a group is itself challenging. The prevailing view is that a researcher should let the group know that he or she is a researcher on a data-gathering mission.*” As the section below reveals, revealing my identity and purpose was not enough to build the confidence of the respondents, and it took the intervention of a third party a restaurant operator to introduce me to the milk vendors.

2.4 Data collection tools and techniques

The data collection methods included semi-structured interviews with various actors along the milk value chain and observation techniques. The data was collected through fieldwork notes, observations, sketches, photographs and copies of various research materials. Semi-structured questionnaires were used for the various actors along the milk value chain because they allowed the respondents to express their feedback and mobility experiences without being limited to specific answers. This was particularly useful in identifying the barriers and limitations of mobility. As a result, the contributions made by the respondents brought out their unique individual experiences.

The study further interrogated the mechanics of the mobility by identifying the barriers that affected the mobility and the adaptations of the actors to overcome these barriers. The questions dwelt on how the respondents experienced mobility. The livelihoods issues were interrogated from the viewpoint of how the activities that the various respondents were engaged in had

contributed to their social mobility. The focus was on what had they had been able to achieve from engaging in the various activities, and their future aspirations.

The interviews were carried out using an iterative approach due to the evolving nature of the activities taking place along the transect especially the construction of the main carriage way; the Ruiru to Uplands road. A relationship was maintained with the respondents so that further interview sessions could be held with them to identify changes in mobility as a result of the evolution of the transect. Repeated interviews foster a relationship with respondents, allowing for a more in-depth understanding of the issues at hand. (Adler & Adler, 2003). At the start of the study, the road was in a dilapidated state, but towards the end of the study, the Ruiru to Upland road had been tarmacked up to Githunguri town, which is 25 kilometres from Ruiru town and about half the length of the 47 kilometres transect. Ruturu and Moi roads had also been fully tarmacked. This provided insights on the effects of the rehabilitated road on mobility along the transect.

Box 2.1: Building confidence and fitting into the schedules of the milk vendors.

Building confidence and fitting into the schedules of the milk vendors

It took some time to gain the confidence of the milk vendors. I could observe the milk vendors riding their motorbikes around Ruiru town, but it was not easy to stop them while they were in the process of transporting their milk unless one was buying from them. First, they were suspicious that it could be a trap by the authorities to arrest them, secondly, they knew their regular customers, and lastly, they were in a rush to make the deliveries. The few who stopped when I waved at them inquired whether I needed some milk and they would leave immediately I gave a negative response. Before they made deliveries, the vendors were in a rush and could not create time for an interview. The field work had to be oriented in such a way as to understand their mobility patterns so that it was possible to meet the vendors after they have done their deliveries.

On 30 May 2019, I met a female milk vendor in Githurai, Ruiru and observed as she alighted a *matatu*, and transferred about 15 milk jerry cans to a hand cart. I introduced myself and she told me that she was on her way to deliver the milk and could only talk to me later. I got her phone number but when I called later, she had already left for her home in Gatundu. I inquired when we could schedule an interview and she indicated that her weekly schedule was usually busy and could only meet me on Sunday the only day she rests. I suspected that the milk vendors avoided staying in the towns after their business is done to avoid encounters with the police, the county *askaris*, and the Kenya Dairy Board (KDB). After several attempts, it was not possible

to schedule a meeting on Sunday because she was engaged with family and other social activities.

I met and interviewed the first milk vendor on 23 March 2019 at 1100 Hrs when I was cycling along Ngenda road in between the coffee plantations. I waved at him and he agreed to stop. I think that he stopped because I was riding a bicycle and the means of transportation I was using was similar to his. I was also alone and away from the town, thus I did not look like a government representative. He was on his way home after selling his milk and was in a hurry and could only take a few questions.

On 14 December 2018 at 0700 Hrs, I saw a milk vendor's motorbike parked outside a restaurant in Ruiru, and I thought that was a good chance to finally meet a vendor. The milk jerry cans were empty, showing that delivery of milk had already been done and maybe the vendor was in the process of collecting the jerry cans from his customers. I thought of two options to get to meet the vendor; either to wait for him next to the *boda boda*, or to look for him inside the restaurant. I took the latter option because I was on my way to a conference and did not have much time to wait. When I got into the restaurant, I was able to identify him from among the other people because he was heavily dressed with a hooded jacket to protect him from the chilly morning weather. When I introduced myself and showed him my research permit and university staff identity to show that I worked at the university and was only interested in research and informed him that I was looking for the owner of the motorbike parked outside, he denied that it was his. I was disappointed, took some tea then left, but then I frequently went to the restaurant with a view of meeting him and befriended the restaurant owner. Miles & Huberman (1994, p. 30) argue that "*an ethnographer setting out to 'hang around' a precinct is continuously making sampling decisions about what to observe, whom to talk with, what to ask, what to write down, whether to stay in one room or another.*" Thus a researcher needs to be patient to gain the confidence of the respondents to gain entry into their circle and also to observe from a distance their activities and schedules and seize the best moments of having conversations with them. I introduced myself to the restaurant owner, explained to him my objective and gave him my business card which had my cellphone number so that he could share it with the milk vendor and request him if he could agree to have an interview with me. But the call was not forthcoming. When I saw the motorbike parked again on 31 May 2019 at 0845 Hrs, I went to the restaurant and took some tea. The restaurant owner having known my objective, took initiative to introduce the vendor to me. He agreed to talk to me and informed me that since he was in the process of collecting the jerry cans, it was not a good time to talk to me. He told me that he would make another trip in the evening to deliver milk, (I later learnt that he opted to

make two trips with lighter loads because it was during the long rains, and the muddy, skiddy roads could not allow him to carry heavy loads on a single trip) and we could meet at 1900 Hrs when he was done with the day's work. "You will not be able to recognise me in the evening. I will be wearing a turban." Indeed it would not have been possible to recognise him in the evening, because with the white turban he would have looked completely different from the hooded jacket that he wore during the day to cover his turban in order to avoid been easily noticed and identified by the police, the KDB and the Kiambu county government officials . After a short while, the vendor left to continue with his work. He may have preferred the night interview because the operations by the KDB and the county government officials ends at 1700 Hrs. I interviewed the restaurant owner and in the course of the interview, he informed me that the vendor had previously declined to talk to me because during the week when we first met, the vendors had faced harassment from the KDB.

In the evening at 1900 Hrs, I returned to the restaurant hopeful to meet him, but found that unfortunately, he had already left. He still did not trust me and had refused to give me his phone number so that I could call him and find out where he was. I could see the three jerry cans of milk that he had delivered. Determined to still meet him, I kept going to the restaurant to have tea, and a month later, we met on 03 June 2019 I had a good long interview with him. The same day the restaurant owner introduced me to Mr. Wanyoike, a 42 years old milk vendor from Kiganjo, Gatundu South who used a *matatu* to deliver his milk. Having learnt that milk vendors were using *matatus* to distribute their milk, I went to the *matatu* terminus and waited for them. As I waited I met Mr. Wanyoike again and he introduced me to another milk vendor and the chain of interviews with the milk vendors was finally established. To build confidence with the milk vendors who used *matatus*, who were mostly women, I befriended mama Kamau a 45 year old tea vendor who operated at the Ruiru *matatu* terminus, and I would wait for them there as I took tea. That way the vendors did not see me as a threat to them. The interviews were conducted at the time the vendors were waiting for the *matatus* to travel back to their homes thus they were at ease to undertake the interviews. It was easier to meet the vendors who used *matatus*, compared to the vendors who used *boda bodas*. The location at the terminus was also familiar to them, thus they felt comfortable to have the interview.

However, their schedules were still complicated. I met mama Wambugu, a 40 years old female vendor from Kigumo, Githunguri while she was waiting for a connecting *matatu* at the Ruiru *matatu* terminus to take her to Wataalam about three kilometres away to deliver the milk. I had a conversation with her as she packed the milk into the connecting *matatu*, but in a short while as we were talking the *matatu* was almost getting filled up and ready to depart for Wataalam,

and the only option to finalise the interview was for me to board the *matatu* and accompany her, which I found to be okay because I would experience the journey. After we had alighted the *matatu* at Wataalam, the lady was hesitant for me to accompany her to the place she was going to deliver the milk. She did not want to reveal the full details of her customers and saw it as a threat to her business. We quickly finalised the interview and she left to deliver the milk.

On another occasion, during an interview with 50 years old mama Wanjira from Nembu, Gatundu South, she pointed out to me that she normally arrived in Ruiru at 0700 Hrs or some few minutes from 0700 Hrs, but that day I had watched her arrive at 1000 Hrs. She indicated that she arrived late because there were few *matatus* because students were going home for mid-term and most of the *matatus* were ferrying high school students home and did not want commuters with luggage. I watched as she requested the services of two assistants to deliver milk to some restaurants near the Ruiru *matatu* terminus after which she called a *boda boda* operator so that she could ferry the milk to other customers. The interview had to be discontinued so that she could deliver the milk.

Source: Author.

2.5 Data analysis and presentation

The qualitative data was collected, transcribed, then sorted through inductive coding into various categories through word processor and then aggregated into various themes and emerging issues. The emerging themes form the organisational structure of the thesis report as per the research objectives. The study utilises the four concepts of geographic thinking: spatial significance, patterns and trends, interrelationships and geographic perspective in the analysis and interpretation of the data (National Geographic Society, n.d.). These were developed by developed by the Canadian Geographic Education Committee of the Royal Canadian Geographic Society (RCGS).

The above concepts of geographic thinking provide a framework for the analysis of the geographical data that is gathered in this study. The spatial significance fits well in the contextualisation of the study area – the Ruiru to Uplands transect that transverses different geographical zones to give variety of geographic data. The study then identifies the patterns of mobility along the milk value chain and then investigates the interrelationship between those patterns of mobility and their impacts on urban-rural linkages and actors livelihoods. Finally after analysis of the data, conclusions are drawn upon which recommendations are made on ways to resolve the issues identified.

Table 2.1: Concepts of geographic thinking

Spatial Significance	Patterns and Trends
<ul style="list-style-type: none"> • identify where places are located on the earth’s surface • determine the unique characteristics of places based on natural and/or human characteristics • analyze the spatial distribution of various elements of the Earth system e.g., people, plants, animals, resources and physical processes 	<ul style="list-style-type: none"> • identify characteristics that are similar and that repeat within a natural or human environment [patterns] • analyze characteristics (spatial, social, political, economic, physical or environmental) of a particular place over a period of time [trends] • examine changes that occur within and between places, processes, and/or characteristics over time [transitions]
Interrelationships	Geographic Perspective
<ul style="list-style-type: none"> • identify connections that exist within natural and human environments • identify connections between natural and human environments • recognize that the interconnected parts of an environment work together to form a system • determine the relationships that exist within a system • analyze the relationships that exist between systems to determine the impacts that systems have on one another 	<ul style="list-style-type: none"> • identify the spatial and ecological context of geographic issues, events, developments and phenomena • identify potential stakeholders and recognize their points of view • investigate and analyze issues through a holistic lens by integrating other disciplinary perspectives (e.g., economic, political, cultural, social, environmental, indigenous) • use geographic information, skills and data to solve problems, make decisions, and formulate plans of action

Source: (National Geographic Society, n.d.).

The study also utilises the political economy approach which “*analyses the economy from its social and political context rather than seeing it as a separate entity*” (MacKinnon & Cumbers, 2011, p. 14). Through this approach, the power relations among the actors along the milk value chain are analysed and discussed to identify their effects on mobility along the milk value chain. MacKinnon & Cumbers (2011) contend that this approach can be ‘spatialized’ to examine the patterns of regional growth and decline. He emphasises that the flow of a particular product involves “*a complex chain of linkages in the production, distribution and exchange of any particular commodity and creates real conflicts of interest between groups of people who*

capture the most added value from the product” (MacKinnon & Cumbers, 2011, p. 15). By utilising the political economy approach, the study makes use of ‘non-economic factors’ that Myrdal (1957) considered to have an effect on development. Myrdal (1957, p. 30) in his critique of the economic theory stated that it had “*disregarded these so-called non-economic factors and kept them outside the analysis.*” He argued that these factors are the “*main vehicles for the circular causation in the cumulative process of economic change.*” Martin (1999) emphasises the need for consideration of these non-economic factors irrespective of whether they are not subject to mathematical representation:

“It means that ‘messy’ social, cultural, and institutional factors involved in spatial economic development are neglected. Since these factors cannot be reduced to or expressed in mathematical form they are assumed to be of secondary or marginal importance...It is precisely the social, institutional, cultural and political embeddedness of local and regional economies that can play a key role in determining the possibilities for or constraints on development, and thus why spatial agglomeration of economic activity occurs in particular spaces and not others.” (Martin, 1999, p. 75).

The political economy approach has been applied in this study to analyse the power relations among the actors along the milk value chain. The study analyses aspects of transport infrastructure development and management policies and its implications in mobility. The application of these policies in regulation of public transport, the role played by the police and its effect on mobility is explored. The research additionally analyses the power relations in regard to the development of the draft regulations for the regulation of the dairy industry in 2018 and their implications on mobility especially as it affects informal milk vendors.

Ethical considerations

A research permit for the fieldwork was obtained from NACOSTI as per the national research guidelines for researching in Kenya. An ethics clearance was not needed for the particular study. All respondents were informed about the nature of the study and asked to give consent before the interviews were conducted. Additionally, the names used in the document are not the real names of the respondents to protect their privacy. This is especially useful because some of the activities and actions like bribing that the farmers and vendors are involved in are illegal and some of the statements they made could lead to their prosecution. Adler & Adler (2003) talks of the need to safeguard the welfare of the respondents to protect them from harm.

2.6 Study Area - The transect

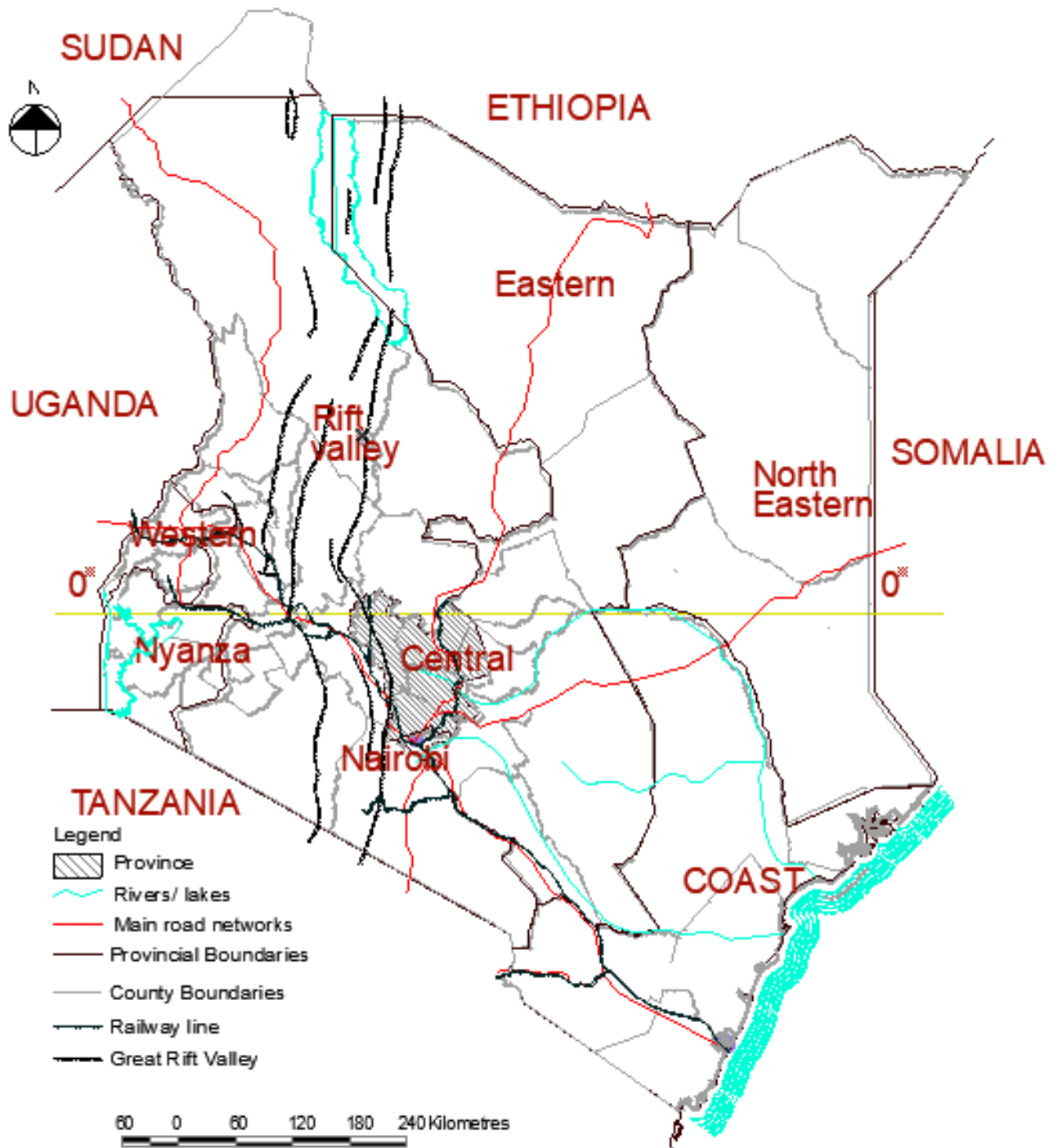
The study area is located in central Kenya which is among the high potential agricultural zones in the Country that constitutes about 9 per cent of the land mass. The transect lies between two major international road networks in Kenya. The first road corridor is the A8 Naivasha road that connects Mombasa, Nairobi and Malaba, the border between Kenya and Uganda. This road runs almost parallel to the Mombasa to Kisumu railway. The second road corridor is the A2 - Thika Superhighway that connects Nairobi to Thika-Sagana-Nanyuki-Isiolo-Marsabit-Moyale which borders Kenya and Ethiopia (Kenya Roads Board, n.d.). It also branches from Athi River to connect to Namanga at the Kenya and Tanzania border.

The transect is located along the slopes of the 160 kilometres long Aberdare mountain range, starting at the edge of the forest in Uplands to the lowland savannah in Ruiru. The transect covers three sub-counties of: Lari, Githunguri and Ruiru. Additionally Murera and Theta wards in Juja sub-county were purposefully selected because of their close proximity to the Ruiru to Uplands road as it approaches Ruiru town (See map 2.2 below). The transect has a diversity of geophysical and geo-climatic features from the highest point sloping towards the lower points. The altitude ranges from 2,400 metres – 1,300 metres above sea level.

The climatic conditions also vary gradually along the transect from cool to warm climate. The vegetation and main cash crops additionally vary from a forest zone to a pyrethrum zone, then to a tea zone, a coffee zone and finally a sisal/ ranching zone in the lower part of the transect. The topography varies from steep V-shaped valleys near Uplands to gentle valleys and plains in the lowland. There is also a human settlements variation along the transect from the village centre in Uplands (less than 2,000 people) to the market centre in Ngewa (Kwamaiko) with 2,452 people and the small town in Githunguri with 10,615 people and finally an intermediate town - Ruiru bordering Nairobi city with 490,120 people (See Map 2.1 and Map 2.4).

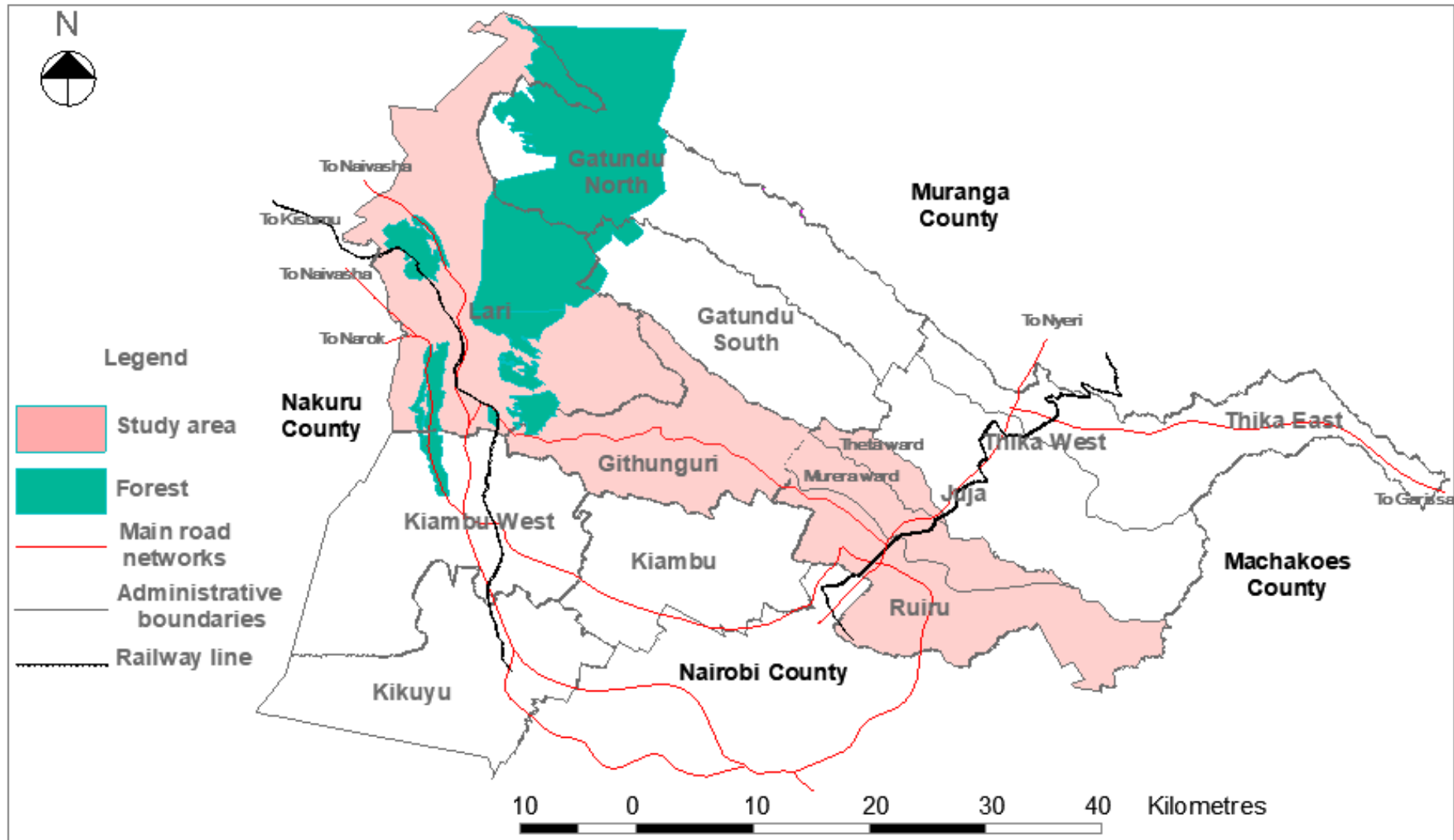
There is a variation of landholdings from small parcels (0.045 hectares) to large parcels (over 500 hectares) separated by a *raini/* line/ colonial boundary between Githunguri and Ruiru sub-counties. The type of dairy farming activities along the transect varies from forest foraging adjacent to the forest to semi-zero grazing, and finally zero-grazing. The transect is a major water catchment zone, and has a range of tributaries and rivers that feed into the second biggest river in Kenya – Athi River.

Map 2.1: Map of regions in Kenya



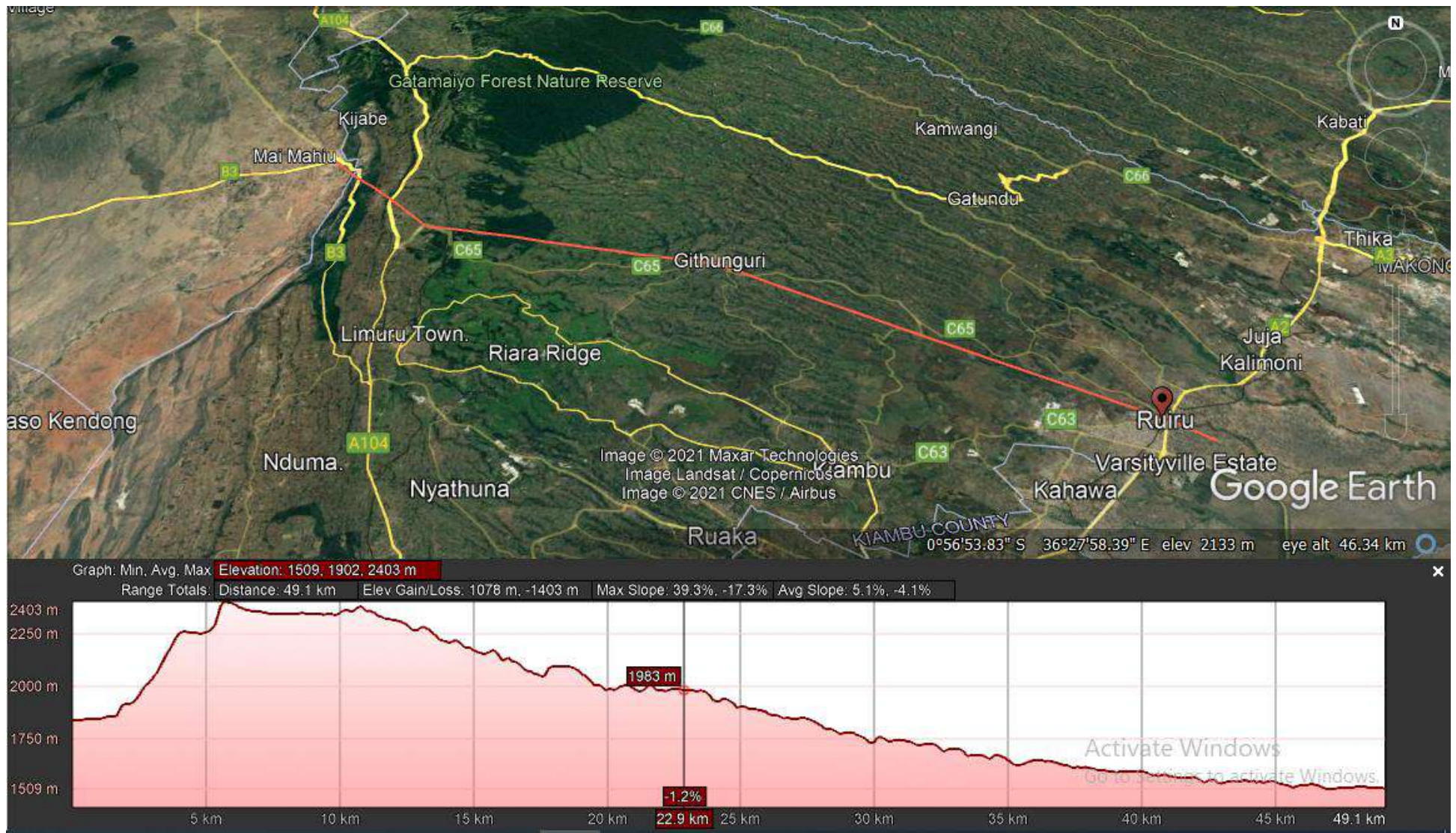
Source: Author

Map 2.2: Map of the study area



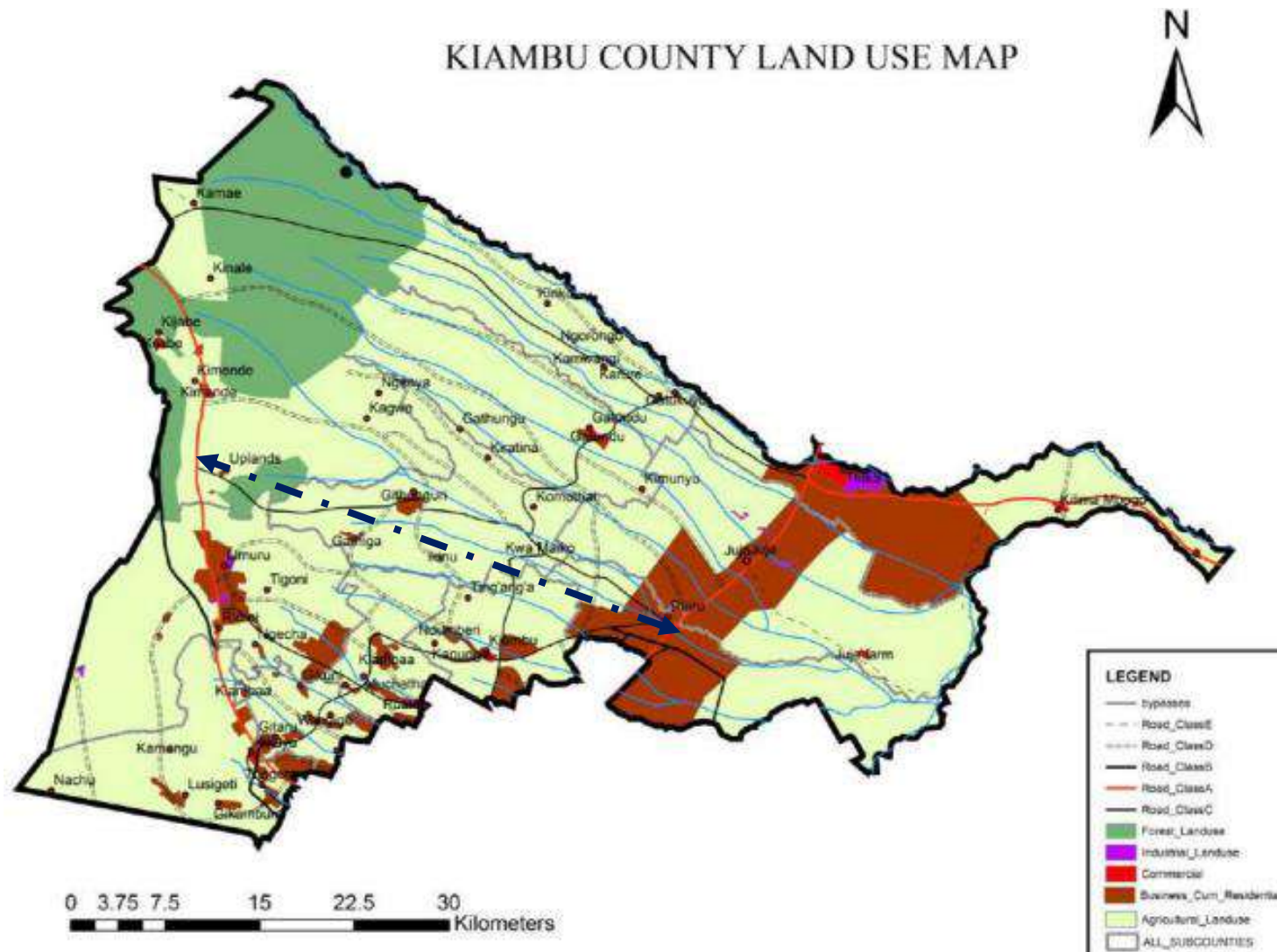
Source: Author

Map 2.3: Cross-section of the transect.



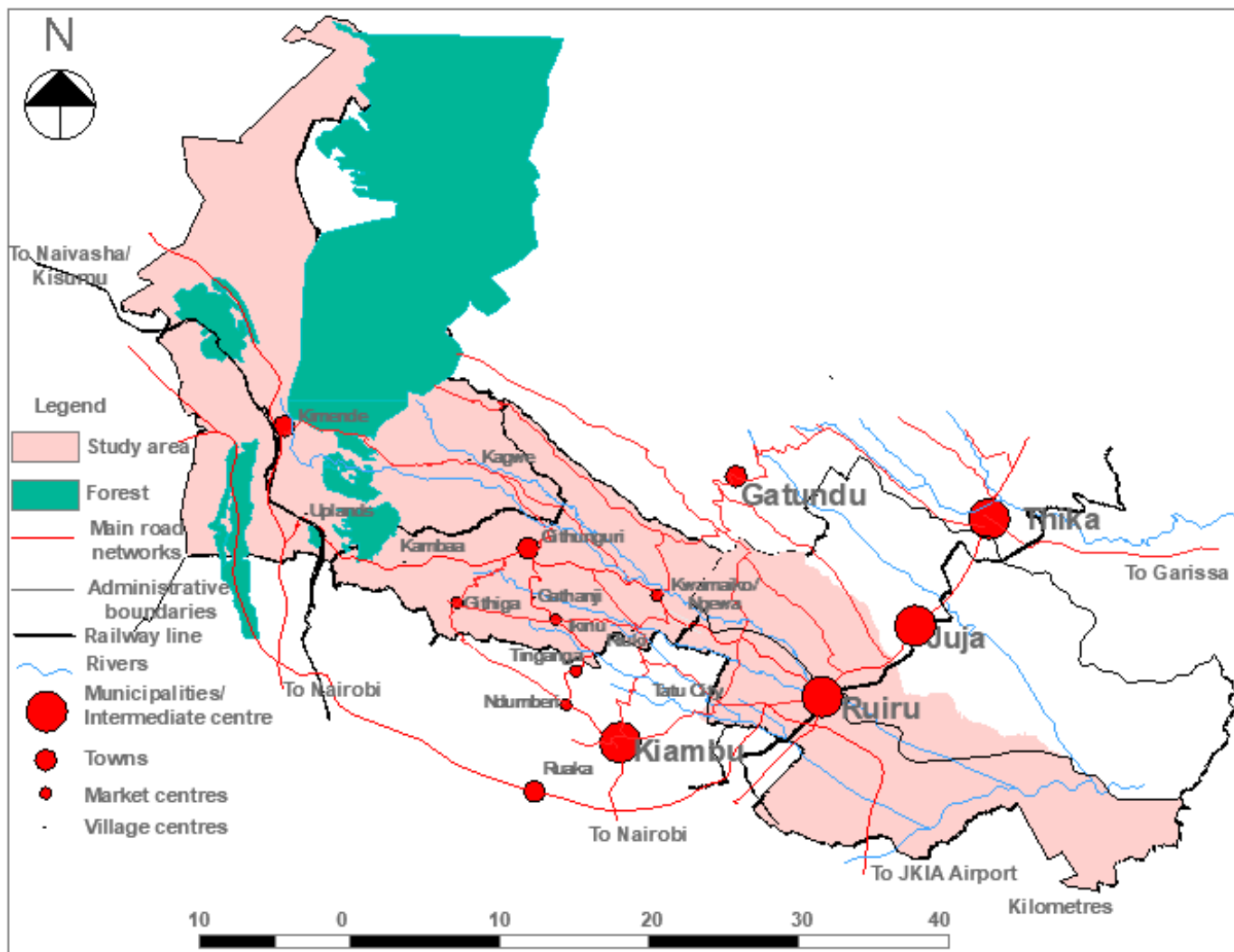
Source: Google Earth, 2021.

Map 2.4: Kiambu County land use map



Source: (County Government of Kiambu, 2018)

Map 2.5: Urban centres along the transect



Source: Author

Climatic and topographical characteristics

The 47 kilometres Ruiru to Uplands transect covers the whole range of four geographical zones found in Kiambu County that is the upper highland, lower highland, upper midland and lower midland zone. The area receives long rains between March and May and short rains between October and November (County Government of Kiambu, 2013). The upper zone has cool temperatures that gradually increase as one moves to the lower zones. Uplands area, the North-Western end of the transect located in Lari sub-county is in the upper highland zone that is located adjacent to the Aberdare range. With an altitude of 1,800 metres above sea level the area receives a reliable annual precipitation of up to 2,000mm and is dominated by plantations of tea. This upper highland zone extends southwards towards Githunguri sub-county which has a mix of tea and coffee plantations. This part of the transect is characterized by steep hills, ridges, and valleys (County Government of Kiambu, 2013).

Githunguri sub-county is located in the lower highland zone with an altitude of 1,500 – 1,800 metres that is characterized by hills, valleys and plateau topography. The lower parts of Githunguri and also the upper parts of Ruiru constituency fall under the upper midland zone which lies at an altitude of between 1,300-1,500 metres above sea level. Lari and Githunguri are a rain rich zone that forms the catchment region for Ruiru and Kamiti rivers that later join the Nairobi River to form Athi River as it exits Kiambu County. The rainfall intensity decreases to an annual precipitation of about 1,200mm towards the lower zones around Ruiru constituency which forms the lower midland zone of the transect. This zone is characterized by flat plains and grassland vegetation (County Government of Kiambu, 2013).

The soil types along this transect are rich well-drained red volcanic soils that are suitable for agricultural activities. However, the lower zone has shallow black cotton soils that are suitable for livestock ranching and sisal. The area produces a wide range of crops ranging from cash crops, food crops and horticultural production. The cash crops include mainly tea and coffee and a little bit of pyrethrum. The food crops include maize, beans, potatoes, sweet potatoes, peas and bananas. Lastly, given the proximity to the Nairobi, the area has increasingly adopted the growing of horticulture crops like kales, cabbages, capsicum, among others. The transect is also a milk-producing area mainly through small-scale zero-grazing farms.

Road and rail connection

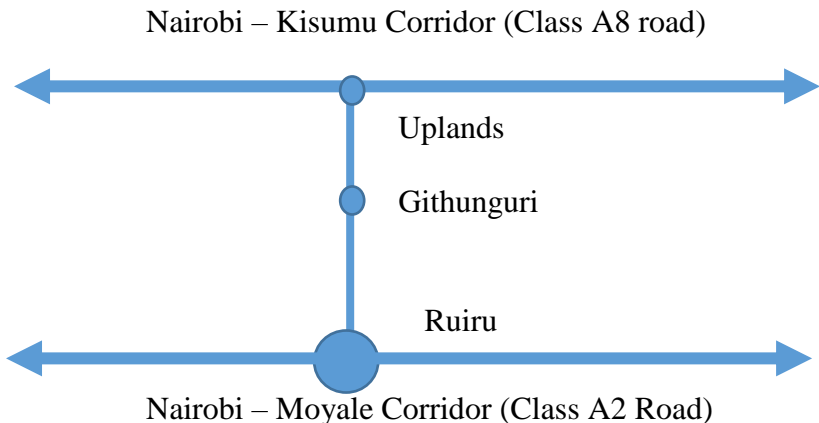
The area's road network lacks regular maintenance thus making sections of it difficult to access. The main connecting road is the Uplands – Ruiru road which was in a dilapidated condition before 2018, and was being rehabilitated in the course of the research. The Kiambu County Government (2013) County Integrated Development Plan (CIDP) mentioned the need to improve the road networks especially to make them accessible during the rainy season. The tertiary roads that connect to the primary and secondary roads in the area form a labyrinth of connecting paths that are about 3-6 metres wide. These roads sometimes have overgrown bushes becoming too narrow for two vehicles to pass each other or sometimes inhibiting vehicular movement. This is not a major departure from the colonial state of the road network in the area as reported by Anderson (2005, p. 119) in his book *Histories of the Hanged: The Dirty War in Kenya and the End of Empire*:

An elaborate network of rural roads and tracks cut across Lari sub-location in every direction. These well-kept mud paths were the arteries that connected Lari's farms to the main highways of Limuru Road and Ruiru road, running along the ridges to the city of Nairobi to the south-east. (Anderson, 2005, p. 119)

While some of the roads have been graded by the County Government of Kiambu and the National Government Constituency Development Fund (NGCDF), the rehabilitation is still not extensive, and the roads are still not well maintained to facilitate good movement especially during the rainy season.

At the edges of the transect, there are two; metre-gauge rail networks; one that passes along Uplands village centre and another that passes through Ruiru town that have both been rehabilitated for commuter and cargo services and are expected to boost spatial flows across the regions that they connect. The Nairobi to Kisumu line that passes through Uplands was re-opened on 17 December 2021 while the Nairobi to Nanyuki line that passes through Ruiru town was re-opened on 11 December 2020. While the commuter services between Ruiru to Nairobi is operational, and the Ruiru railway station has been rehabilitated, the commuter services between Uplands and Nairobi was not operational at the time of the study. The Nairobi to Nanyuki train operates only on Fridays and Sundays, departing from Nairobi- Nanyuki at 0900 Hrs on Fridays and from Nanyuki-Nairobi on Sundays at 0900Hrs. The distance between the two locations is about 177 kilometres, takes about six hours and costs Ksh. 200. However the operation of the rehabilitated line has had some challenges including breakdown of the trains while on transit.

Figure 2.1: Main transport corridors adjoining the Ruiru to Uplands transect



Source: Author

Economic activities

The layout of the parcels of land in the small landholdings in Githunguri and Lari are influenced by the configuration of the roads in the area, such that the residential buildings are constructed near the connecting roads which usually have a flat or gentle slopes. The subdivision of the land is also such that most households prefer their parcels of the land to touch a section of the adjoining roads and a section of the river. This is to ensure that the two amenities are easily

accessible to the households. The planning guidelines require that every parcel of land should have a road reserve of a minimum of nine metres width. Due to the diminishing land sizes, and this pattern of subdivision of land, the width of the parcels is usually narrow (about 10 to 30 metres), with an elongated length stretching to the river at a distance of about 500 metres to one kilometre (see Figure 2.2.). These kind of linear settlement patterns attract business activities along the roads, especially at the intersection where village and market centres are usually located.

The land sizes in the area are diminishing, with the average land holding in Kiambu county being 0.045 Ha (an eighth of an acre) for small-scale farms and 69.5 Ha for large farms (County Government of Kiambu, 2018). Like other parts of Kiambu County, the main economic activity along this transect is agricultural activities, with tea and coffee being the main cash crops grown in the area. Agricultural activities which are boosted by the presence of rich fertile soils and sufficient rainfall are the main source of income and employment for the small scale farmers and farm labourers in the area with some of the towns and centres along the transect being dependent on agriculture for their growth. The Kiambu labour office data showed that 75 per cent of the employees (wage earners) work in the tea and coffee plantations (County Government of Kiambu, 2018).

Figure 2.2: A valley with strips of land planted with napier grass and coffee on the foreground.



Source: Field work, 2019.

In the North-Western part of the transect, the farmers keep sheep, pigs, and cows, and grow horticulture products like cabbages, kale, peas, coriander and carrots because the area is too

cold for the cultivation of tea. There was cultivation of pyrethrum in the area that diminished with the decline in the sector due to mismanagement of the Pyrethrum Board of Kenya in the 1990s leading to delayed payment to farmers. Uplands area was also famous for pig keeping that was steered by the presence of Uplands Bacon Factory before its collapse in 1986 (See appendix IV).

The upper zones in Githunguri constituency are where the smallholder coffee farmers are located, while the lower flat zones are occupied by the large scale coffee plantations. Coffee from the smallholder farmers is marketed through cooperative societies that have processing factories distributed across the area, while the large coffee estates process and market export their coffee directly. Smallholder farmers who are still engaging in coffee farming in the area ensure that the coffee trees are healthy by ensuring that they administer fertilisers and pesticides to boost production. The coffee farmers ensure that terraces along the slopes are well maintained, and the coffee trees are not inter-cropped with other plants. A selected number of smallholder farmers undertake value addition by processing the coffee using manual, diesel or electric coffee pulp removing machines, drying the coffee beans on racks and selling the dried coffee to processors. Coffee productivity in the area has continued to decline as farmers abandon it and diversify to other agricultural activities like dairy farming, fruit farming and horticulture. The coffee bushes have been cut and replaced with napier grass as shown in (see Figure 2.2) and coffee processing factories like Riuki and Riagithu have been shut down due to low production.

Production of tea is prevalent in the Northern part of the transect and is boosted by the presence of the Kambaa tea factory run by Kenya Tea Development Agency (KTDA), located at Kambaa centre (7.8 Kilometres from Githunguri town) along the transect. Interviews with farmers revealed that returns have reduced compared with the past. Tea produced is usually collected from a series of tea collection centres located across the area and sold to the Kambaa tea factory. There was presence of middlemen buying tea from farmers for speculation (See figure 2.3). This phenomenon of tea ‘hawking’ is a national challenge in the growth of the tea sector, whereby farmers in need of immediate cash sell the tea to the middlemen who in turn sell it to KTDA under their accounts, expecting higher returns. The prices at which the middlemen buy the tea are usually lower, leading to low returns among the farmers. Tea ‘hawking’ is illegal in Kenya and is an indication of cash flow problems and its prevalence sustains the cycle of poverty.

Figure 2.3: Brokers buying tea from farmers



Source: GSV, 2018

Milk production along the transect is boosted by the presence of several milk processing factories located along the transect. These include: Brookside Dairy Ltd the largest milk processing company in Kenya which was formed in 1993 with control of over 42 per cent of the processed milk in Kenya, and is owned by president Uhuru Kenyatta's family. Githunguri Dairy FCS Ltd was formed in 1961 and is the third-largest milk processing company; Uplands PD&F Ltd was established in 2014; Canaan Factories Ltd in 2019; Palmhouse Dairies Ltd in 1996 and Elite Dairies Ltd in 2019. While Githunguri Dairy FCS Ltd relies on milk sourced from the catchment area along the transect within Githunguri sub-county, Brookside Dairy Ltd, Uplands PD&F Ltd and Canaan Factories Ltd have had to diversify to buy milk from other parts of the country in order to increase their productivity driven the high demand of milk in the country. Githunguri Dairy FCS Ltd has over 26,029 registered members and produces over 230,000 litres of milk daily. Uplands Dairy Ltd collects about 75,000 litres of milk from over 5,500 small scale farmers in Lari sub-county and other parts of Kenya. Brookside Dairy Ltd does not rely on milk from the adjacent locations in Ruiru, but instead buys milk from milk over 300 milk cooperatives located across the country.

The proximity to Nairobi and neighbouring towns has increased the demand for milk products, providing a sustainable market. Most dairy farmers along the transect practise zero-grazing; (See figure 2.4) where animals are enclosed in a structure, rather than left to openly graze. This kind of cattle keeping is necessitated by the diminishing land where cows can graze in open fields. Thus the cows are immobile while the farmer actively commute to different areas in search of fodder and other animal feeds. In the past when the land was adequate, the cattle could

graze in fenced paddocks. Some of the farmers in Lari practice semi-zero-grazing where the parcels of land are relatively larger, while the farmers located adjacent to the forest practice forest foraging. The dairy farmers along the transect mainly keep exotic high yielding cows like Friesian and Ayrshire (See figure 2.4).

Figure 2.4: Zero Grazing in Githiga, Githunguri



Source: Field survey, 2019

Urbanization along the transect

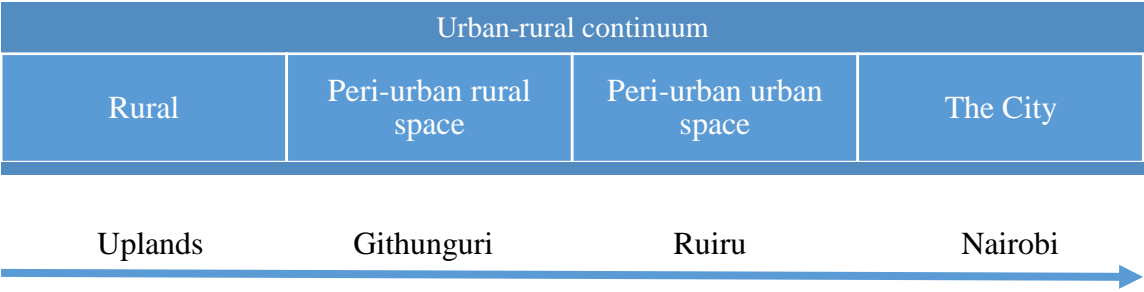
Githunguri town is located in Githunguri sub-county in Kiambu County about 40 kilometres from Nairobi and can be characterized as a rural town. Githunguri sub-county has a total population of 165,232 people (KNBS, 2019a) with five wards namely: Githiga, Githunguri, Ikinu, Komothai and Ngewa. Githunguri is the most urbanized ward that hosts an urban population of 10,615 people. There are market centres located in Githiga with a population of 5,565 people, Ngewa with 2,452 people and Ikinu with 2,532 people (KEBS, 2020). These small towns and market centres serve as service centres for the surrounding rural areas and provide services that are not available in the village centres spread across the sub-county (See Map 2.5).

The transect falls under the peri-urban zone of Nairobi, but with some differentiated transition from Ruiru that is adjacent to the City of Nairobi to the distant village centres like Uplands. Roberts (2016) indicates that the peri-urban zone is an area that is usually not easy to define due to the overlapping rural and urban characteristics in both rural and urban areas. The transition from rural to urban is that of a continuum from the rural farms to the rural villages,

small towns, and intermediate towns to the large towns. Village centres exhibit certain urban characteristics, and while they cannot be categorised as market centres because their population falls below the 2,000 people as defined by the Urban Areas and Cities (Amendment) Act, No 3 of 2019, they are in transition to becoming urban centres.

The character of the towns and market centres along the transect is shaped by their location in relation to the City of Nairobi and also the underlying activities in the town. Ruiru town has commercial and industrial land uses while Githunguri town; Ngewa, Ikinu and Githiga market centres offer support to agricultural activities. The towns located further from the City of Nairobi are more oriented towards the support of rural activities while the towns adjacent to the city like Ruiru are oriented towards urban activities and are more influenced by the City of Nairobi. This creates a distinct peri-urban, urban space and a peri-urban, rural space. The farming activities taking place in Ruiru town are those of urban agriculture where production and marketing takes place within the urban areas, with farmers additionally keeping poultry, and livestock and also engaging in horticulture production mainly in green houses or vacant plots of land. At this peri-urban interface, there is existence of urban activities in rural areas and rural activities in urban areas. Urban agriculture is a rural activity that is taking place in an urban area where the predominant activities are urban. While both Ruiru and Githunguri towns are located at the periphery of Nairobi, Ruiru town being adjacent to Nairobi is in the peri-urban urban space while the peri-urban zone adjoining Githunguri constituency is in the peri-urban rural space. Brient (2013, as cited in François, 2017) differentiates the rural-urban periphery to show the peri-urban area that has an urban orientation and is dominated by urban activities and that peri-urban areas with a rural orientation that is dominated with rural activities.

Figure 2.5: Urban rural continuum.



Source: Adapted from (François, 2017)

Ruiru town is a satellite town that borders Nairobi and is located 23 kilometres from the Nairobi CBD. Its growth is boosted by its close proximity to the capital City Nairobi and a good transportation network through Thika road, making it an attractive dormitory town. It has the highest urban population in Kiambu County - 490,120 people (KEBS, 2020). The demand for

housing in this area, and a growing middle class have driven real estate development in the town for both individual homeowners and people seeking to rent houses. It is the ‘bedroom’ of Nairobi. The town additionally has industrial activities including Brookside Dairy Ltd the largest milk company in Kenya that processes milk transported from other parts of the Country to its Ruiru processing plant. Other industries include Devki Steel Mills Ltd, Dormans Coffee Ltd, Danco Plastics, Mabati Rolling Mills Ltd, Kenafric Bakery Ltd, Spinners & Spinners Ltd, and Bidco Industrial Park among others. The town additionally hosts two major ‘new town’ developments: that is Tatu City and Northlands City. The growth of the peri-urban zone of Nairobi features both a ring of development surrounding the City of Nairobi and a corridor development along the major connecting corridors leading to the city. The town has a mix of high-income neighbourhoods like Kahawa Sukari and Membley estates and low-income neighbourhoods like Kihunguro and Githurai.

Githunguri town is also shaped by its proximity to the city and it hosts a section of the population that works in Nairobi because of its relatively cheaper living conditions. It is also well linked to Kiambu town, the headquarters of Kiambu County through Githunguri to Kiambu road that is in good condition. The link to Ruiru town is inhibited by the poor condition of the Ruiru to Uplands road along the transect³. However compared to Ruiru, Githunguri town is less influenced by the City of Nairobi. The major reason could be that it is located 40 kilometres from Nairobi CBD and the second reason could be because it is suitable for agricultural activities. OECD (2013) and Veneri (2014) show that from empirical data from OECD small regions, the spread effects are affected by the proximity to urban areas. The small town has carved a niche as an agricultural town. It started as an administrative centre that grew into a small town driven by increased agricultural activities. Its growth is currently driven particularly by the dairy sector. The commercial activities in the town are geared towards milk production with a proportion of shops selling animal feeds and the town having a presence of agrovet outlets. It is also notable that Githunguri and Lari sub-counties are the major milk-producing areas along the transect compared to Ruiru sub-county. 27 years old Karimi wa Hay who operates her hay business in Ruiru town along Thika road indicated that her customers are not from Ruiru town. *“Most customers are from far. Here (Ruiru) there are no buyers.”*

Githunguri town has a system of linkages with market centres like Ngewa, Githiga and Ikinu. GIKAKI *matatu* Sacco which operates between Githunguri and Kagwe village centre noted an increase in mobility during market days that alternate between Githunguri and Kagwe. Githunguri market opens on Monday, Thursday and Saturday while Kagwe market opens on

³ By the end of the study the Ruiru to Uplands road had been rehabilitated from Ruiru to Githunguri town

Wednesday and Friday. Kagwe is a growing village centre town located about 11 Kilometres from Githunguri town and serves as a service centre to the surrounding Lari sub-county. It is also there that the Uplands PD&F Ltd is located. Uplands village centre at the Northern end of the transect suffered dormancy and has remained as a village centre as a result of issues discussed in the section below.

Decline of towns and village centres

The reverse of the urbanisation process can be the decline or stagnation of an urban area as a result of the weakening of certain sectors or unforeseen extreme events. This section looks at the events leading to the decline and stagnation of Uplands village centre. (Myrdal (1957) outlines how an event in an area can lead to cumulative events that have an impact on the growth of an area. He gives an example of a factory that burns down and is not rebuilt and as a result, leads to unemployment and a decrease in demand for goods and services of related businesses leading to their decline. Consequently, the businesses move out to look for more profitable locations leading to decline of that locality. In contrast, he indicates that the growth of a town can ignite the development of a locality. He emphasises the effect of events on the interconnections and linkages within a region:

“The principle of interlocking, circular inter-dependence within a process of cumulative causation has validity over the entire field of social relations. It should be the main hypothesis when studying economic under-development and development” (Myrdal, 1957, p. 23).

Uplands village centre has had seasons of periodic growth, decline and stagnation as a result of the decline in the sectors supporting the growth of the surrounding rural areas. The centre is surrounded by the forest and the steep fall of the Great Rift Valley that limits its expansion northwards. The centre has faced past historical setbacks (See appendix IV) that affected its growth into an urban centre. One is the infamous Lari, massacre, then the collapse of the Uplands Bacon Factory, the collapse of the Kenya Railways and the decline in the pyrethrum agricultural sector. Stemming from the staple theory discussed in section 1.6 in the Theoretical and conceptual framework, the decline of bacon and pyrethrum production led to an economic decline of the area. These historical events served as triggers for the economic decline of that centre.⁴ The village centre faces a re-birth with the setting up of the Canaan Factories Ltd milk processing plant in 2019 which has the potential to transform the growth of the area. The

⁴ These are discussed in detail in appendix IV

rehabilitation of the Ruiru to Uplands road and the rehabilitation of the previously dormant Nairobi to Kisumu railway is also likely to spur the growth of the village centre.

2.7 Summary

Qualitative techniques were adopted in this research. The research focussed the milk value chain and the Ruiru to Uplands transect. A transect study was used because of its capacity to make comparisons on the mobility patterns at different locations along the transect which has a rich variation in terms of climatic, topographical, vegetation, and human settlement patterns. Primary and secondary data sources were used to achieve the study objectives and answer the research questions. The primary sources included in-depth semi-structured interviews with various stakeholders, participant field observations and focus group discussions. The respondents were selected through purposive and snowball sampling and interviewed to the point of saturation, where there was no more new incoming information. The qualitative data was collected, transcribed, then sorted through inductive coding into various categories through word processor and then aggregated into various themes and emerging issues.

The study utilises the four concepts of geographic thinking: spatial significance, patterns and trends, interrelationships and geographic perspective in the analysis and interpretation of the data (National Geographic Society, n.d.). The spatial significance fits well in the contextualisation of the study area – the Ruiru to Uplands transect that transverses different geographical zones to give variety of geographic data. The study then identifies the patterns of mobility along the milk value chain and then investigates the interrelationship between those patterns of mobility and their impacts on urban-rural linkages and actors livelihoods. Finally after analysis of the data, conclusions are drawn upon which recommendations are made on ways to resolve the issues identified. The political economy approach was also applied in this study to analyse the power relations among the actors along the milk value chain.

3 Mobility patterns along the milk value chain

Movement is purposeful and is targeted at fulfilling certain needs like access to goods, services, people, and information among others. The dairy value chain exhibits various patterns of systemic movements from production, collection, processing, and distribution of milk. This chapter outlines these patterns as they take part along the Ruiru to Uplands transect. Patterns are natural or human-made phenomena that exhibit similar characteristics or traits in a particular context or time span. The mobility patterns under-listed exhibit characteristics that show similarities and repetitiveness as depicted in the report. The chapter also analyses the drivers of mobility along the dairy value chain.

3.1 Drivers of mobility

Movement is purposeful and is targeted at fulfilling certain needs like access to goods, services, people, and information among others. The intensity of the mobility depends on the level of sophistication of the human occupation such that communities involved in subsistence farming will move over shorter distances compared to those undertaking industrial activities in mega-cities (Lowe & Moryadas, 1984). Mobility along the transect is driven by several factors that are discussed in this section. The mobility is also shaped by the varying land use activities along the transect, the state of milk as it progresses along the value chain and the demand for milk as a product.

Limited land holding

As indicated in the previous section on the area of study, the size of land holdings in Kiambu County has decreased due to sub division of land as a result of population increase. The average landholding of 0.045 hectares (County Government of Kiambu, 2018), is not enough for farmers to sustain a large number of dairy cattle exclusively from fodder sourced from their farms. The options that the farmers have are to keep fewer cows or to supplement the animal feeds from other sources, which necessitates mobility. Although dairy farming with fewer cows is cheaper, it results in lower revenues, while keeping a large number of cows has higher costs, but higher returns due to economies of scale. To keep a large number of cows, farmers need to supplement the fodder they grow on their farms with outsourced fodder and commercial feeds. While it is an advantage to increase the animal stock, the production costs should be minimised to ensure a return on investment. A report on the Dairy Value Chain in Kenya indicated that “*low production leads to low income which in turn leads to low production creating a poverty trap. Investing in feeding is impeded by low cash flow*” (TechnoServe Kenya, 2008, p. 19). The report additionally points out that for a farmer to make a 10 per cent profit while practising *zero*

grazing, they needed to keep at least 6 cows, and if they were using semi-grazing, they would require to keep at least 10 cows. The report further indicated that a farmer needed to produce at least 15 litres of milk per day to break-even. The shift towards commercial agriculture from subsistence agriculture drives mobility. Commercial agriculture requires more farm inputs which cannot be sustained by the small parcels of land.

Mr. Kinyanjui, a 47 years old farmer from Riuki, Githunguri who keeps two calves on a one-acre farm indicated that the small farm size is one of the limiting factors in the expansion of his dairy business, with the other factors being lack of capital and means of transportation. While he is able to sustain his calves from his one acre piece of land, his revenues are low. The same challenge of limitation of small parcels of land was divulged by 52 years old Mr. Mburu a farmer from Githurai, Ruiru town who has 20 cows:

“It is not easy to expand this business. When the number of cows increases, I sell them... I have bought land in Gatundu where I plan to expand the dairy farm... I delay giving artificial insemination after milking for a whole year to reduce the population of the herd contrary to the practice of doing it after three months.”

Farmers have devised strategies to overcome the challenges of diminishing land including: leasing land, buying fodder; buying industrial and commercial forage, and developing storage structures for fodder according to 46 years old Mr. Kiama the Livestock Officer, Githunguri sub-county. Mr. Karanu a 37 years old farmer from Githunguri indicated that some dairy farmers were sourcing silage from as far as Narok County located approximately 141 kilometres from Githunguri. He indicated that he owned a three-quarter piece of land and leased out half an acre piece of land to supplement his fodder requirements. The issue of diminishing land holdings is even more amplified in urban areas. 76 years old Mr. Kuria a farmer from Githurai, Ruiru town whose dairy farm is on a 0.375 acres plot of land in Githurai, Ruiru town relied entirely on buying feeds for his animals in form of market waste from Githurai market located 800 metres from his plot. 77 years old Mr. Gathumbi, a farmer from Githiga resorted to getting maize stalks from Kiambaa area about 15 kilometres from his farm. He bought the maize stalks from maize farmers who leased out land from the late Mbiyu Koinange’s⁵ family. He additionally bought hay from Narok and transported it to his farm using a lorry he owned. 54 years old Mr. Ndirangu from Ngochi, Githunguri had six cows in a quarter-acre piece of land inherited from his parents. To get enough feeds for his cattle, he has acquired two acres of land

⁵ The large tracts of land were owned by the family of a former minister in Jomo Kenyatta’s government (the founding president). Due to a prolonged land succession challenges involving the surviving members of the family, the utilization of the land was limited, and it was leased to farmers from nearby locations.

in another location about two kilometres away from his farm/home. With this land, he has sufficient napier grass for his dairy farm during the rainy season, but he has to buy some napier grass during the dry season. 50 years old Mr. Ngige, from Gathaithi, Githunguri initially had half an acre of land. He leased an additional two and a half acres of land to get a sufficient supply of napier grass and did not require to buy any other fodder. 47 years old Mr. Kagwe, a farmer from Miguta, Githunguri owned one acre of land and leased about two acres. In a good season the three acres provided adequate fodder for his animals. He pointed out that the supply of napier grass dependent on how well it was cultivated (quality) for instance through adding manure and soil testing to ensure high yields.

The type of dairy farming

Dairy farming is prevalent along the transect. In Kiambu County, it is the primary enterprise whereby about 70 per cent of the farmers keep 2-3 cows under zero-grazing. Milked production had a significant increase from 264,773,621 litres in 2013 to 308,818,919 litres in 2016 (County Government of Kiambu, 2018). Zero grazing (see figure 2.4) the predominant type of dairy farming along the transect makes the farmer mobile while immobilizing the cows (see Table 3.1). Zero grazing works well with the farmers with small parcels of land hence its adoption in the area. All the farmers interviewed in this study practised zero grazing. Zero-grazing is an indication of intensive dairy farming.

Table 3.1: Mobility in various types of animal husbandry

Forest Foraging	<ul style="list-style-type: none"> •Cows mobile •Farmer immobile
Semi) Intensive - Paddock Grazing	<ul style="list-style-type: none"> •Farmer immobile •Animals mobile
Intensive -Zero Grazing	<ul style="list-style-type: none"> •Farmer mobile •Animals immobile
Extensive - Ranching & Pastoralism	<ul style="list-style-type: none"> •Farmer mobile •Animals mobile

Source: Author.

Perishability of milk

The perishability of milk makes it necessary for farmers to make sure that the product reaches the consumers or processors as soon as possible to avoid spoilage. However, advancement in technology has overcome this barrier such that milk industries can manufacture milk that can

last for up to six months. Milk vendors who sell raw milk have to make sure that they sell the milk within a span of about 12 hours from when it is milked. The vendors also prefer to transport the milk during the night when it is cool so as to reduce spoilage.

Demand of milk as a product and raw material

There is a demand for milk as a raw material among the processing companies that are not able to meet their processing capacity which was at 40 per cent according to a study in 2008. *“Brookside, New KCC and SpinKnit⁶ account for over 80 per cent of the formal market. This group of three is constantly looking for new milk sources to fill processing plants to capacity”* (TechnoServe Kenya, 2008, p. 2).. Canaan Factories Ltd has a capacity to process 80,000 litres of milk but was currently processing 50,000 litres per day. *“There is a demand for milk – Currently no processor has enough of the raw product.”* Mr. Irungu a 38 years old manager at the factory pointed out. He indicated that the milk processing companies have to compete for the product from the farmers and have come up with strategies to retain farmers including through: prompt payment, competitive pay, offering training, and linking farmers to service providers for inputs and financial support. As a result, the milk companies have farm extension managers who are in charge of supporting farmers to boost milk production.

The competition for raw milk is not only among the producers and also between the producers and the milk vendors whose capacity for utilisation of their processing plants One of the reasons for the high demand for milk by the processors is because they only handle 20 per cent of the marketed milk in Kenya, with the rest of the milk being sold through informal channels from the farm to neighbours, through informal channels by milk vendors, and in milk parlours (Karanja, 2003; Muriuki, 2003; Nassiuma & Nyoike, 2014; TechnoServe Kenya, 2008; Tegemeo Institute, 2016). Blackmore et al. (2015) and Blackmore et al. (2021) were of the view that the government regulators were under pressure from large milk processing companies to reduce the competition from milk vendors through stringent regulations.

The consumer demand for raw and processed milk is high in Kenya. The per capita milk consumption in Kenya is the highest in sub-Saharan Africa, at 110 litres which is expected to increase by 5.8 per cent annually to 220 litres per capital consumption in 2030 driven by a traditional inclusion of milk in the diet, high rate of urbanisation, a growing middle class and a potential export market. (Njeru, 2022; Van der Lee et al., 2016). USAID-KAVES (2015)

⁶ Spinknit was acquired by Brookside Dairy Ltd in 2010

predicted that Kenya would experience a milk an annual deficit of 675 million litres in 2017 which would grow to an annual deficit of 1.2 billion litres by 2022.

3.2 Direction of movement

This section answers the question of what is moving and to where it is moving. It outlines the spatial flows along the milk value chain and the directions of the movement created from the production to the distribution of milk. The section also discusses the rural to urban connections created as a result of these flows. The directions of movement vary from rural to rural; rural to urban or urban to urban. The direction of movement in the production phase focuses on the farmers’ movement in search of service provision and farm inputs mainly animal feeds. The animal feeds have further been classified into three main groups that are relevant to this study: fodder crops, processed feeds and by-product feeds (see Table 3.2). The last two sections then outlines the directions during the collection and distribution of milk.

Table 3.2: Locally grown and commercial feeds available in the area

Locally grown fodder	Processed feeds and supplements	By-product feeds
Napier grass, various types of hay, maize stovers, various weeds, banana stalks and leaves, tree foliage, and silage	Wheat bran, maize germ, dairy meal, wheat pollard, fish meal, cotton-seed cake, sunflower cake,	Poultry waste, various market vegetable waste, industrial waste – spent grains brewers waste & pineapple peels pulp

Source: Author.

Service provision

Towns act as focal points for the provision of support services to the dairy industry. The services include: veterinary, AI (Artificial insemination), insurance (valuation of cattle), banking, repair (motor vehicles, farm machinery and equipment), consultancy, transportation, conferencing, extension/ training, savings and credit. *“The industry needs support. We support farmers. If no support is given, it will collapse”* pointed out Mr. Mwaura a 55 years old private veterinary doctor based in Githunguri town. The public and private processing companies offer extension services to the farmers through their trained workers. This involves joint or individualised technical training for the farmers on aspects like: new farming approaches/ technologies/ products; prevention of diseases; livestock nutrition; livestock hygiene; and financial

management. It also includes visits to the farms for practical demonstration activities. The farm extension benefits the farmers in boosting their milk production and on the other hand, it benefits the processing companies by boosting the supply of raw milk to the factories and also retaining the customers by offering them a free training services and assisting them to address the challenges that they face. The government farm extension workers play a key role in disease control by inoculation in case of outbreaks and linking farmers to financial institutions and other actors. Githunguri Dairy FCS Ltd has 14 farm extension workers who support their members daily through advisory and training services. The farm extension workers are equipped with motorbikes to commute to the surrounding rural areas to meet with the farmers either individually or in groups.

Uplands PD&F Ltd engages the local farmers through an elaborate farm extension and training programme with six farm extension workers aimed at boosting their milk supply. The programme has resulted in increased milk productivity from an average production of five litres to 14 litres per day. The farmers not only benefit from the training and extension programmes, but also from linkages with micro-finance institutions that offer them loans secured by the milk they supply. In addition, the company provides the farmers with animal feeds and offers veterinary services on credit. At an extension training session organised in Kamburu, Lari, at the chief's camp, about 70 farmers were in attendance from the locality. The provincial administration was also represented by the area chief. The target group for the training were members of 'route' five which had 104 farmers who were active out of 225 registered members. The session was moderated by the farm extension workers from Uplands PD&F Ltd. The training focused on strengthening farmers' financial skills and also good animal husbandry practices. The issues facing the farmers like logistical challenges during the collection of milk were also discussed. The farmers were sheltered in a tent to avoid direct sun. The meeting was between conducted 0900 Hrs to 1200 Hrs so that the farmers could go to milk their cows at 1300 Hrs in time for the delivery of milk at 1400 Hrs. Suppliers of processed feeds and other farm inputs also attended the training to give their input in regard to animal nutrition and answer questions pertaining to their products and also market some of their products to the farmers. Financial institutions present informed the farmers about their financial products. After the event, there was networking among the farmers, the farm extension workers and the service providers followed by a farm visit to one of the farmers' who produced a relatively higher quantity of milk. The farmer was advised on various ways of increasing milk production, while the other farmers were able to learn from his experiences.

Veterinary services form a core support service that farmers require without which they would make losses in terms of decreased milk production or death as a result of untreated diseases.

This service is regulated by the government of Kenya through the Livestock and Fisheries Department which has offices in every sub-county including Githunguri. The government licenses the agrovet outlets and the veterinary doctors to monitor quality and ensure adherence to ethical standards in clinical practice. The agrovet outlets stock animal drugs and have trained veterinary clinicians or doctors who offer advice to farmers on health, nutrition and other issues affecting their animals. Some of the agrovet outlets additionally sell animal feeds. Githunguri Dairy FCS Ltd has five veterinary technicians who are equipped with vehicles and motorbikes to travel across the sub-county to provide artificial insemination (AI) services. The company has a digital record of the artificial insemination services to assist the farmers to track the reproductive health of their animals. Clinical veterinary services are offered by private veterinary doctors who are mainly based in the towns.

Mr. Mwaura a 55 years old veterinary doctor from Githunguri town has been in operation for the past 22 years and has witnessed the growth of the dairy industry in the town. He indicated that the town had about 20 agrovet outlets that shared a consumer base from the large population of dairy farmers from the surrounding rural areas. He also indicated that the town had three veterinary doctors including him and about 100 technicians, some operating from the village centres or their homes. His agrovet outlet acts as his office and the centre of convergence of the services that he offers to the farmers. Mr. Mwaura viewed the town as a market for his products, whose growth he attributed to being driven by milk production. Therefore although the practitioners were many, the market was robust enough to sustain the large pool of service providers. His customers are either walk-in customers or regular customers, and was at the moment serving 3,000 farmers (active clients), but had a database of 10,000 clients. He wished to “*grow with the farmers,*” illustrating that by ensuring that farmers remained productive, he would in turn be able to sustain his business. He offers clinical, AI, consultation, training and insurance services in Githunguri. He additionally stocks and sells animal drugs and mineral supplements to the farmers from his agrovet. The products are sourced locally or imported from other countries. Some of the importers of semen and animal drugs to Kenya are Coopers Kenya Ltd, Highchem East Africa, Twiga Chemicals, ABS TCM Ltd, and Kenya Animal Genetic Resources Centre (KAGRC) all located in Nairobi. His work involves frequent mobility because he has to visit the farmers to offer services representing an urban–rural interaction. He has two vehicles and two motorbikes and has employed three veterinary technicians to assist him. In total, the four of them carried out about 30-40 AI and clinical visits per day, with the main disease being mastitis and milk fever. The main mobility challenge he encountered was that the roads were not in good condition, especially during the rainy season, and since his enterprise did not have a four-wheel vehicle (he was using a Toyota corolla saloon vehicle),

mobility was a challenge. His areas of coverage were the rural areas surrounding Githunguri constituency. He operated within a radius of about 10 kilometres from Githunguri town in areas like Githiga, Gakoe, Kwamaiko, Ngochi, Gitaha and Ha Donga, and indicated that this was dictated by the time it took him to travel so that he could serve as many customers as possible through short visits. “*If you travel over long distances, you become inefficient and expensive.*” He further added that previously he had a customer in Kahawa West (27 kilometres from Githunguri) near Ruiru and Kagwe⁷ (11 Kilometres from Githunguri), but he linked them to other veterinary doctors near their farms because of the inefficiency created by the longer distance. He went on to say that travelling longer distances would require him to charge higher costs, lowering his competitiveness. Mr. Mwaura’s area of operation represents a functional area within which he operates beyond which it would not be economically possible to be in business due to time limits and fuel costs.

During one of the visits to Mr. Maina’s farm, he indicated that he had previously had a phone conversation with the farmer to try and find out if he could assess the case and give advice over the phone. However, this was not possible so he had to make a physical visit to the farm. The particular case was an ongoing treatment of foot and mouth disease that had caused one of the dairy cows to have a septic wound on the leg. He applied hydrogen peroxide to the wound and left the farmer with additional drugs to apply. He noted that the phone communication was not clear and upon the visit, the case seemed more severe than he had imagined. Mr. Mwaura was to make a follow-up visit after five days.

Transport services are important in supporting the milk industry, given that not all farmers can afford the various means of transportation and the mobile nature of the activities in the dairy sector. Various means of transportation are utilised depending on various factors like flock size, affordability, distance, terrain, season among others. The means of mobility include: lorries, pickups, tuk-tuks, *matatus*, *boda bodas*, hand carts and bicycles. At the towns, pickups, motorbikes (*boda bodas*) and lorries are parked at strategic locations to wait for customers (see figure 3.1).

⁷ Although Kagwe seems to be a shorter distance, the road between Kagwe and Githunguri was in a bad condition before it was tarmacked in the year 2019

Figure 3.1: Pickup trucks for hire in Githunguri town.



Source: GSV, 2018.

Mr. Kagwe had a lorry and pick up which he used to buy and transport *machicha* from EABL headquarters in Ruaraka to farmers located at various parts of Githunguri and its environs before the decentralisation of the sale of *machicha* to about 15 distribution centres in Kiambu County (discussed in the next section). He offered this service to farmers who did not own vehicles to help them buy *machicha* in small quantities or to farmers whose vehicles were grounded because of mechanical or other problems. He picked the *machicha* on Tuesdays, Wednesdays and Thursdays which were the days that were allocated by EABL for the sale of *machicha* to vendors who were about 25 in total. The demand for his services depended on the scale of production of the farmers, with large scale farmers like Elite Dairies Ltd located near Ruiru town that has over 1,000 cows requiring about 20-30 tonnes of *machicha* per day and engaging about eight vendors. The transportation of *machicha* additionally depended on the availability of stock and the season. During the dry season, there was increased demand for *machicha* due to the reduction of fodder. He bought the *machicha* at Ksh. 522 per unit and sold it between Ksh. 800-1000 per unit depending on the distance travelled and the condition of the road to a farmer's location. Following the decentralisation of *machicha* to various locations in Kiambu, he currently operates a *machicha* outlet in Kagwe village centre in Lari sub-county.

The town, market and village centres have various *boda boda* sheds/ stations where these motorbike taxis wait for their customers. The use of *boda bodas* is an emerging means of mobility in rural and urban areas due to their low cost of fuel consumption, their ability to access dilapidated road sections that are not easily accessible by vehicles, and their ability to enable customers to order for goods and request for transport without having to travel to those locations. Farmers can call *boda boda* transporters and request them to ferry animal feeds, while the farmer makes the payment to the seller through mobile money transfer (M-Pesa). For shorter distances, non-motorised transport is utilized like hand carts, wheelbarrows and bicycles.

Young men use bicycles, donkey pulled carts and motorbikes to cut and collect grass from parcels of land located within the large coffee plantations on the lower parts of the transect. This grass is then sold to the farmers located near the coffee plantations creating employment opportunities. Some of the grass vendors own dairy cows, therefore they make trips to get grass for both their animals as well as their customers.

Figure 3.2: Use of a *boda boda* in transportation of animal feeds.



Source: Field work, 2018

Figure 3.3: Non-motorised transportation of processed feeds.



Source: Field work, 2018

Collection and distribution of milk by the Githunguri FCS Ltd and Uplands PD&F Ltd is through hired transport in the form of trucks, lorries, pickups, *boda bodas* and bicycles. The companies procure these services from private individuals with priority being given to members of the local community thus impacting positively to their livelihoods. The maintenance of these vehicles is the responsibility of the owner including ensuring that they are thoroughly washed daily, giving rise to another service in the form of car wash businesses that have come up in Githunguri town and Kagwe village centre. Milk vendors especially women rely on *boda bodas* to collect milk from the farmers located along tertiary roads from where it is taken to various points along the main roads to be picked by *matatus*. The milk vendors prefer to use specific *matatus* that know the routes that they normally use.

Due to the old nature of the pickups owned by the farmers, they regularly require mechanical services. The vehicles additionally require an annual inspection and have to be in suitable condition for this inspection. The mechanics are located in the towns, but also ‘rescue’ the farmers when their vehicles have a mechanical problem in the course of their commutes. 52 years old Mr. Nderitu a mechanic operates from a vacant plot that he has leased in Ruiru town and also has a dairy farm in Miguta, Githunguri. He owns a pick up vehicle which he uses to tow farmers’ vehicles when they encounter mechanical problems and for also picking *machicha* for his cows.

Processed animal feeds

Feeds (including fodder) account for 60-70 per cent of the production costs in the livestock industry (ABS TCM, 2013; Auma et al., 2018) raising the demand for these inputs and creating a market for them. Towns, market centres, village centres and milk collection centres⁸ are the main locations where the farmers access processed animal feeds and other farm inputs. These are also referred to as compound feeds that are processed from a variety of ingredients to offer diverse nutritional and physiological benefits to the animals. The various processed feeds and the raw materials used to manufacture them include: rice, maize and wheat bran, dairy meal, pellets, soy bean meal, cotton-seed cake, maize germ, and wheat pollard. In addition, 70 per cent of the ingredients used in the manufacture of processed feeds in Kenya are imported from the East and Southern African countries and other parts of the World; consisting of grains and seed cake by-products (ABS TCM, 2013; TechnoServe Kenya, 2008) thus linking dairy sector to the global processed feeds value chain. Munene (2021) indicates that the reason behind the

⁸ Milk collection centres in most cases are located at the village and market centres

sourcing of feeds from the two East African counties is that they are available at a cheaper cost. Further, the demand for processed feeds in Kenya exceeds the available supply (Auma et al., 2018) raising the cost of processed feeds production, therefore driving the importation of feeds ingredients.

Figure 3.4: Sale of commercial feeds along Market Street in Githunguri town



Source: GSV, 2018.

Along the transect, these processed feeds are sold in the towns, market and village centres, creating movement to these locations from the surrounding rural areas. The processed feeds are manufactured locally by various companies located in Nairobi, Ruiru, Thika, Isinya, Naivasha, Nakuru, and Kiambu among others. Some farmers source the animal feeds directly from the producers, but most are sold by the retailers. The processed feeds supply chain creates a chain of linkages between the town, market and village centres along the transect with other surrounding towns and regions within and beyond Kenya.

It was observed from the research that Githunguri town has more businesses selling processed feeds compared to Ruiru town. The cluster of businesses selling processed feeds in the town is attributed to the high demand of these feeds from the surrounding smallholder farmers. Githunguri is experiencing a growth in the dairy sector while Ruiru being a satellite town at the periphery of Nairobi is witnessing real estate investment, creating a demand for construction materials and leading to the setting up of business ventures supporting that particular sector. Ruiru is also a poultry farming area because of its warm climate thus the processed feeds outlets support this type of farming. The businesses selling processed feeds and other farm inputs range

in size with some retailers operating roadside businesses while others have set up large warehouses to get enough storage for their products. 46 years old Mr. Kiama the livestock officer indicated that chaff cutters sourced from India retail at a cheaper price in Githunguri compared to other parts of Kenya and farmers travel to Githunguri from other parts of the country to source them. This may be because they are sourced in bulk, hence they retail at a cheaper price, an advantage of the economies of scale created as a result of clustering.

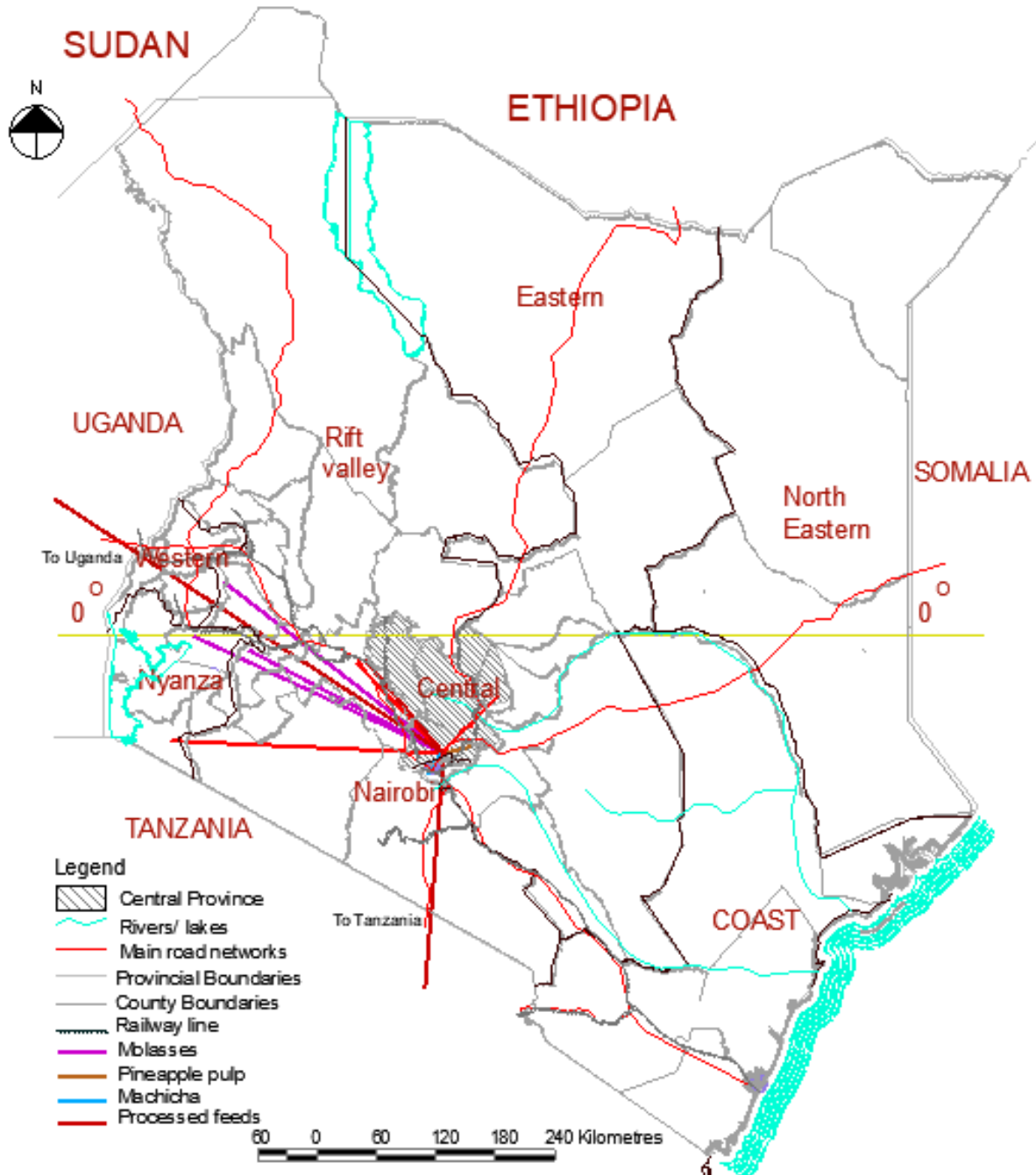
One such outlet that sells farm inputs is run by 45 years old Mr. Kang'ethe of Baraka feeds in Githunguri town along the Ruiru to Uplands road which he started in March 2020 during the onset of the COVID-19 outbreak. The business sells various processed feeds and supplements at wholesale and retail prices. In addition to processed feeds, he sells molasses, *machicha*, salt supplements, pineapple pulp, hay, yeast (a microbial protein), and 20-litre jerry cans (for those carrying molasses). He sources these inputs from diverse locations within and outside Kenya. Molasses is sourced from factories in Western Kenya, pineapple pulp from Thika, and *machicha* and yeast from Ruaraka.⁹ He sources hay from Nakuru, Mwea and Kuria. He is an appointed distributor of Safi feeds whose factory is located in Nakuru and Amani feeds whose factory is in Kiambu town. He sources maize germ, pollard, soy bean meal and wheat bran from the neighbouring countries of Tanzania and Uganda (See Map 3.1). He used his trucks for transportation of all his products including the processed feeds from Uganda and Tanzania at Ksh. 3 per kilogram using trucks with a capacity of 28 tonnes. He took advantage of his other business venture that deals with transport and logistics to ensure that when his trucks transport goods to the two neighbouring countries, they return to Kenya with the feeds. Except for molasses, he can transport the other products using his trucks enabling him to sell his products at a wholesale price. He sells his products to farmers from areas surrounding Githunguri town including Nyanduma, Kagwe, Kiriko, Gathanji, and Ikinu. He had one customer from Naivasha (Approximately 70 kilometres from Githunguri town) who buys about 20 jerry cans of yeast and transports it with his van. Farmers use motorised and non-motorised means of transport including: wheelbarrows, bicycles, donkey carts, tuk-tuks, motorbikes/ *boda bodas*, pickups, and saloon cars.

To cut costs in production, some farmers process their own dairy meal, which is the main processed feed that is given to dairy cattle to boost their milk production. They buy the ingredients and use a 'formula' to mix the feeds in the required amounts. The mix is composed of:

⁹ The next section discusses these industrial by-product feeds in more detail

high energy feeds like maize germ, wheat pollard, molasses, maize bran and wheat bran; high protein feeds like lucerne hay, cotton seed cake, soya bean meal, sunflower seed cake, sesbania leaves, calliandra leaves and fish meal; and mineral like dicalcium phosphate, limestone, rock phosphate or mineral premix (KARI, 2008).

Map 3.1: Links created by Mr. Kangethe's animal feeds outlet



Source: Author

These products are sourced from agro-vets located in various urban centres including Githunguri town, and some of these ingredients have their origin from the neighbouring countries of Uganda, Tanzania, Southern African countries and India. Mr. Waithuki whose farm is located in Githunguri sub-county processes his own feeds daily for his 40 cows. He acquired the formula for mixing the feeds from a training at the Kabete Animal Health Industry Training Institute. The production cost equates to Ksh. 1,300 - 1,400 per bag, compared to the market rates of Ksh. 1,800 a sack. He has a daily production of 650 litres which he attributes to using his own feeds (Maina, 2021). The ingredients he uses to prepare 1,000 kilos of dairy meal are as follows:

Table 3.3: Ingredients used by Mr. Waithuki to prepare dairy meal feeds.

S. no.	Ingredient	Amount (Kg)
1.	Maize germ	260
2.	Wheat pollard	100
3.	Wheat bran	240
4.	Sunflower	50
5.	Macadamia	50
6.	Groundnuts	60
7.	Cotton seed	150
8.	Fish meal	10
9.	Dairy salt	10

Source: (Maina, 2021).

Various 'formulas' for the manufacture of dairy meal processing feeds can be found on farmer websites and social media. They have inconsistent proportions and it is hard to tell the one that has the right proportions. ABS TCM (2013) in their study on regulations pertaining to the manufacture of processed feeds in Kenya indicated that there were existing challenges in: enforcement, weakness in the supply chain, constraints in safety, quality of the feeds and their ingredients. The study recommended the elimination of unlicensed manufacturers, self-regulation through AKEFEMA (Association of Kenya Feed Manufacturers), review and strengthening of the regulatory framework, formation of an animal feeds regulatory board to register, license and regulate actors, and promotion of local production of feeds ingredients. Dairy farmers along the transect indicated that poor quality of the processed feeds was among

some of the challenges they faced in milk production. KARI recommends the following ratio for the preparation of the feeds.

Table 3.4: Low cost home-made supplement for dairy cows.

Ration for 100 kg of ordinary supplement	Ration for 100 Kg of high yield dairy supplement
75 kg energy feeds	68 kg energy feeds
23 kg protein feed	30 kg protein feed
2 kg minerals.	2 kg minerals.
Actual mix for 100 kg of ordinary supplement	Actual mix for 100 Kg of high yield dairy supplement
57 kg Maize germ	50 kg maize germ
18 kg Wheat pollard	16 kg wheat pollard
17kg Lucerne hay	2 kg molasses
6 kg Soya meal	14 kg cotton seed cake
2 kg Dicalcium phosphate.	12 kg lucerne hay
	4 kg fish meal.

Source: (KARI, 2008)

KARI (2008) indicated that 20 per cent of the production cost is from buying dairy meal and making the ordinary home-made dairy supplement would cost Ksh. 750 and the high yield home-made supplement Ksh. 850 (Prices at June 2008) compared to the dairy meal price then at Ksh. 1,150 reducing the cost by 26 per cent. The institute recommended that home-made feeds were an alternative to giving the dairy cows an inexpensive and palatable supplement without reducing the nutritional quality.

Greenfield Millers located in Kiambu town specialises in selling animal feeds and the ingredients to farmers. It was notable that farmers travel from Githunguri to this particular animals feeds supplier located Kiambu town due to their confidence in the quality of feeds he offers. Farmers buy the various ingredients that they use to prepare their home-made processed feeds depending on their livestock needs, and either carry them separately or the miller mixes them using a feeds mixer machine. 47 years old Mr. Kagwe a farmer and *machicha* vendor from Miguta, Githunguri buys the ingredients and mixes them himself. He indicated that the

ingredients for making the dairy meal are sourced from various locations: fish meal from Gikomba (which has a large fish market), sunflower cake from cooking oil processing companies and maize germ from Uganda (considered to be cheaper and of better quality). He indicated that the quality of feeds was wanting – the weight was an issue, and farmers could not undertake an analysis to assess the quality.

Fodder

Napier grass

The climatic conditions along the transect especially the section between Kwamaiko and Kambaa are ideal for the cultivation of napier grass, making it the main source of fodder along the transect. The lower sections near Ruiru are drier, while the sections near the Aberdare forest are cold slowing down its growth. Other sources of fodder in the area include banana leaves and stalks, weeds, pruned maize, post-harvest maize stovers, and sweet potato vines. As discussed in the introduction, the land previously under coffee farming has been converted for use in napier grass cultivation (see Figure 2.2). Farmers move to get napier grass either from within their farms, or from other locations. From their farms, the farmers use non-motorised transport. Given the sloppy terrain, the fodder is carried on the shoulders by men and on the backs by women.

Figure 3.5: A farmer transporting napier grass with a wheelbarrow at Magomano, Githunguri.



Source: (GSV, 2018).

These duties are shared among the household members including the children with assistance from hired labourers for those who have one. While some farmers engage full-time labourers who are paid monthly, others hire labourers on demand and pay them daily wages. For instance, a labourer could be hired to transport the napier grass uphill from the lower parts of the slopes to the cow shed or in other instances to transport and spread manure on the napier grass to improve productivity. On the flat locations of their farms, the farmers use wheelbarrows to transport the fodder (See Figure 3.5). Farmers who do not keep dairy cows cultivate napier grass which they sell to the dairy farmers on demand. Thus dairy farmers will commute to areas near their farms to pick fodder sold to them by their neighbours. The choice of means of transport is determined by the amount of fodder that the farmer needs to transport, affordability, and the distance that the farmer needs to travel. A wheelbarrow is useful for picking fodder on short distances of about 1-2 kilometres on relatively flat terrains or gentle slopes. The limitation of the distance one can travel is determined by the physical endurance of the individual and the terrain.

Figure 3.6: Transportation of napier grass with pickups.



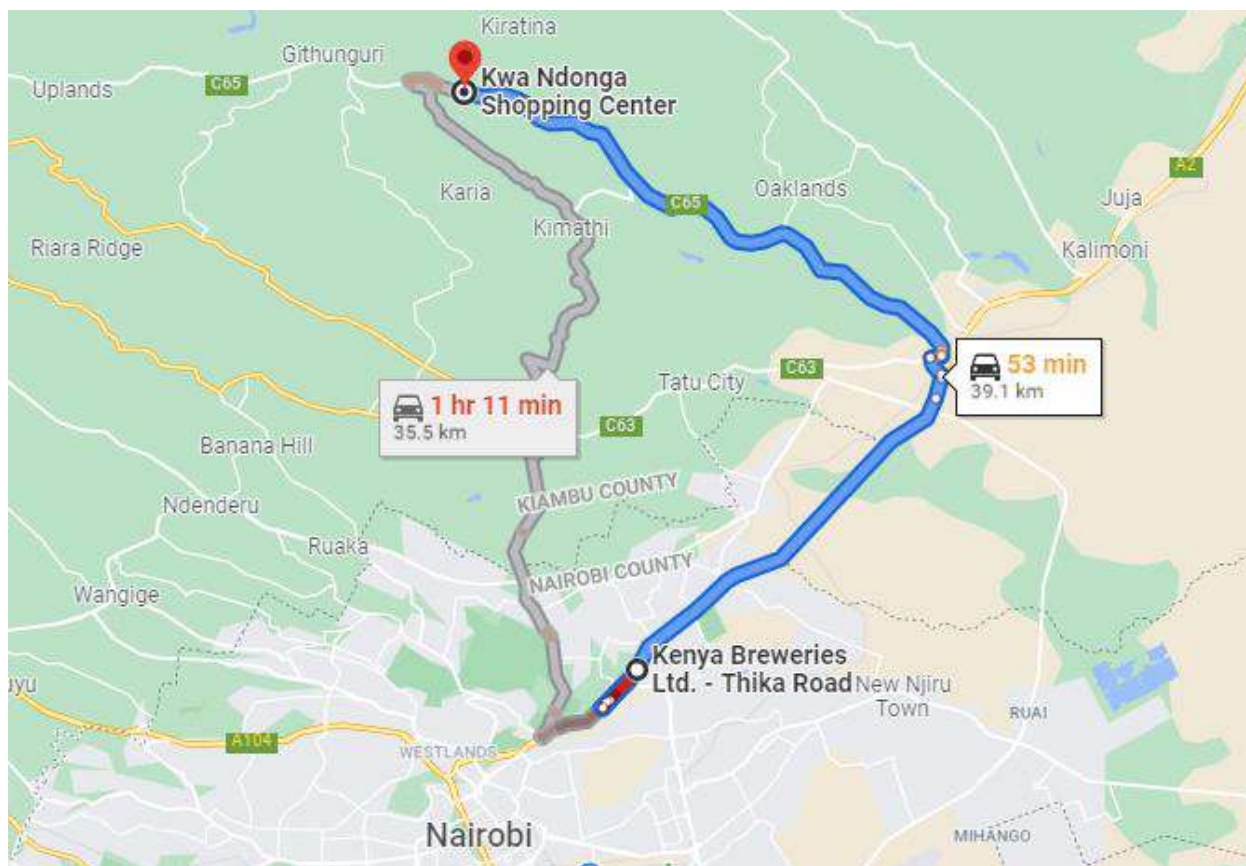
Source: GSV, 2018.

Carrying a load downhill takes less effort than carrying it uphill. With a bicycle, farmers are able to travel further within a distance of about 10 kilometres especially if the direction of travel with the load is downhill. Once the napier grass is purchased, farmers could ferry it to their farms over a period of about two weeks for daily use. The seller usually gives the farmers between two weeks and a month to clear the fodder. Farmers who have pickups transport the

napier grass in bulk to reduce the number of trips taken due to the cost of fuel. The farmers usually park the pickup or lorry by the roadside and hire labourer(s) to cut the napier grass and transport it uphill (if it is on a slope) and load it on to the pickup (See Figure 3.6). Sometimes the napier grass is cut one or two days before to allow it to wither so that it is lighter and also good for the digestion of the cattle. The kind of mobility in search of napier grass creates rural to rural linkages unlike the mobility in search of commercial feeds which creates rural to urban linkages.

76 years old Mr. Maina a dairy farmer from Ha Donga, Githunguri has five cows and five heifers on one acre piece of land which is also used by his wife in cultivating bananas, arrow roots and fruits. Their only source of feeds from within his farm are the banana stalks and leaves which he considers to be of low nutritional value and not effective in boosting milk production. Thus he has to travel to other locations to source for fodder. He relies on land owned by his two relatives for fodder because they live in Nairobi and have allowed him to utilise their land for free. One of the relatives is a brother who has land adjacent to his farm which like Mr. Maina, he inherited from their late father. On this land, there are banana stalks which he occasionally uses to feed his cows. His brother also bought four acres of land at Riagithu, five kilometres from his farm half of which is used to grow napier grass. Additionally, Mr. Maina's brother-in-law bought a one and a half acres of land in Mitahato, three kilometres from his farm on which his wife plants maize, a source of maize stovers. Through the four parcels of land, Mr. Maina can get substantial amount of fodder for his animals, but this is still not enough to sustainably feed his animals and he has to occasionally buy hay. He uses his pickup to get fodder from these locations while the fodder adjacent to his farm is picked by his labourer. He still additionally gets 1.2 tonnes of *machicha* from Githunguri every week (He used to get it from EABL in Ruaraka, Nairobi, 35 kilometres away until March 2020 (see map 3.2) which is seven kilometres away and animal feeds and hay on credit from Ha Donga or Kanjai milk collection centres that are one and three kilometres away respectively. Occasionally, hay vendors deliver hay to his farm which he pays for in cash or through M-Pesa. Mr. Maina additionally travels to Mboi Kamiti which is 13 kilometres away to buy maize stovers. Before he was able to make use of his relatives land, as found out from earlier interviews with him, he used to travel to Tatu city on the lower part of the transect to buy grass. He indicated that in Tatu city, the source of grass was diminishing due to construction activities. The mobility in search of feeds for the animals represents dynamism and requires adaptation to situational changes like land use, climatic conditions, and seasons that determine the availability of fodder in different locations.

Map 3.2: Ha Donga to EABL, Ruaraka



Source: Google Maps, 2021.

Farmers buy or lease out parcels of land at different locations for use in planting napier grass. 50 years old Mr. Ngige from Gathaiti, Githunguri relocated to a half-acre parcel of land he purchased in 2015 where he keeps 19 dairy cows and uses the quarter acre of land from where he relocated from and an additional three separate parcels of land totalling to three acres which he has leased located about three kilometres away from his farm to grow fodder which he gets with his pickup. These are enough for his supply of fodder. He used to buy a total of 2.4 tonnes of *machicha* per week which he sourced with his pickup two times a week from EABL, Ruaraka, Nairobi.

Due to the limited size of land in the urban centres for dairy farming, the farmers practising dairy farming in urban areas buy land in the rural areas and plant napier grass. This is the case of Mr. Mburu a 52 years old farmer who keeps 20 cows on an eighth-acre plot of land in Githurai, Ruiru town. He has acquired two acres of land in Gatundu, where he sources napier grass, and plans to establish a cottage industry for milk pasteurization and yoghurt manufacture there in future. He had already built a cattle shed and acquired 10 cows. 76 years old Mr. Kuria whose 0.375-acre farm is also located in Githurai where he keeps 12 cows and has acquired one acre of land in Murera, Ruiru town where he grows napier grass.

Hay

Hay is used by the farmers due to the diminishing fodder supplies within their farms, especially during the dry season. Retailers and in some instances farmers directly source hay of varying qualities from diverse areas within the country. Narok, Naivasha, Laikipia, Nakuru, Kuria and Kakuzi in Thika are sources of Boma Rhodes and Lucerne hay that farmers attributed to high yields due to its high protein levels. Some ranches near Mboi Kamiti, along the transect which were previously under coffee cultivation, now plant and sell hay to farmers. These include Muiruri wa Laban and Manilla farms. Narok and Laikipia additionally are a source of supply of barley and wheat straws that are by-products of grain harvesting. Mwea in Kirinyaga County, a rice-growing area is a source of rice straw. The livestock officer indicated that rice straw contains silica which has little nutritional value, but some farmers do not know the difference or prefer it due to its cheaper cost. Hay is bulky and business operators who do not have enough resources to put up warehouses build informal structures to shelter the hay or shelter it from adverse weather conditions using polythene bags. Business operators make use of road reserves to store and sell the hay to reduce the operational costs of paying rent. Along the road reserves in the small towns, market centres and village centres between Kwamaiko/ Ngewa and Githunguri town there are temporary sheds storing and selling hay (see figure 3.7).

Figure 3.7: Sale of hay in bales and sacks along the road in Kwamaiko/ Ngewa market centre.



Source: GSV, 2018.

56 years old Mr. Wachira a farmer from Riuki, Githunguri occasionally stocks hay and orders it directly from his farm through a telephone call to the supplier who delivers it directly to his farm, upon which he then makes payment through M-Pesa. He has constructed enough storage

on the upper part of the cow shed so that he can buy and store enough hay when it is cheap and to also reduce the number of trips in search of hay. During one of the deliveries of the hay, when I accompanied Mr. Wachira, he pointed out that the quality of the hay was not good as per his expectations, because it was wheat straw from Narok, which has less nutritional value compared to Boma Rhodes hay. He paid Ksh. 180 per bale for it.

Figure 3.8: A lorry delivers wheat straw to Mr. Wachira's farm in Riuki, Githunguri.



Source: Field work, 2019.

77 years old Mr. Gathumbi a farmer from Githiga, Githunguri uses his lorry to ferry Boma Rhodes hay from Nakuru to his two-acre farm. The lorry can carry about 300 bales which he buys at a cheaper price of Ksh 130-140 and stores it in his warehouse. At the time of the interview on 02nd June 2019, the hay was being sold at Ksh. 200-250. The farmer additionally made silage from maize stovers which he sourced from Mbiyu Koinange's¹⁰ farms in Kiambaa sub-county about 10 kilometres from his farm. He had 30 cows, eight of which were being milked and were producing 100 -110 litres of milk per day. He indicated that he sourced hay when it was cheap because during the dry season it can cost up to Ksh. 300. Vendors with good storage buy it in bulk when it is cheap and sell it during the dry season.

Some of the milk cooperative societies have identified solutions for cushioning farmers from fluctuating costs of hay. They have leased land in the hay growing regions, where they grow and sell it to their members at a cheaper cost. Nyandarua County were cultivating hay in Nyahururu and selling it to their members at Ksh. 150 which is cheaper than the market rates. The cooperatives have leased 1,180 acres of land from which they are able to grow quality hay. The partnership is through a public limited company that the two cooperatives have registered called Hay and Forage (HnF) formed with technical support from Kenya Markets Trust and

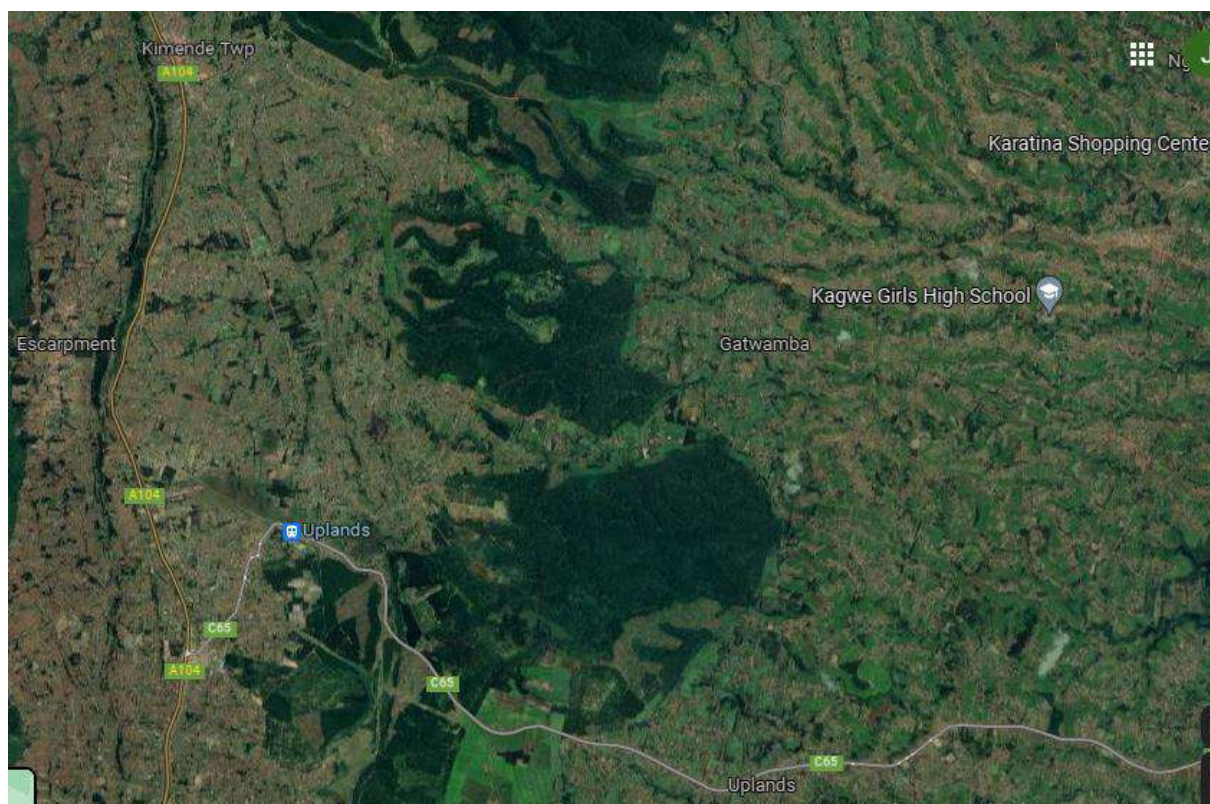
¹⁰ This was a former minister in the founding president Kenyatta's government who owned large parcels of land in Kiambu that were currently unutilized due to prolonged succession issues following his death.

Technoserve with funding from DFID. Ndumberi cooperative was previously purchasing hay from Delamare farm in Naivasha at Ksh. 180-250 (Munene, 2014). The fluctuation in hay prices has exposed farmers to higher production costs, especially during the dry season. Therefore, producing and transporting hay in bulk is a viable solution to reducing the cost of production and vulnerability to seasonal changes in prices.

Forest forage

The farmers that located in Lari sub-county on the upper zone of the transect adjacent the Aberdare forest take their cattle to graze in the forest. This minimizes the cost of feeding, because the farmers just need to give some little fodder and processed feeds to the cows in the morning and evening to boost milk production. Lari was historically known for its grazing land since the pre-colonial period. During the dry season, the Maasais could take their cows to Lari to graze. The name ‘Lari’ is derived from the Maasai language meaning “*the place of green grass.*”¹¹

Map 3.3: Forested sections along the Aberdare Forest Reserve.



Source: Google maps, 2021.

The Aberdare forest reserve cuts across Kiambu, Murang’a, Nyeri and Nyandarua counties. The forest zone on the Southern part of the reserve that forms the Kikuyu Escarpment Forest is

¹¹ https://en.wikipedia.org/wiki/Lari_Constituency

fragmented as a result of previous encroachment. For management purposes, the Kikuyu Escarpment Forest was further divided into six forest stations: Kereita (also referred to as Gatamaiyu forest), Uplands, Kinale, Kamae, Kieni, and Raggia. Kereita is further divided into Bathi, Gatamaiyu and Nyanduma zones named after the rivers that pass through those forest sections. As part of forest conservation measures, the Kenyan government in 1986 created a tea plantation buffer zone between the forest and the communities living adjacent to the forests referred to as the Nyayo Tea Zones. They are supposed to form a buffer zone between the forests and the human settlements to prevent infringement into the forest. The tea zones are managed by the Nyayo Tea Zones Development Corporation whose conservation efforts include the development of tea nurseries, planting of indigenous trees, and planting and managing tea plantations around gazetted forests in Kenya. It operates 19 zonal offices and two tea processing factories in Kirinyaga and Nandi counties. Three of the offices are along the Aberdare forest situated in three of the counties where the forest cuts across – Nyeri, Murang'a and Kiambu. The tea zone land along the Gatamaiyu/ Kereita forest is currently not under tea cultivation and is an open grassland. It was also previously used for pyrethrum cultivation under the management of the Pyrethrum Board of Kenya (PBK) before the decline of the sector in the 1990s. The Aberdare forest has an electric fence around it to prevent the elephants from getting into the neighbouring farms, protect the animals from hunters, and prevent encroachment, and logging. However, the parcels of land that are allocated to the tea zones are not fenced with electric wires, and it is in these locations that farmers take their cattle to graze. The farmers also graze their cattle along the road reserves at the edge of the forest, and this is visible when passing through the Kinale forest along the Kagwe – Kimende road. This is also the case near uplands along the Ruiru to Uplands road.

The farmers located about one kilometre from the forest take their cattle to the tea zones and forest to graze. One such location is the open space located near Gikara shopping centre one kilometre from the Mau road that is under construction. Farmers located next to this tea zone take their animals there to graze and those located at the neighbouring ridges cross a stream through a makeshift footbridge to take their cows and sheep to graze. There is a path along the electric fence that was used during its construction, which has been maintained by the villagers as a shortcut to cross the valleys and ridges.

Map 3.4: Open grazing land at a Nyayo tea zone near Gikara village centre in Lari sub-county.



Source: Google maps, 2021.

Mr. Mwaura a 55 years old farmer whose farm is located in Gikara village, Lari sub-county adjacent to the forest takes his cows to the tea zone area to graze. After the cows are milked in the morning at 0600 Hrs, they are given some feeds and later escorted to the forest at about 0800 – 0830 Hrs to graze. The cows roam in the open land at the tea zone by themselves and do not require a herder to look after them. The cows are then escorted back to the cow shed at 1300 Hrs for lunchtime milking and back to the forest at 1400 Hrs. The cows return to the farm in the evening by themselves and have mastered the routine. They are then milked in the evening at 1900 Hrs and given some processed feeds and silage. The farmer indicated that the grass from the forest just fills the cows and he has to supplement the feeding with silage, processed feeds and salt to get more milk. He makes the silage from fodder that he grows on his farm. The farmer keeps five cows, three of which are being milked producing a total of 19 litres a day. Mr. Mwaura indicated that the challenge with grazing at the open space is that due to the previous cultivation of pyrethrum, it affects the eyes of the cows making them lose their eyesight. The cows also acquire ticks because of their interaction with other cows. About eight families from the neighbourhood take their cows to the open space at the tea zone to graze. Usually, the animals are left to roam around, but farmers could tether some of the cows that need to be controlled. Bulls are not allowed to graze from this space to control breeding. Some of the cows venture into the forest to graze through a path that is used by women to fetch firewood and return by themselves from the forest in the evening. Usually, these are the heifers that do not require to be milked or cows that are dry waiting to calf. They have bells so that the

farmers know their location in the forest. The common wild animals are the elephants that occasionally venture to the Kikuyu Escarpment Forest; but they do not attack the cows. “*Even if there are elephants, cows can enter the forest to graze.*” Indicated Mr. Mwaura.

Figure 3.9: Cows grazing at the Nyayo tea zone adjacent to the Kereita forest



Source: Fieldwork, 2019

While Mr. Mwaura indicated that it is difficult for the cows to get lost irrespective of whether they have lost their eyesight, one of his neighbours, Mr. Ngare indicated that his neighbour’s cow that had no eyesight on one occasion did not return to the farm for the lunchtime milking, prompting the neighbour together with his farm assistant, to venture into the forest to search for it that afternoon but they could not find it. It came back the following day in the evening, accompanying the women who were fetching firewood from the forest. Mr. Ngare also indicated that another neighbour’s cows sometimes get lost for even three days and he goes to look for them. The cows have bells tied to their necks to assist the farmers in tracing them.

Grasslands

The direction of the movement along the transect is also influenced by the settlement patterns in the area. The North western part of the transect is densely populated with smaller parcels of an average of 0.045 hectares (County Government of Kiambu, 2018) compared to the South eastern part of the transect which has large coffee plantations. The two zones form a clear and distinct boundary, which the locals refer to as “*Raini*” a manifestation of the colonial settlement patterns that separated the local natives from the colonial settlers. After independence, the large coffee farms retained the same company names but the ownership changed. The Kenyan elite at the time, those in positions of leadership like parliamentarians, senior government workers

and businessmen became the new class of large landowners (El-Ghonemy, 2006). These farms had a lease of 999 years which was reduced to 99 years with the promulgation of the new Kenyan constitution in the year 2010. Notable among the large coffee farms between Kwamaiko and Ruiru are Tatu and Mchana owned by Socfinaf Company Ltd which is now transforming into Tatu City a new town development (See Map 3.5) characterised by real estate and industrial land activities, and categorized by the Government of Kenya as a special economic zone gaining tax exemptions. Phase one (965.66 Hectares) and phase two (885.22 Hectares) of Tatu City development undertaken by Rendeavour Group covers an area of approximately 1850.77 hectares (4,571 acres) (Kibwage, 2019). As a result of the real estate developments, the availability of the grass has reduced.

Within these large-scale coffee plantations, there are sections of land that are not suitable for coffee production because of poor drainage or the nature of the soils. These sections are left as grasslands and it is in these locations that the smallholder farmers rely on to cut grass for feeding their cattle. Additionally, due to the decline in the coffee sector, some of the large coffee plantations faced neglect, resulting in the growth of bushes and grass, which the farmers use. Further in some plantations, the coffee bushes have been cut, as they slowly transform into real estate projects, giving rise to the growth of grass and weeds.

In Tatu city, the farmers pay an entry fee to access the grasslands depending on the capacity of their means of transportation (see Table 3.5). The farmers use various means of transport ranging from canters, pickups, motorbikes, bicycles and donkey pulled carts. The farmers could opt to cut the grass by themselves which is the case, especially for those transporting the grass in smaller quantities using hand carts, bicycles and motorbikes. Alternatively, they can opt to hire labourers at a fee. The labourers reside in low-income neighbourhoods adjacent to the coffee plantations like Ruturu and BTL and they charge farmers depending on the amount of grass they cut which depends on the means of transport. The farmers usually call the labourers before making the trip so that they can save time.

Map 3.5: Master plan of phase two of Tatu City bordering Ngewa (Kwamaiko) to the East



Source: (Kibwage, 2019)

Table 3.5: Labour cost incurred in getting grass

S. No.	Means of transport	Entry fees to coffee estates (Ksh.)	Labour fees for cutting grass (Ksh.)	Selling price to customers (Ksh.)
1.	Bicycle	80	Cut for themselves	350
2.	Motorbike	150	200	500-600
3.	Donkey cart	200	600-700	2,000
4.	Pick up	800 ¹²	1,500	4,500 – 5,000
5.	Lorry (3 tonne)	3,000	2,500	7,000

Source: Field work, 2019

Cutting and selling of this grass has become a business venture. The traders cut the grass at the plantations and transport it to the farmers located near Kwamaiko/ Ngewa market centre. A bicycle of cut grass is sold at Ksh 350 while a motorbike delivers grass at Ksh. 500-600 per trip depending on the season. Bicycle traders can make two trips in a day, while motorbike traders can make three trips in a day. Bicycles, motorbikes and donkey pulled carts were observed ferrying grass between Ruiru and Kwamaiko. With GSV, there were notable activities involving the cutting, displaying and selling of grass along Kigumo road that runs parallel to the Ruiru to Uplands transect (See Figure 3.10 and Figure 3.11).

Figure 3.10: Farmers transporting grass along Ruiru – Githunguri road from the plantations on the lower parts of the transect.



Source: GSV, 2018.

¹² The price for entry to Tatu City was increased from Ksh. 800 to Ksh. 1,500 in 2020

Figure 3.11: Cutting, selling and transportation of grass along Kigumo road.





Source: GSV, 2018.

Additionally, some of the smallholder farmers who work in the coffee farms or go to trade in Ruiru ferry grass for their cattle using bicycles and motorbikes on the way home after casual labour or business activities. Casual labourers normally work between 0800Hrs to 1300 Hrs and they were observed travelling back home with some fodder.

Silage

Silage is made through anaerobic fermentation of the fodder that helps to retain moisture and sugars that would have been lost if the fodder was dried. Silage can be made from various sources of green fodder like grasses, maize stovers, and sorghum. The farmers source fodder for the preparation of silage from areas like Yatta, Machakos, Gatuanyaga, Mwea, Kabati, Karatina, Naivasha, Nakuru, Narok and Laikipia. It is worth noting the considerable distance travelled in obtaining silage that is made possible by bulk transportation, middlemen and the technology of being able to preserve the fodder in form of silage. Some vendors advertise the sale of silage and hay on Facebook, blogs, and other online platforms. The vendors source the silage from large-scale maize farms and sell it to smallholder farmers from other parts of the country. They are equipped with forage choppers and also balers to seal the silage with plastic sheeting. Compressing the fodder into bales, makes it less bulky and eases the transportation to various locations. Maize stovers silage which is common is sold either with maize cobs or without maize cobs. A lorry of 10 tonnes without maize cobs was being sold at Ksh. 30,000 while with maize cobs at Ksh. 50,000 in October 2021. While some of the vendors offer transportation to the farms, some may require the farmer to use their own means of transport or hire out transport to ferry the silage. Along the transect, there are silage vendors located at Ikinu and Ting'ang'a market centres and Githunguri town who buy it in bales and sell it to farmers at Ksh. 10-14 per kilo.

Farmers additionally source maize stovers for the preparation of silage from nearby farms. One such farm is Mboi Kamiti Farmers Company Limited, located 17 kilometres from Githunguri town which was previously a coffee farm bought by smallholder coffee farmers after independence. It was jointly owned by about 8000 smallholders. As a result of mismanagement and decline of the coffee industry, coffee farming no longer takes place, and the land was subdivided into parcels of an eighth or quarter of an acre among the shareholders who now grow maize and other crops, or lease their land out to other farmers. Farmers buy post-harvest maize stovers from these farms, with a pickup being sold at Ksh. 800 – 1200, and the cost of cutting and filling the pickup at Ksh. 600. Farmers can also buy the fodder depending on the size of land; with maize stovers occupying a quarter of an acre costing Ksh. 2,000 when in plenty and Ksh. 5,000 when there is scarcity. Some of the farmers hire out forage cutters and chop the fodder before transporting it to their farms. However, due to the close proximity of this area to the dairy farmers located near Githunguri sub-county, most farmers prefer to transport the maize stovers to their farms and chop them with their chaff cutters to either feed them to their cattle immediately or for use in making silage.

Mr. Muiruri a 45 years old farmer from Githunguri town who keeps 15 heifers and grows maize fodder in Gatunyaga, Thika, 60 kilometres from his farm on a five-acre leased parcel of land. The maize takes about three months to mature. In that particular season in August 2020 when he was interviewed, after maturity of the maize, he hired a forage chopper from a friend and transported it to Gatunyaga using a lorry also owned by the friend. It took him three days to chop the fodder, load and transport it using two hired lorries each with a capacity of nine tonnes. In total, he transported 63 tonnes of fodder from which he paid the owner of the lorry and forage chopper in kind by sharing with him three lorries of the fodder (27 tonnes), while he kept the other 36 tonnes. At the farm, it took him four days to prepare the silage with the assistance of nine day labourers. It involved compacting the silage in air tight layers by rolling a drum filled with water (to increase weight). The silage was mixed with molasses to enhance fermentation and was stored in an underground masonry structure where it took 21 days to mature. Although the process of preparation of the silage is usually labour intensive, once the silage matures, it is an easy and convenient way to feed the cows. The 36 tonnes of silage that he acquired from the leased farm was enough to feed the 15 heifers he owns for 4-5 months in time for the next season. He also owns a one-acre piece of land where his farm is located on which he grows napier grass.

Figure 3.12: Harvesting of fodder using a silage chopping machine.



Source: (Munene, 2019)

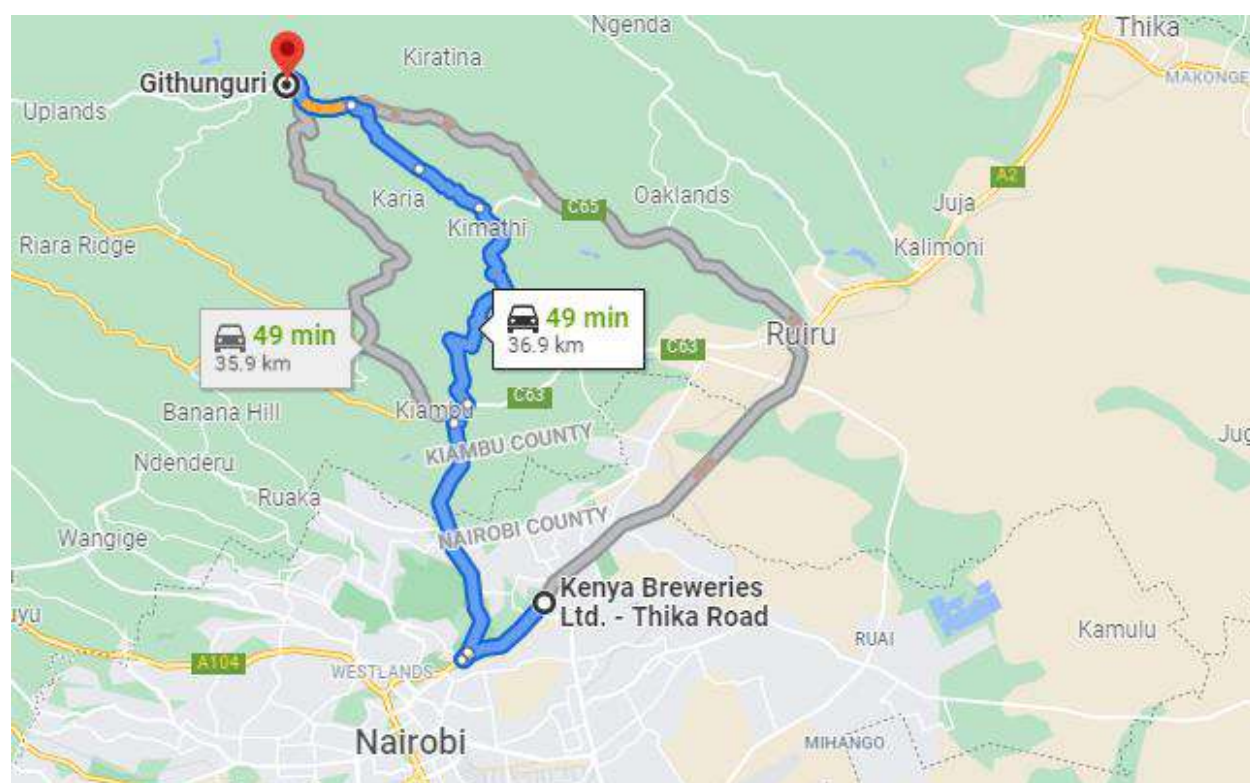
By-product feeds

Dairy farmers additionally rely on by-products from industrial processes as alternative source of feeds for their livestock. The location of these factories and distributors of these feeds form points of convergence for dairy farmers. Given the central location of the Ruiru to Uplands transect within Kenya and as well as being on the peri-urban zone of Nairobi that hosts industrial centres like Thika and Ruiru, it is economical for farmers to get industrial waste from factories located in these peri-urban areas due to their proximity.

***Machicha* - brew industrial waste**

Spent grain (*machicha* as it is locally known) is a by-product of beer-making process that forms 85 per cent of brewing waste. *Machicha* could be from sorghum-based beer production (mainly sourced from the EABL plant in Kisumu in Western Kenya) or barley husks (from the EABL plant in Ruaraka, Nairobi). It is rich in energy, fibre and protein and farmers attribute it to increased milk production. EABL plant in Ruaraka produces 100-150 tonnes of *machicha* daily and dispenses one tonne per minute. It is located about 35 kilometres from Githunguri town and can be accessed through various routes. EABL Kisumu is located about 350 kilometres from Githunguri town and farmers are unable to access it directly. The *machicha* from Kisumu is not commonly sold along the transect because of the high transportation costs.

Map 3.6: Distance from Githunguri town to EABL plant in Ruaraka, Nairobi.



Source: Google maps, 2021.

Amani feeds, the agent hired by EABL to sell the *machicha* has been in operation since 2008. The company sold the *machicha* from Ruaraka, Nairobi until March 2020 at the onset of COVID-19 when it decentralised the sale of *machicha* to two stations one located at Ridgeways and the other at Dumberi. When Kenya got its first case of COVID-19 on 13 March 2020, Kenyans shunned public spaces including bars and restaurants as advised by health officials. On 22 March 2020 following recommendations by the National Emergency Response Committee (NERC) on COVID-19, bars were closed effectively stopping beer production and consequently production of *machicha* reduced. The bars were temporarily opened following a presidential directive on 6 July 2020 for take away drinks, only leading to some limited production of beer, but they were closed again on 27 July 2020 until 29 September 2020 when they were allowed to re-open and operate until 2200 Hrs. Additionally the COVID-19 restrictions were characterised by night curfew of varying timelines further reducing beer intake. Upon resumption of beer production, Amani feeds started selling *machicha* from various outlets in Kiambu County through over 15 appointed agents. The research discusses the dynamics of the farmers buying *machicha* before and after the decentralisation and its implications on urban-rural linkages.

Before the sale of *machicha* was decentralised, Amani feeds had registered approximately 250 farmers and 25 *machicha* vendors known as ‘transporters.’ The farmers were allocated one or two days a week to pick *machicha* at EABL headquarters in Ruaraka, Nairobi, while the vendors were allocated not more than three days. The farmers picked *machicha* on Monday, Friday, and Saturday while the vendors picked *machicha* on Tuesday, Wednesday, and Thursday to manage the traffic at the dispensing station at Ruaraka. When all farmers were served during the days allocated to them, the transporters were allowed to also pick *machicha*. Due to the fluid characteristic of *machicha*, it can only be ferried by pickup trucks and lorries. The *machicha* is sold in 100-kilogram units at a cost of Ksh. 522 per unit. A pickup truck can carry about 10 to 12 units, while lorries carry between 15 to 20 units¹³. Farmers who do not own these means of transport, or who cannot buy it in large quantities rely on the vendors who sell the *machicha* to them at a profit. The vendors sell the *machicha* at Ksh. 10,000 per pickup truck making a profit of Ksh. 4,000. This eventually raises the cost of production for the farmers which they all indicated that it was high.

The customers paid for *machicha* electronically through the bank reducing the element of carrying physical cash.¹⁴ Upon paying for the *machicha* the farmers then travelled to Ruaraka,

¹³ The pickups have a capacity of one tonne, and carrying an extra unit could lead to overloading of the vehicle and eventually mechanical problems.

¹⁴ This reduced the element of theft because they mostly travelled during the night to pick *machicha*.

then organised themselves the schedule they would follow to get the *machicha* through an appointed a leader who coordinated them when they arrived in Ruaraka to avoid congestion due to limited parking space at the factory premises. The farmers relied on parking within the neighbourhood of the factory near Naivas supermarket or Ngumba estate. Each farmer was allocated a registration number by Amani feeds, and they got *machicha* in the order which they were registered, that is from the first to the last (1-250) or from the last to the first (250-1); a critical element that determined how they planned their journey. The company communicated to the farmers through bulk SMS system, to inform them of the availability of the *machicha* and other information regarding production. Before the company set up the bulk SMS system, communication was through word of mouth, and due to delay in relaying the information, it was not clear to the farmers when they would get the *machicha*, thus they would “*camp there and stay the whole night*” stated 38 years old Mr. Kibe of Amani feeds. After the SMS communication was set up, farmers travelled to Ruaraka only when there was availability of *machicha* which was sold between 0400 Hrs to 1800 Hrs.

Figure 3.13: Trucks and pickups awaiting collection of *machicha* at EABL, Ruaraka, Nairobi.



Source: GSV, 2018.

Farmers started arriving from 0200 Hrs so that they could get an ideal place to park their vehicles. The farmers first reported to the parking space near Naivas supermarket where they registered their presence. They then waited for their turn to be called as per the day's order from 1-250 or 250 -1 after which they proceeded to the parking space near Ngumba estate. At Ngumba Estate, they were given a coupon/ token which they used to access the EABL staff car park and eventually the dispensing point. The coupon was then taken after they are served. At

the EABL in Ruaraka, Amani feeds was serving up to 250 farmers in a day. According to Mr. Kibe, the farmers were coming from Kiambu County: Githunguri, Ikinu, Ndumberi, Ting'ang'a, Kwamaiko, and Githiga. He attributed this to the location of dairy processing companies in those areas – Githunguri Dairy FCS Ltd and Palmhouse Dairies Ltd located in Githunguri and Ndumberi Dairy FCS Ltd located near Kiambu town. The company had a register¹⁵ indicating the location of the farmers which informed the decision to set up distribution points in various parts of Kiambu County in March 2020. The distributors were initially located in Kwamaiko, Ikinu, Ting'ang'a, Kimende, Riagithu, Githunguri, Kagwe, and Githiga; but by 2021, there were over 15 distribution centres around Kiambu county each selling *machicha* to about 50 farmers a day. As a result of the decentralisation, the company transports the *machicha* from EABL headquarters in Ruaraka to the two outlets in bulk using 15-tonne lorries. The appointed distributors also pick *machicha* from Ruaraka. As a result, the company has raised the cost of *machicha* by about 25 per cent. The ability of the company to transport the *machicha* in bulk ensured that the increase in the cost was relatively low. As Mr. Kibe put it, “*it is cheaper for farmers to pick machicha from the outlets and distribution points because transportation of one pickup with a capacity of one tonne is less economical than transportation with a lorry whose capacity is ten times more.*” Decentralisation has reduced the distance that farmers have to travel to pick *machicha* to about less than 1- 10 kilometres compared to the over 35 kilometres they had to travel before. Thus although the cost of the *machicha* has been raised, the cost of transportation has reduced. One unit of *machicha* which was previously sold at Ksh. 522 was now being sold at Ksh. 700. Mr. Maina a farmer from Ha Donga, Githunguri indicated that, he used to buy 12 units of *machicha* at Ksh. 522 totalling to Ksh. 6,224 at EABL, Ruaraka. At the outlet in Githunguri which is near his farm, he was buying 60 buckets at Ksh. 130 at a total of Ksh. 7,800 which was equivalent to 12 units. The difference is Ksh. 1, 576 which was almost equivalent to his previous cost of fuel to Ruaraka at Ksh. 1,500 notwithstanding the cost of wear and tear of the vehicle. The fuel cost to go to Githunguri from his farm about 7 kilometres away is about Ksh. 300.

Additionally, the *machicha* sold in the decentralised locations is measured in small quantities of one bucket (20 kilograms) unlike when it was measured in units of 100 kilograms. Thus smallholder farmers who previously bought it from vendors can buy it from the appointed distributors at a cheaper price. Moreover, the farmers have the freedom to use any means of transportation which was not the case when they previously got the *machicha* from Ruaraka. The farmers can use wheelbarrows, bicycles, *boda bodas*, tuk-tuks, saloon vehicles, pickups or lorries. The *machicha* is poured on the trucks, put in containers or loaded in sacks from which

¹⁵ The register was not made available during the research

it can be transported by any means of transport. Figure 3.14 shows a *boda boda* loaded with two sacks of four units ready for transportation. These units were bought by a farmer from Kanjuko (three kilometres from Githunguri town). The farmer paid the distributor by M-Pesa and would then pay for transport services upon delivery. The *boda boda* operators complained that due to the watery nature of the *machicha*, they have to wash the *boda boda* and that it also wets their clothes during transportation, thus they only take the job if they have no other customers, or if it is a frequent customer. The *boda boda* operators have to a times cover the load with a polythene sheet to avoid getting wet.

Figure 3.14: A *boda boda* loaded with *machicha* at Githunguri town.



Source: Field work, 2021.

The farmers no longer have to travel early like they did when travelling to Ruaraka; they can buy the *machicha* at their convenience and save on time. The short distance needed to travel is valuable to the farmers because they own old vehicles which they are not comfortable driving over long distances. In addition the longer the distance the more the police blocks they encounter along the way, and they would rather relate with the police near their neighbourhoods whom they are more familiar with. Mr. Njihia a 65 years old farmer from Gathanji picks *machicha* from Githunguri town which is about five kilometres from his farm. He indicated that “if I had a good transport I can get *machicha* at EABL, but my pick up is not in good condition. I use it for shorter distances.” At times his pickup experienced breakdowns. At the time of the interview at the Githunguri outlet, Mr. Njihia had purchased four buckets of *machicha* and two 20 litre jerry cans of yeast. He transported them using his Nissan sunny saloon vehicle. He also

indicated that he got discouraged from going to Ruaraka early in the morning and at times waiting overnight until morning to get *machicha*. He makes the trip to get *machicha* in Githunguri twice or once a month. This trip is important in sustaining his dairy business because his cows reduce production when they do not get *machicha*. At the time of the interview, they had cut productivity by three litres in a day because he had delayed to replenishing his supply for *machicha*.

45 years old Mr. Kang'ethe of Baraka feeds Githunguri, indicated that the demand for *machicha* by farmers was high compared with the available supply. He attributed this to low production by EABL as a result of low beer consumption driven by COVID-19 curfew restrictions that had reduced uptake of beer. The economic slowdown as a result of COVID -19 had also affected the buying power of beer consumers. Mr. Kibe of Amani feeds was of the same opinion, but he also highlighted that beer consumption was facing competition from cheap alcohol/ spirits that were sold in the 'wines and spirits' shops.

The decentralisation has made the *machicha* more accessible to the farmers at almost the same cost. Additionally, decentralisation excludes the middlemen, thus enabling the smallholders to access farm inputs at a cheaper cost. This in turn reduces their cost of production and boosts productivity. Cash flow is an issue that smallholder farmers are faced with, thus being able to access a product in small quantities near their farms where they can make use of cheaper means of transport like bicycles, wheelbarrows, and motorbikes boosts equity. The role of the urban, market and village centres is notable as points of convergence where the supplier and the rural populations converge.

Molasses

Molasses is a by-product of sugar production that is sourced from sugarcane producing regions in the Western part of Kenya that is useful in aiding digestion, boosting appetite and as an ingredient in the preparation of silage. 45 years old Mr. Kang'ethe of Baraka feeds Githunguri who supplies molasses in his outlet in Githunguri town is licenced by the Agriculture, Fisheries and Food Authority, Sugar Directorate to procure a maximum of 20 tonnes from Muhoroni Sugar Company Limited, Sony Sugar Company Limited and West Kenya Sugar Company Limited all located in the Western part of Kenya. He pays an annual licence of Ksh. 6,000 per year. He hires a tanker to transport the molasses from the factories in Western Kenya at Ksh. 5 shillings per litre and sells the molasses at the wholesale price at Ksh. 18 per litre having bought it at Ksh 6 per litre. He has additionally enlisted distributors from the surrounding village and market centres of Gakoe, Kwamaiko, Gathanji and Ikinu. He indicated that transportation

considerations were important in ensuring that a retailer makes a margin in the sale of animal feeds. “For the product (molasses) to get at a good price, I need to buy a tanker so that I can reduce the cost of transportation.”

Figure 3.15: Mr. Kang’ethe’s animal feeds supply outlet located in Githunguri town.



Source: Field work, 2020.

Pineapple pulp

Pineapple pulp is a by-product resulting from the processing of pineapples. The feed has a good source of energy and fibre. The by-products are sourced from Thika, located about 50 kilometres from Githunguri town where Delmonte Kenya Limited has a monopoly in pineapple processing from the approximately 8,000 acres of land it owns in Thika that extends between Kiambu and Murang’a counties. The company is among the top five exporters of pineapples globally. Given the long distance between Thika and parts of the Ruiru to Uplands transect, fewer farmers venture to go to Thika to buy pineapple pulp, and more prefer to buy *machicha* from EABL in Ruaraka which is nearer. Mr. Njihia buys one pick up of pineapple pulp from Mr. Kang’ethe’s animal feeds outlet in Githunguri town, which is enough to last him a month. He allows it to ferment and then mixes it with fodder and hay. Vendors buy the pineapple pulp in bulk, transport it to Githunguri and then sell it to farmers in smaller quantities. Delmonte Kenya Limited does not allow vehicles of less than three tonnes capacity to get the pineapple pulp from their factory. In an interview on October 2020, 45 years old Mr. Kang’ethe of Baraka feeds Githunguri indicated that he sourced pineapple pulp from Thika once a week using a 15-

tonne lorry and sold it in units of one tonne to the farmers. In a consecutive interview on March 2022, he had increased the trips to three times a week due to high demand.

Some farmers also source pineapple peels from markets and fruit vendors. 52 years old Mr. Karanja gets three sacks of pineapple peels from fruits vendors in Kasarani every day for free. He also gets watermelon waste from Githurai which he uses to feed his animals in his farm in Membley, Ruiru.

Chicken waste

Waste from chicken fed on commercial feeds is another alternative source of feeds for dairy cows. Chicken do not fully digest the food they eat leaving some nutrients that are useful for the livestock. The feeds are rich in nitrogen and protein and boost the production of milk at a cheaper cost compared to the other processed feeds. The chicken waste forms when the chicken bedding has sawdust or wood chipping to trap the chicken waste. As the chicken scratch and peck on the litter bedding, they ensure that it is thoroughly mixed. The waste is then sieved to exclude the saw dust and chippings which are utilised as manure.

Some farmers practise both dairy and poultry farming, and use the recycled chicken waste from their poultry farms to feed their cows. This was the case for 65 years old Mr. Njihia, from Gathanji prepared his chicken waste feeds from his poultry farm. Other farmers have to buy the feeds from retailers, because they cannot source them directly from the animal feeds processors and the poultry producing areas due to the long distance involved and also due to the contracting requirements with the feeds suppliers like Isinya feeds who are located at Isinya; Chania feeds located in Thika; Kenchic that has farms in Kajiado, Athiriver and Naivasha and Legorn feeds that is based in Thika and has a depot in Githunguri town.

The vendors also source the chicken waste from smallholder farmers whose poultry farms are located in Ngong, Ruai, Gatukuyu, and Thika. One such vendor is 65 years Mr. Mucheru who operates his business in Githunguri town. His stall is strategically located on the road reserve at the junction of the Ruiru to Uplands road and Githunguri to Kagwe road (see Figure 3.16). His business is adjacent to three other vendors selling the same product. The structures are built with iron sheets supported by a timber framework to shelter the feeds from rain and get enough heat to dry the feeds. The structures also need to be aerated so as not to retain moisture and to release ammonia from the manure. Mr. Mucheru chose the location because it is exposed, visible to passers-by and customers, and close to the flow of people. He gets the chicken waste from Gatukuyu, Mang'u in Gatundu North sub-county which borders Thika town. In this locality, the farmers have specialized in poultry farming just like Githunguri residents have

specialized in dairy farming, thus there is abundance of chicken waste. He had tried in the past to source feeds from the large scale chicken growers and feeds processors, but the profit margins were low, so he no longer buys from them. The companies sell a canter (three-tonne lorry) at Ksh. 40,000.

Figure 3.16: Sale of Chicken waste at the road side near Githunguri town.



Source: GSV, 2018.

He sources the feeds every two weeks, depending on the demand from his customers, getting 36 sacks of the chicken waste at a cost of Ksh. 250 using his pickup (with a capacity of one tonne) to transport the chicken waste to his stall and making one trip per day for three consecutive days to transport the waste; when demand is high he makes four trips. He makes the daily trips to ensure that upon arrival at the stall, he can sieve the chicken waste to exclude the edible feeds from the saw dust. The latter is sold as manure at Ksh. 200 per sack. He normally departs to Gatukuyu at 0600 Hrs and arrives when the farmers have already packed the waste into sacks. It is then poured onto the pickup and compressed to capacity. He has a canvas on the side of the vehicle to prevent spillage during travel. He prefers to use his pick up because hiring a lorry which is more convenient would cost him more money. Additionally, the poultry farmers usually have a moderate supply of chicken waste that cannot fill a lorry, thus he sources from different farmers whose farms are in varying locations. A canter would require about 120 sacks for it to fill. He passes across the valleys to reduce the distance - through Kibichoi, Gathage, Gatundu, Mutero, and then to Gatukuyu (see. Map 3.7). It is a distance of about 50 kilometres and he indicated that the roads are in good condition in Gatundu, except for some sections near Githunguri area (referring to the sections along the Githunguri to

Uplands road under rehabilitation). He indicated that there is a ‘*karima*’ – hill at Gatundu that has not been fully constructed, thus when loaded, he needs to be careful to engage the powerful gear to make it up the hill. On the way he usually encounters police and he knows how to handle them.

Map 3.7: Journey of Mr. Mucheru from Githunguri town to Gatukuyu village.



Source: Google maps, 2021.

He sells the feeds to the farmers at Ksh. 90 per bucket, and Ksh. 900 a sack. The customers pick the product using motorbikes, bicycles and sometimes they hire pickups. Some could send a *boda* and upon making a payment through M-Pesa they can pick the feeds. He also sells saw dust as a complementary business. The sale of chicken waste is common in the small towns, market and village centres near Githunguri. Mr. Ndirangu a farmer from Ngochi buys chicken waste for his animals from Githunguri town or Matuguta village centre at Ksh. 100 for one bucket, and a sack at Ksh. 1,000.

Vegetable waste

Vegetable waste that is gotten from the markets is another source of feeds for the livestock that is popular especially among the dairy farmers living near urban areas due to the proximity of their farms to the markets. One such market is Githurai informal market located in Ruiru town at the edge of Nairobi and Kiambu counties. This market specialises in the sale of food and is strategically located along Thika road which connects Nairobi to the Central Kenya region. Different sections of the market specialise in various foodstuffs. Due to the crowded stalls and previous demolition of sections of the market encroaching on to Thika road and railway reserve

during their rehabilitation, the vendors encroach onto the adjoining roads to sell their produce; including the service lanes along Thika road. The section that sells green maize is located along a road adjoining Mwhoko road. 76 years old Mr. Kuria has a dairy farm located on a 0.375-acre plot about 800 meters from Githurai market where he sources vegetable waste. He buys the maize cobs and husks to feed his 12 cows. Due to his small parcel of land, he relies entirely on outsourcing all the animal feeds for his cattle. He has to rely on mobility to get his milk business going, and he goes to the market every alternate day to get the vegetable waste where he buys two bags of maize cobs and two bags of maize husks each at about Ksh. 150. On a normal working day, Mr. Kuria will park his pickup truck at the edge of the market along the railway reserve.¹⁶ He then heads to the market section selling maize cobs and husks. The main activity in this section is offloading of maize from the lorries arriving from different parts of the county; removing the green maize husks and finally removing the kernels (seeds) from the cob. The kernels are sold to customers including restaurants for cooking food.¹⁷ The maize husks and cobs are packed in separate sacks. Usually the market vendors who are familiar with him reserve the waste ready for him to pick it up. Farmers pick the vegetable waste through various means of transport depending on their location, some send *boda bodas* to pick the vegetable waste and pay by M-Pesa. Mr. Kuria indicated that during the dry season, there is a higher traffic of farmers buying vegetable waste due to the scarcity of fodder during that period. During the dry season the price of one sack increases up to Ksh. 300. After buying the vegetable waste, he hires a loader who transports the sacks to his pickup van parked about 40 metres away and pays him Ksh. 50 -100 depending on the number of sacks. At the farm, he uses a chaff cutter to chop the maize husks, and a grinder/ crusher to break the maize cobs to bran. He feeds his cows with a mixture of the two while also adding processed feeds which he buys from the locality. Mr. Kuria additionally used to get eight units of *machicha* every week from EABL, Ruaraka and also has a one-acre farm in Murera, Ruiru about 15 kilometres away from his farm where he plants napier grass. He produces about 50-60 litres per day, and sells the raw milk directly to consumers at Ksh. 70 per litre from his gate house which serves as a temporary milk parlour. The price of raw milk in the urban centres is double the price that farmers in rural areas get. Mr. Kuria sells the milk on a daily basis to ‘contracted’ customers - seven who buy in the morning and 12 in the evening.

¹⁶ I accompanied Mr. Kuria to source for feeds at the market.

¹⁷ They are an ingredient in the preparation of *Githeri* a meal composed of maize and beans commonly eaten in restaurants and popular among the Kikuyu community

Figure 3.17: Maize section of Githurai market where farmers get vegetable waste.



Source: Field work, 2019.

Figure 3.18: Mr. Kuria's gate house which serves as his kiosk for selling milk



Source: Field work, 2019.

Vegetable waste can also be gotten from horticulture rejects at the cargo section of the Jomo Kenyatta International Airport (JKIA). Kenya earns 23 per cent of the GDP from horticulture export. While processing and grading of the horticultural produce for export, 22 per cent of it goes to waste (Lab of tomorrow, 2016). These feeds are either put into compost or used to feed livestock. The sorting and grading of the horticultural produce is done at the cargo section of the airport which is about 55 kilometres from Githunguri town. The long distance involved could be the reason why none of the respondents went to the airport to pick up the horticultural waste. This is a case where alternative fodder is available but at a distance that is not within the reach of the farmers along the transect, and can only serve the farmers near the airport.

Milk collection

Upon the production of milk, the direction of milk is usually to the collection centres, while some of the raw milk is sold by farmers directly to the milk vendors. Milk collection centres or collection points are normally located within a short distance that usually does not exceed one kilometre. Due to the short distance to the milk collection centres, farmers mainly use non-motorised means of transport like walking, hand carts, and bicycles. Farmers with a higher quantity of milk use motorbikes and pickups to deliver their milk. The milk is ferried to the collection centres by the farmers themselves or their labourers who originate from other regions across the country (some from Uganda). Githunguri Dairy FCS Ltd collects milk two times in a day between 0500 Hrs to 0900 Hrs in the morning and 1400Hrs to 1900 Hrs in the evening. The staff at the collection centres undertake spontaneous checks on the quality of milk including the density test to check incidents of the addition of water to increase the quantity. This is done using a lactometer also known as a hydrometer. There is also the alcohol milk testing gun that checks the acidity of the milk due to the addition of sodium bicarbonate (Magadi soda/ baking soda locally known as *Igata*). This test checks the stability of milk to ensure that it does not coagulate during the thermal processing of UHT milk. It checks for the presence of neutralisers that mask acidity. Sodium bicarbonate is used in the preservation of milk especially by the milk vendors to prolong the life of the milk, however, its use is not controlled and the farmers and vendors do not know the quantities they need to use. These neutralisers can interfere with the processing of yoghurt and cheese due to their antimicrobial effects. If the graders at the milk collection centres note variances in the standard of a farmer's milk, farm extension workers are sent to assess the cause of the variance and identify the cow that may be causing the milk to loose quality. If a farmers is found to knowingly add impurities in their milk, they are fined Ksh. 25,000 and suspended from delivering milk for a certain period. The quantity of milk delivered is recorded on a digital register and on a card that the farmer keeps and immediately after the records are entered, the farmer receives an SMS showing the amount of milk delivered

and the time of delivery. This is essential in ensuring that a farmer who relies on the labourer to deliver the milk can confirm whether the quantity weighed at the farm tallies with the quantity recorded at the centre to reduce cases of theft.

Due to the large number of farmers who converge at the milk collection centres, the village and market centres where the milk collection centres are located transform to become centres of other directly related or unrelated activities. Githunguri Dairy FCS Ltd offers farmers processed feeds, milking salve, salt, hay and other farm inputs at the milk collection centres. These products are offered on credit, and at the end of the month, the farmers are deducted the total expenses. The company additionally gives the farmers food supplies on credit. The milk collection centres also attract related businesses that sell animal feeds and hay. This is because some of the inputs sourced from Githunguri Dairy FCS Ltd are sold slightly more expensive than at the retail outlets, so farmers willing to buy in cash source their supplies from these shops. The labourers and farmers also take the opportunity to buy other household goods and socialise at the centre before going back to their farms. This convergence of activities at the milk collection centre attracts business opportunities in the provision of household goods and services such as barbers, eateries, restaurants, bars, flour mills, tailors, butcheries, and veterinary technicians.

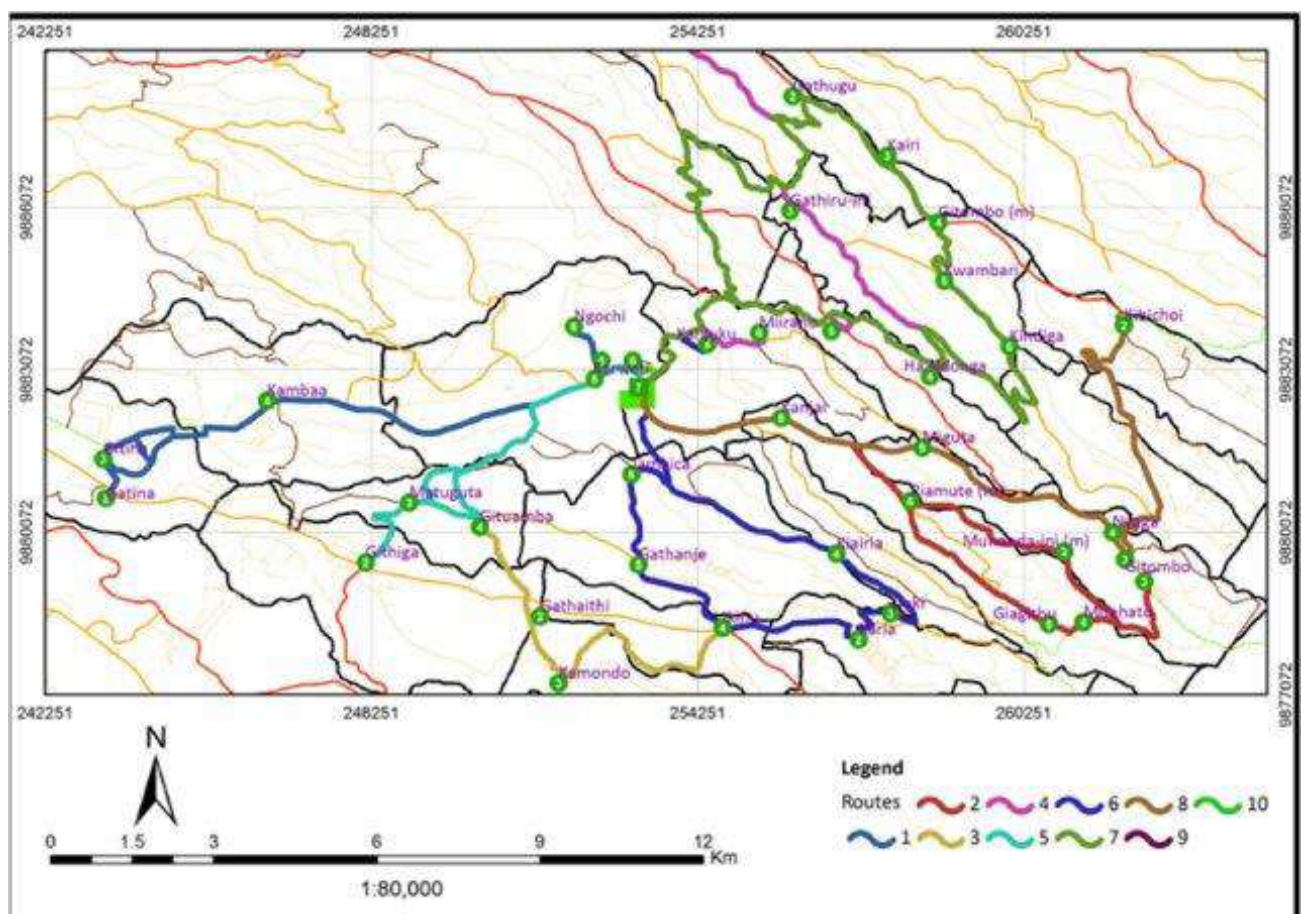
Figure 3.19 Farmers delivering milk at Mung'u junction milk collection centre near Githiga market centre.



Source: Field work, 2018.

The company has 10 routes and 17 lorries (Ngigi & Wangai, 2012) with a capacity of carrying 10,000 litres. The location of the factory reveals its centrality in relation to the milk collection centres scattered across the surrounding village centres and rural hinterland. The routes run parallel to the ridges given the topographical terrain of the area. In addition the boundary of Lari constituency is notable in the Western and Northern parts which forms the area of operations of the company.¹⁸ A GIS analysis of the efficiency of the routes by Ngigi & Wangai (2012) revealed that there was inefficiency in the mapping of the routes leading to overlapping and as a result raising the cost of transportation. He concluded that the routes could have been reduced from ten to eight.

Map 3.9: Routes used by Githunguri Dairy FCS Ltd to deliver milk to the factory.



Source: (Ngigi & Wangai, 2012).

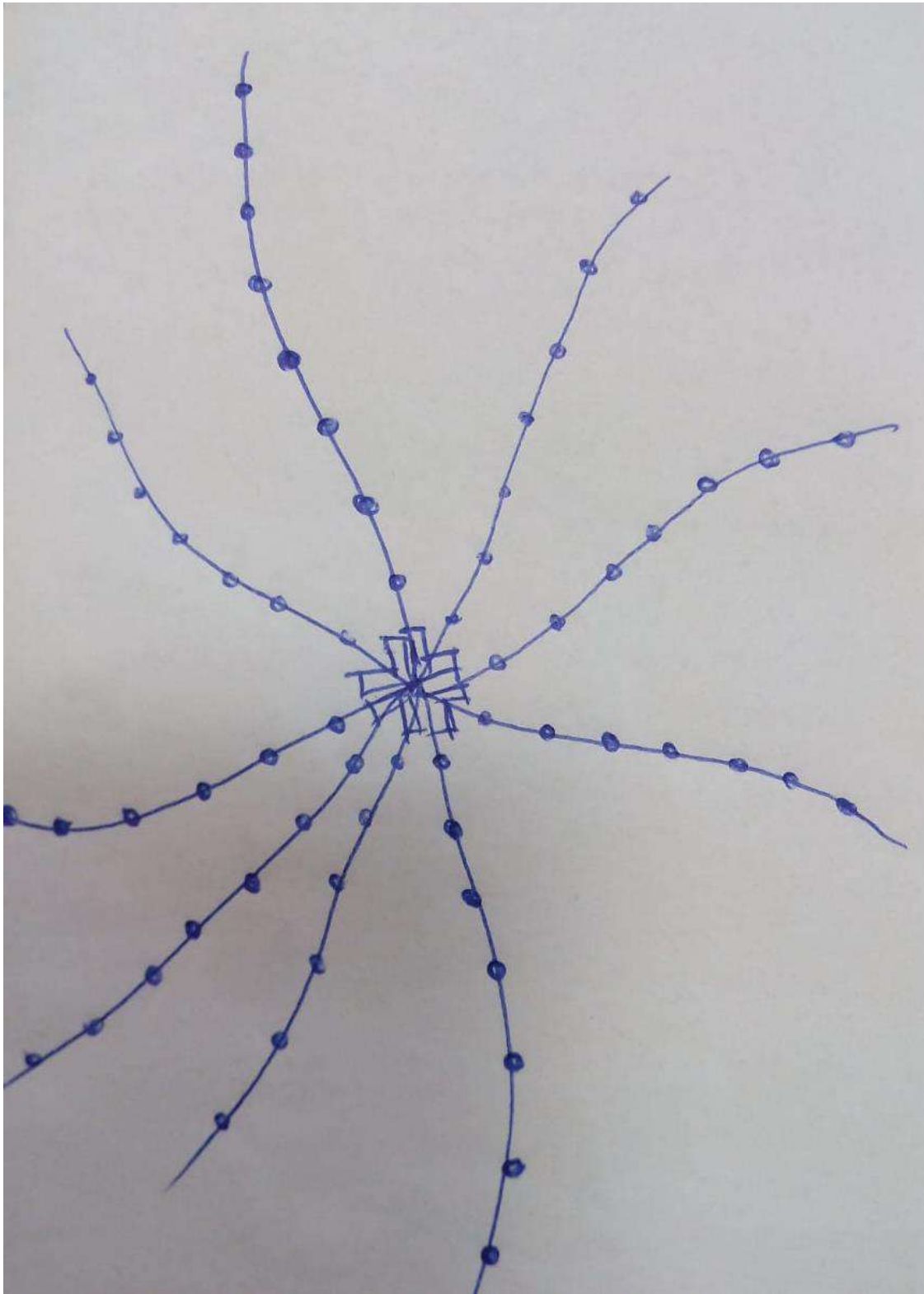
Uplands PD&F Ltd has identified specific routes that it uses in the collection of milk from the catchment zone that consists of mainly Lari sub-county and parts of Gatundu South and Gatundu North. The company additionally sources milk from various cooperative societies across the country because the milk from the surrounding rural areas is not enough to sustain

¹⁸ Dairy cooperatives have a defined zone of operation that form their catchment. They should operate within these zones to avoid competing with each other. Private companies have no geographical limit of operations.

its capacity. Uplands PD&F Ltd being a private company can collect milk from any part of the country. The company was processing 75,000 litres per day against its capacity of 200,000 litres in 2019. The company was initiated in 2014 following the collapse of the milk cooperative societies operating in Lari. These were Gatamaiyu that was operating in Kagwe, Kereita in Kimende, and Kamahia operating in Kamburu and Kagaa and finally Kinare milk cooperative. These four cooperatives had jointly invested in a processing plant that produced Sundale milk. Due to issues of mismanagement, the production of Sundale milk collapsed in 2012. The cooperatives were then collecting milk and selling it directly to Brookside Dairy Ltd, Spinknit, and NKCC processing companies. The milk was also sold to milk parlours in Kiambu and Nairobi. Additionally, after the collapse of the cooperatives, farmers sold milk to vendors, while some of the farmers would take their milk to Githunguri Dairy FCS Ltd, while others gave up milk production. The absence of a processor and cooperative led to losses among the farmers and exploitation by milk vendors. Uplands PD& F started in October 2014 to fill this gap and missing link in the value chain. To edge out the milk vendors, the company promised farmers to collect milk throughout the year and offered a reliable market for their produce. In addition, the company did not limit the quantity of milk the farmers could deliver to them which was the case with the vendors whose uptake of milk fluctuates with market demand. Milk was not returned to the farmers if not taken up by the market which was happening when they were selling to the vendors. They also came up with clear payment dates for the milk supplied, where farmers are paid every fifth of the month. The company currently has over 5,500 registered farmers delivering milk to them and its products include long and short life milk, ghee, butter, cream, and yoghurt. The milk under the brand name *pascha* is the most popular, and locals refer to the company by that name.

The company has a total of 28 routes that it uses to collect milk at various points along each route. The company hires 11 lorries, 17 pickups and 10 motorbikes depending on the terrain and the number of farmers along a certain route. In the hilly locations and areas where there are earth roads, the company uses motorbikes to collect milk. The milk is collected from 0300 Hrs to 0600 Hrs in the morning and 1400 Hrs to 1700 Hrs in the evening. A route can have 15 – 25 stop overs. In Gatundu, the milk is collected once per day between 3 am – 6 am because of the long distance to that particular location.

Figure 3.20: Milk collection from strategic points and routes adopted by Uplands PD&F Ltd.



Source: Author.

The difference in the milk collection logistics between Uplands PD&F Ltd and Githunguri Dairy FCS Ltd is the nature of the collection centres; the ones used by Uplands PD&F Ltd are in the open and not sheltered compared to the ones used by Githunguri Dairy FCS Ltd, thus the farmers may be subjected to the adversities of weather like rain or hot sun when delivering milk.

In addition, the company does not have employees at the collection points. Each lorry has a driver, loader and ‘grader’. The grader is in charge of ascertaining the quality of milk and also measuring the quantity. The farmers have to wait for the lorry, which at times could be delayed or sometimes could leave before they arrive, and the waiting period at each point is limited to a few minutes. As a result, in some instances, the farmers take the milk to the collection points and return to their farms to continue working. They then pick the jerry cans later after the ‘grader’ collects the milk, takes the measurements and records on the farmer’s card in their absence. This is based on trust, but complaints and discrepancies can be reported in a future delivery where the farmer waits for the ‘grader’ to make the complaint. Uplands PD&F Ltd also sourced milk from Narok, Bomet and other milk cooperatives in Kiambu, and transported the milk to its factory using tankers.

Figure 3.21: Unmanned jerry cans awaiting collection and recording by the ‘grader’.



Source: Field work, 2021.

Brookside Dairy Ltd largely owned by the Kenyatta family (50 per cent shareholding, 40 per cent by Danone a French company and 10 per cent by Dubai equity firm Abraaj Group) is the largest milk processing company in Kenya, with operations in more than 12 countries (Vidalon, 2014), and controlling over 42 per cent of the milk market in Kenya with its headquarters in Ruiru town. The company benefits over 160,000 farmers either as individuals or through cooperatives and manufacturers of various milk products with the main brand being Brookside. Over the past 10 years, the company has expanded and acquired other milk companies like Delamare, Ilara, Tuzo and Molo Milk. Due to its extensive milk catchment zones, the company has over 80 cooling centres located across the country (Ngotho, 2020) from where the milk is

collected from the farmers, cooled, and stored before being transported in tankers to the company's processing factory in Ruiru town. The tankers are jacketed so as not to lose heat, with their shiny surface making them function as a thermos and ensuring that they maintain the cold temperatures acquired at the cooling centres. Notably, Brookside Dairy Ltd does not rely on milk produced along the Ruiru to Uplands transect because it has suppliers from all over the country. The company buys about 1.5 million litres of milk per day and has partnered with over 300 milk cooperatives across the country (Mureithi, 2017). Elburgon Progressive Dairy Farmers Cooperative Society located in Kuresoi, Nakuru County is one such cooperative that is located about 200 kilometres from Ruiru. It was formed in 2010 and currently has 1,300 farmers, and it delivers a total of 4,000 litres per day to Brookside dairy Ltd. The cooperative society has two cooling centres with a total capacity of 5,000 litres and a laboratory for checking quality. Before the formation of the dairy cooperative, the farmers were exploited by milk vendors, they also had to travel long distances to the collection points and had to wait for the lorry collecting milk. (Mureithi, 2021; Njoroge, 2021)

Figure 3.22: A tanker picking milk from Elburgon Progressive Dairy Farmers Cooperative Society.



Source: (Mureithi, 2021).

Canaan Factories Ltd located at Nyambari in Uplands on the upper most part of the transect, also mainly depends on milk from dairy cooperatives located in other parts of the county and also from farmers in the surrounding locations. The company began operations in 2019, manufacturing milk, yoghurt, butter, cream, ghee, and ice cream under the brand name - *Alfresh*.

It has enrolled 1700 farmers, but targeted to increase the number to 10,000, and has a capacity to produce 80,000 litres but was in 2020 processing 50,000 litres per day. The shortfall of 30,000 litres of milk is an illustration of the high demand for raw milk among processing companies. Mr. Nyaga a manager at the company indicated that “*currently no processor has enough of the raw product.*” The strategy by the milk processing companies to retain and increase farmers who deliver milk to the companies include: prompt payment, competitive pay, offering training, and linking the farmers to service providers for inputs and financial support. Due to its location at the junction of the Nairobi to Naivasha highway, Canaan Factories Ltd is able to connect easily to the milk-producing areas in the Rift valley. Its local catchment area is the lower and upper Lari which includes Gatamaiyu, Kimende, Kijabe, Kamburu and Kinare. The company had nine routes and nine lorries, and the routes had between 10-15 collection points. The company sourced about 30 per cent of its milk directly from the farmers, while the other 70 per cent was acquired through milk cooperatives from the Rift valley and Central Kenya regions in locations like Narok, Bomet and Meru; and transported using its four tankers. Mr. Nyaga indicated that the cost of transporting milk using the tankers was cheaper at Ksh. 1 per litre of milk compared to the cost of transporting milk from the neighbouring farmers which was at Ksh. 3 per litre of milk. Thus it would be more strategic for the companies to acquire the milk cheaply from distant locations and transport it to the factory.

Milk collection by the vendors follows a similar pattern like that of the processors in that there are agreed points and times of collection between the vendors and the farmers. Some farmers prefer this mode of selling milk to the vendors due to cash flow issues, thus when in need of immediate cash they sell the milk to the vendors instead of waiting for the monthly payment from the milk processing companies. Like the processors, the vendors have specific routes that they use to pick the milk mostly along the roads. The collection of the milk is done early in the morning by around 0400 hours or the previous day from 1400 hrs ready for transportation the next day. The vendors use non-motorised means of transport like walking and cycling and also *boda bodas* to collect milk from the farmers. Due to the bulky nature of the milk and the intensity of the manual labour required, sometimes the vendors require assistance from family members or hired labourers. Additionally, since the vendors cannot carry all the jerry cans of milk as they proceed with the milk collection, they pick a few jerry cans at a time and leave them at certain points along the road, from where a *boda boda* can transport them to the *matatu* stop or if located along a *matatu* route; the *matatu* picks the jerry cans along the way. The vendors buy the milk at Ksh. 34-40 and sell it in Ruiru town at Ksh. 50 -60.

55 years old Mr. Waiganjo buys his milk from Kiganjo, Gatundu South about 25 kilometres from Ruiru town from 30 farmers spread over a distance of about five kilometres. He starts

picking the milk from 0400 Hrs and departs to Ruiru at 0530 Hrs which takes him about one hour by motorbike. He uses his *boda boda* which he has fabricated (see Figure 3.23) so that it can carry 40 plastic jerry cans of milk weighing up to 200 kilograms. The farmers supply him with 5-10 litres of milk daily and usually bring the milk to the roadside from where he picks it.

Figure 3.23: Fabricated motorbike with a capacity of about 200 litres of milk.



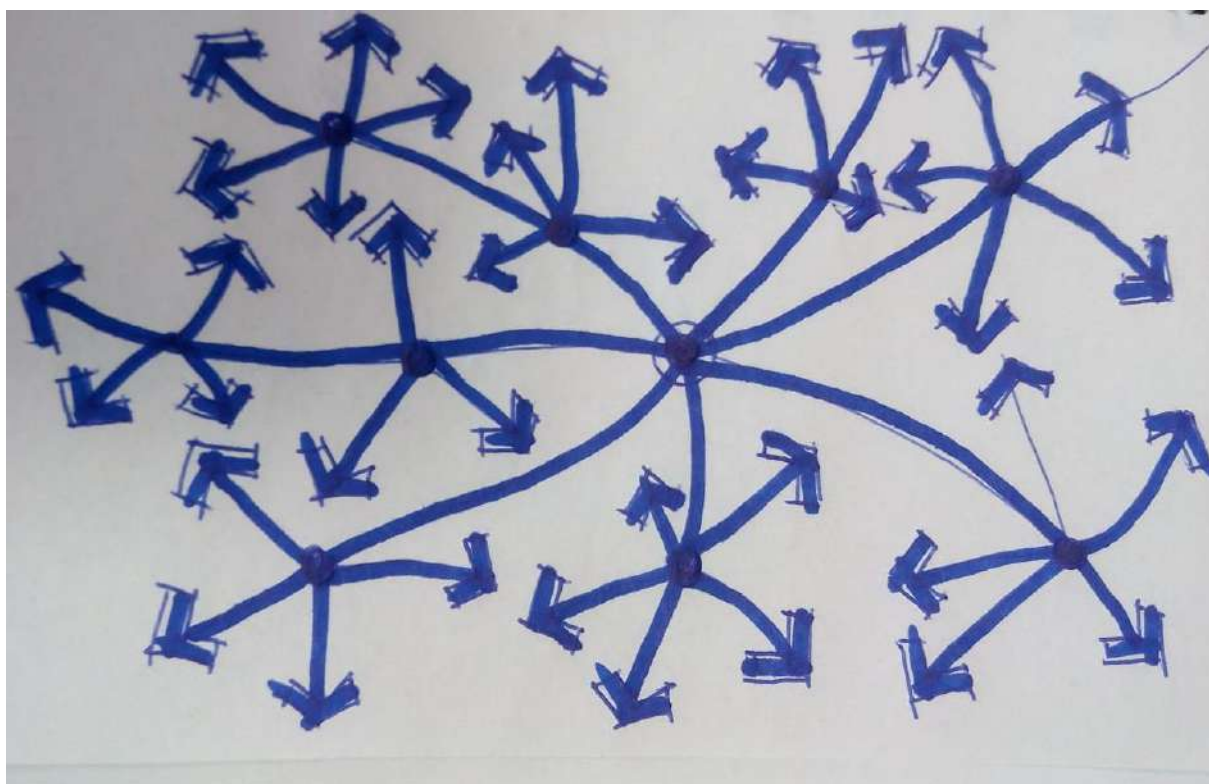
Source: Field work, 2019.

55 years old Mama Wambui buys her milk from Kigumo, Githunguri which is about 20 kilometres from Ruiru town where she sells it. She buys 150 litres of milk from 10 farmers who supply her with between 15 to 20 litres each. She collects the milk from house to house along a distance of about three kilometres. The farmers milk their cows at 0200 Hrs and she starts collecting the milk at 0300 Hrs and departs to Ruiru town at 0355 Hrs. She has specific farmers who supply her with milk. *“You cannot leave to collect milk without farmers. You have to make prior arrangements with them.”* Mama Wambui is assisted by her children to do the work. Her older son gets the milk from across the valley in the morning with a motorbike she owns and ferries it to the *matatu* stop, while the younger son drops the jerry cans to the households in the evening after school. She pays the farmers depending on the informal agreements with them: sometimes daily, after two days or weekly. She additionally keeps two cows producing 8-10 litres of milk which she also sells, and has been in the business since 2003-2004.

Milk distribution

The milk produced by the processing companies is distributed across the country creating linkages between the factories located along the transect with towns, regions and other countries. Brookside Dairy Ltd has operations in over 12 countries. The means and distance of distribution of the milk depends on the process of manufacture. Short life pasteurised milk that has a shelf life of about three days is distributed to locations near Nairobi, while long-life pasteurised milk is distributed to distant locations. Uplands P D&F distributes its milk through 22 depots located all over the Country. The milk is transported to the depots in bulk through large capacity trucks from the processing plant in Kagwe. These are 10 tonnes Isuzu FRR trucks, 10 tonnes Isuzu FH trucks, 15 tonnes 10 wheeler trucks and finally trailer trucks with a capacity of 30 tonnes. The 10-tonne trucks are 11 while the 10 wheeler trucks are two and trailer trucks are six. The type of trucks used and their capacity depends on the depot location, depot capacity and accessibility of the destination. It also depends on the market demand of the area (Huge uptake requires the use of trailer-trucks). The company commonly delivered its milk using the 10-tonne trucks and preferred to distribute its milk through depots to reduce the cost of distribution. It is cost-effective to transport the products to the depots in bulk and then distribute the products in smaller quantities to other regions. Transportation in large volumes reduces the cost of transportation per litre (TechnoServe Kenya, 2008).

Figure 3.24: Distribution of milk through depots to different parts of the Country



Source: Author.

At the depots, the milk is distributed through branded sales vans/ market vehicles depending on the market extent. These could be four tonnes trucks (canters), pickups, vans, station wagon vehicles (Toyota Probox), motorbikes, and bicycles. There are 62 vehicles that sell the milk from the depots. Every depot has a supervisor, an accountant who takes stocks, oversees loading, offloading and undertakes reconciliation. The staff at the depot report to a regional commercial supervisor/ manager. The staff at the depot places an order at the company headquarters in Kagwe. Nairobi region is the main market for the milk produced and four of the depots are located in this area in Kasarani, Kawangware, Donholm and Rongai. Nairobi region has five distribution routes namely: Kibera, Machakos, Thika Road, Eastlands, and the Central Business District (CBD) that target the highly populated areas. Each route has a vehicle that carries both long life UHT and short life milk. The company targets low-income earners and sells its milk slightly below the market rates to attract this customer base. Some consumers prefer to buy long-life milk in bulk for use over a long period to avoid frequent purchases that would be the case when buying short life milk. 500 millilitres of short life milk was being sold at Ksh 43 while the same amount of UHT milk was at Ksh. 45. 200 millilitres of short life milk was retailing at Ksh. 15 and UHT was being sold at Ksh. 15 in May 2019.

Lodwar, Lamu and Hola are emerging markets that the company targets because they are remote and insecure regions that few companies venture into leading to higher demand of milk from these locations. However transportation to these areas requires police escort and in addition due to the rough terrain, the company prefers to use Isuzu FSR trucks that have larger wheels and more powerful engines. In distant locations, only UHT is sold due to its durability. In case of spoilage, the milk is returned to the factory and taken to a farm owned by the company for use in feeding pigs and calves. The depot and headquarter staff have to check to confirm the returned milk. Fuelling of the vehicles is done at a filling station located at the company headquarters in Kagwe to reduce fuelling costs, but maintenance of the vehicles is undertaken by the owners of the hired vehicles. Every vehicle located at the depot has a route plan showing its daily or weekly planned trips, but for the Nairobi market, the delivery is daily because of the short distance involved.

Unlike Uplands PD&F Ltd which distributes its milk through depots, Canaan Factories Ltd distributes its milk through appointed distributors. The company sells its milk in central Kenya, Nairobi, Eastern, North Eastern, Rift valley and Nyanza.

The Kenya Dairy Board licences small scale cottage industries to process milk. 54 years old Mr. Ndirangu operates a milk processing cottage industry from his farm/ home in Ngochi, Githunguri, two kilometres from Githunguri town. He covers the whole milk value chain from

production to distribution and has six dairy cows that produce 80 litres in the morning and 60 litres in the afternoon. He additionally sources 210 litres of milk per week from Nyara, Limuru about 35 kilometres away from Githunguri at Ksh. 45 per litre. He prefers milk from this location because it has no impurities like *igata* which can inhibit the production of yoghurt. This is an indication that commuters can travel a longer distance in search of quality. He travels to Nyara three times a week on alternate days and picks up the milk using his pickup truck. Previously when he started pasteurizing, he was producing 300 litres of milk but was at the time experiencing low production.

Figure 3.25: A licensed cottage milk industry in Ngochi, Githunguri.



Source: Field work 2019.

Figure 3.26: A milk ATM in Githunguri town.



Source: Field work, 2019.

Buying milk is expensive and estimates indicate that processors spend 50 per cent of their costs on purchasing milk (TechnoServe Kenya, 2008) while (Tegemeo Institute (2021) puts the cost of acquiring milk at 34 per cent. He processes the milk through the batch pasteurisation (low heat pasteurisation) process by boiling it with firewood for two hours to 85-90 degrees Celsius, after which he cools the milk for three hours inside a pool of water and then stores it for two hours in a fridge. He indicated that when milk boils directly from a cooking pot, it rises at a

temperature of 43 degrees Celsius while milk that is boiled from sealed containers placed in water can attain 90 degrees Celsius (see Figure 3.25). The process does not involve the addition of preservatives. This pasteurised milk can stay for three days without getting spoilt. He prepares the yoghurt by boiling the milk at 40 degrees Celsius then removing the cream and adding the culture. He sells the pasteurised milk at Ksh. 55 per litre through two milk ATMs one in Githunguri town and the other in Kiambu town, The Githunguri milk ATM run by his wife operates between 0700 Hrs to 2400 Hrs, while the one in Kiambu which he manages operates between 0700 Hrs to 2300 Hrs to allow him time to close and travel home. He employs one ATM operator and one casual in the farm, while his wife operates the general merchandise shop adjacent to the Githunguri ATM. He sells about 150-170 litres per day from both milk ATMs but has a capacity to pasteurize 300 litres per day. He also sells 50 litres of yoghurt per day at Ksh. 100 per litre.

Elite Dairies Ltd located along the Ruiru to Uplands transect, five kilometres from Ruiru town also engages in all the processes in the milk value chain. The farm has 1,000 dairy cattle and produces 4,300 litres of milk on a four-acre farm (See Figure 3.27).

Figure 3.27: Elite Dairies Ltd located near Ruiru town.



Source: (InooroFM, 2021).

The company pasteurises its milk and sells it to supermarkets including Naivas one of the largest retail chains in Kenya with 74 branches. The company also sells milk and yoghurt directly to consumers and has additionally opened 11 milk ATMs in Embakasi 35 kilometres away. Due to its location in an urban area, the farm relies entirely on external sources for its animal feeds, and sources silage from the Rift Valley region (Biznakenya, 2021; InooroFM, 2021; Njoroge, 2021).

Informal distribution of milk

The informal distribution channels of milk are through the vendors who buy the milk from rural areas and sell it in the urban centres. Their customers include restaurants, individuals, milk parlours and general household merchandise shops. Ruiru town being a satellite town of Nairobi is a source of market for raw milk due to its large population. The preference for raw milk is because it is cheaper, rich in cream and is also considered to be natural and free from chemicals. The consumers like raw milk because it is considered fresh. *“The milk is direct from the cow”* indicated 47 years old mama Kimani who operates an informal restaurant at the Ruiru *matatu* terminus. *“People like raw cow milk more than packet milk. They say packet milk has many chemicals because of preservatives. If I use packet milk, I could still make a profit but I like raw milk because it is thicker (rich in cream)”* added Mama Kamau a 45 years old lady who also operates an informal restaurant at the Ruiru *matatu* terminus. Mama Kamau buys 10 litres of milk (two jerry cans) from two milk vendors at 0630 Hrs when she opens her business then empties the jerry can and gives them back to the vendors. She sells a cup of tea at Ksh. 20 per cup and pays a daily licence to the Kiambu County government at Ksh. 20 per day, and had been in operation for the past one year. This shows that the public is not well informed and is not able to ascertain the quality of milk. The preference for raw milk is based on assumptions that raw milk is pure and not adulterated, which is not always the case. However the safety concerns regarding the quality of milk in Kenya are not only an issue of the milk sold in the informal sector but also that in the formal sector. (Blackmore et al., 2015, 2021)

Since milk is a product that is used by households early in the morning for making tea and coffee, and also in restaurants, the vendors have to travel early in the morning to supply the milk to their customers. The vendors leave by 0400 Hrs to ensure that they are able to reach their customers by 0500- 0600 Hrs in the morning. They prefer to transport the milk at night so that they can evade police and also due to the cool temperature that keeps the milk in good quality. Delay in transportation would lead to the milk getting spoilt. The vendors use *matatus* and *boda bodas* to transport the milk to the urban areas. When the vendors arrive in Ruiru, they drop the jerry cans to their customers and wait for them to empty them before picking them.

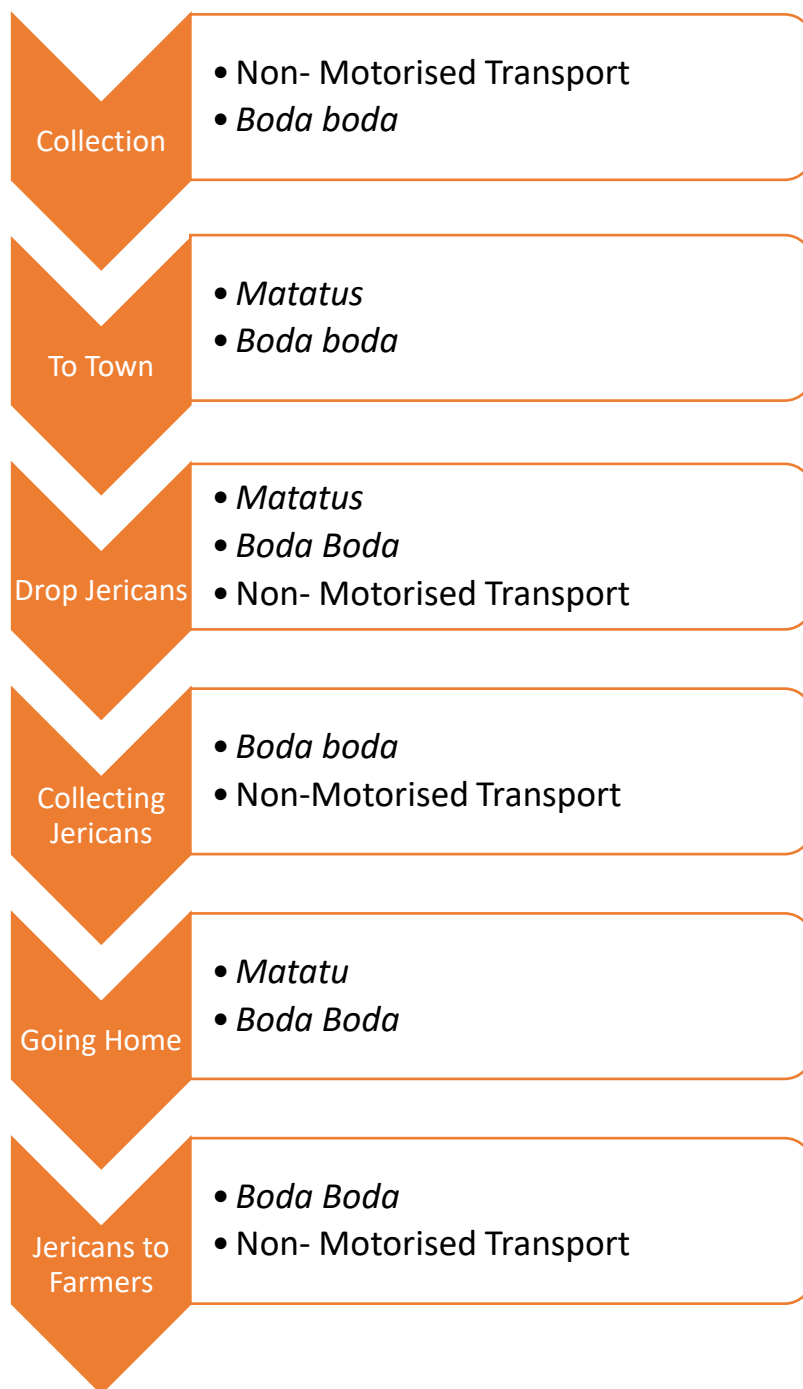
Given that the milk is distributed to various places, the vendors distribute it on foot, hire a *boda boda* to assist them in the distribution, or take another *matatu* to various neighbourhoods. In Githurai, Ruiru town, I observed a milk vendor offloading about 15 jerry cans from a *matatu* that was then loaded into a hand-pulled cart for distribution to the various customers.

50 years old Mama Wangechi from Kigumo, Githunguri (25 Kilometres from Ruiru town) uses a *matatu* from Kigumo to Ruiru after which she picks another *matatu* in Ruiru town to Wataalam neighbourhood located about four kilometres from Ruiru *matatu* terminus where her customers are located. She sells the milk in Wataalam to three restaurants, five general shops, and ten milk parlours. She delivers the jerry cans to her customers and then picks them up when they are emptied between 0700 Hrs to 0900 Hrs. She then travels back home where she arrives at about 1100 Hrs and embarks on washing the jerry cans. She also takes care of her cows and does household work. She buys the milk from 20 farmers spread over a two-kilometre radius who sell to her a total of 60 litres of milk that she packs in 16 jerry cans and pays them weekly. During transportation to Ruiru, the milk is packed in batches of about five jerry cans and placed under the seats of the *matatu* or inside the boot of the *matatu*. This is to ensure the loads are portable due to their heavy weight, and also to ensure that they fit into the storage spaces in the *matatu*. If the jerry cans were to occupy the passengers' seats, the vendors would be charged more. However, during the transportation back to the rural area, the jerry cans are placed in sacks carrying about 25 jerry cans and hung at the door of the *matatus* boot (see Figure 3.30) or on the top of the *matatu* due to their light weight.

Matatus are not a reliable means of transportation, and sometimes they are late or may refuse to carry customers with heavy and bulky loads like milk jerry cans. The vendors prefer to use particular *matatus* that they have prior arrangements with. Mr. Wanyoike a 42 years old milk vendor from Kiganjo, Gatundu South indicated that he was late for his delivery because the *matatu* he normally used had left with some of the milk because they could not trace where he was located with the rest of the milk. He was able to find the *matatu* later in Ruiru town. Even with the subsequent *matatu* that he took that day, he still arrived in Ruiru late because it got stuck along the road making him late for delivery. “*I prefer to use a specific matatu which knows the routes I use because for other unfamiliar matatus, I have to make calls to them to inform them where I have left the milk.*” His daily collection was 200 litres (40 jerry cans of five litres each) from 20 farmers located within a distance of 3-4 kilometres and he sold it in Ruiru to five restaurants and five general merchandise shops. In one of the neighbourhoods where he sells the milk near Ruiru prisons, he hires a motorbike to distribute the milk, and he then collects the jerry cans himself on foot. 38 years old Mr. Kimotho who operates Amani restaurant in Ruiru town is one of Mr. Wanyoike's customers. He buys 70-80 litres of milk per day from five

milk vendors at Ksh. 45-50. The milk arrives at the restaurant between 0400 Hrs to 0800 Hrs. The vendors first drop the jerry cans then they come picking them after he has emptied them. Selling tea is the main revenue source for his restaurant business. Figure 3.28 summarises the process of informal distribution of milk by the informal milk vendors.

Figure 3.28: Choice of means of transportation used in informal milk collection and distribution.



Source: Author.

Figure 3.29: Jerry cans awaiting transportation back to the rural areas



Source: Field work, 2018.



Source: GSV, 2018.

Some of the vendors like 55 years old Mr. Waiganjo from Kiganjo, Gatundu South make two deliveries in a day. In the morning he supplies 130 litres which he delivers at 0630 Hrs, picks the jerry cans at 0730 Hrs and then leaves for home where he arrives by 0900 Hrs. He picks the evening milk at 1600 Hrs, stores it in a freezer to avoid spoilage and delivers it (50-170 litres) by 1900 Hrs. His customers are based in Gitothua, Ruiru town at the market, five restaurants and four milk parlours. At Amani hotel, he delivers 30 litres - 50 litres in the morning and 20 litres in the evening.

65 years old Mr. Kariamburi who operates a milk parlour/ restaurant in Ruiru town uses milk from his farm located in Kiganjo, Gatundu South constituency, 25 kilometres from Ruiru town. His farm produces 150 litres of milk which is his main supply. This is from 20 dairy cows (eight that were being milked) that he rears on a quarter of an acre plot of land where he also lives. He transports the milk with his pickup and arrives in Ruiru at 0800 Hrs. He additionally sources 100 litres of milk from a farm in Kiganjo when demand is high. His customers are individuals, restaurants and institutions. His restaurant consumes 50 litres of milk for use in the preparation of tea.

To handle issues of perishability, milk vendors label each jerry can to ensure that the farmer supplying the milk can be traced in case of milk spoilage. In addition, the customers also prefer to use one vendor. *“I buy from a specific person whom I trust. You cannot know good or bad*

milk, so you have to stick to one person” said 47 years old Mama Kimani, an informal restaurant owner operating at the Ruiru bus terminus. She had bought milk from one vendor for the seven years she had been in operation. In addition, the vendors ensure that the cans are washed thoroughly. They prefer washing them themselves and do not entrust the farmers to wash them to avoid contamination which could lead to spoilage. The clean jerry cans are then distributed to the customers ready for the next supply the following day. Additionally, some of the vendors have lactometers for testing the density of the milk to assess if farmers have added water.

Figure 3.31: Jerry cans labelled to ensure traceability.



Source: Field work, 2019.

Farmers practising dairy farming in urban areas like 52 years old Mr. Mburu whose farm is located in Githurai, Ruiru town sells the raw milk directly to their customers. He has 20 cows of which 12 were being milked and in total they produced 150-200 litres of milk daily. His customers are the urban residents staying in Githurai neighbourhood and institutions (a bank and a Sacco) located in Githurai centre. Additionally, he gets customers from other locations like Membley and Thika who buy a weekly supply of about eight litres. Each day, he delivers an average of two litres of milk to 75 customers located within the neighbourhood who pay either in cash or monthly. The customers who pay monthly are mainly the residents with children. He chooses not to sell his milk to restaurants because their prices were low.¹⁹ He sells his milk between Ksh. 60-70 shillings per litre to residents, and Ksh. 70 to institutions. This is almost double the Ksh. 34-42 price that rural farmers get. He indicated that “*customers like the*

¹⁹ The restaurants buy milk from vendors at Ksh. 45-55

milk because they see it being milked and sold on the spot directly without any chemicals being added.” They trust his quality “I cannot add water and sell to a customer for two years,” an indication that he has been able to retain long-term customers. The distribution of milk is undertaken by his labourer at 0500 Hrs before customers depart to work. It is a logistical challenge, and the labourer has to drop the milk from door to door, and at times could find the gate of the compound locked or encounter dogs. 76 years old Mr. Kuria a farmer who is also located in Githurai, Ruiru town sells his milk at his gate house at Ksh. 70 per litre to regular ‘contracted²⁰’ customers (see Figure 3.18).

3.3 Distance of movement

There are different conceptualisation of measurement of distance travelled; Lowe & Moryadas (1984) have broken it down into four categories the first being the physical measure that gives the spatial distance between two points in metric units, the second one is the economic measure that is based on the cost that is incurred to move from one point to another. The third category is the perceptual measure that is based on human beings’ perception of the distance between two points. The perceptual measure of distance while it may be subjective since it is based on an individual’s mental map or images of a certain area forms a basis of decision making by some of the commuters. Lastly, time measure is based on the time taken to travel from one point to another. Time measure varies due to a number of reasons as highlighted below:

In contrast to physical distance, which is invariant, time distance is a function of the mode of movement, the density of traffic on the route, the physical environment or characteristics of the surface over which movement occurs, the manmade regulations concerning movement, and finally the state of the art in reference to movement technology. (Lowe & Moryadas, 1984, p. 22)

Distance to the source of farm inputs, raw materials and market is not only a factor of consideration in regard to planning a commute but also in the location of retail businesses and industries. Due to the perishable nature of milk, the product needs to be moved over shorter distances. Fodder is also perishable and needs to be transported over short distances. However, with the intervention of technology, milk and fodder can be transported over longer distances. Through jacketed tankers, milk processing companies like Brookside Dairy Ltd, Uplands PD&F Ltd and Canaan Factories Ltd transport cooled milk over long distances to their factories without compromising the quality. Without appropriate control measures in the transportation of raw milk, the quality of milk can decrease with the distance and length of the trading chain

²⁰ These are customers who had a prior arrangement with him

(Omore et al., 2005, as cited in Blackmore et al., 2020). Further through pasteurisation technology, milk can be transported and sold to distant locations. Milk can even be stored over long periods in powder form. Thus the condition of the product being transported determines the distance that it can travel. Technologies that prolong the life of fodder through its conversion to silage enable the distance that it can travel to be longer. Hay is transported when it is dry making it stay for longer periods thus even when it is acquired in large quantities, suppliers and farmers are able to store it for future use. It is important to empower farmers on the application of these technologies that prolong the life of milk and fodder.

Perishable fodder crops are transported in smaller quantities because they need to be used in smaller quantities before they spoil. Notably, the movement of fodder has a short value chain compared to processed feeds that have longer value chains that extend even to the neighbouring countries and to other continents. Distance travelled correlates to the length of the value chain. Longer value chains involve longer distances and vice versa. This relates to a findings by Mbonile (2017) on the flow of goods along the Mbeya Highlands in Tanzania. She concluded that manufactured goods travelled over a distance of about 1,000 kilometres as compared to the short distance of 6-10 kilometres for the sale of farm crops like cabbages, mangoes, oranges, onions, rice, millet and honey in the local markets.

The distance of movement travelled by the farmers in pursuit of animal feeds is dependent on a number of factors including: the means of transport used, the condition of the vehicle, the cost of transportation, the availability of the feeds, availability of storage facilities, and the cost of feeds. In most cases, fodder is usually available in the neighbourhood thus it does not require longer distances to acquire. The availability of a product locally reduces the distance of travel, effectively reducing the cost of production. However, during the dry season, the availability of fodder in close proximity is limited and farmers have to travel over longer distances in search of fodder.

The distance travelled also depends on issues of cost- effectiveness. *“The more you go (longer distance) the more the cost. Farmers need to travel the shortest possible motorable distance.”* Emphasised Mr. Njihia a 65 years old farmer from Gathanji, Githunguri. By motorable distance, Mr. Njihia meant that the shortest distance was also determined by other factors like the quality of the road or the season. This is because the distance may be short but the place inaccessible, or during the rainy season some areas may not be accessible. Thus travelling to inaccessible places may be costly in terms of damage to the vehicle, delays and the risk of getting stuck in the mud. Transportation costs are a factor in raising the cost of milk production, and this phenomenon creates a limit of the viable distance that farmers can travel in search of feeds

beyond which the commute would lead to losses. The viable travel distance to and from small and intermediate towns creates a functional area that a town serves. Beyond this distance, the farmers cannot travel to a particular town because the commute would not be cost-effective. Unlike retail traders, the farmers are limited in transferring transportation costs incurred to the milk processors since they have no much control on the pricing of milk which rarely changes (Tegemeo Institute, 2021). However, even the retail traders and service providers have a limit in which they can transfer expenses to their customers and remain competitive. 55 years old Mr. Mwaura a veterinary doctor operates within a radius of about ten kilometres beyond which he would have to charge more for his services, and it would take him a longer time to travel, limiting the number of clients that he can serve.

However, the issue of cost-effectiveness may not be a consideration where issues of quality are considered. Mr. Ndirangu who has a cottage processing farm in Ngochi, Githunguri sources his milk from Nyala, Limuru, 35 kilometres away from Githunguri. While he could get the milk from his locality, he prefers to make a long journey to Nyala where he feels the quality of milk is better for his yoghurt production. He indicated that the milk from Nyala *“has no impurities like igata which can inhibit the production of yoghurt.”* Farmers will also travel further if the quality of the road is not good and they opt to use a longer routes that are of better quality as discussed in section 4.1. The type and quality of the means of transport can also be a limitation to the distance that can be travelled. Farmers are not comfortable driving their old vehicles over long distances. The farmers fear that these old vehicles will experience breakdowns along the way and would not want to experience this while in the city where there are traffic jams or in unfamiliar territories. *“If I had a good means of transport I can get machicha at breweries, but my pick up is not motorable to go to Kenya breweries. I use my pick up for shorter distances.”* Indicated Mr. Njihia a 65 years old farmer from Gathanji, Githunguri. For shorter distances the farmers can rely on their pickups, but for longer distances, the farmers hire transport services.

The distance farmers travel is dependent on the means of transport they own. Owning a means of transport enables farmers to travel further. The distance travelled through non-motorised means depends on the individuals' physical endurance. This depends on age, health, weather, terrain, and load among other factors. Walking or using wheelbarrows limits the distance of travel to about one kilometre, while using a bicycle could extend the distance to about 15 kilometres. A motorbike can move further to about 50 kilometres, while a vehicle breaks barriers to mobility to hundreds of kilometres.

“A farmer must have an available means of transport: bicycle, wheelbarrow, motorbike or pickup. When you hire transport it is expensive. If it is your own means

of transport, then it is cheaper. All you require is fuel, irrespective of whether you have a license or not.” Mr. Njihia, Gathanji, Githunguri.

It is also notable that for longer value chains, products have to be transported in bulk to save on costs through economies of scale. The processing companies take advantage of the economies of scale in the transportation of the raw milk to the factories from the catchment areas for processing and in the distribution of milk to other parts of the country in large volumes to depots located in other parts of the country. The processed feeds suppliers also transport the feeds from distant locations using trailer trucks to save on transport costs. Even over short distances transportation in larger volumes saves costs.

45 years old Mr. Kang’ethe of Baraka feeds Githunguri transports *machicha* to his outlet using three-axle trailer truck with a capacity of 30 tonners that costs him fuel of Ksh. 7,000 fuel per trip compared to a 10 wheeler 14 tonnes lorry that he was using in the past that used fuel of Ksh. 4,500 per trip saving him about Ksh. 2,500 per trip. *“It’s cheaper to transport more than it would be to transport less quantity. One pick up (referring to the means of transport that farmers use to get machicha) is more expensive to transport than a truck whose capacity of 10 times more.”* Pointed out 38 years old Mr. Kibe of Amani feeds. Additionally, the ability of the transporters to compact their goods also facilitates the transportation in bulk. A good comparison is the way the farmers transport the grass from Tatu city (refer to Figure 3.10) compared to the compact hay and silage that is transported from the Rift valley.

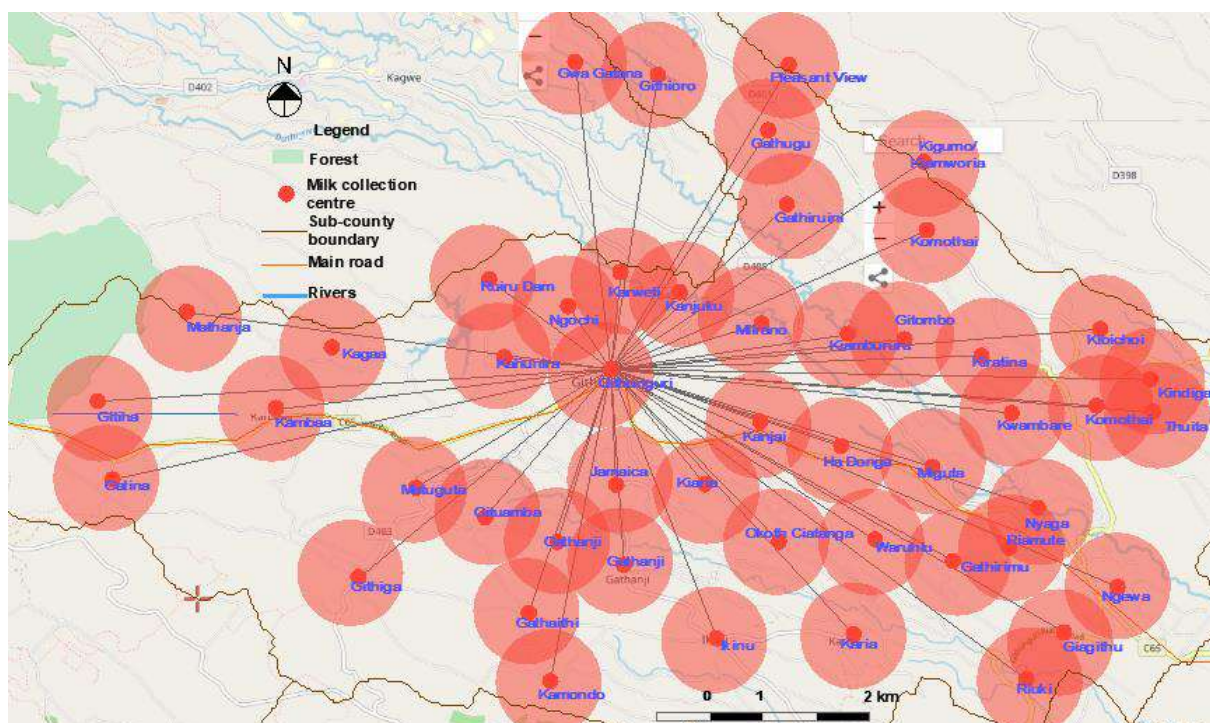
Figure 3.32: A trailer-truck used by Mr. Kang’ethe to transport *machicha* and a tanker used to transport molasses.



Distant locations attract middlemen to facilitate the linkages between those towns, regions and nations to locations along the transect, and as a result lengthening the value chain. The areas bordering Thika that is Gatukuyu, Gatundu North have a cluster of poultry farming as noted by 65 years old Mr. Mucheru who buys chicken waste from there. This poultry producing cluster depends on feeds from Thika town which is 17 kilometres away where there is a cluster of animal feeds factories, wholesalers and retailers that support the poultry business and produce a variety of animal feeds. However, due to the 50-kilometre distance separating the poultry producing cluster from Githunguri town, there is minimal direct interaction between Gatukuyu and the farmers located along the Ruiru Uplands transect. Instead, they rely on middlemen to source feeds produced in Thika and also the chicken waste that is sourced from Gatukuyu. Without these middlemen, the local farmers cannot access distant products. However, this comes at a cost because the middlemen have to add profit margins. Thus the issue of access to value chains is key in alleviating poverty and cheap access to goods and services in rural areas. To facilitate these linkages and interactions, the town hosts the middlemen – they are centralised/ clustered in a location where farmers can access them. In addition suppliers and industries can set up depots and outstations from favourable locations if there is a sufficient market to support the sustenance of those depots. This is the case of Legorn Feeds International Limited which is based in Thika but has two depots in Gatukuyu and Githunguri further giving an indication of the existence of the two clusters. The high demand for animal feeds from these locations has led to the setting up of depots in these locations. Eventually, it could lead to the setting up of manufacturing lines in these centres as they grow which can eventually lower the cost of feeds. ABS TCM Ltd (2013) indicated that the location of processed feeds companies and their distributors is in urban areas (majorly Nairobi and Thika) limiting the access and raising the cost of these feeds to the farmers located in distant towns and rural areas.

Table 3.6 below summarises the approximate limits of distance that different products and services flow arising from the findings. Fodder is sourced within the locality while hay and silage move over a longer distance. Processed feeds flow over longer value chains that extend even beyond national borders. Veterinary services are offered within the locality over a distance of about 10 kilometres. The approximate distance that farmers make to the milk collection centres is usually about 1-2 kilometres (See Map 3.10).

Map 3.10: Distance to Githunguri Dairy FCS Ltd milk collection centres



Source: Adapted from Google maps and Satellites.pro, 2021.

However, the milk vendors collect milk from the farmers over a longer distance of up to about 10 kilometres, while milk processing companies pick milk from the collection centres within a distance of about 10-15 kilometres if picking from the local catchment zones and over 200 kilometres when sourcing milk from distant areas which is the case of Brookside Dairy Ltd, Uplands PD&F Ltd and Canaan Factories Ltd. Raw milk is sold within a distance of about 50 kilometres, while short-life pasteurised milk is sold within a distance of about 100 kilometres and finally long-life pasteurised milk over a distance of beyond 500 kilometres.

Table 3.6: Approximate distance of movement of goods and services

S no.	Product/ service	Approximate distance of flow in kilometres
1.	Fodder	About 0-15
2.	Hay and silage	About 200
3.	Processed feeds	Over 200/ International
4.	Veterinary services	About 10
5.	Milk collection by processing companies	Locally 0-15 Regional over 200

6.	Milk collection by vendors	About 10
7.	Sale of raw milk	Within 50
8.	Sale of short life pasteurised milk	Within 100
9.	Sale of long life pasteurised milk	Over 500

Source: Author.

3.4 Spatial-temporal changes in mobility

Time of movement

The milk value chain is process-oriented, with distinct activities that should be done at certain times and within certain timelines and at specific places from the farm, collection centre, processing plants to the marketing of the raw or processed milk. The fluctuations in the intensity of the activities create spatial-temporal variations in space. At a particular time, a milk collection centre could be crowded with farmers delivering milk, while at another time the milk collection centre would be deserted or would be involved in other activities like the transportation of the collected milk or disbursement of animal feeds and household goods to the farmers. The perishability of milk dictates that for good quality milk to be produced, the timelines have to be followed in order to avert losses. Time is of the essence in the transportation of milk. The cows are fed and milked at regular times, and delay in milking high yield cows could lead to the leaking of milk from the cows under, which increases the risk of the cow getting mastitis. The raw milk also needs to be taken to the cooling centres within two hours after milking to keep it in fresh condition (Government of Kenya, 2021b). Therefore, the milk collection and cooling centres are located close to the farmers to facilitate efficient and timely collection of milk.

The trip to collect *machicha* at the EABL headquarters in Ruaraka needed careful planning by the farmers before the sale of *machicha* was decentralised to various outlets in Kiambu County. This was because a divergence in the timelines would lead to a wasted trip and losses. The fuel cost for 76 years old Mr. Maina from Ha Donga, Githunguri was about Ksh. 1,500 accounting for 30 per cent of the cost of the 10 units of *machicha* he usually bought at Ksh. 5,520. He had to depart by about 0300 Hrs to ensure that he got adequate parking space at Naivas supermarket near Garden estate flyover. The farmers were supplied with *machicha* in the order of their registration numbers, and if they were not available at the time of dispensing, they would lose

their chance and had to wait for all the farmers to be served, and by the time it was their turn to be served, the *machicha* could have been exhausted. From consecutive interviews, 76 years old Mr. Maina a farmer from Ha Donga, Githunguri changed the time he departed to get *machicha* because of a number of factors. On 02 February 2019 he left to get *machicha* at 0600 Hrs and arrived at 0700 Hrs and was able to pick *machicha* at 0900 Hrs, and arrived at his farm at 1000 Hrs. In a consecutive interview on 06 May 2019, the farmer indicated that he had changed his departure time to 0230 Hrs because at that time there were few vehicles on the road, and he was able to avoid glare from the oncoming vehicles at night. In addition, in the night he was able to get parking space because there were few vehicles as compared to the limited parking during the day. He indicated that when a farmer missed suitable parking, they had to park in muddy sections where their vehicles could get stuck. In addition, he preferred getting *machicha* before the early morning traffic jam caused by vehicles going towards Nairobi City centre. At one time because of the traffic jam, his vehicle developed mechanical issues (overheating of the clutch) as a result of the heavy load his old vehicle was carrying. Farmers also wanted to avoid the police.

“At one point as I was going to get machicha, I was stopped by the police who delayed me and as a result I was late to get machicha and missed my opportunity. As a result I had to get another alternative to feed the cows” indicated Mr. Maina in regard to his encounter with the police.

Although driving through the lonely coffee plantations at night while going to get *machicha* posed a security issue, he had never encountered criminals in the course of his journeys, and also the presence of police roadblocks at a section called Animer and Kamiti corner gave him a feeling of security. This shows the dynamism of the commutes taken by the farmers and the need to adapt to the changing situations.

Milk delivery by the vendors is done at night because of the cool weather, to have the milk in time for preparation of the morning tea by their customers and to also avoid the police. The field work had to be conducted after the milk vendors had finished making their deliveries. Before deliveries, they were unsettled and in a rush to afford the time to undertake an interview. It was impossible to stop them while they were on the *boda boda* transporting their milk unless one was making a purchase. First, they were suspicious that it could be a trap by the authorities. Secondly, they knew their regular customers, and lastly, they were in a rush. The vendors finished their deliveries at 0900 Hrs and began travelling back to their homes between this time and 1100 Hrs. I was able to meet them at the *matatu* terminus and at the restaurants where they sell their milk. The vendors using *matatus* have to ensure that they keep time because when

they are late, they may fail to link up with the particular *matatu* that carries their milk necessitating them to make arrangements with other *matatus* who may not be aware of their whereabouts or the points at which they have placed their milk. This was the case for Mr. Wanyoike a 42 years old milk vendor from Kiganjo, Gatundu South who on the interview on 03 June 2019 had been left by the *matatu* he normally used and had to look for another *matatu* to transport the milk.

The activities conducted at different times influence the functioning of the town centre. Traders have to be aware of the operational hours of farmers to know at which times and places they can find them in large groups. This is the case during milk collection where the farmers congregate at the milk collection centres to take their milk. Traders operating at these village centres selling various produce target these farmers at these particular times. These include butcheries, restaurants and general merchandise shops. From the field survey, it was found out that the shops and restaurants open at 0400 Hrs so that farmers taking their milk at 0500 Hrs can buy from the shops on their way home. In another instance, coffee vendors sell coffee to farmers at night at the parking lot outside Naivas super market as they await their turn to get *machicha* in Ruaraka, Nairobi. Additionally, suppliers of various farm inputs and service providers usually target farmers' training sessions where they market and sell their goods and services.

From the above discussions, it is evident that there is a consequence in deviating from the timelines which, usually results in losses and time wastage. For instance, feeding of the cows, milking and transportation of the milk to the collection centres has to be done within specific timelines, and delay in one of the processes could result in losses whereby for instance a farmer would have to throw away the milk because he/ she is late to take it to the collection centre. Farmers could encounter losses if they are late to get *machicha* and if they fail to get it, they are forced to look for other alternative sources of fodder. Milk vendors could lose customers if they delay in making deliveries because the customers would be forced to look for alternative places to buy milk. "*When I get late, customers complain or get milk from other sources.*" Mama Wambui, a 55 years old milk vendor from Kigumo, Githunguri.

Seasonal change in mobility

Mobility patterns change with the dry and rainy seasons. During the dry season there is reduced availability of fodder.

It is easier and cheaper to get food for people than to get food for animals. During the dry season it becomes extremely challenging to get food for cattle, because there

is little fodder around the area. Thus one has to commute to other areas in search of fodder or rely on hay that is sold by the farmers' cooperative. I have to take loans during the dry season since milk production during this season also goes down. Mr. Maina, 76 year old farmer at Ha Donga, Githunguri

The statement was in reference to the unreliability of sourcing feeds during the dry season, whereby a farmer is not assured of getting the fodder at a fair price as compared to human food which he thought was more available in shops around the neighbourhood and from his farm. This illustrates the importance of mobility to the farmers in search for fodder for their animals which can be likened to the mobility of pastoralists in search of grazing fields. The dry season further affects the cash flow of the farmers due to reduced milk production and increased costs of animal feeds.

Napier grass, the most commonly used fodder crop along the transect grows rapidly during the rainy season, but its growth slows down during the cold and dry season. *“When it is too dry the supply of fodder reduces; when it is raining there is no problem - people give out napier grass.”* Said Mr. Njihia a 65 years old farmer from Gathanji, Githunguri. The reduction of fodder forces the farmers to venture and search for it where it is available or source for alternative feeds at the urban centres. . The less available the fodder is, the longer the distance that farmers have to travel in search of it.

“There is less napier grass during the dry season, and I have to move to get the napier grass where it is available. I also buy grass from the grasslands near the coffee plantations towards Ruiru. Hay is also less during the dry season. I have to get what is available.” Mr. Muriuki, a 48 year old farmer from Kambaa, Githunguri.

During the dry season, the farmers also depend on vendors for the supply of hay and animal feeds. 54 years old Mr. Ndirangu from Ngochi, Githunguri has sufficient napier grass during the rainy season, but during the dry season, he has to buy napier grass and hay from other areas which means that his pattern of mobility changes with seasons. While farmers are mobile during all seasons, there is a surge of movement during the dry season which is driven by increased demand for animal feeds as the farmers move further away from their neighbourhoods giving rise to this seasonal change of movement. Additionally the reliance on processed feeds, by-product feeds and hay during the dry season increases mobility towards the town and other locations where these feeds are found.

Demand of animal feeds is higher during the dry season and the price also increases during this time. Traders hoard feeds and sell them during the dry period. The inability of the smallholder farmers to cushion themselves from the effects of changes in weather conditions affects their profitability during the dry season because the profit margins are reduced by the increased cost of inputs. “*During the dry season the demand for hay is higher*” indicated 27 years old Karimi wa Hay who supplies hay in Ruiru town. 45 years old Mr. Kang’ethe of Baraka feeds confirmed that during the rainy season the price of hay could be as low as Ksh. 140, but during the dry season it can go up to Ksh.300. He indicated that vendors buy hay during the rainy season in bulk when it is cheap, then store it and sell it during the dry season at a higher price. The price of vegetable waste from the markets also increases during the dry season. Mr. Kuria a 76 years old farmer from Githurai, Ruiru indicated that during the dry season a bag of maize cobs waste from Githurai market costs up to Ksh. 300 per sack compared to the usual price of Ksh. 150 per sack. He indicated that during the dry season, farmers from as far as Githunguri travel to Githurai market to buy the vegetable waste. Additionally, when the production of maize is in low supply either when it is out of season or when there is low yield, the maize cobs waste becomes more expensive.

The feeding of the cows also changes with the seasons. During the rainy season, the farmers will use more of the fodder crops available from their farms. When the maize is harvested in Kiambu and its environs in the two harvesting months of August and in March, the farmers supplement their fodder feeds with maize stovers which they source from neighbouring farms and especially locations where farming takes place on leased or idle land like Mboi Kamiti in Riabai near Kiambu town or Mbiu Koinange’s land in Banana, Kiambu. During the dry season, farmers supplement the napier grass fodder with hay, cut grass from the lower part of the transect, maize stovers, weeds, and banana stalks. The findings are consistent with previous studies that have shown that the quality of feeding during the dry season is poorer compared to the rainy season (Auma et al., 2018; Njogu, 2017, Nyaata et al., 2000; Omore et al., 1999).

Feeding crop residues and crop by-products with low nutritional value, such as sugarcane tops, banana stems, legumes and rice straw during dry season, were found to be an emerging trend as a dry season feeding strategy. Sugarcane tops and rice straws, which farmers previously collected freely and used as fodder during dry periods, are presently being traded and offer a business opportunity for the youth in Migori, Kisumu, Kakamega, and Bungoma, where farmers use them for feeding during dry seasons. (Auma et al., 2018, p. 17)

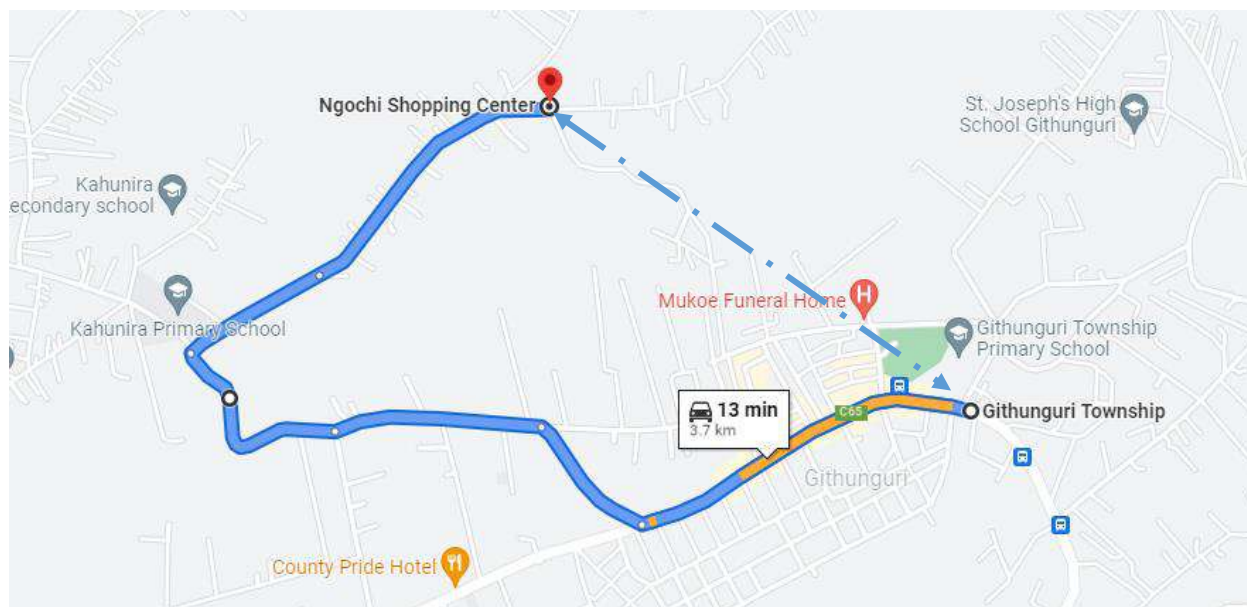
During the rainy season, while fodder is in plenty, the condition of the earth roads deteriorates, and the roads become inaccessible because they are not resilient to the seasonal fluctuations of weather. The earth roads become muddy and the farmers risk getting stuck in the course of sourcing the feeds. Thus, whereas fodder is available during the rainy season mobility at this time faces limitations. *“I buy maize stalks at Mbiyu Koinange’s farms where people have leased out farms. It’s difficult to get there during the rainy season and that is when fodder is available.”* Mr. Gathumbi a 77 years old farmer from Githiga, Githunguri indicated. *“Roads are more problematic and slippery during the rainy season”* pointed out 48 years old Mr. Muriuki, a farmer from Kambaa, Githunguri. *“When it is raining, it is difficult to get feeds. The car gets stuck. During the rainy season, the feeds are more, but getting them is difficult.”* indicated 52 years old Mr. Karanja a farmer from Membley, Ruiru. He also added that it was difficult to get labourers to cut grass when it was raining because they are usually busy planting crops in their farms, while during the dry season it was not easy to cut grass because of the hot sunny weather conditions. The challenge of mobility during the rainy season was also cited by 55 years Mr. Mwaura a veterinary doctor operating in Githunguri town indicated that one of the main challenges that he faced in delivery of his services was the poor condition of the roads especially during the rainy season.

Commuting to the milk collection centres irrespective of the short distances involved is difficult during the rainy season, especially when one is carrying a load and passing through muddy roads. The farmers have to push their bicycles and hand carts through the muddy roads. The lorries, pickups and motorbikes collecting the milk sometimes get stuck while picking milk during the rainy season and as a result, they get delayed or spill the milk. At the milk collection centres that are not sheltered, the farmers get rained on as they await the lorries, and if the lorries are delayed the agony of getting rained on is prolonged especially at night when the temperatures are cold.

Poor mobility during the rainy season also affects the milk vendors because carrying the jerry cans of milk in the rain is a difficult and laborious task. The vendors have to collect the milk when it is raining because waiting for the rain to subside would create delays and the vendor could be left by the matatu and get late in making the delivery. *“During the rainy season, I could be left by the vehicle.”* Pointed out 55 years old Mama Wambui, a milk vendor from Kigumo, Githunguri. The roads in addition become slippery; riding a *boda boda* along the slippery roads with a heavy load is risky. The poor condition of the roads during the rainy season renders sections of the road impassable forcing farmers to change routes, increasing the distance of travel and consequently travel costs. 54 years old Mr. Ndirangu from Ngochi, Githunguri who transports milk to his milk ATMs in Kiambu and Githunguri towns daily from his cottage

processing plant in Ngochi has to make a longer journey during the rainy season. While the section from Githunguri to Kiambu is tarmacked and not affected by seasonal changes, the short cut section between his farm/ cottage industry and Githunguri town is an earth road that gets slippery during the rainy season. Therefore during the rainy season, he has to travel an extra two kilometres as illustrated in Map 3.11.

Map 3.11: Mr. Ndirangu's longer route to Githunguri town



Source: Adapted from Google maps, 2021.

Transportation of milk during the dry season affects its quality especially if transported without protection from excessive heat. The milk processors use jacketed tankers and have also installed coolers at the collection stations to ensure that the milk transported is at the ideal temperature. However, the milk vendors have limited knowledge on the preservation of milk and they also do not have cooling facilities which exposes the milk to warm temperature conditions. The dusty roads during the dry season are also not good for the milk even though the containers are usually covered. 47 years old Mama Kimani who operates a tea selling business at the Ruiru *matatu* terminus indicated that the quality of milk is good during the rainy season but during the dry season, it could have a smell. She also additionally pays more for the raw milk during the dry season, with the prices fluctuating between Ksh. 50-70. In a similar pattern to the increase in the price of fodder, the price of processed milk is affected by seasonal changes. The price of processed milk usually faces adjustment by the milk processing companies during the dry season, but rarely translates to an increase in the farm gate prices (Tegemeo Institute, 2021). The milk vendors also increase the price of milk during the dry season. *“It never lacks in supply, but it could change. During the dry season, it is more expensive.”* Indicated mama Kimani 47 years old tea seller at the Ruiru *matatu* terminus.

Box 3.1: 2022 milk shortage in Kenya as a result of a prolonged dry period.

2022 Milk shortage in Kenya as a result of a prolonged dry period

In March and April 2022 at the time of finalising this report, there was a shortage of milk in supermarkets and other retail outlets. The standard newspaper reported that the shortage was attributed to a prolonged dry period that had affected the availability of pasture, an increase in the price of processed feeds and poor feeding consequently lowering milk production. Mr Tom Nyagechaga, representative of the Kenya National Federation of Farmers (KENAFF) and chairman of the Kitale New KCC factory indicated that the milk delivered to the factory had dropped by 50 per cent. He added that the milk vendors had increased the price of milk in Kitale from Ksh. 40 to Ksh. 70. The price of processed packet milk had also risen by Ksh 5-10 shillings (Osinde & Mbentwe, 2022).

The KDB indicated that the milk production had dropped by 15 per cent and attributed the reduction to insufficient rains during the October – December short rains season and a drought that was being experienced in over 23 counties in Kenya (Ngotho, 2022; Osinde & Mbentwe, 2022). *"Our dairy sector depends on the October-December short rains which sustains the sector during the dry months of January to March. However, last year, there was depressed rains, hence the low production,"* Managing Director Kenya Dairy Board Margaret Kibogy (Ngotho, 2022)

Source: (Ngotho, 2022; Osinde & Mbentwe, 2022).

Frequency of mobility

The mobility patterns from production to distribution portray some semblance of repetitiveness, routine, habits and frequency. The farmers have a predictable pattern of movement that is determined by the number of cows a farmer has, means of transport used and also the commitments they have with various suppliers or service providers such as picking of *machicha* at the EABL headquarters or delivery of milk to the milk collection centres. Contractual obligations like buying *machicha*, and milk delivery to the milk companies or milk vendors are given priority when planning the commutes. The trip to get *machicha* is ‘contractual’ in such a way that registered farmers have to get *machicha* on the days allocated to them contrary to which their registration could be revoked and allocated to another farmer. Therefore the farmers ensure that they do not miss the trip to get the *machicha*. The other trips to get other sources of feeds are periodic, but they do not have a specific day when a farmer should undertake the trip. Milk collection is also very specific, occurring two times a day, from 0500 Hrs to 0900 Hrs in

the morning and 1400Hrs to 1900 Hrs in the afternoon for those delivering milk to Githunguri Dairy FCS Ltd. Delay in milk delivery results in losses, therefore farmers carefully plan their time to ensure that delivery of milk to the collection centre is always on time. Farmers additionally rely on farm labourers to ensure that while they are away their cows are taken care of. The collection and distribution of raw milk also follow certain routines and frequencies of the various activities involved. For instance, the sale of raw milk by the vendors to the restaurants, milk parlours and customers residing in towns occurs daily – in the morning or evening.

The frequency of the trips depends on the cycle of payment of the milk, such that at the end of the month when farmers are paid for their milk, there is increased commuting as farmers use the money to buy stock for the upcoming month. “*At the end of the month, people carry feeds from the milk collection centres in bulk.*” Indicated 76 years old Mr. Maina from Ha Donga, Githunguri. The frequency of the trips and activities can be daily, alternative days, weekly, fortnight, monthly, or yearly. The means of transport that farmers use also dictate the number of trips they make. Non-motorised means of transport that cannot carry heavy quantities like walking, the use of wheelbarrows or bicycles necessitate more frequent trips compared to using lorries or pickups.

56 years old Mr. Wachira resides in Ruiru town but has a dairy farm in Riuki, Githunguri about 20 kilometres away (see Map 4.3 and box 4.4)). He uses his double cabin pickup vehicle to get animal feeds for his seven cows and three calves. He mainly relies on cut grass near the coffee plantations in Ruiru, napier grass on his one-acre piece of land, commercial feeds and *machicha* to feed his cows. He used to make a trip to EABL, Ruaraka every week to get *machicha* before it was decentralised, and was also making a trip every two weeks to get processed feeds in Kiambu town. Mr. Wachira was additionally getting cut grass from Tatu City in Ruiru every week. While the location of where he gets the feeds may change with seasons, he maintains a frequency of travel to source the various feeds at least weekly. Mr. Karanu a 37 years old farmer from Githunguri town was making a trip to Githunguri town, one kilometre away from his farm with his pickup van every week to buy hay for his cows at the time of the interview on 07 February 2019. He relied on 7-14 bales of hay per week to supplement the fodder he was getting from his three quarter acre piece of land to feed his 20 cows, with the frequency of trips changing with the season. During these trips he also bought processed feeds.

The weekly routine for 76 years old Mr. Kuria a farmer from Githurai, Ruiru town was as follows: on Monday, Wednesday, Thursday, Saturday and occasionally on Sunday he went to Githurai market to get vegetable waste. He additionally travelled to Ruaraka, Nairobi every week

on Monday to get machicha and also occasionally went to see a mechanic for routine maintenance of his vehicle. He occasionally went to his farm in Murera, Ruiru to get napier grass.

3.5 Summary

The drivers of mobility along the Ruiru to Uplands transect are driven by the decreasing parcels of land that necessitate mobility in search of animal feeds for the dairy cows. Additionally, commercial dairy farming requires farmers to keep at least six cows (TechnoServe Kenya, 2008). Consequently, the larger the herd the more fodder that is required, necessitating mobility. Further, the type of dairy farming along the transect is zero-grazing where the animals are enclosed. Zero-grazing is an indication of intensive dairy farming. Commercial agriculture requires more farm inputs which cannot be sustained by the small parcels of land. Further, the presence of milk processing factories increase the demand for raw milk, thus increasing its flow from the farmers to the factories and consequently from the factories to the consumers. Lastly, the perishability of milk is a key determinant of how it moves especially when it is in its raw form. Milk vendors have to ferry the milk to the urban centres within approximately six hours after milking to avoid spoilage. They also have to ferry the milk during the cooler times of the day like early morning or in the evening so that they can maintain the milk in a good state. The shift towards commercial agriculture from subsistence agriculture drives mobility.

The directions of movement by the farmers are towards where service providers are and to locations where farm inputs are available. Service providers travel to where the services are needed in the case of veterinary and artificial insemination services. The farm inputs and service providers are located in the urban centres and a few in the village centres. The direction of the raw milk is towards the urban centres for processing and processed milk towards other towns. As a result of this mobility, village centres, market centres and towns emerge as the focal points as farmers commute there to source farm inputs and services, and sell their produce including raw milk. The services and farm inputs also disperse or flow from the centres to the rural areas. It is notable that the access and availability of sufficient supply of farm inputs at the nearest location to farmers reduces the need to travel over longer distances and consequently reduces the cost of production. This was evident in the decentralisation of the sale of *machicha* from EABL headquarters in Ruaraka, Nairobi to over 15 outlets in Kiambu County that made the product more accessible. The presence of appointed distributors of animal feeds processing companies and setting up of depots by some of the companies in Githunguri towns also reduces the cost of feeds and makes them more accessible to farmers through various means of transport.

The direction of movement by the farmers is dynamic depending on the season and areas where fodder is available. Farmers travel further during the dry season when fodder is in less quantity in their neighbourhood, and have to source it from other locations. The price of fodder during the dry season rises, while milk production decreases due to poor nutrition, limited fodder availability and the high cost of production. The seasonal fluctuation of animal feeds prices exposes farmers to higher production costs during the dry season. A solution to reducing this vulnerability that was identified during the study is producing, preserving and transporting fodder in large quantities. The findings are consistent with previous studies that have shown that the quality of feeding during the dry season is poorer compared to the rainy season (Auma et al., 2018; Njogu, 2017, Nyaata et al., 2000; Omore et al., 1999). Additionally as indicated in previous research findings the price of milk sold by the retailers and vendors also increases, but rarely translates to an increase in the farm gate prices (Tegemeo Institute, 2021).

Due to the perishable nature of milk, the product needs to be moved over shorter distances. Fodder is also perishable and needs to be transported over short distances. However, with the intervention of technology, milk and fodder can be transported over longer distances. Through jacketed tankers, milk processing companies like Brookside Dairy Ltd, Uplands PD&F Ltd and Canaan Factories Ltd transport cooled milk over long distances to their factories without compromising the quality. Further through pasteurisation technology, milk can be transported and sold to distant locations. Distance travelled correlates to the length of the value chain. Longer value chains involve longer distances and vice versa. This relates to a finding by Mbonile (2017) on the flow of goods along the Mbeya Highlands in Tanzania. She concluded that manufactured goods travelled over a distance of about 1,000 kilometres as compared to the short distance of 6-10 kilometres for the sale of farm crops.

To reduce the transportation costs, there is a limit to the distance that a farmer can travel in sourcing animal feeds while maintaining profitability because unlike retail traders and processors, the transportation costs incurred by farmers are not transferrable to the milk processors since they have no much control and negotiating power in the variations of the pricing of milk. Commuting beyond this 'viable' distance would lead to losses. The 'viable' travel distance to and from small and intermediate towns creates a functional area of a town and its catchment area and target population.

In addition, the distance that farmers are able to travel is dependent on the type and quality of the means of transport they own, and the availability of cheap, quality farm inputs and services in a particular town. Farmers and milk processors can travel over longer distances when they have higher capacity means of transport like pickups, lorries and trailer trucks because of the

economies of scale, or where they are assured of getting quality raw materials or inputs compared to what is available in their locality. The retailers of farm inputs and service providers also have a limit to the distance which they can travel, and transfer the transportation expenses to their customers while remaining competitive, therefore creating their functional area of operation within the radius of the town or market centres where they operate.

The role played by the milk processing cooperatives is notable as identified from the findings. The collapse of four milk cooperatives operating in Lari sub-county shows the implication of the vacuum created by their absence including losses to farmers as a result of milk that was returned having not been sold, cash flow issues and exploitation of the farmers by the milk vendors. This is a contrast of the situation in Githunguri sub-county where the Githunguri Dairy FCS Ltd has established an efficient system of collection, processing, marketing and distribution of milk, and in addition has established a support system by providing farmers with loans, farm inputs, training, AI services and even household goods. The milk processing cooperatives and private milk processing companies in the case of Uplands PD&F Ltd that filled the vacuum created by the collapse of the dairy cooperatives in Lari as a result of mismanagement make the dairy value chain more efficient by providing the necessary linkages from the production to the distribution of milk.

4 Barriers and adaptations to mobility along the milk value chain

This section answers the question: how fast does a person or thing move? The section focuses on the character and the mechanics of movement. While infrastructure has a major influence on the character of mobility, the research found out that there were additional factors and determinants that affect the nature of mobility as outlined in the section below. (UN-Habitat, 2013, p. 107) emphasises that even with the existence of road infrastructure, there could be barriers to mobility:

“Investments in urban transport infrastructure does little to alleviate the mobility difficulties of the urban poor or other vulnerable and disadvantaged groups if the services provided are unaffordable or physically inaccessible. Such barriers contribute to socio-spatial inequities in urban areas, including discrimination against vulnerable and disadvantaged groups. These barriers are not only fiscal or technical in nature, but arise from political, social and institutional factors that prevent progress towards socially sustainable urban mobility systems.”

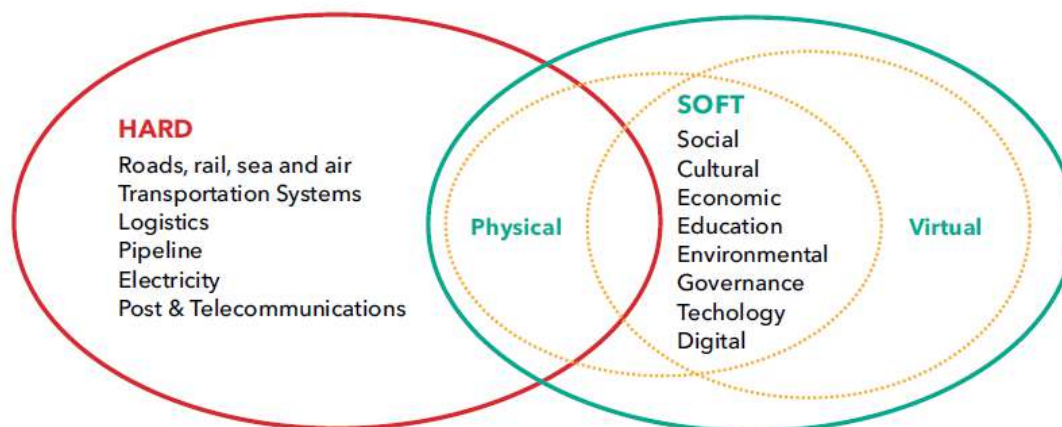
The nature of the journey from point A to point B depends on a range of factors and experiences in the course of the journey. In this section, these experiences are categorised into two main groups, those enabling the movement which have been referred to as enablers, and those inhibiting or slowing down the movement referred to as barriers.

These barriers and adaptations of mobility constitute the *“hard and soft connectivity and network infrastructure.”* While the hard elements are physical in nature, the soft elements are mainly virtual *“intangible capital, ideas, information, data, and knowledge exchanges between governments, business, and individuals”* (Cities Alliance, 2019, p. 42) (see Figure 4.1). Soft elements are supported by ICT and other technological infrastructure, and the integration of hard and soft infrastructure through sensory technology and ICT leads to the development of smart infrastructure (Lindfield & Roberts, 2021). Simpson (2021, p. 68) broadens the ‘soft’ elements of infrastructure to encompass issues of governance, standards and regulations, and emphasises the importance of the integration of the hard and soft elements of connectivity:

“Efficiency in transportation and logistics networks depends on the effective combination of ‘software’ (governance, regulation, standards and pricing) and physical assets (scale, quality and technical integration) to make the networks operate and reduce the transaction costs of the transport function”

Road infrastructure, technology and topography constitute the hard elements, while affordability, gender, solidarity, choices, preferences, institutional, and regulatory frameworks constitute the soft elements.

Figure 4.1: Interrelationship between hard and soft connectivity and network infrastructure.



Source: (Cities Alliance, 2019, p. 42)

The barriers to mobility affect the efficiency of how users are able to move and carry on with their daily activities while the enablers of mobility are the adaptations and the actions that the actors undertake to overcome these barriers. While the enablers serve the purpose of strengthening the links between urban and rural areas, barriers and movement act as the ‘de-links’ of the urban-rural interactions, and further aggravate urban-rural linkages. The section additionally discusses the effects, losses and costs of these barriers to mobility, and their implications on rural-urban connections.

PART ONE: Barriers to mobility along the milk value chain

This section discusses the barriers that impede mobility along the Ruiru – Uplands transect with a focus on their effects on the milk value chain. The section categorises the barriers to mobility into three main categories: the spatial barriers, the socio-economic barriers and the political barriers.

4.1 Spatial barriers

Poor road infrastructure

Roads can qualify to be either an enabler or barrier of mobility depending on their quality. Accessibility especially in rural areas in Africa is a challenge that is imposed by various barriers that inhibit movement from point A to B. While some of the primary connecting roads have tarmac and some secondary roads are of murram making them motorable in all seasons, most

of the connecting roads are impassable, especially during the rainy season. The poor road conditions reduce the accessibility and the efficiency in the flow of resources, farm inputs and services between rural and urban areas. This neglect of the interior roads makes mobility a challenge along the transect. *“Connecting roads are very bad. Only the main roads are good. I have to drive slowly when delivering milk to my milk ATMs in Githunguri and Kiambu to avoid spillage”* noted Mr. Ndirangu, a 54 years old farmer and cottage milk processor from Ngochi, Githunguri.

Before the beginning of the rehabilitation of the Ruiru to Uplands in 2018, the state of the road was such that vehicles avoided the main carriage way and passed on the murrum road shoulders to avoid the huge pot holes that existed in between the remaining patches of tarmac. The pot holes slowed the vehicle’s movement as one navigated into and out of them at a speed of 10-20 kilometres/ hour which made the journey long and tiring. In this case the dilapidated condition of the road made the time measure of that particular section of the road longer. The road was additionally dusty during the dry season and muddy during the rainy season. The deputy president, Willian Ruto in describing his journey along the Githunguri Kagwe Kimende road that was in a similar state which he used on his way to Wandemi Catholic Church in Kagwe village centre, Lari sub-county for a public event during which he promised to rehabilitate the two roads described it as follows:

“When I was coming, I felt your pain. I remembered a story in the Bible. Is the journey to Heaven simple or tough? The journey from Kimende to this place is almost like that,” (Mugo, 2016)

The chairman of the Ginyali Sacco indicated that the section of the Ruiru to Uplands road at Gititha was such that the *matatus* were dropping passengers there to avoid getting stuck. The passengers would then walk along the muddy section to pick *matatus* at the other section of the road (see Figure 5.2).

The effect of mobility as a result of poor road conditions depends on the kind of commute, the distance to be travelled and the means of transport used. Short commutes that require non-motorised transport like taking the milk to the collection centre are not viewed as problematic because the farmers can wear gumboots when the roads are muddy as compared to those using vehicles and motorbikes that would get stuck in the mud. The distances to the collection centres are short, about one-kilometre radius, making the task of commuting in this case less rigorous. *“Roads are not so bad because the centre where we take milk is nearby - 10 mins walk.”* Indicated Mr. Kagwe a 47 years old *machicha* transporter and farmer from Miguta, Githunguri.

The poor quality of the Ruiru to Uplands road before rehabilitation affected mobility in the area. An interview with the farmers revealed that, they avoided the road because of its dilapidated status. Farmers going to Ruaraka area to collect *machicha* from EABL often had to take a longer route to avoid this section of the road. In an interview with Mr. Wachira a 56 years old farmer from Riuki, Githunguri on 31 January 2019, he stated that he was using the Kirigiti - Kiambu road to get *machicha* in Ruaraka which was longer but more motorable. He indicated that he could shorten the distance through Ruturu road if it was rehabilitated. In another interview with him on 12 June 2021 when the Ruiru – Uplands road was tarmacked up to Kwamaiko, he indicated that he had reverted to using the road. He also indicated that he was also using Ruturu road because it was tarmacked. “*Routes change depending on the condition of the road.*” He indicated. The farmer has to make a rational choice either of using more fuel to travel a longer distance versus incurring higher maintenance costs as a result of using a dilapidated section of the road. The heavy loads that the farmers carry makes them take a longer time to pass through a rough road than through tarmacked roads. Rough roads additionally results in the vehicles breaking down and higher maintenance costs. On 12 November 2021 Mr. Wachira indicated that as a result of the rehabilitation of the roads leading to his farm in Riuki, he uses less money on vehicle maintenance. “*I save on repairs because of the good condition of the road. I have not done repairs for a long time. The Riuki – Ikinu is good with murram. Previously I was going at a loss. I was frequently changing the bushes.*” The bushes are usually rubber washers that are fitted in the vehicles’ suspension system to reduce the movement and noise at the joints while driving through bumpy and rough roads (Popely, 2016). Driving along rough roads makes them to wear out quickly necessitating frequent replacement.

“*I stopped using the Tatu [Ng’enda] road because the section at the bridge inside the farm is in bad condition, and that section of the road is rough.*” Mr. Maina, 76 years old farmer from Ha Ndonga, Githunguri pointed out during an interview on 02 February 2019. Like Mr. Wachira he was using the Kirigiti – Kiambu road which was longer. He indicated that if the Ruiru – Githunguri road was in good condition, he could use it because it was shorter. This was indeed the case after the road was rehabilitated up to Kwamaiko, as revealed in a later interview with him on 10 February 2021. “*There are several routes I can use to get machicha- I prefer the road that is tarmacked.*” Mr. Maina indicated. Mr. Kagwe a 47 years old farmer and transporter of *machicha* indicated that “*roads play a big role in mobility. Dilapidated roads lead to damage of the vehicles.*” When he transports *machicha* to a farmer, the condition of the connecting roads determine the price which he charges them.

The roads adjoining the Ruiru to Uplands road were also in a bad condition. This included the Githunguri to Kagwe to Kimende road where the Uplands PD&F Ltd is located which at the

beginning of the research in 2017 was in a dilapidated condition before it was rehabilitated between 2018 and 2020. 38 years old Mr. Kagema the extension manager of the Uplands PD&F Ltd in charge of the collection of milk indicated that as a result of the poor road network, lorries would get stuck especially during the rainy season leading to spoilage of milk. He also revealed that the roads are dusty during the dry season – which is also not a good hygiene condition for the milk. 35 years old Mr. Kinuthia, the logistics manager at Uplands PD&F Ltd reiterated the views of his colleague that the poor condition of roads adjacent to the factory makes it difficult to collect and distribute milk:

“The vector is not as straight. Some routes are impassable. The poor infrastructure not only affects the area adjacent to the factory, but also the areas surrounding the depots where the company stores milk for distribution in major towns. The roads connecting to those towns are sometimes in bad condition for example in Kisii and Lodwar. In Kisii, a vehicle got stuck for three days and we had to get a rescue. In Narok, while the company’s trucks’ were on the way to Posmoru for delivery of milk, they encountered a damaged bridge, and it took the truck four days to make it back to the factory.”

The proprietor of the Uplands PD&F Ltd indicated that the *“access road to the factory is through a difficult terrain and a neglected road whose tarmac has worn off almost completely.”* By referring to the road as being neglected, the businessman insinuated that the responsible actors had not made steps to rehabilitate the road. The description of the state of roads as being ‘difficult’ is reiterated by the directors of GIKAKI Sacco who also use the Githunguri – Kagwe road: *“the road is problematic and in a bad condition – it is a difficult road. A journey of less than 40 minutes takes one hour and twenty minutes from Kagwe – Ruiru.”* As a result of the poor conditions of the road, only older vehicles exist with newer vehicles choosing other routes. NAGIRU Sacco operating between Ruiru – Githunguri reiterated that due to the bad condition of the Ruiru to Uplands road, customers had changed the routes they use to get to Ruiru town. The customers opted to travel over a longer distance but over a shorter time to avoid delays. They were of the view that when the road is rehabilitated, the volume of traffic would increase. During a strike in Nyambari village centre on 09 May 2016 by more than 200 members of Ginyali *matatu* who provide services between Githunguri town– Uplands/ Nyambari centre – Limuru town, protested against the condition of the Ruiru to Uplands road, with the members of the Sacco lamenting that the poor condition of the road had increased their cost of repairs, frequent vehicle breakdowns and also discouraged investors from the centre (Kiai, 2016).

The condition of the road also affects service delivery. 55 years old Mr. Mwaura a veterinary doctor based in Githunguri town whose company makes 30-40 AI and clinical visits per day, complained about the state of the roads. At some locations, he is usually forced to park the car at a distance and walk to the customers' farms because the paths are too narrow for the vehicle to access. *"Roads get to the end and I have to walk to the farm."* A community health worker, Mumbi wa Leah from Kambaa village indicated that cases of home deliveries were being reported because the pregnant mothers could not make it to the hospital or health centres due to the condition of the road especially during the rainy season (Mugo, 2016).

The milk vendors also indicated that their mobility was affected by the quality of the roads. Mr. Waiganjo a 55 years old milk vendor from Kiganjo, Gatundu South carries a heavy load of about 200 litres on his motorbike. With this amount of weight and on a rough road, the danger of falling can be high. He added that during the rainy season has to make two trips because of the poor state of the road which makes him spend double the amount of fuel he uses during other trips.

"Roads are not good. Someone can fall when driving the motorbike with milk. I have fallen once. During the rainy season the likelihood of falling is higher. The motorbike could also get a puncture during the dry season, and if this happens to the front wheel one is likely to fall." Mr. Waiganjo a 55 years old milk vendor from Kiganjo, Gatundu South.

The cost of poor infrastructure translates to an increase in costs of production or of doing business. Infrastructure should be resilient to seasonal weather conditions - the seasonal fluctuation of mobility affects the farmers. Earth roads are the most affected, thus the need for their rehabilitation and transformation to all-weather roads with at least a murrum or gravel surface to ensure good mobility throughout the year.

"It is worse when it rains and our motorcycles break down from time to time and we spend a lot of money repairing them... A short distance that normally takes you 15 minutes ends up consuming 45 minutes when it rains" Sospeter Muriithi, a boda boda operator" (Karume, 2017).

Poor road conditions can completely delink a village or town from other areas by cutting off the connectivity between them. This was the case at the Kirenga to Kimende road near Lari Boys High School (Kanyora junction) in Lari constituency where the rains created a deep pothole that completely disconnected the road. In Figure 4.2 a lorry transporting goods along the road

had to offload the goods from one side of the road for them to be ferried by non-motorised means due to the deep pothole.

Figure 4.2: Dilapidated section along Kimende – Kirenga road in Lari sub-county.



Source: Facebook, 2020.

The poor condition of the Ruiru – Uplands road before its rehabilitation led to fewer commuters along the route, as they opted for more reliable routes. The scarce customers lead to poor returns in the *matatu* business that eventually leads to *matatus* deserting the Ruiru to Uplands route for more profitable routes, leaving older vehicles, aggravating the situation further and causing more delays in travel and desertion of some towns and village centres. The deserted towns become dormant as customers decrease and businesses close down. These towns do not attract business because of few customers and poor accessibility. The dilapidated roads lead to a process of cumulative causation that affects other sectors of the rural economy. According to Mr. Nyaga a 38 years old manager at Canaan Factories Ltd located in Uplands village centre, the company outsources mechanics and stainless steel welders from Nairobi despite these services being available in Githunguri town which is closer. They prefer getting the services from Nairobi because of the poor road connection between Githunguri and Uplands leading to the loss of potential customers who could have visited Githunguri town. Poor road infrastructure

makes Uplands village centre to re-orient itself to other centres for provision of goods and services, cutting the rural-urban links with Githunguri town. Mr. Wachira 56 year old farmer from Riuki, Githunguri indicated that as a result of the rehabilitation of the Riuki to Ikinu road that passes along his farm, *matatus* that had previously deserted the route were now returning. This is illustrated in the vicious cycle of ‘broken’ infrastructure below:

Figure 4.3: The vicious cycle of ‘broken’ infrastructure.



Source: Author.

Difficult terrain conditions

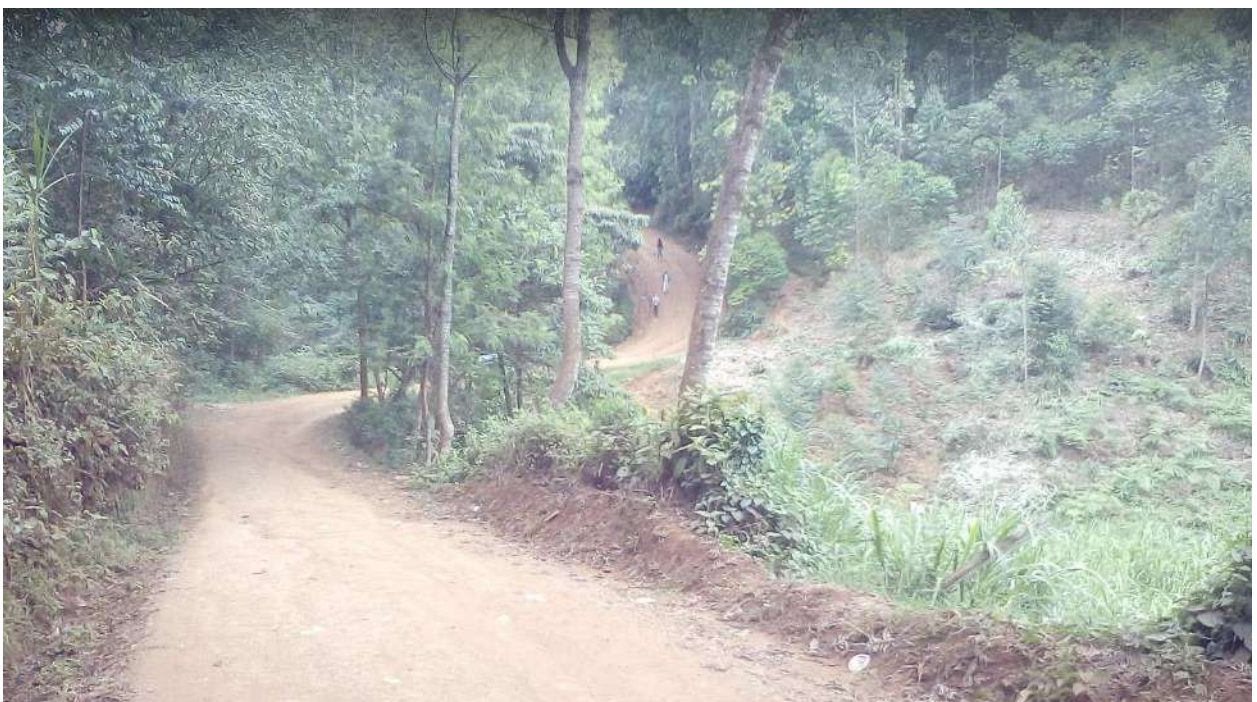
The Ruiru – Uplands transect runs along the slopes of the Aberdare mountain range that is characterised by topographical features in the form of V-shaped ridges and rivers. Most roads run parallel to the ridges, usually at the top part of the ridge, and where they have to run across the ridges, their construction necessitates cutting a wedge on the valley to create a motorable slope through which vehicles are able to navigate. It also necessitates the construction of bridges, raising the cost of construction. There is also the existence of meandering roads that cut across the valleys, sometimes with steep ascents and descents. Earth roads at these sections are difficult to navigate especially during the rainy season, and some of the widths of these roads are additionally not adequate enough to allow two vehicles to pass each other. Where there are no motorable roads, commuters have to use footpaths to walk along the steep slopes, cross rivers through makeshift wooden bridges, which is exhausting. During the rainy season, the paths are slippery and could lead to falls. This is the experience that the milk vendors have to go through when getting milk from the farmers.

“You get tired collecting the milk. I collect the milk from the road along my home and I have to cross the next ridge. After I place the milk in strategic locations, the boda boda has to go around the road to pick the milk.” 55 years old mama Wambui, a milk vendor from Kigumo.

42 years old Mr. Wanyoike a milk vendor from Kiganjo, Gatundu South indicated that:

“I have to go round the ridges to collect the milk, passing through the narrow road networks along the villages often leads to a dead end at the end of the ridge. Some parts of these roads are in bad condition, and some are accessible only through narrow foot paths in the village.”

Figure 4.4: A road connecting Githunguri to Ngochi cutting through a ridge.



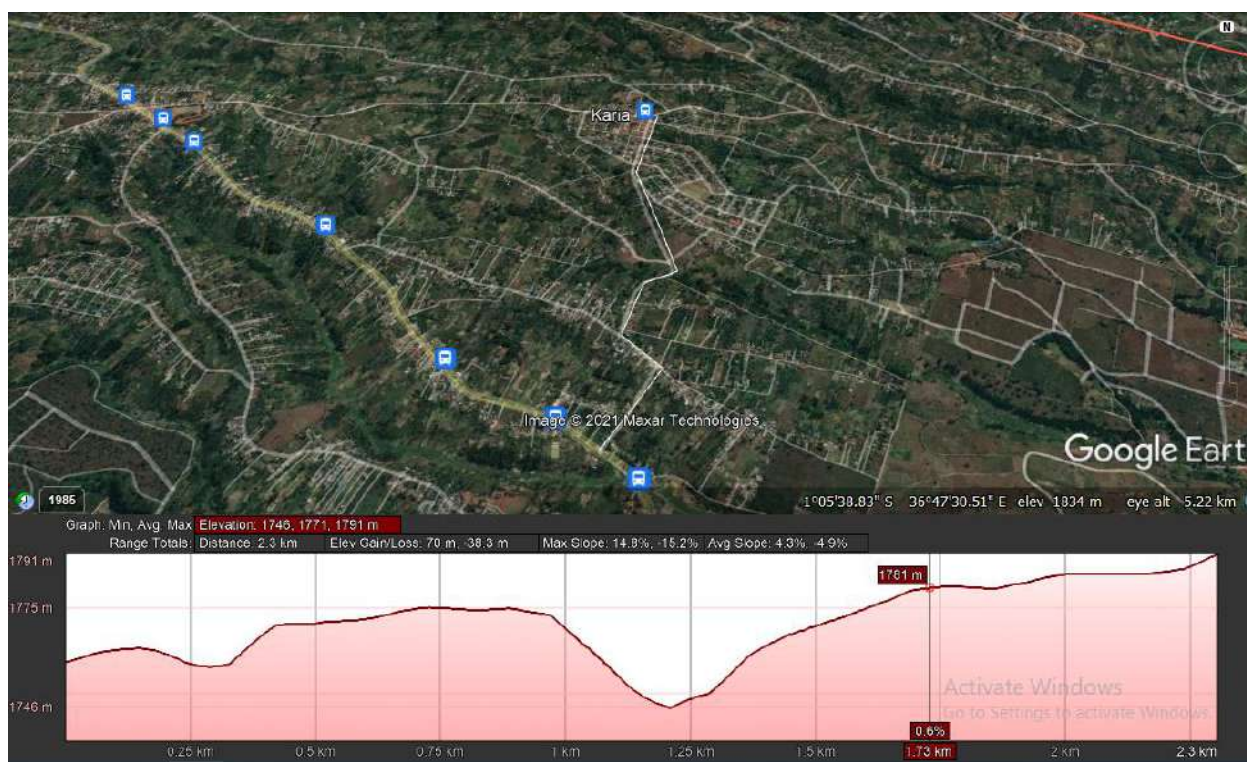
Source: Google maps/ Kawa John Misiko.

Figure 4.4 shows the earth road that connects Ngochi village centre which 54 year old Mr. Ndirangu who has a farm and a cottage milk processing industry uses everyday to take the processed milk to Githunguri and Kiambu town where he operates milk ATMs. During the rainy season, it is not possible to use this section of the road, and he has to take a longer route that adds an extra two kilometres which increases the cost (see Map 3.11).

During the course of the fieldwork, I experienced such a terrain while accompanying Mr. Wachira a 56 year old farmer from Riuki, Githunguri when he took a short cut between Maigotha along Kiambu road and Karia village centre (see Map 4.1). This particular road had a mix of earth and gravel surface, but it was motorable because we used it during the dry season.

However, due to the steep valleys, he had to engage a strong gear to manoeuvre uphill. It would have been risky meeting a vehicle going downhill while accelerating up the valley because the road was narrow only allowing one vehicle to pass. Luckily the road had few vehicles and we did not encounter any oncoming vehicle along the way. The passers-by had even to squeeze themselves by the hedges of the farms along the road to allow the vehicle to pass. We gave a lift to a lady we met along the way because there are no *matatus* along the earth roads. Mr. Wachira indicated that he gives lifts to pedestrians he meets due to the challenges of mobility along such roads.

Map 4.1: Cross-section of Maigotha along Kiambu road and Karia village centre



Source: Google maps, 2021.

The difficult terrain conditions were also indicated by the milk processors. Mr. Kagema a 38 years old manager at the Uplands PD&F Ltd indicated that the hilly terrain limits the amount of milk that the lorries collecting milk can carry due to spillage and to avoid heavy loads. Therefore the vehicles are not utilized to capacity raising transportation costs. The chairman of the company indicated that the access road to the factory is through “*a difficult terrain.*” The term “difficult” is an indication of the extent to which the topography of the area affected the company’s transport logistics.

The steep topography is also a cause of *ituika* / landslides and erosion during the rainy season on the upper part of the transect in Lari sub-county. The landslides involve a sudden movement of the water-logged soil downslope and occurs mainly after heavy rains and have been a cause

of displacement, death and damage to infrastructure including road and rail network. In describing the state of the rail infrastructure in the 1950s in Lari, Anderson & Anderson (2005) indicated that:

“In the rainy seasons there was plenty of work of this kind, landslides being common along the precipitous incline of the escarpment, keeping the engineers and their labour gangs busy.” (Anderson & Anderson, 2005, p. 121)

In May 2020 as a result of heavy rains, 50 families in Matathia, Bathi, Magina and sections of Gitithia villages Lari were displaced by landslides. The road connecting Kimende and Escarpment village was also disconnected as a result of the mudslide *“making it impossible for pedestrians, motorists and motorcyclists to pass”* (Mugo, 2020). Figure 4.28 shows residents of Machani village in Lari clearing mud from a section of a road that was affected by a mudslide cutting connectivity.

Non-reliability

Non-reliability is an outcome of barriers to mobility that arises because a commuter or motorist is not able to efficiently meet the expectations of the commute especially in terms of time as a result of existing barriers. Non-reliability reduces the assurance of executing the commute within a certain time or even the possibility of not being able to complete the journey. The *matatus* are the most affected by unpredictable journeys because their journeys are not executed within specified timelines, a phenomenon that was prevalent before the rehabilitation of the Ruiru to Uplands road. Mr. Maina a farmer indicated that one has to stay at the Ha Donga *matatu* stop for an undefined time when using the route because of few *matatus* plying that route.²¹

“The matatu that arrives at the stop may be filled to capacity at times, and may not carry the passenger. The driver could also decide to carry excess passengers. The commuter has to then wait for another one for even over 20 minutes, and when it eventually arrives, it could stay at that particular matatu stop until the next matatu arrives, after which it continues with the journey slowly, sometimes reversing or diverting from the main route to go pick up and search for customers causing further delays.” 76 years old Mr. Maina, Ha Donga, Githunguri.

²¹ As discussed previously the few *matatus* are occasioned by the poor condition of the road that has led to *matatu* operators withdrawing their vehicles from the Ruiru to Githunguri route due to high maintenance costs, and relocating them to other routes that have better road conditions.

During the construction of the road there was an additional risk of the *matatus* getting stuck in the muddy sections of the road. He described the nature of the commute along the route as “*problematic*.” A frequent commuter along the Ruiru-Githunguri route Mrs. Kinuthia who resided in Kahawa West (10 kilometres from Ruiru town) who was working as the principal of Kanjai secondary school along the Ruiru to Uplands road indicated that the journey from Ruiru to Kanjai where the school is located was supposed to take about 40 minutes to one hour, but it could take two hours. She indicated that the *matatus* took a long time in Kwamaiko/ Ngewa market centre as they waited for customers leading to delays – the *matatus* did not depart from this stop until they filled up. She further indicated that the *matatus* were old and the duration between the *matatus* was long, and the road dusty.

The nature of the roads also affects milk collection, with the lorries collecting the milk getting delayed especially during the rainy season as a result of becoming stuck in the mud or having to use alternative routes to avoid the ‘difficult’ sections. The lorries could also develop mechanical problems along the way. The resultant effect of this delay is that the farmers have to wait in the cold at night, sometimes when it is raining. The reliability of the farmers’ pickups is also not predictable. The farmers prefer to use the vehicles for short journeys to avoid mechanical challenges while in distant locations. A dairy farmer and mechanic who lives in Miguta, Githunguri and operates a garage in Ruiru town, 52 years old Mr. Nderitu indicated that he has on several occasions been called by farmers to repair their vehicles when they stalled along the way.

The milk vendors are also affected by the unreliability of the *matatus*. Mr. Wanyoike, a 42 year old milk vendor from Kiganjo, Gatundu South described how he uses a *matatu* to ferry milk to Ruiru town from Kigumo. He first picks the milk from the farmers at agreed collection points, then he drops the milk at various sections along the main road and then instructs a *matatu* to pick him up and collect the milk along the way. He prefers to use a specific *matatu* which knows the points where he strategically places the milk. If he uses another *matatu*, he has to make calls to the driver to inform him/her where he has placed the milk. During an interview with him on 03 June 2019, the *matatu* had left him because it could not locate the place where it was supposed to pick him up, although it had already collected some of the milk. He was able to trace the *matatu* later in Ruiru town upon arrival. He also indicated that sometimes the *matatus* are late, or they get stuck in mud along the road delaying his journey. The vendor uses his motorbike to transport the milk to Ruiru on Sunday because *matatus* are few during the weekend. He indicated that does not use motorbike often because of the chilly, rainy and windy weather in the mornings, as well as the strict requirements by the KDB to transport milk using metallic containers. Another milk vendor, 50 years old mama Wangechi from Kigumo,

Githunguri indicated that: *“The journey is not predictable. I may get late in the morning or the matatu may be late”*. 55 years old mama Wambui, a milk vendor from Kigumo indicated that *“sometimes the matatu could develop mechanical problems along the way or get late. During the rainy season, the motorbike could also have mechanical issues when they are rained on.”* 50 years old mama Wanjira from Nembu indicated that the challenge she had when using the *matatus* was that sometimes they are full and had no space for her, or at times she is not carried because of the bulkiness of the milk luggage. On that particular day of the interview, she said that *“Today I arrived at 1000 Hrs because students were going home for mid-term and there were few matatus.”*²²

4.2 Socio-economic barriers

Affordability

Affordability is a critical component in achieving sustainable transportation. SDG 9 seeks to *“build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.”* with target 9.1 aiming at developing *“quality, reliable, sustainable and resilient infrastructure...with a focus on affordable and equitable access for all”* (UN Desa, 2016). Additionally, affordability is integral in creating inclusivity and sustainable mobility. Investment in good road infrastructure in itself does not solve the challenges of mobility. Barriers to mobility including affordability determine how those roads are put into use by the intended populations. The poor may not be able to effectively utilise good roads (UN-Habitat, 2013). Affordability includes the ability to own a certain type of a means of transport, which varies depending on the individual’s financial strength. Farmers have acquired and modified various means of transport to enable them to travel the longest possible distance and carry the largest possible weight.

In the previous sections, an analysis of the distance through which various means of transport can move was shown. While non-motorised transport offers the cheapest means of transport, it entails the use of human energy. As a result, if a farmer can only afford a non-motorized means of transportation, the amount of load they can carry and the distance they can go in search of animal feeds is limited. Farmers who are not able to travel over longer distances, have to rely on middlemen to source farm inputs at a higher cost. The other option that the farmers have is to hire transport services. *“Without a car, dairy farming is difficult....without a car (pick up) I cannot keep cows.”* Indicated Mr. Wachira a 56 years old farmer from Riuki, Githunguri;

²² During school closures the *matatus* focus on carrying students who hire them to be taken to various destinations as a group

emphasising on the necessity of having a pickup as a dairy farmer. This illustrates car dependency in dairy farming such that *“it is becoming increasingly difficult for carless people to enjoy the same range of choices and aspirations as their more mobile compatriots”* (Cahill, 2010, p. 9). The farmers who cannot afford the various means of transport are excluded from effectively engaging in profitable dairy farming. Further, the higher the number of cows a farmer keeps the higher the returns they are able to get; benefiting from the economies of scale. Keeping such a number of cattle necessitates movement in search of animal feeds using a reliable and cheap means of transportation.

Motorised transport relies on fossil fuels which have been fluctuating, with the highest cost of petrol in the last 10 years taking place on 14 September 2021 (Hebling, 2021). The high cost of fuel is one of the factors that raise transportation costs. Other factors include: poor road networks, high maintenance costs, hiring of transport, and the long distance of travel due to limited access to goods and services. These issues are discussed in this section with highlights of their effect on mobility. Owning a car and good roads are not an assurance of mobility. Mr. Nderitu a 52 years old farmer and mechanic from Miguta, Githunguri said that while he had made efforts to ensure that his car was in a good condition, and had acquired the necessary permits from the NTSA, his problem at the moment was that due to the effects of COVID-19, the revenues from his informal garage business in Ruiru town had dwindled affecting his cash flow and as a result, he could not afford fuel for his pickup to enable him to move: *“I just need fuel, the wheels of the vehicle are good, and the body good, but I cannot start the vehicle to go anywhere without fuel. Police do not disturb because the car is good.”*

Farmers complained that one of the challenges in dairy farming was the high transportation costs. *“Getting fodder is also a challenge. There is the fuel cost that increases the cost of production.”* Pointed out 52 years old Mr. Karanja, a farmer from Membley, Ruiru town. The same sentiments were echoed by Mr. Karanu 37 years old farmer from Githunguri town and 52 years old Mr Mburu a farmer from Githurai, Ruiru town. The cost of fuel additionally depends on the route that the farmer uses, such that if a farmer uses a longer route as a result of poor road conditions, the costs increases proportionally. The increase in fuel cost with distance travelled creates a limit to the distance that the farmers are able to travel in search of fodder beyond which they would make losses. 76 years old Mr. Kuria and 52 years old Mr. Mburu who are located adjacent to Githurai market in Ruiru town spend less on fuel, increasing their profits. They are also located about 10 kilometres to EABL headquarters in Ruaraka, so they save on fuel when travelling there to get *machicha*. They are also located close to the patches of grasslands near Ruiru town. However, their location in town limits the availability of napier grass or other cultivated fodder increasing their fuel cost as they commute to the rural areas in

search of the above. The rural farmers' situation is an opposite of the above, and they have to commute longer distances to get *machicha*, while they commute shorter distance to get napier grass from their farms or leased farms.

Figure 4.5: Graph showing the rising cost of fuel in Kenya.



Source: (Hebling, 2021).

Smallholder dairy farmers own a range of means of transport including: wheelbarrows, bicycles, hand carts, motorbikes, saloon vehicles, pickups, and lorries of various capacities. Each means of transport is applicable for a certain range of distance in which it can be used, and the amount of goods that it can transport. Thus in various instances, farmers may be required to hire out means of transport they do not own, which is expensive especially over long distances compared to fuelling their vehicles. Mr. Ndirangu a 54 years old farmer and small scale processor from Ngochi, Githunguri indicated that:

“One needs a vehicle to practice dairy farming. To hire is costly and with a means of transport, one can move further where the cost of animal feeds is cheaper. Even if within their neighbourhood there is no fodder, one can move further.”

He uses his pick up to get *machicha*, napier grass from a two-acre farm he acquired 2-3 kilometres away, napier grass from land that he has leased, chicken waste from Matuguta village, processed feeds from Kiambu town and grass from Tatu city. 45 years old Mr. Kang’ethe of Baraka feeds Githunguri a supplier of processed feeds and *machicha* in Githunguri noted that *“farmers have a challenge with transport,”* and most of his customers use hired

transport to get *machicha* from his outlet. He also noted that the farmers additionally preferred to hire pickups than motorbikes because the pickups can carry more *machicha* which helps them save on the number of trips. He had three customers who use donkey carts and two customers who use bicycles. Although *boda bodas* pick *machicha*, they often decline to offer the farmers transportation because of the wetness of the *machicha*. He intended to acquire a three-wheeler tuk-tuk truck with a one tonne capacity and an inclining carrier to assist farmers in the delivery of the animal feeds and *machicha*. The limitation of not owning a means of transportation with a larger capacity is that the farmers have to buy their supplies in smaller quantities. This was not possible before when *machicha* was sold from EABL headquarters in Ruaraka because farmers could only get it using pickups or lorries. With the sale of *machicha* in the decentralised locations farmers buy it in small quantities of 20-kilogram buckets and pick it with all kinds of means of transport. In this case decentralisation brings equity and cheaper access to products.

Pineapple pulp from Del Monte Limited in Thika is sold only to those with lorries, excluding farmers with all other means of transportation. The farmers buy pineapple pulp with pickups and other means of transportation from the vendors, creating middlemen and raising the cost of the feeds. Owning a means of transport is also an advantage for animal feeds suppliers. 45 years old Mr. Kang'ethe of Baraka feeds Githunguri indicated that he is able to sell to the farmers his products at wholesale prices because he sources the products – some from Uganda and Tanzania using his own trailer trucks except for molasses which he hires a tanker. *“For the product (molasses), I use hired transport. It is expensive. For the product to get at a good price, I need to buy a tanker so as to reduce the cost.”* He said in reference to hiring tankers for molasses transportation. Additionally longer distances necessitate transportation in bulk using trailer trucks which are a huge investment that only a limited number of business people can afford. Furthermore, filling the truck with commodities costs a significant amount of money, thus the ability to travel out of the country to source for feeds is limited to a few businessmen. Processed feeds retailers buy from the importers at wholesale price before selling it to the farmers.

However, in contrast the milk companies opt to hire transportation services from private vehicle owners for the collection and distribution of milk due to the logistical challenges involved. This model reduces the cost of maintenance which is transferred to the owners of the vehicles and the cost of investment in a fleet of vehicles. The owner of the hired vehicle has to ensure that milk gets to the company during milk collection and to the depots during milk distribution, although the company can intervene in case of challenges. 35 years old Mr. Kinuthia, Uplands PF&D indicated that the company hires appropriate trucks of various capacities to transport the milk to different areas. For remote areas like Lodwar the company uses heavy-duty lorries

which have bigger wheels and more powerful engines ideal for the rough terrain in those regions.

Gender limitations in mobility.

Mobility is experienced by men, women, and different age groups in varying ways. Cresswell (1999) points out that mobility is embodied differently, and women and men are perceived differently while on the move. In view of the milk value chain there are certain activities where more women or men tend to participate in. The physical activities involved in milk production are mainly carried out by men. In all the farms that were visited, it is the men who were interviewed and who were managing the dairy businesses. Additionally, the resident farm labourers were all male.²³ A similar observation was made by Farm Radio International:

“The division of roles is interesting. In most farms I have visited where both husband and wife are farmers, I find the men drifting towards dairy while women tend to prefer poultry” (Farm Radio International, 2019).

Katothya (2017) in a study on the assessment of gender participation along the milk value chain observed that whereas dairy farming offered opportunities to both men and women in improving their livelihoods, their participation in the value chain has indications of segregation that does not favour the women equally. The report observes that the participation of women along the value chain is less than that of men with more segregation occurring vertically as one progresses along the milk value chain from production to distribution.

Mr. Ngige a 50 years old farmer from Gathaiti, Githunguri indicated that in his household he is the one involved in the dairy business *“My wife takes care of other businesses.”* Mr. Ngige employs two male labourers to assist him to take care of the 19 cows that he rears. 54 years old Mr. Ndirangu a farmer and small-scale milk processor from Ngochi, Githunguri town manages the production and pasteurization of the milk while his wife sells the milk at the milk ATM in Githunguri town where she also operates a retail shop. He has one male labourer who takes care of the six cows and also assists him in the pasteurisation of the milk. He has additionally employed two female assistants at the Kiambu milk ATM that is busy because Kiambu is a larger town compared to Githunguri. Mr. Muriuki a 48 years old farmer from Kambaa, Githunguri runs the milk business, while his wife runs a clothing business. He employs one

²³ Occasionally female laborers are hired to ferry napier grass on their backs from the farms to the cattle pen, but rarely reside in the farms.

labourer to take care of his 13 cows and 4 heifers. During the field work only male farmers were interviewed, with the women more actively involved in milk vending.

It was evident how the barriers to mobility affected men and women in different ways. One key observation made was that the labourers and farmers who cut grass from the lower parts of the transect were men. The heavy and rigorous work involving the cutting and transportation of the grass with bicycles and hand carts did not attract the participation of women. 46 years old Mr. Njaramba who was usually hired by the farmers to cut for them grass along the farms adjoining the Ruiru to Uplands road indicated there were no women who cut grass along that road, but there were a few women cutting grass and selling it in sacks along the Murera and Kigumo roads. The security of women cutting grass in the lonely bushes in the coffee plantations could have discouraged them from engaging in the activity.

Another notable gender variation in mobility is the distance travelled in search for fodder. Men tend to commute longer than the women, with the latter being involved in carrying the napier grass uphill from the lower parts of the slope to the cow sheds and getting fodder that is grown from the farms leased in nearby locations while the men on the other hand travel longer distances with bicycles, motorbikes or pickup vehicles in search of fodder for the animals. While both women and men take milk to the collection centres, more men were observed at the collection centres because the labourers are mostly men. Katothya (2017, p. 45) points out that milk delivery to the milk collection centres is commonly undertaken by the youthful labourers and he indicates that the reasons why women are less involved in this activity is: “*male physical strength, [that is required] especially during rainy seasons; male ownership of motorbikes; and the fact that the delivery must be made in the early morning.*”

A few women picked *machicha* from the EABL in Ruaraka which may have arisen due to the reasons stated above, but also due to the fear of insecurity associated with night-time commutes especially for those travelling from the rural areas. The long wait for the *machicha* especially at night may also have been a challenge for the women. Additionally, the role of driving and maintenance of the old pickup vehicles is relegated to the male members of the household. Mr. Maina a 76 years old farmer from Ha Donga indicated that there were about 10 women who got *machicha* who were mainly from various locations in Nairobi. He added that there were no restrictions for women to get *machicha*, because “*the procedures were orderly and allowed women to get machicha as men would, but only the enterprising and daring women get machicha.*” The security situation in Nairobi and the rural areas differs, and areas near the city have street lights, more police patrol, more people (compared to the large sections that rural

farmers have to commute through the coffee plantations as stated above), which could create more perceptions of security among the female commuters.

It was observed that women in the dairy value chain were more involved in the retail sector, running milk parlours and vending milk. Among the milk vendors, there was a striking difference in the way the male and female vendors transported milk. It is not easy for the women to use a motorbike especially while carrying a heavy load, and no women were observed transporting milk with a motorbike or bicycle. The women preferred to transport the milk using *matatus*. The women vendors additionally complained about the strain of the work involved in the course of the milk collection and distribution activities and often sought assistance from the other family members and spouses:

“I get tired collecting the milk. I collect from the road along my home and I have to across the river to get to the next ridge. I hire a boda boda to go around the road to pick the milk which I leave along the road.” I work together with my children. My son gets across the ridge and the other son drops the jerry cans to the farmers’ homes.” 55 years old mama Wambui, a milk vendor from Kigumo, Githunguri.

The report on gender assessment along the milk value chain points out that while there is a significant number of women participating in milk vending, their participation is on a smaller scale compared to that of men, they have less access to equipment, credit, skills, information and that the women travel less distance compared to the men (Katothya, 2017). The findings of the report in regard to the limited distance travelled by women compared to men are in concurrence with this study. The report attributes their limited travel to limitations in capital and competing domestic roles in the early morning hours and in the evening. The above reasons make women less competitive as compared to men in dairy-related businesses. The report however points out that in Kiambu county where the Ruiru to Uplands transect is located, there is an emergence of business-oriented women who have been able to take advantage of the proximity to the City of Nairobi to advance their milk vending businesses. This is in concurrence with Mr. Maina’s sentiments that enterprising women were the ones who were travelling to pick *machicha* at EABL in Ruaraka, Nairobi. UN-Habitat (2013) and World Bank (2010) also note the vulnerability of disadvantaged groups in mobility. The report indicates that due to the gendered roles, the commuting patterns of women are different from that of men, especially the married women. The report further indicates that women have multi-purpose trips due to time limitations, and limited access to means of transport. *“whether in urban or peri-urban areas, women tend to make more trips, although over shorter distances, than men”* (UN-Habitat, 2013, p. 115).

Rural women wear mostly dresses or skirts, and this could limit their use of bicycles or motorbikes. Riding bicycles and motorbikes in the areas along the transect is considered to be a male activity. *Boda boda* riders were also predominantly male and no women riders were observed. Katothya (2017) similarly observed that women do not use motorbikes to transport the milk to urban centres for two reasons; first because they do not own motorbikes, and secondly because of negative stereotypes that motorbikes are not suitable for them. Although this study confirmed that some of the female vendors like 55 years old Mama Wambui and 40 years old Mama Wambugu both from Kigumo owned motorbikes, it also showed that the motorbikes were used by the male members of the households (the son in the case of Mama Wambui and husband in the case of Mama Wambugu) to collect milk from the farmers while the vendors used *matatus* to ferry the milk to the urban centres. Women riding bicycles and motorbikes would be considered as ‘*Wanja Kihii*’ or Tom boy.” The term means a woman who picks the behaviour of boys. World Bank (2010, p. 23) reports that: “*In extreme cases, cultural beliefs can prevent women from using non-motorized transport means such as bicycles as these can be considered as inappropriate and unwomanly.*” These means of transport are considered to be ridden by men, and it is not common to observe a lady riding a bicycle or motorbike.

In Gikuyu society, women with masculine tendencies have no admiration and such are referred to as wanja kahii. In spite of the fact that boys are preferred to girls, ihii, 'uncircumcised boys' are often ill-mannered and lack of manners is associated with them.(Wango, 1998, p. 129)

There also exist variations of mobility with age differences. One aged respondent 76 years old Mr. Maina from Ha Donga, Githunguri indicated that one of the reasons he travels at 0200 Hrs in the night to get *machicha* was to avoid the glare of headlights from oncoming traffic. He also prefers to travel when there is less traffic. While the effect of glare and other eye conditions may affect different age groups, it may be more pronounced among older people.

Due to these gender limitations in mobility, access to goods and services in close proximity is essential in ensuring that both men and women can be able to easily get them. This was the case in the decentralisation of the *machicha* that is now available in the village, market, and urban centres towns within walking distance to the farms and with a wide range of means of non-motorised transport. Katothya (2017) recommends that to promote inclusivity along the milk value chain, women should be supported in among others accessing farm inputs, credit facilities, veterinary services, tools, equipment, training, access to collection centres and markets.

Security

Several commutes along the milk value chain take place at night when the security situation may be risky. The morning milk collection is usually between 0400 Hrs – 0500 Hrs. While insecurity incidents are rare during milk collection because of the significant number of people commuting at the same time, women may not be comfortable to take milk to the collection centres during this time. A similar finding was reported by Katothya (2017) who pointed out the limitations of women in delivering milk in the early morning hours as pointed out in the previous section. The milk is normally delivered to the collection centres by the male members of the household or the farm labourers.

Another security concern raised by the respondents was the state of loneliness in the areas surrounding the coffee plantations where the farmers go to cut grass. Although these areas are patrolled by private security, the farmers do not feel secure. *“The area is also usually deserted and there is a risk of being attacked or hijacked in the forest while cutting grass.”* Stated Mr. Karanja, a 52 year old farmer from Membley, Ruiru. Mr. Waruiru a 45 years old milk vendor from Kwamaiko who uses the route through the coffee plantations along Ngenda road that cuts through Tatu City indicated that he fears transporting milk along the route at night for fear of insecurity. During the night at 0400 Hrs when he is transporting the milk to Kahawa West, he often uses the Ruiru - Uplands road but when going back to his home, he uses Ngenda road which is shorter. Mr. Njaramba a 46 years old labourer who cuts grass in the lonely coffee plantations indicated that while he is concerned about his security he has to still work and ignore the security fears. *“I leave that to God. Everyone has their day of departing from this World.”* He indicated that although he had not been a victim of crime, he had witnessed victims of robbery who had been accosted and left in the plantations both dead and injured in the course of his work. The coffee plantation area is referred to as *Kamiitu* or place of thieves in Kikuyu language because of the incidences of theft. The area was feared during the night because carjackers drove their victims to the coffee plantations and abandoned them there. In December 2014 the bodies of two missing children were discovered in Tatu City coffee plantation. It was suspected that they were killed in a different location and the bodies were dumped there (Ndungu, 2014). In March 2020, a vehicle belonging to a missing person was found abandoned near Oaklands coffee estate along the Kimbo – Kiganjo road (People Reporter, 2020). Before the sale of *machicha* was decentralised, farmers travelled to get it in Ruaraka at night, and they had to travel in groups of about three vehicles so that in case of a vehicle breakdown a farmer was not left stranded in the bush alone, but was assisted by the other farmers. However, some farmers felt that they were less vulnerable to attack after the introduction of cashless payment. The farmers were no longer targeted by the car-jackers because they were not expected to be

carrying money. Mr. Maina indicated that before the introduction of the cashless system, at one time a farmer gave a stranger a lift at the back of the pickup van, and at some point, the stranger covered the windscreen with a blanket, hijacked the car and took the *machicha* money and left the farmer without hurting him. He added that the presence of police roadblocks along the route increased the feelings of safety and security at night.

Some areas were considered more insecure than others. “*Security depends on different areas, some areas like Karia are considered insecure.*” Mr. Kagwe a 47 years old farmer and transporter indicated that he has to take precautions in certain locations. Karia village in Githunguri which he pointed out to be insecure had been associated with the presence of the *Mungiki* a banned ethnic group that was linked to incidents of extortion and ethnic violence in various parts of the country. In December 2002 a group of about 500 suspected members of the group on a revenge mission attacked Karia villagers, looting shops, burning houses and slaughtering animals leading to two deaths. The incident occurred when the suspected Mungiki members were attending the funeral of their member in Karia village who had been killed a few days before by the villagers for being part of the group that was terrorising the villagers (Mula & Riunge, 2002).

4.3 Political barriers

This section looks at the underlying social-political issues that affect mobility along the milk value chain. It utilises a political economy approach, which “*analyses the economy from its social and political context rather than seeing it as a separate entity*” (MacKinnon & Cumbers, 2011, p. 14). Through this approach, mobility along the milk value chain is evaluated to ascertain the social and power relations among the actors involved. The section looks at how these power relations shape mobility along the milk value chain.

Police harassment

It is paradoxical that while the police are supposed to aid mobility, are sometimes considered to be the cause of barriers to movement. The functions of the police as outlined in section 24 of the National Police Service Act Revised Edition 2012 include: to maintaining law and order, ensuring there is peace, and protecting life and property. Section 54 of the Act outlines the role of the Kenya police service in maintaining order on the roads. Their role is to “*regulate and control traffic and keep order and prevent obstruction in public places... public roads and streets*” (Government of Kenya, 2012b). Section 57 of the Act gives the police powers to “*stop, search and detain*” vehicles in the course of their duty. These powers are further reinforced in section 105 of the Traffic Act Cap 403 which allows the police officers to enter the vehicle,

drive it or ask the driver to drive the vehicle to the police station while section 65 gives the police the powers to erect barriers on the roads, referred to as roadblocks while carrying out their duties. These roadblocks are authorised by the Officer Commanding Station (OCS) as per the National Police Service Act Revised Edition 2012. The county commander of the police service is supposed to keep a record of the roadblocks in their respective counties including the reasons for their erection as per the Act. The inspector-general of the police service is supposed to give guidelines on the administration of the roadblocks across the country, while the members of the public are also allowed to make complaints regarding the use of the roadblocks to the county police commanders. Section 69 (a) of the Traffic Act Cap 403 (Government of Kenya, 2018) further indicates that these roadblocks should be gazetted by the inspector-general of the police service. The Act indicates that there should be no roadblocks in unauthorised places except in unique cases where they can be mounted with authorisation by the inspector general or an authorised member of the police service on his or her behalf.

The traffic police department is in charge of implementing the police mandate in regard to the laws mentioned above. The police undertake these functions together with the National Transport and Safety Authority (NTSA) whose mandate as per the National Transport and Safety Authority Act No. 33 of 2012 includes registration and licensing of vehicles; inspection and certification of vehicles; regulation of Public Service Vehicles (PSVs); conducting inspection of vehicles; advising the government on road safety; researching and educating the public on road safety (Government of Kenya, 2012c). As part of the NTSA Act, the uniformed police have the power to stop and conduct inspections on any vehicle to ensure compliance with the Act. During the inspections, police are allowed to demand documents such as licences, inspection certificates, and other documents outlined in the Act. It is an offence under the Act to obstruct the police from conducting the checks.

While the above laws define how the police should conduct themselves while undertaking their duties, there are cases of misuse of powers, use of excessive force and corruption in the police force. Githinji (2017) asserts that corruption in the police force threatens peace and security in Kenya since corruption tolerates criminality, brutality and even terrorism. He links the root of brutality and excessive use of force to the colonial police force that was structured to oppress the population. Lastly, he proposes that the attempts to reform the police service through the National Police Service Act Revised Edition 2012 should be backed by political will, training, financing and equipping of the police force.

“Since the colonial era, operations and crackdowns have been avenues for collective and punitive punishment, human rights violations, extortion, trumped-up charges and unlawful use of force” (Kiprono, 2022)

Transport operators especially those operating public service vehicles complain of harassment and extortion by the police. A newspaper article highlighted how the police extortion has affected the *matatu* business. The police demand bribes that are transmitted secretly through handshakes, slipping of money into the licences²⁴ or dropping the money on the ground (Chagama, 2021). The *matatu* operators have in the past expressed their anger towards the extortion by the police through *matatu* strikes, the infamous one being the strike during the implementation of the ‘Michuki rules.’” The police occasionally undertake ‘operations’ or ‘crackdowns’ on vehicles that are not in good condition which the commuters especially those operating public service vehicles like *matatus*, *boda bodas* or transport vehicles like pickups and lorries view as ways of extorting money from them. The collision between the police and the government is aggravated by the existence of cartels in the running of the *matatu* industry (Chagama, 2021; Rasmussen, 2012) characterised by defiance and lack of respect for law and order. The *matatus* operate informally in disregard to the existing laws and have their own informal ‘laws’ of operation (Rasmussen, 2012) which creates a conflict between them and the police as the latter attempt to dismantle the cartels and enforce law and order. The relationship between the police and the transport operators fluctuates from that of collusion when the police overlook the faults in their vehicles and condone flouting of traffic rules in return for bribes to that of ‘operations and crackdowns’ where the police break this informal contract to prosecute the transporters operating outside the confines of traffic laws. Mr. Ndathe the chairman of Kaka Travellers Sacco that operates between Githunguri and Nairobi indicated that their transport businesses experience losses when their vehicles are impounded and their employees (drivers and touts) are arrested (Njenga, 2011).

"We have lost a lot of money through police harassment as we are arrested even when we have not committed any offence. Matatus are impounded even after going for vehicle inspection," (Njenga, 2011).

The Chairman of the *Matatu* Welfare Association, Mr. Dickson Mbugua complained that police bribery had become so common and normal in the public transport sector which he sarcastically proposed that it should be legalised so that government can benefit from it instead of select

²⁴ The old driving licences are such that they are foldable and can accommodate the hidden notes. The bribes are transmitted to the police when they request to have a look at the licence. Usually the police pretend to look at the licence, as they pick the bribe.

individuals in the police service. Though being sarcastic, he was emphasising the extent of the vice in Kenya. He decried that the vice was draining the public transport sector (Ng'enh, 2021).

“It has become normal for law enforcers to demand kitu kidogo (bribe) on our roads across the country. If you don't comply, your vehicle is impounded and you are taken to court with several charges and you end up paying more than Sh100,000 in fine.”

Mr. Dickson Mbugua, Chairman of the Matatu Welfare Association, 15 November 2021 (Ng'enh, 2021).

Figure 4.6: Police check at Kamiitu along the Ruiru Uplands road.



Source: GSV, 2018.

Police harassment during travel was a common experience among the respondents using pickup vehicles. It was so prevalent to an extent that it was considered a normal occurrence in the course of their commute. Mr. Kuria, a 76 years old farmer from Githurai, Ruiru indicated that *“there is normal police harassment along the road”* a description that shows acceptance of the practice of police harassment during commuting. The police usually conduct the traffic checks early in the morning from about 0600 Hrs to 0900 Hrs. Their presence on routes that do not normally have traffic jams shows that the intention is not necessarily to control traffic. This is the time that farmers are getting *machicha* and *matatus* are ferrying commuters to Nairobi. One of the respondents indicated that *“In the morning, along Kiambu road at 0600 Hrs policemen are on the road waiting for the pickups.”* The police target *matatus* and pickups because they are more likely to have faults or non-compliance with traffic rules. They are also supposed to undergo annual inspections to ascertain their roadworthiness, to which some do not comply.

“You have to be stopped by police; when they see a pickup they know there is money.” Indicated 56 years old Mr. Wachira a farmer from Riuki, Githunguri. He indicated for his case, he did not experience much harassment because he has a double cab vehicle that is considered a saloon car and thus does not require an annual inspection certificate/ sticker. The police will quickly release the commuter who gives the bribe. “They do not usually check for anything, they are out to get money.” Indicated Mr. Maina a 76 years old farmer from Ha Donga, Githunguri. For those who resist parting with the bribe, the police identify a fault from their vehicles as indicated by 65 years old Mr. Mucheru, a chicken feeds vendor based in Githunguri. “They [police] will not leave you because they need something [a bribe]. They will say you have overloaded.”

The costs incurred as a result of the harassment by the police includes: increased cost of commuting as a result of the change of routes, fines, increased cost of production and delays in commuting. Mr. Maina indicated that:

“At one point as I was going to get machicha, I was stopped by police who delayed me and as a result, I was late to get machicha and consequently I had to look for alternative feeds for the cows...I have to change the routes to avoid the police as I go to get machicha. Police target pickup vehicles because they are old.”

The more the police checks present along the way, the more money commuters spend on the bribes. This means that travelling over longer distances leads to more costs of bribing police along the various police checks along the way. Also, the more unfamiliar the route the more the harassment. Thus the owners of the old pick up vans prefer not to take long journeys to avoid unfamiliar territories. Therefore the farmers could access *machicha* more easily when its sale was decentralised from Ruaraka, Nairobi to the village centres because they could use their old vehicles over the shorter distances.

Box 4.1: Government reaction towards the sexual harassment incident involving *boda boda* operators.

Government reaction towards the sexual harassment incident involving *boda boda* operators²⁵

On 4 March 2022, a female motorist was involved in an accident with a *boda boda* operator along Wangari Mathai Road (formerly Forest road) in Nairobi. As a show of solidarity with the affected *boda boda* operator, the other operators ganged around the motorist robbing and sexually harassing her. This incident was recorded in a video that was shared widely on social

²⁵ More details concerning the incident on appendix II

media leading to a public outcry. Such incidents of the *boda boda* operators harassing motorists had been witnessed in the past such that in case of an accident involving a *boda boda* operator and a motorist, the other operators would act in solidarity with the affected operator. They would mob around the motorist in such a way that they intimidate them irrespective of whether the particular *boda boda* operator was the one who was on the wrong. In some cases, the *boda boda* incidents would turn out to be violent, which was the case of an accident involving a *boda boda* operator and a school bus in Embu, whereby the other *boda boda* operators are suspected to have burnt down the bus (Mugo, 2021). In another instance, the former Chief of the Defence Forces, General (Rtd) Julius Karangi was involved in an accident with a *boda boda* operator where he was almost lynched by the other *boda boda* operators before they recognized who he was. He indicated that “*They did not even care to acquaint themselves with what had transpired. They wanted to lynch me despite me being the one aggrieved*” (Mutura, 2020). The *boda boda* operators could have opted to harass and intimidate the motorists as a strategy to ensure that the cases are settled out of court or they do not have to compensate the motorists at all because if the traffic disputes end up in the courts they may be obligated to pay fines. They also could have felt like it is them against the influential middle-income groups who own the vehicles.

The immediate government response following the sexual harassment incident was to initiate a crackdown on all *boda boda* operators which was declared by the President, Uhuru Kenyatta. The operation was characterised by incidents of corruption and harassment of *boda boda* operators by police, whereby the operators especially those who could not part with a bribe were arraigned in court and their motorbikes were impounded by the police. On the first day of the crackdown, over 200 motorbikes were impounded. The *boda boda* operators then kept off the roads and also held public protests condemning the harassment, indicating that government should arrest the perpetrators of the criminal activities instead of condemning all the operators. The absence of the *boda boda* operators caused a disruption of mobility and livelihoods for those who depended on the means of transportation, including the delivery of parcels, milk and food. It also caused a disruption of the livelihoods of the *boda boda* operators who lost income.

Since the incident occurred during an election year, it became a political issue, with the two main presidential candidates showing solidarity with the *boda boda* operators. Raila Odinga, the former Prime Minister of Kenya, who was also involved in an informal coalition with the President, Uhuru Kenyatta commonly known as the “handshake” in contrast with the President’s declaration of a crackdown on all *boda boda* operators, condemned the harassment of the *boda boda* operators indicating that not all of them were criminals. The Deputy President, William Ruto on the other hand condemned the crackdown, indicating that *boda boda* operators were legitimate business people, and government should not view them as criminals. He called

on the *boda boda* operators whose motorbikes had been impounded to collect them from the police stations, a statement that his colleagues in government viewed as an act of incitement.²⁶ Following the criticism, the government called off the crackdown on the operators and reversed its approach to that of inclusive consultations. Interior Cabinet Secretary, Fred Matiang'i established a task force to work on reforming the sector²⁷ that included representatives of the *boda boda* operators. He also declared that the *boda boda* operators should be given back the motorbikes that had been impounded by the police. The Governor of the City of Nairobi also called for the release of the impounded motorbikes. The police were also encouraged to have consultative meetings with the *boda boda* operators and to sensitise them to traffic regulations.

Figure 4.7: A police officer engaging a group *boda boda* operators.



²⁶ During the second term of President Uhuru Kenyatta, he was not in good terms with the Deputy President William Ruto, whom he accused of campaigning instead of delivering on the government's agenda. The President reached out to the opposition leader Raila Odinga and declared that he would work together with him on delivering the governments' agenda, and also declared support for him in the 2022 presidential elections. This declaration was publicly shown through a handshake between the President and Raila Odinga. This informal coalition seemed to put the president and his deputy in collision and in essence the Deputy President seemed to be in opposition to some of the governments' agenda. He felt that the president had betrayed him by declaring to support the candidature of the opposition leader in the 2022 elections.

²⁷ This was the second time the government was setting up a task force to reform the sector, having set up another task force on "Policy, Legal and Administrative Reforms Regarding Public Service Motorcycle Transport in Kenya" on 21 November 2018 that was to be in force for 60 days (Mwangi, 2018)

Source: National Police Service/Twitter

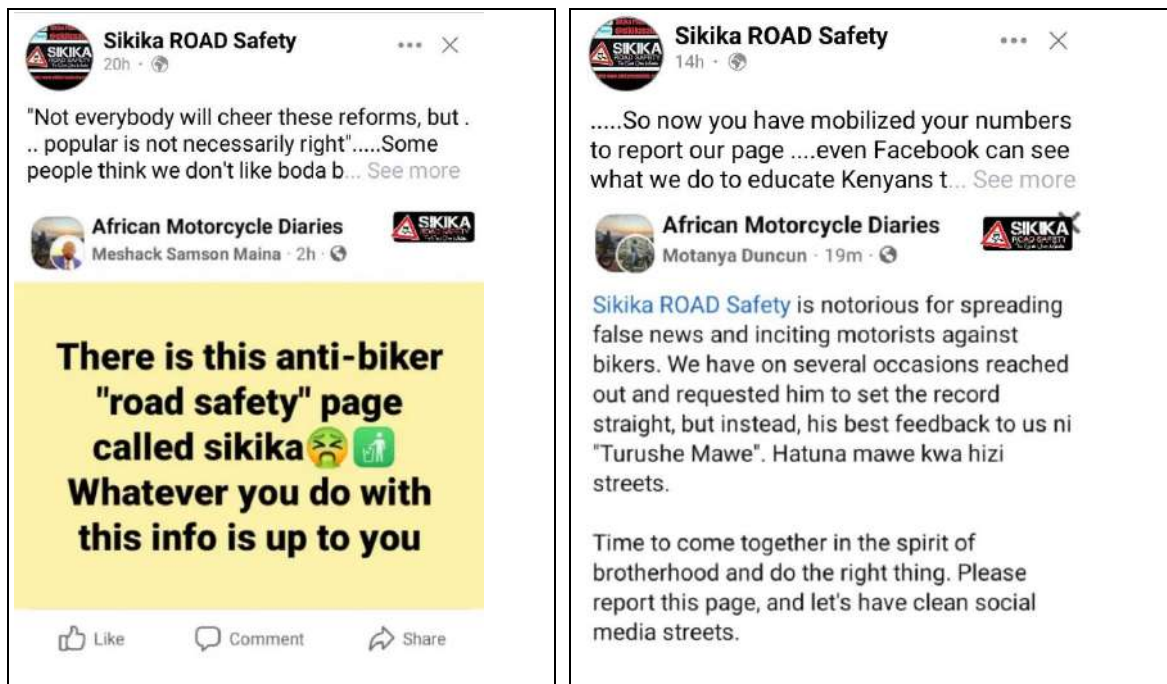
Figure 4.8: Boda boda operators displaying messages to the public



Source: Chara George/Twitter, 2022. Source: Sikika/ Facebook, 2022

An analysis of some of the social media reactions as a result of this incident showed that there seems to be a class war between the boda boda operators and the middle class who own the vehicles. The motorists find the boda boda operators a nuisance, and feel that the operators are the cause of accidents taking place on the roads.

Figure 4.9: Sikika Road Safety vs African Motorcycle Diaries



Source: Facebook/ SIKIKA, 2022

They also feel that they are the perpetrators of other criminal incidents. They additionally feel that the boda boda operators drive carelessly and do not follow the traffic laws, and that the boda boda operators take the law into their hands in case of traffic accidents. On the other hand, the boda boda operators find the motor vehicle operators disrespectful (madharau) while driving their vehicles in disregard to the welfare of the boda boda operators.

Source: Author.

On 19 June 2019, following complaints about harassment of commuters by the police, the Inspector General of Police, Hillary Mutyambai announced new rules on the setting up of roadblocks across the county. He instructed that the regional and formation commander were responsible for the operations along the roadblocks and traffic management in their areas of operation, and would be held responsible for the actions by the officers under their command:

"Traffic check points & roadblocks on highways shall only be mounted with express authority of Regional/Formation Commanders, must be justified & rationalized," IG of Police, Hillary Mutyambai (Mwende, 2019).

The IG noted that the issue of corruption along the road was abetted by both the motorists who want to break traffic rules and the police. He indicated that to end the vice, it called for:

"both parties not only to desist from corrupt activities on the road but also to stand against such by reporting them to relevant authorities," IG of Police, Hillary Mutyambai (Ombati, 2019).

This statement was echoed by the police spokesman Bruno Shioso who indicated that violators of traffic rules

"opt to induce the officer to look the other way. Unfortunately, this behaviour has become a syndicated road culture that affords a road villain the undeserved freedom to once more offend," police spokesman Bruno Shioso (People Reporter, 2021)

On 7 September 2021, the National Police Service (NPS) headquarters issued a statement banning the operation of all unauthorized roadblocks in the Country. This was because despite the measures put in place to regulate them through the regional and formations commanders, corruption was still taking place. There was also continued setting up of authorised roadblocks despite the previous direction given by the IG. The IG of police was reacting to complaints that

motorists were being harassed at roadblocks and delayed for hours. (People Reporter, 2021).

The directive was as follows:

“Every commander to ensure that there are no roadblocks, no static traffic checks, no detaining of motor vehicles along the road for long hours, and no taking of bribes from motorists with impunity,” IG of Police, Hillary Mutyambai (People Reporter, 2021)

The above findings illustrate the challenges in eradicating corruption along the roads. Despite orders issued by the police boss, two years later, harassment and erection of roadblocks along the roads was still taking place.

In contrast to the fear of the police during the day where the farmers view them as a barrier to their mobility, their presence at night is viewed by motorists as an assurance of safety especially among the farmers who used to travel at night to get *machicha* because they had to pass through the lonely coffee plantations. The presence of police roadblocks along the roads at night is seen as a deterrent to criminals. The police additionally provide security for the distribution of milk in insecure remote locations like Lodwar, Lamu and Hola where Uplands PD&F Ltd sells its milk. These regions are prone to harsh terrain and insecurity and thus they require a police escort.

Strict regulations governing the dairy sector

Strict regulations governing the dairy sector create opportunities for harassment of milk vendors by the government authorities. Due to the strict regulations, few milk vendors have operating licences and they operate illegally, making them vulnerable to arrest by the police with support from the Kenya Dairy Board (KDB). The Government plays various roles in the regulation of the dairy value chain, with the main actor being the KDB mandated by section 17 of the Dairy Industry Act CAP 366 to *“organise, regulate and develop the efficient production, marketing, distribution and supply of dairy produce.”* Section 19 of the Act gives the KDB powers to make regulations *“prescribing the manner of handling, transporting and storing of dairy produce intended for the use of or consumption by any person other than the producer thereof”* (Government of Kenya, 2012a). Muyesu (2019) is of the view that the extensive powers given to KDB in licensing, inspecting and regulating the dairy sector creates room for bribery and harassment.

The KDB developed draft regulations for the regulation of the dairy industry in 2018. Under these regulations, the sale of raw milk was prohibited, and the farmers were only allowed to sell

raw milk through milk cooperatives or other organised groups to milk processors except those producing over 500 litres of milk. The processors were also supposed to buy raw milk only from licenced milk cooperatives or other groups whom they had contracts with. The transportation of raw milk was to be done using stainless steel or aluminium cans and was only allowed up to the level of milk collection centres and coolers. Further transportation of milk required an annual permit issued by the KDB. These regulations proposed hefty fines of Ksh. 3,000,000 or three years imprisonment or both (Kenya Dairy Board, 2018) to individuals acting contrary to them. A later draft of the regulation that circulated in the social and mainstream media indicated fines of up to Ksh. 500,000 (Kimuge, 2019) which were still a huge penalty to the smallholder farmers.

These regulations faced widespread criticism and resistance from social and mainstream media, farmers and other stakeholders because of the prohibition of the sale and consumption of raw milk at the farm level and outlawing of the milk vendors. The regulations seemed to favour the milk processors with an aim of increasing the amount of milk that is delivered to the milk processors and reducing competition from the milk vendors. Out of the marketed milk, 80 per cent of the milk is sold through informal channels from the farm to neighbours, sold by milk vendors, and in milk parlours (Blackmore et al., 2021; Karanja, 2003; Muriuki, 2003; Nassiuma & Nyoike, 2014; TechnoServe Kenya, 2008; Tegemeo Institute, 2016). Further, most of the processing companies were operating below capacity with the total processing capacity at 3.75 million litres per day out of which only 46 per cent was utilised (Mwita & Adhiambo, 2022).

Changes in regulations governing the milk industry in Kenya are viewed with scepticism and politicised because of the dominance of Brookside Dairy Ltd that is owned by President Uhuru Kenyatta's family which controls over 42 per cent of the milk processed in Kenya. Policy changes are viewed to be a form of state capture and creation of dominance by the milk processors and in particular Brookside Dairy Ltd (Karecha, 2019; Muli, 2019; Muyesu, 2019; Ndi, 2018, 2020; Nyamuta, 2019).

The approach that was used by KDB in the formulation of the draft regulations was devoid of participation from stakeholders. Over 400 farmers rejected the regulations, indicating that they had not been consulted in the formulation of these regulations (Kivuva, 2019). They indicated that the regulations would lower their earnings and that they sell raw milk to their neighbours at Ksh. 40 per litre while the milk processors were buying the milk at Ksh. 26 per litre. They further complained that the requirements that raw milk should only be sold to the processors would affect farmers who are located far from the milk collection centres and they would have to incur more costs to transport the milk to the milk cooperatives. There was also fear that the

milk cooperatives would buy milk at a lower price and the farmers would not have an option to sell to other actors in the market. There was also a perception that the regulations favoured milk cooperatives and processors (Kivuva, 2019). Research by Tegemeo Institute (2021, p. xii) indicated that *“prices offered by hotels, direct consumers and traders were relatively higher than those by cooperatives and processors.”*

42 years old Mr. Wanyoike a milk vendor from Kiganjo claimed that *“the dairy board [KDB] is a problem. Farmers are exploited. If milk vendors are eliminated farmers will get a problem. The companies usually reduce the price of milk in the rainy season. If we are not there the farmers will have a problem.”* A research by van der Lee et al. (2016) showed that the milk vendors operating close to the urban centres offered the best milk prices to the farmers. Mugo (2022) reported that farmers in Nyeri had complained that a milk processing company had taken advantage of them by offering to buy milk from them at Ksh. 43 per litre, upon which they had abandoned delivering milk to their milk cooperatives, and after a few months, the milk processing company changed the conditions and indicated that they could only purchase the milk at Ksh. 35 per litre claiming that there was an excess supply of milk. The farmers indicated that the milk processing company usually conducted campaigns with offers to buy milk at higher prices, and upon the farmers joining, the company would change the terms of the contract. Following this experience, the farmers decided to stick to their milk cooperative that pays Ksh. 37 per litre. The milk vendors struggle to get recognition from the National and County government regulators. Kiambu County viewed the milk vendors as middlemen who exploited the farmers and proposed a barrier at Kamburu, Lari to limit the movement of milk vendors as per the 2018-2022 CIDP (County Government of Kiambu, 2018). The KDB were also not keen on engaging the milk vendors, and a study on the extent of engagement of the milk vendors by the KDB as part of the training and certification (T&C) project that was piloted in Kenya by an NGO (SITE Enterprise Promotion) between 2006-2008 and led by the Ministry of Livestock and Fisheries Development in collaboration with KARI, ILRI and the KDB with an aim of supporting the milk vendors to: access markets, uphold proper hygiene standards in the handling of milk and ensure that they were progressively licensed by the KDB (Alonso et al., 2018) reported that:

The authorities are under increasing pressure from large processors in the formal dairy sector, who want to reduce competition and gain greater market access/coverage. As a result, policymakers are reluctant to support more inclusive, legitimising approaches to working with the informal sector. This could represent one of the greatest threats to the scheme’s sustainability and long-term success.

Both traders and trainers report that the KDB's participation and engagement in the scheme has been lower than originally designed. The KDB has lacked buy-in or commitment to the scheme at both national and local levels, although engagement has varied in different offices. The KDB is taking too long (up to four years) to issue licences to traders and give accreditation to BDS [Business Development Services] providers. This slows down the ability of BDS to provide training and weakens one of the possible incentives for both traders and BDS to engage in the scheme. The low number of traders being trained and therefore new licences meant the KDB did not see the economic returns they had anticipated, which perpetuated their lack of commitment and buy-in. Traders, having paid for and undertaken training, did not get the licence they were expecting and so there is no incentive to train. The scheme can only be a success with buy-in and commitment from government at all levels (Blackmore et al., 2015, p. 3).

The rationale behind the training was to ensure that the milk vendors upheld the quality and safety standards which are the basis of the criminalisation of milk vending so that they would be formally recognised as actors in the milk value chain, which would in turn improve their livelihoods and boost job creation (Alonso et al., 2018).

Following public outcry, the draft regulations were suspended by the KDB on 25 March 2019 to allow for further stakeholder consultations and participation. The regulations were revised and gazetted on 26 February 2021. The new regulations did not change much, but they allowed the farmers to sell milk to their 'immediate' neighbours which was the main criticism of the draft regulations. The other sections of the regulations were largely maintained. Section two of the regulations prohibits hawking or vending of milk except through milk bars and dispensers while section 31 outlaws the transportation of milk using *matatus* and other public service vehicles, with section 32 prohibiting the transportation of milk using jerry cans. The regulations allow for the operation of licenced milk bars and dispensers under strict regulations for the sale of only pasteurised milk. The fines for contravention of the regulations were reduced to Ksh. 10,000 (Government of Kenya, 2021a). The revised regulations further reinforced the prohibition of vending of raw milk and the elimination of informal actors in the dairy value chain. The KDB clarified that the motivation for the development of the regulations is to be at par with international hygiene standards of milk handling to enable the exportation of milk. It also emphasised that the new regulations were aimed at ensuring the consumers get quality milk (Kimuge, 2019). According to the Managing Director of the KDB, Margaret Kibogy, the regulations were working and that following their enactment in 2021, the formal sector was marketing 800 million litres of milk per year from the 600 million litres per year that they were

marketing before, and she was hopeful that it could rise to 1 billion litres per year (Ngotho, 2022).

The milk vendors fear the KDB more than the police because they are more familiar with the police along the routes they use. During the days when the KDB is undertaking the crackdowns, the vendors refrain from supplying milk in urban areas or they use alternative routes to avoid arrest. They communicate with one another if they notice the KDB vehicles. For vendors using *matatus* they are forced to terminate the journey and get alternative means of ferrying the milk to the towns or make losses. The fear of government officials was evident in the operations of the milk vendors, and they were reluctant to be approached. During the fieldwork, they could not agree to stop when they were waved at. When I first met a milk vendor in Ruiru on 14 December 2018 and approached him for an interview showing him my staff identity to show that I worked at the university, he was very hesitant to be interviewed because he thought I was a government official; he even denied owning the *boda boda* that he had parked outside the restaurant where he had just supplied the milk. I met him about two more times, and he only agreed to be interviewed after I was introduced to him by one of his customers – the proprietor of Amani restaurant. The restaurant owner later told me that the milk vendor previously hesitated to be interviewed the first time I approached him because that week the vendors had faced harassment from the KDB.

54 years old Mr. Ndirangu is licenced by the KDB to operate a cottage milk processing industry and two milk ATMs in Githunguri and Kiambu towns and he therefore does not experience police harassment since he is compliant. He previously was a milk vendor, and when he made inquiries on the requirements for getting a licence from the KDB, he was informed that he could not get it without being able to pasteurize his milk. He researched and came up with a way of batch pasteurization using firewood energy (see Figure 3.25). The KDB regularly inspect his facility to ensure there is adherence to hygiene standards. KDB has created room for the existence of these small scale dairy industries. As per the Dairy Industry Act (Cap. 336) the dairy industry (registration, licensing, cess and levy) regulations, 2021, the owner of the cottage processing plant should operate in an ideal environmental and hygiene conditions that do not compromise the quality of the milk including adequate water facilities for cleaning the equipment, sanitation facilities, hand wash facilities and storage. A milk ATM should be of materials that can easily be cleaned, and the milk should be kept in temperatures of between four to six degrees. The premises hosting such dispensers should have among other things adequate water, hand washing facilities, impervious surfaces, adequate light, proper ventilation, and convenient access to sanitary facilities (Government of Kenya, 2021b). As illustrated by the case of Mr. Ndirangu, there is potential for the milk vendors to transform their business

ventures incrementally into either cottage industries or milk ATMs. Thus for the government to achieve commercialisation of the agriculture sector and encourage the development of cottage processing industries, which have the potential to create employment opportunities and boost income, they need to adopt a more inclusive approach in their engagement of the milk vendors. Tegemeo Institute (2021, p. xiii) advocates for the accommodation of milk vendors in the dairy value chain:

“Since the informal markets are playing a role in linking producers to markets and improving profitability of dairy production, there is need to explore innovative ways of co-opting this segment of the market and bringing it into the formal sub-sector. This would entail setting standards for the segment, registering the actors in the segment and enhancing surveillance and enforcement of the standards. The result will be the creation of an enabling environment for increased private sector entrepreneurship in milk marketing and will generate employment directly and through linkages with other actors in the dairy value chain”

Setting up of large milk processing factories is a rigorous process. During a visit to one of the milk processing factories, 22 different licenses and permits needed for the operation of the company were displayed at the reception of the factory. The government should reduce the bureaucratic requirements for setting up an industry through a one-stop agency that coordinates the regulatory process instead of the piecemeal registration with various government authorities. In addition, during milk distribution, the milk processors have to pay for separate branding licenses in all the Counties they transport the processed dairy products to, failure to which they get harassed by the municipal police/ *askaris*. Branding of their vehicles in each of the counties where their vehicles pass is expensive. Uplands PD&F Ltd indicated that they experienced harassment when distributing milk across the different counties. In addition, they have to acquire distribution licenses for every County, and they also have to pay for ferry charges in Mombasa. The bureaucratic procedures and requirements exclude the vendors from engaging in the formal milk production.

A KDB licence is only one of many requirements traders need to fulfil before they can freely commercialise milk. Traders are confused by which licenses they need and when they need to renew them and often fail to see any positive return from having so many licenses. The amount of red tape involved presents a significant burden for small-scale businesses to formalise and the need for multiple authorisation (Blackmore et al., 2015, p. 3).

The KDB conducts sensitisation training on milk handling to ensure that hygiene standards are improved. They have also developed training manuals on the handling and transportation of milk by the milk vendors which are available on their website. Figure 4.10 shows the Cabinet secretary of Agriculture Mwangi Kiunjuri and the Governor of Embu County, Martin Wambora sensitising farmers on the appropriate containers that can be used in the transportation of milk.

Figure 4.10: Cabinet secretary for agriculture illustrating how milk should be transported.



Source: Ministry of Agriculture, 2020.

COVID-19 Restrictions

The COVID-19 travel restrictions COVID caused disruptions of movement in Kenya like in other parts of the World, and had an impact on the spatial flows along the milk value chain particularly on the informal milk distribution in urban areas and the flow and access to farm inputs. By the time the first COVID-19 case was reported in Kenya on 13 March 2020, the Kenyan public had already witnessed the devastating effects of COVID-19 in China, and this news was received with fear and anxiety. Despite the fact that the country was placed under curfew two weeks after the first case was reported, and although it took three weeks before the cessation of movement within Nairobi and Mombasa metropolises was put in place, the people had already imposed self-restrictions of movement for fear of the disease. There was fear in the rural areas where the older people reside given the reports that COVID-19 had serious effects among older people and those with pre-existing conditions who are mostly the elderly citizens. The people stayed in their homes and mobility was restrained even before the onset of the COVID-19 restrictions. In the early stages of the spread of the disease, there was little

information about it and there were rumours about its causes, effects and treatment. The people watched in horror the devastating effects of the disease in Europe and the United States of America, and the comments by Melinda Gates that the disease would hit Africa hard caused panic among the people.

The president had previously set up a National Emergency Response Committee (NERC) on Corona virus on 28 February 2020 before the announcement of the first case in Kenya to coordinate the government's response to COVID-19. During the first presidential address on 15 March 2020 the focus of the restrictions were on educational institutions and international flights, whereby travel into Kenya from countries with COVID-19 cases was stopped and all other international travellers were required to self-quarantine and all educational institutions were closed. Additionally, people were advised to work from home, to make use of cashless payments and avoid crowded places. Following this announcement, Safaricom a Public Limited Company on 16 March 2020 waived M-Pesa transactional fees for transfers of amounts of less than Ksh. 1,000 in order to attract cashless transactions. This was a relief to farmers who use this form of payment when buying feeds and also use it to receive money including support from family members. The company also increased the daily transaction amounts from Ksh. 70,000 to Ksh. 150,000. The mobile phone users were also allowed to keep up to Ksh. 300,000 in their phones from Ksh. 140,000. This was useful for the traders who receive payments through M-Pesa. At the same time on 18 March 2020, the Central Bank of Kenya (CBK) instructed banks to waive the transactional costs of transferring money between M-Pesa wallets and bank accounts and vice versa. CBK also directed that banks should review personal loans based on customers' requests.

On 20 March 2020, the NERC issued a statement through the Minister of Health that bars and entertainment joints were to close at 1930 Hrs from 23 March 2020, and individuals were supposed to stay 1.5 metres apart, while markets were supposed to take sanitary precautionary measures. He also announced that 14 seater *matatus* would carry a maximum of 8 commuters; 25 seater *matatus* a maximum of 15 commuters; and 30 seater *matatus* and buses were to carry 60 per cent of their capacity. The resultant effect of the reduction of seating capacity was that the commuting fares were increased, raising transportation costs. While the capacity of the public service vehicles had been reduced by about 40 per cent, some of the *matatus* increased their fares by even 100 per cent (Agutu, 2020; Rotich, 2020). The increase in fares raised the operational costs especially that of milk vendors who use the *matatus* daily to deliver milk to urban areas. The public service vehicles were only allowed to carry to their full capacity 16 months later on 09 August 2021.

Figure 4.11: *Matatu* fares increase as a result of reduction in passenger capacity.



Source: (Agutu, 2020)

On 22 March 2020, the NERC announced through the cabinet secretary of health, Mutahi Kagwe: the suspension of all international flights from countries with high rates of infection, mandatory quarantine in government facilities for international arrivals, closure of all bars, restaurants to operate for only take away services, and suspension of all religious gatherings. The minister indicated that the drastic actions were being implemented because of the seriousness of the disease and also because some of the people had ignored the precautionary measures that had been previously put in place. It is on that day that the cabinet secretary for health, Mutahi Kagwe made the famous statement that “*If we continue to behave normally, this disease will treat us abnormally.*” The *matatu* operators were singled out as some of those who were ignoring the measures put in place and the minister gave a warning that *matatu* Saccos whose members were ignoring the measures would be deregistered. The reduction of restaurants’ operating hours reduced the demand for milk because the restricted time of operation meant that the operators could only serve limited customers. Further, the fear and anxiety of COVID-19 and the communication by health officials that people should avoid

public places and stay at home had already reduced the number of people visiting restaurants. Consequently, the reduced operating hours reduced the demand for milk from the milk vendors disrupting the informal value chain. The farmers had to look for alternative places to sell their milk. The closure of bars on the other hand disrupted the beer value chain, and EABL reduced operations because the supply of beer was relegated to take away services in ‘wines and spirits’ outlets and supermarkets. This in turn reduced the supply of *machicha* affecting the farmers who depend on it to feed their livestock. 38 years old Mr. Kibe of Amani feeds, a distributor of *machicha* indicated that the effects of COVID-19 had significantly reduced its availability.

“Business has gone down – The production of machicha has gone down... We are selling less because of low productivity, but could sell more... When farmers do not get machicha, their milk production goes down and this reduces sales.”

As a result of low productivity, Mr. Kibe indicated that farmers’ cash flow had been affected thus the number of customers had consequently reduced even after the COVID-19 restrictions had eased at the time of the interview on 23 April 2021. Such a sudden disruption of feeding patterns leads to low milk production. Due to the unreliability of getting *machicha* and cash flow issues, farmers were opting to use other products to feed their cows. This was the case for Mr. Muriuki a 48 years old farmer from Kambaa, Githunguri who indicated that he had stopped using *machicha* after the COVID-19 restrictions and was now giving his cows processed feeds mixed with water.

Mr. Maina, a 76 years old farmer from Ha Donga, Githunguri indicated during an interview on 10 February 2021 that milk production during the COVID-19 restrictions was costly because farmers had to rely on processed feeds which are expensive. He indicated that while people could still get *machicha*, it was not always available due to low production at the factory. Thus he was at the time getting processed feeds from Ha Donga milk collection centre which was just one kilometre away from his farm. He indicated that the cost of the feeds was higher compared to *machicha* and he was worried that he might get no returns from the business. 56 years old Mr. Wachira from Riuki, Githunguri indicated that he struggled to get *machicha* during the COVID-19 containment period. He indicated that because of low production of *machicha*, it was not available for all. *“Tulikuwa tuna ng’ang’ana kupata machicha (we had to struggle to get machicha)”* he added that at times *“when COVID-19 became too much, they had to scramble for machicha amongst the other farmers.”* He indicated that he *“survived”* because he could still venture out to look for *machicha* while the other farmers *“were fearing the disease and were not getting the little machicha that was available.”* He was referring to the fear and anxiety at the onset of the disease. When *machicha* production reduced drastically, its sale was

discontinued from the EABL dispensing station at Ruaraka, Nairobi, and the little machicha that was produced was sold from the Amani feeds outlets at the Garden Estate flyover outlet about two kilometres from the EABL factory, at Marurui dispensing outlet, and at Dumberi near Kiambu town. A lorry could get the little *machicha* that was produced from the factory and then park outside the outlet at Garden estate flyover from where the *machicha* would be sold to the farmers. Sometimes there were more farmers compared to the *machicha* that was available hence the struggle to get it. This discouraged the farmers from distant locations who could not risk travelling to Ruaraka and then failing to get it. Mr. Wachira would pick the *machicha* from the outlet and also buy yeast in jerry cans and 10 sacks of multi gum which was sold at Ksh. 55 shillings per kilo (about Ksh. 600 per sack). On some days he would pick two jerry cans of yeast in jerry cans of 200 litres each at Ksh. 20 per litre (a total of 400 litres) and *machicha* of Ksh. 2,000. In comparison to the other farmers, Mr. Wachira thought he was not affected by COVID-19 “*a lot.*” He also thought the proximity of his home in Ruiru town to Ruaraka enabled him to take a risk to travel there to check if he could get it. He kept in contact with the workers at the outlet who could tell him when *machicha* was available. He indicated that “*other farmers were affected, especially those without vehicles. My brother stopped keeping cows at that time and is only planning to keep them again.*”

The second presidential address on 25 March, 2020 focussed on the state’s interventions to cushion Kenyans from the effects of COVID-19 including tax relief to workers, cash transfers to the elderly and vulnerable population, and reduction of V.A.T, reduction of interest rates, and flexible loan repayments. The president also announced that a nationwide curfew would take effect on 27 March 2020 between 1900 Hrs and 0500 Hrs. The dawn to dusk curfew marked a significant restriction of movement affecting the whole population except those classified as offering essential services. The curfew was implemented by the Kenya police service and was characterised by chaos, police harassment, ruthlessness and brutality. While the president had given the people two days to prepare for the curfew, on the day of implementation, sections of the population were stranded in the towns due to traffic congestion. Those who were caught outside their homes during curfew hours faced the wrath of the police (Bearak & Ombuor, 2020). Six people died and others were injured in the first 10 days of implementation of the nationwide curfew as police shot, kicked, lobbed tear gas and whipped people as they were going to their homes from work (Human Rights Watch, 2020).

The secretary of health Mutahi Kagwe in his address on 28 March 2020 urged the population to stay at home during curfew and indicated as follows in reference to the issue of police brutality, “*am appealing to our people to make it very unnecessary for them to engage the police by staying at home and observing the measures given.*” He seemed to blame the offenders for

breaking the law and provoking the police to be harsh on them. He however urged the police to treat the people “*humanely*.” The president of Kenya, Uhuru Kenyatta also urged the police to:

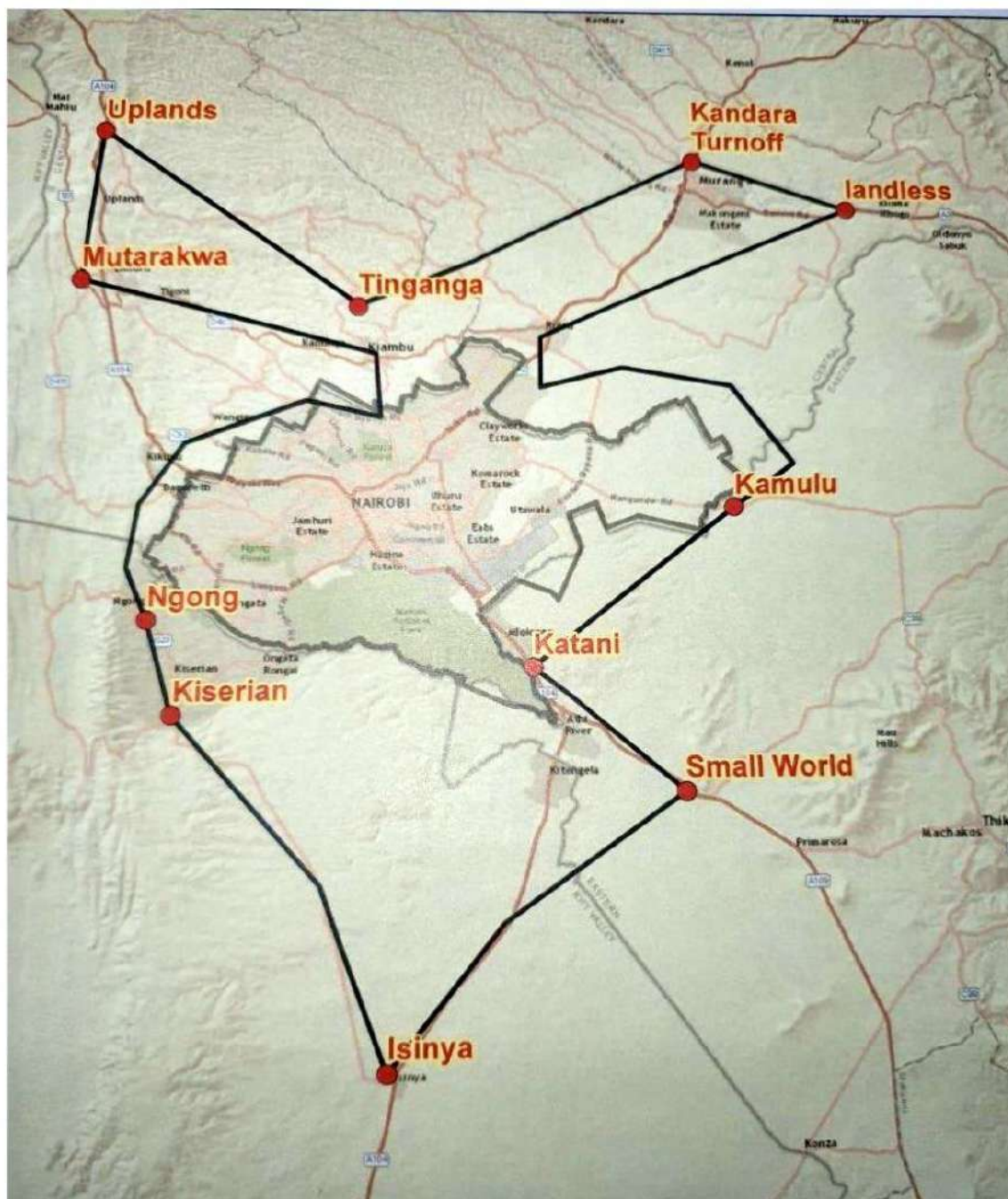
“be mindful and sensitive as they enforce the curfew and the additional measures we are taking today. They must however remain firm, fair and strictly abide by the dictates of the law.” Uhuru Kenyatta, President of the Republic of Kenya, 24 March 2020.

10 days after the imposition of the curfew, during the third presidential address on 06 April 2020, the president indicated that as a result of the epidemic being localised in the Nairobi metropolitan areas (80 per cent of the cases) and the coastal counties of Mombasa, Kilifi and Kwale (14 per cent), it had become necessary to impose a cessation of movement into and out of the counties in the affected regions which would take effect the same day. This cessation of movement was to be supervised by the Kenya police service and the ministry of interior and coordination of national government, and was to affect mobility by foot, bicycles, motorbikes, vehicles, rail or by air. The flow of food and supply of goods was to continue normally (see Map 4.2).

The Ruiru to Uplands transect was within the areas affected by the cessation of movement. Police set up a barrier at Kamiti along the Ruiru to Uplands road, at Riuki along the Kirigiti to Kwamaiko road and at Ting’anga’a road that connects Kiambu road to Kirigiti – Kwamaiko road. While the government required goods transporters to have a sticker to transport goods in and out of the Nairobi metropolis, they were not strict, and they allowed the farmers as long as they showed proof that they were engaging in farming activities. However, due to the presence of the police along the roads, farmers with unconditioned vehicles could not venture out of their farms to avoid police harassment at the barriers. Additionally, the farmers stayed at home because of the uncertainty of getting *machicha*. 45 years old Mr. Kang’ethe of Baraka feeds Githunguri had acquired a permit/ sticker to cross the roadblock between Nairobi and Kiambu County. The initial implementation of the cessation of movement directive was very strict before it was clarified that goods could be allowed to move beyond the counties. He indicated that at the onset of the restriction of the movement, he was crossing to Githunguri from his home in Ruiru through a private coffee plantation, before joining the Ruiru Uplands road past the police roadblock that was located at Kamiitu. He indicated that this was later eased and the police allowed pickup trucks and lorries to pass in and out of Kiambu. These forms of informal crossings were referred to as ‘*panya*’ routes, referring to the underground tunnels that rats use. The *boda* operators used these routes to ferry people into and out of the Nairobi metropolitan area through ‘*chochoros*’ or shortcuts passing through the coffee plantations. While walking

along Ng'enda road during the restrictions, I witnessed *boda bodas* carrying passengers passing through the coffee plantations.

Map 4.2: Boundaries of the cessation of movement into the Nairobi metropolitan area.



Source: Government of Kenya, 2020.

Mr. Muiruri a 45 years old farmer from Githunguri town who keeps 15 heifers and grows maize fodder from a hired farm in Gatuanyaga, Thika, 60 kilometres from his farm but lives in Ruiru town indicated that he witnessed the challenges of mobility during the COVID-19 restrictions especially the confinement within the Nairobi metropolitan area. He indicated that at the onset of the restrictions, he was “locked” up at his home in Ruiru and he could not be able to commute

to Thika to supervise the farming activities or travel to his farm in Githunguri because the authorities could not allow commuters to pass through the police barricades using *matatus* and personal vehicles which is the one he was using. He recalled how he had to pass through a *panya* route through the Delmontel Ltd pineapple plantations by “*talking*” to the private security personnel manning the plantations. He entered through a gate at one end of the plantation and exited at another gate re-joining the Thika - Garissa road past the police barricade that was positioned at Gatwanyaga. He had to stay at the farm for a week before travelling back through the same route. He indicated that when the police became less strict, when travelling to his farm in Githunguri, with his saloon car, he had to carry some seeds in the vehicle to justify that he was travelling to plant them on his farm. The curfew restrictions affected the informal milk vendors who usually depart at 0400 Hrs to the urban centres after collecting the milk from farmers. They could only depart after 0500 Hrs. The farmers who relied on selling milk to the informal vendors were affected by the closures. Additionally, the restrictions of movement into and out of the Nairobi metropolitan area affected the transportation of milk through public transport vans (*matatus*), and the vendors had to find alternative ways of getting the milk to the market. This particularly affected the female milk vendors who are not able to transport the milk through *boda bodas* and depend on public transport. 55 years old Mama Mukami from Kiambururu, Githunguri indicated that during the COVID-19 restrictions, she hired a *boda boda* and transported the milk through the coffee plantations to get to Ruiru town because *matatus* were not operating. She indicated that other milk vendors who relied on *matatus* had to quit their milk vending businesses. She added that at the roadblocks “*we experienced harassment from the health people.*” The vendors using *boda bodas* were able to access the towns through *panya routes/* shortcuts to get to the urban centres. Additionally, the farmers had to look for alternative markets for their milk due to the closure of restaurants, offices and schools which are major markets for raw milk (Vall et al., 2021). This additionally led to a decrease in revenues among the milk vendors.

The curfew and containment measures were extended further during the fifth presidential address on 25 April 2020 and the sixth presidential address on 16 May 2020. Further, during the sixth presidential address, the president ordered cessation of in and out of Tanzania and Somalia except for cargo vehicles. The president indicated that the decision to close the borders was because 50 per cent of the people that had gotten COVID-19 infections that week including truck drivers had crossed to the neighbouring countries. The drivers of the cargo vehicles were supposed to take COVID-19 tests and could only gain entry if their results were negative. In the ninth address on 07 July 2020, the cessation of movement in and out of the Nairobi metropolitan area and Mombasa County was withdrawn but the curfew remained in place at varied timelines

until the presidential announcement on 20 October 2021 during the Mashujaa celebrations, when it was finally withdrawn.

The COVID-19 restrictions affected the importation of goods from Uganda and Tanzania which includes animal feeds and ingredients for its manufacture. The announcement by the president of Kenya, Uhuru Kenyatta to close the border with Kenya and Somalia sparked a diplomatic row with Tanzania, who retaliated by closing their border for a few days before the issue was resolved by the transport ministers from the two countries. When the truck drivers were required to undertake a mandatory COVID-19 test at the border points, initially it took a long time the test results to be issued, and the truck drivers would wait for days at the border testing stations for the results causing long queues of trucks stretching up to 30 kilometres (Soy, 2020). This would delay their travel by even two weeks. The truck drivers were suspected of transmitting the Corona virus and faced harassment from the authorities in the neighbouring countries (Yusuf, 2020). Uganda which had fewer COVID-19 cases feared that the truck drivers from the neighbouring countries would increase the rate of infection in their country, had at some point implemented a system called “*relay trucking*” where Kenyan drivers would drive the trucks to the Kenya – Uganda border from where they would pass the truck to the Ugandan drivers. Uganda’s president indicated that while the country needed the goods, it did not need the disease (Wadkar, 2020). This relay trucking together with the delay in the journey was an additional cost of transportation. 45 years old Mr. Kang’ethe of Baraka feeds Githunguri indicated that during the COVID-19 restrictions in 2020, he was not able to get the supplies from Uganda because of delays at the Kenya – Uganda border due to the COVID-19 tests. The cost of getting supplies from the manufacturers was higher. “*When travelling outside the country, a journey of one day would take two weeks.*” To resolve the issue of delays caused by the testing and awaiting for results at the border stations, the government established a system through which the truck drivers would be tested at Mai Mahiu, then they would proceed with the journey, and the results would then be released along the way before they arrived at the Kenya-Uganda border. The results would be released within a day and the drivers would then show the negative COVID-19 results to the border personnel through a mobile phone application installed on their phones.

The NERC allowed the restaurants to re-open on 27 April 2020 with an initial operating time between 0500 Hrs to 1600 Hrs. The restaurants were allowed to serve alcohol together with the meals. The bars were temporarily opened following a presidential directive on 6 July 2020 for take away drinks but they were closed again from 27 July 2020 until 29 September 2020 when they were allowed to re-open and operate until 2200 Hrs. During the thirteenth presidential address on 04 November 2020 and the fourteenth address on 12 March 2021, bars and restaurants were ordered to close by 2100 Hrs. On 26 March 2021 during the fifteenth

presidential address, as a result of the third wave of the Coronavirus, bars in Nairobi, Machakos, Kajiado, Kiambu and Nakuru counties were ordered to close while restaurants in these counties were allowed to only offer take-away services. The bars and restaurants were re-opened again, on 01 May 2021 during the president's Labour Day speech and allowed to operate until 1900 Hrs. The unpredictable opening and closure of bars and restaurants affected their operations and reduced the uptake of milk and beer which consequently affected the operations of the farmers.

The bars through the Pubs, Entertainment, and Restaurants Association of Kenya (PERAK) and the Bar, Hotel and Liquor Traders Association (BAHLITA) a week before Mashujaa Day celebrations, lobbied for the president to lift the curfew and increase the bars' hours of operation. They indicated that as a result of the pandemic, bars and restaurants had closed, and people working in the sector had lost jobs. They further argued that since the religious institutions had also been allowed to open, and public service vehicles had been allowed to carry to full capacity, in the same breath, bars and restaurants should also be allowed to operate for longer hours (Mwita, 2021; Nyawira, 2021; Oruta, 2021).

“Closing at 7pm has left many businesses struggling with low sales and inability to pay workers. We are praying that this time the government will open the economy or even add us more hours,” BAHLITA chairman Simon Njoroge (Mwita, 2021)

EABL commercial director, Joel Kamau indicated that 42,000 bars operating in Nairobi and 110,000 national wide sell their products and emphasised the need for bars to operate 24 hours to prevent loss of jobs and revenue (Mwita, 2021). While the curfew was lifted on 20 October 2021, the bars were only allowed to operate until 2300 Hrs following an announcement by the cabinet secretary of health, Mutahi Kagwe. COVID-19 changed the consumption patterns of beer. During the COVID-19 restrictions period, there was increased sale of 'spirits' because bars were closed and people could only buy alcoholic drinks from the '*wines and spirits*' outlets and supermarkets. The proliferation of these alcoholic outlets increased competition between them and the bars that mostly sell beer. Additionally the depressed economic situations as a result of the COVID-19 pandemic resulted in low revenues and job losses that made beer unaffordable causing users to take cheaper alcoholic drinks.

In an interview on 12 November 2021, Mr. Wachira indicated that while the sale of *machicha* was on going at the Amani feeds outlets, it was still not easily accessible. While the effects of COVID-19 had reduced, the supply of *machicha* was still not high. He tried getting *machicha* from the outlet at Marurui, but it was not easy.

“I was also getting machicha at Marurui [one of the few locations where machicha was being dispensed]. It was a challenge getting it from there, because at times I found lots of people and I had to queue and sometimes left without it. I stopped going to Marurui because it was a problem... When going to Marurui it was stressful. I was not sure whether I would get machicha. At the Githunguri outlet, I was also not sure I could get it. I was almost giving up on machicha, even though the owner of the outlet in Githunguri was helping me to get machicha from there.”

He got *machicha* from the Githunguri outlet about four times. He could call the owner of the outlet to find if *machicha* was available, and then he would make a trip to Githunguri from his home in Ruiru to pick the *machicha* and take it to his farm in Riuki. This being a distant location, he could not risk making the trip when he was not assured of getting the product. While the Githunguri outlet was closer to the farmers in Githunguri, it was far from his home in Ruiru compared to the EABL headquarters in Ruaraka, Nairobi. He found it cumbersome to keep calling to find if *machicha* was available, so he indicated that he had opted to feed his cows with processed feeds mixed with water.

4.4 Summary

The nature of the transportation networks have an influence on the growth and form of human settlements and economic development (Lowe & Moryadas, 1984; Omondi, 2003; Rodrigue, 2020; Rodrigue & Notteboom, 2012; UN-Habitat, 2013). As per the study, the nature of the transportation networks determines the commuting patterns in form of choice of routes and towns visited making commuters to have a preference to travel to certain locations and abandon others. Thus while ‘hard’ infrastructure in form of the roads is key to connectivity it is not an assurance of efficient mobility and should be integrated with ‘soft’ infrastructure to enhance connectivity (Cities Alliance, 2019; Lindfield & Roberts, 2021; Simpson, 2021; UN-Habitat, 2013). In addition to the quality of infrastructure, mobility is influenced by other factors and barriers including affordability, gender, age, culture, security, reliability, topography, institutional and governance aspects. The barriers to mobility have a cost that is borne by the commuter in terms of delays in travel, higher production costs, lack of investment, and higher maintenance costs.

While the main barrier of mobility identified in this research is the poor state of road infrastructure and the limitations that it causes, it is however notable that other underlying factors also limit mobility along the milk value chain. The poor road conditions reduce the accessibility and the efficiency in the flow of resources, farm inputs and services between rural and urban areas. Poor road conditions also increase the cost of production in terms of

maintenance of the vehicles and longer travel distances in order to avoid dilapidated sections. As shown in the research, the poor condition of the Ruiru – Uplands road before its rehabilitation led to fewer commuters along the route, as they opted for more reliable routes. The reduced number of customers led to poor returns in the *matatu* business that eventually led to *matatus* deserting the Ruiru to Uplands route for more profitable routes, causing desertion of some market and village centres. The deserted centres became dormant, as customers decreased and businesses closed down. The centres could also not attract investment due to the low number of customers and poor accessibility. Thus dilapidated roads lead to a cumulative causation process that affects other sectors of the rural economy.

The effect of mobility as a result of poor road conditions depends on the kind of commute, the distance to be travelled and the means of transport used. Short commutes that require non-motorised transport like taking the milk to the collection centre are not viewed as problematic because the farmers can wear gumboots when the roads are muddy as compared with those using vehicles and motorbikes that would get stuck in the mud. The distances to the collection centres are short, about one-kilometre radius, thus the task of commuting in this case is not so rigorous.

The study established that there are socio-economic factors that determine the distance that commuters can travel and the extent to which roads are put into use by communities. The distance that a farmer is able to travel corresponds to the affordability of a mode of transport, such that farmers owning a wheelbarrow would travel a short distance while sourcing fodder compared to a farmer owning a pickup or motorbike. Thus in certain instances, farmers need to hire means of transport that they do not own, which is expensive compared to using their own vehicles. The limitation of not owning a means of transportation with a bigger capacity is that the farmers have to buy in smaller quantities, thus making more trips and spending more on fuel. The research also reveals that among the milk vendors, there were striking differences in the way the male and female vendors transported milk. It is not easy for the women to use motorbikes while carrying heavy loads, and no women were observed transporting milk with a motorbike or bicycle. The women preferred to transport the milk using *matatus*. The research additionally reveals that women travel a shorter distance as compared to the men which is similar to findings by Katothya (2017) who pointed out that women travel lesser distances due to limitations of capital, physical endurance, competing domestic roles, access to means of transport, engendered roles where men own and manage the dairy businesses, security, and skills.

The research findings illustrate the implications of strict rules on mobility. Due to the strict rules that govern the handling and transportation of milk including the requirement to use aluminium containers, most of the vendors operate illegally. The milk vendors interviewed indicated that on certain occasions the KDB with the support from the Kenya police service conducts crackdowns on the unlicensed milk vendors. The research also illustrates the power relations in the formulation of policies, such that the milk processing companies have more influence than the farmers and milk vendors in the formation of policies and regulations. The KDB developed draft regulations for the regulation of the dairy industry in 2018 that prohibited the sale and consumption of raw milk at the farm level and outlawed the milk vendors. The regulations were perceived to favour the milk processors and a form of state capture and creation of dominance by the milk processors and in particular Brookside Dairy Ltd that is owned by President Uhuru Kenyatta's family (Karecha, 2019; Muli, 2019; Muyesu, 2019; Ndi, 2018, 2020; Nyamuta, 2019).

The power relations are also evident in the actions by the police in the enforcement of traffic regulation and COVID-19 regulations. Their operations are characterised by a display of power through top down crackdown of individuals flouting traffic rules and regulations. The research also reveals knee-jerk reaction to incidents instead of consultative search for solutions among stakeholders. In addition, transport operators especially those operating transport service businesses complained of harassment and extortion. The respondents outlined that the occurrence of bribing along the roads was a common phenomenon. The research also outlines the effects of police actions and COVID-19 restrictions in disrupting mobility and flows along the milk value chain especially as it affected the farmers and informal milk vendors.

PART TWO: Adaptations to the barriers to mobility along the milk value chain

Just like urban and rural populations develop livelihood strategies to deal with various challenges and limitations, the actors along the milk value chain have developed some coping strategies and adaptations to overcome the barriers to mobility discussed in the previous section. Owuor (2006) discusses coping strategies among poor urban dwellers who devise strategies to cope with the difficult financial situations they faced in the urban areas by diversifying their livelihood activities and also developing survival strategies which included engagement in agricultural activities in rural areas to supplement their income or get some source of food. These adaptations are also referred to as enablers of mobility because they serve as catalysts of mobility as opposed to the barriers to mobility that serve as deterrents of mobility. These include technological strategies to enhance their communication, enhance their means of transport and overcome the barriers to perishability. The commuters have also developed optimisation

strategies to make their trips more efficient, reduce wastage, save on costs, choose optimal routes, choose appropriate means of transportation, limit the number of trips they make, use codes to communicate and lastly conceal their commutes where necessary. Lastly, commuters have also developed political strategies that include collaborating and befriending those in authority like the police to avoid harassment, networking and working in solidarity through cooperatives like the Githunguri Dairy FCS Ltd and also protesting to push for their agenda.

4.5 Technological strategies

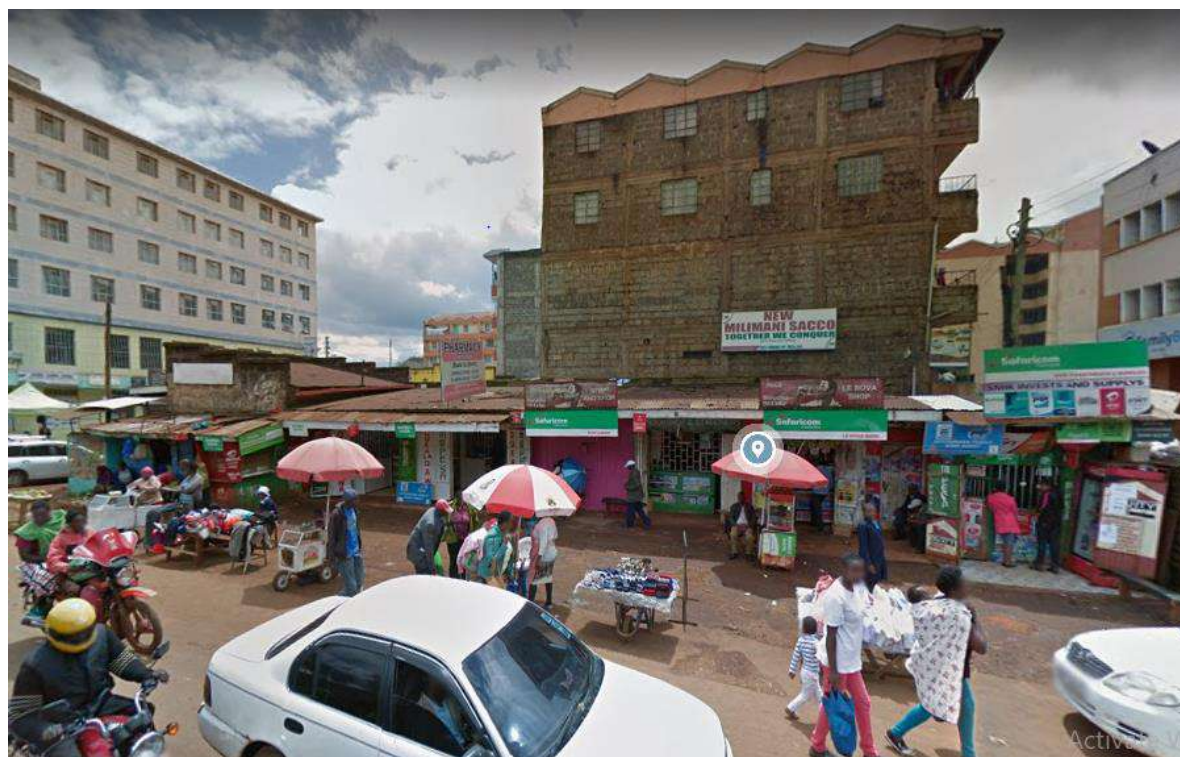
In this section, the use of technology in reducing the barriers to mobility is discussed in terms of how it has shaped mobility and its role in enhancing connectivity. Technological changes have had an impact on people's lives including mobility. Mobile phones in particular have transformed people's lives and have created a virtual space where human beings can interact with each other without necessitating their physical presence. This was evident during the COVID-19 pandemic where mobility was restricted, but virtual interaction through messaging, voice and visual communication was still possible. Existing literature shows that technological advancements have aided in overcoming geographical constraints of physical distance (Cahill, 2010; Coe et al., 2010; MacKinnon & Cumbers, 2011). These *“space shrinking technologies have brought the world closer together, effectively reducing the distance between places in terms of the time and costs of movement and communication”* (MacKinnon & Cumbers, 2011, p. 3). *“Virtual mobility”* has reduced the necessity of some forms of commutes through the use of mobile phones and emails creating inter-locality, inter-regional, and international linkages (Cahill, 2010, p. 2).

Mobile money payments

In 2019 mobile phone coverage in Kenya was 52,168,066 people, while mobile money subscription was at 32,634,883 (CAK, 2019). This is against a population of 47,564,296 in Kenya. Data from the 2019 population census revealed that 43.5 per cent (20,694,315) of the Kenyan population aged three years and above owned a mobile phone, 22.6 per cent used the internet and 10.4 per cent used computers. Kiambu county in particular where the transect study was conducted had a higher mobile phone ownership which was 66 per cent (KNBS, 2019b). Additionally, in 2019, there were 290,432 active mobile agents in Kenya (CAK, 2019). These mobile agents including M-Pesa act as micro-banks where individuals can deposit and withdraw money. Mobile money technology has revolutionised business transactions through a unique cashless and wireless transactions that are similar to the use of credit cards. With a mobile phone, an individual can buy airtime, save money in a mobile 'wallet', deposit money in a bank

account, make payments, send and receive money, borrow and pay loans, buy goods and pay for services. M-Pesa has the largest mobile cash services provider in Kenya that is offered by Safaricom PLC with over 160,000 agents²⁸. M-Pesa is particularly useful to smallholder operators who send and receive small amounts of money. Its application in financial transactions along the milk value chain shows evidence of how it has aided connectivity between rural and urban areas.

Figure 4.12: A series of M-Pesa outlets at Githunguri town along Ruiru-Uplands road.



Source: GSV, 2018.

The mobile money services are interlinked with customers' bank accounts to enable them to transfer money to the bank from the phone wallet and vice versa. This reduces the need to go to the bank to deposit or withdraw money. Retailers can transfer the money from M-Pesa transactions to their bank accounts through M-Pesa. The retailers can additionally get M-Pesa statements to review the payments received and the transfers to their bank accounts. The physical cash can be deposited at any M-Pesa agents' outlets that are available in the village centres and towns. The availability of M-Pesa agents in many neighbourhoods and villages means that the bank has been brought close to the people. Additionally, the mobile phone acts as a mini-bank account that holds money for the users, so even those without bank accounts can have a way of safely keeping their money. This integration of bank accounts and mobile money

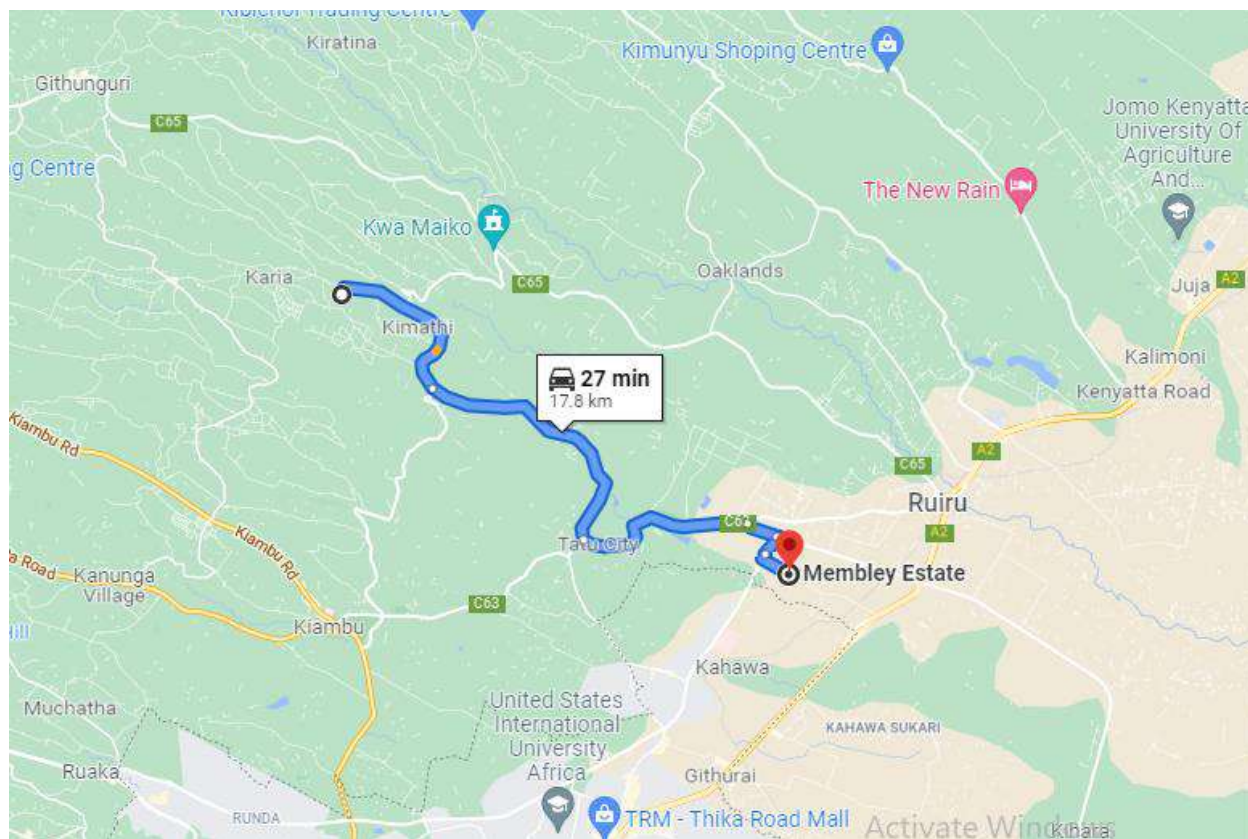
²⁸ <https://www.safaricom.co.ke/personal/index.php/m-pesa/getting-started>

allows farmers to conduct cashless payments which improve security, especially for the farmers who used to travel at night to get *machicha*.

Matatus also make use of the mobile money systems to sustain an efficient parcelling service whereby farmers are able to order for products in neighbouring towns including Nairobi and have them delivered along the *matatu* stops or terminals. This is particularly useful in sourcing of equipments and spare parts that are not available in Ruiru or Githunguri from Nairobi. There has been debate on how to introduce cashless payment of fares within the *matatu* industry, but this has still not taken effect.

The use of mobile phones which all the farmers interviewed had occasionally reduced the necessity of travel among them. The farmers utilised both voice calls and the mobile money transfer service M-Pesa. The farmers could call a supplier of a certain product (including the attendants at the milk collection centre stores), pay them through M-PESA and hire the services of a pickup or *boda boda* transporter to ferry the goods to their farm. This reduces the need for commuting and saves on the cost of travel that the farmer could have incurred to travel to the town or village centre. While accompanying 56 years old Mr. Wachira from Riuki, Githunguri during fieldwork, I observed as he made a call to the supplier to place an order for hay, upon which it was delivered by a lorry to his farm before he finally paid for the bales of hay through M-Pesa. Mr. Wachira in a consecutive interview on 12 June 2021 indicated that due to the complexities of getting *machicha* as a result of the COVID-19 complications, he had resulted to using processed feeds to sustain his animals. He was coordinating with his farm labourer for the feeds to be delivered to his farm from a supplier in Riuki village centre. He could call the supplier of the animal feeds in Riuki (Man Kush shop) located about two kilometres from his farm. Man Kush was a distributor of *chachu* (yeast) which is also a by-product of the beer manufacturing process and sourced from Amani feeds. He could buy six 20 litre jerry cans and one sack of maize germ from Uganda “*which smells good and is appealing to the cows*”, then pay the supplier with M-Pesa and hire a *boda boda* to transport the feeds to his farm at a cost of Ksh. 150. This could be approximately 180 kilograms. He ensured that the *boda boda* transported the maximum load to minimise the trips which he needed to pay for. Since he was residing in Membley estate Ruiru about 18 kilometres from his farm in Riuki, the use of the phone and M-Pesa reduced the necessity of him using his pickup truck to source feeds from other locations. He indicated that “*since I started buying yeast and animal feeds from the Riuki outlet, I now have time to do other things. When I was getting machicha from the Githunguri outlet, I had to queue and it took my time.*”

Map 4.3: Distance between Mr. Wachira’s home in Ruiru and his farm in Riuki.



Source: Google maps, 2021.

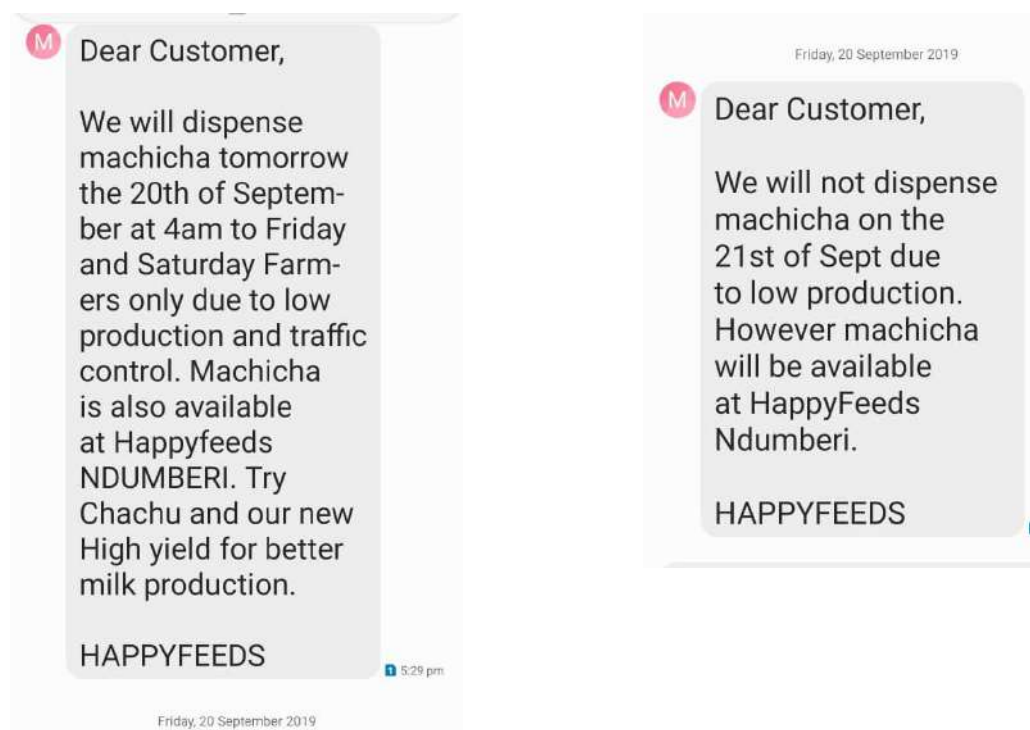
Substituting commutes with calls and messaging services

Through mobile phone, farmers are able to communicate with service providers like the veterinary doctors for examination of their animals and artificial insemination reducing the necessity to travel. “*To get the services of a veterinary doctor, I just make a call to him*” Indicated Mr. Maina a 76 years old farmer from Ha Donga, Githunguri. Mr. Maina added that he could at times call the veterinary doctor for advice who would then indicate which drugs to buy to treat recurring conditions like mastitis. The application of tele-medicine is taking place in many parts of the World where patients do not have to go physically to see the doctor. Consultations can be done through video conferencing. During the fieldwork, I observed Mr. Maina call the veterinary doctor who took about 30 minutes to get to the farm to examine one of his cows that had foot and mouth disease.

The other use of mobile phone technology was the bulk messaging service. Amani feeds would use the service to inform the farmers of the days when *machicha* would be dispensed at the EABL factory in Ruaraka, the availability and the sequence to be followed when farmers were getting the *machicha*. This reduced incidences of farmers travelling to Ruaraka and not being able to get *machicha* which would lead to losses. It also enabled the farmers to adequately plan for their trips. In one instance while accompanying Mr. Wachira, whose farm is in Riuki,

Githunguri to get *machicha*, upon arrival at the factory, we found out that it not being dispensed that day. Mr. Wachira then realised that he had not checked his messages for him to be aware that *machicha* was not available on that day. The farmers who get *machicha* additionally had a *WhatsApp* group that assisted them in communicating among themselves on the issues affecting them. The use of mobile phones additionally enabled the farmers to call mechanics or other farmers for assistance in case their vehicles got a mechanical problem.

Figure 4.13: Automatic bulk messaging system.



Source: Field work, 2019)

Githunguri Dairy FCS Ltd has an electronic system that sends an automatic message to farmers once the milk is delivered at the milk collection centres. This technology helps the farmers to monitor production on daily basis and reduces the need for the farmer to make trips to the collection centre to confirm their records. The farmers can additionally delegate the work of delivering the milk to the collection centres to the farm labourers without fear of being cheated.

Breaking the barriers due to perishability

Milk is a highly perishable product and has limitations of the time that it can stay in raw form before spoiling and also its shelf life after processing. Raw milk can be kept for a few days by cooling and refrigerating it. As per the KDB regulations, raw milk should be cooled between four to seven degrees Celsius within two hours of milking or transported to the cooling or processing centres within two hours after milking. Githunguri Dairy FCS Ltd has invested in

12 coolers at some of the collection centres to ensure that the milk gets to the factory in a good state for the production of high quality milk. The collection centres without coolers are either supposed to transport milk to the nearby cooling centres or directly to the factory. The milk is then transported to the factory in Githunguri town using six tankers owned by the company. Brookside Dairy Ltd the largest milk processing company in Kenya relies on the cooling technology to keep the milk it purchases from across the country at the right temperature before it is transported to its processing factory in Ruiru town. Jacketed tankers maintain the milk in good condition during transportation over long distances to the factories breaking the barriers to perishability. Transportation of milk through the tankers from cooperatives within a distance of about 200 kilometres is at a cost of Ksh. 1 per litre compared to the collection of milk from the surrounding hinterland which is at Ksh. 3 per litre according to 38 years old Mr. Nyaga a manager at Canaan Factories Ltd during an interview on June 2021. By transporting the milk in bulk, the company is able to take advantage of economies of scale. This technological advancement in the transportation of milk reduces the need to have processing industries located close to the milk production areas which is the case for Brookside Dairy Ltd. Since there is no significant weight gain during processing, there would be no significant change in the unit cost of transportation of the raw and processed milk.

“By overcoming the constraints of geography (distance and space) through investments in transport and communications infrastructure, corporations have reduced the effects of distance as it becomes easier and cheaper to transmit information, money, and goods between places. As such, time and space are effectively being compressed through the development of new technologies.”

(MacKinnon & Cumbers, 2011, p. 3)

The barriers due to the perishability of milk have been overcome through the processing of milk. Milk in Kenya is processed through two main methods. The first is through pasteurization; where the milk is heated at about 70 degrees Celsius for 15-25 seconds to kill pathogens then cooled at three degrees. The processed milk can stay for 2-5 days and when refrigerated 12-21 days. The other method of processing is Ultra Heat Treatment (UHT) where the milk is heated at 138 degrees Celsius for four seconds and can stay for over six months. Uplands PD&F Ltd has through the application of UHT technology, being able to transport and sell milk to remote areas in Kenya like Lamu and Turkana. Due to its durability, it exclusively sells UHT milk in upcountry markets while in the Nairobi region the company sells both short-life and long-life milk. The limit to the distance where milk is marketed depending on the nature of the milk: raw milk can only be marketed within a short distance of about 50 kilometres; while pasteurized milk over a distance of about 100 kilometres and UHT milk over a long distance of over 500

kilometres. Rural industrialization plays a critical role in overcoming the barriers due to the perishability of milk through value addition that enables raw materials from rural areas to be transported over longer distances, strengthening the spatial flow and ability of products to move over longer distances.

The silage making process is another technology that has been applied to lengthen the distance from which fodder can be transported as discussed in the section on storage of fodder.

Adaptation and modification of means of transportation

To enhance mobility, farmers have modified their means of transportation to fit to their mobility demands. The farmers make use of modified wheelbarrows and hand carts to carry the aluminium milk containers (see Fig 4.14). The various types of hand carts used for carrying milk are sold in the urban centres like Githunguri town. The milk vendors modify their motorbikes to ensure that they can carry between 150 – 200 litres (see Figure 3.14). The prevalent use of the plastic jerry cans by milk vendors when ferrying milk using motorbikes and *matatus* is because of their small size and light weight which makes it easy to pack them in gunny bags in groups of about five jerry cans filled with milk under the seats of the *matatus* during the journey to the urban centres, and in groups of about 15 empty jerry cans that are fitted into gunny bags and packed in the boots of the *matatus* or tied at the top of the vehicle or hanged at the boot door of the *matatus* after the sale of the milk (see Figure 4.15). However, a major limitation of the jerry cans as containers for carrying milk is that they are difficult to clean, which is the reason that the KDB does not allow their use in milk transportation. Despite this challenge, the vendors have devised a strategy to ensure that the cans are labelled to enable tracing of the farmers who supply them with the milk so that in case the milk gets spoilt they can locate the specific farmer (See Figure 4.16). Additionally, some of the milk vendors ensure that they wash the jerry cans themselves. The KDB is also sensitising the farmers to carry milk through a modified motorbike that is able to carry four 50 litre aluminium cans of milk totalling to about 200 litres of milk (See Figure 4.10).

Figure 4.14: Modified wheelbarrow and handcart.



Source: Field work, 2019.

Figure 4.15: Transportation of empty jerry cans by *matatu*.



Source: GSV, 2018.

Figure 4.16: Labelling of jerry cans for traceability



Source: Field survey, 2019.

The pickups are also modified to ensure that they carry heavy loads. Mr. Mucheru a 65 years old businessman who sells chicken waste feeds uses canvas that is held in place by a metallic frame to ensure that he carries a huge load and that the chicken waste that he transports does not pour out or get blown by the wind. The farmers getting *machicha* also use canvas to make sure that the *machicha* does not pour out while commuting while farmers who use station wagon

vehicles recline the back seat so that they can carry heavier loads in the vehicles. Toyota Corolla, Toyota Sienta and Toyota Probox are saloon cars that are considered to take heavier loads and withstand the rough terrain conditions in rural areas. They are popular with rural residents because they perform both roles of carrying passengers and goods. Two of the farmers interviewed were using their saloon vehicles for the transportation of animal feeds.

Storage space

To limit the number of trips that the farmers make in sourcing animal feeds, farmers have devised strategies to store a large quantity of animal feeds. Mr. Kiama, 46 years old Githunguri sub-county livestock officer noted that farmers can reduce transportation and production costs by buying animal feeds and other farm inputs in bulk when they are in plenty and cheap, preserving, and storing them in good condition. Investing in adequate storage facilities enables the farmers to access quality feeds throughout the whole week or several months. The types of storage differ in size and the materials used to construct them. Some farmers opt to use the space above the cow shed to store the animal feeds (see Figure 4.17), while others construct storage pits for silage underground. The larger the size of storage the longer the time that the farmer can take before he requires additional feeds. With enough storage space, farmers can acquire the fodder in bulk when it is in plenty during the rainy season and store it for use during the dry season.

Figure 4.17: Storage space built by a farmer above the cowsheds.



Source: Field survey, 2019.

Figure 4.18: A make-shift shelter for storing napier grass.



Source: Field survey, 2019.

Figure 4.19: Compaction and storage of silage in an underground pit.



Source: Field work, 2021.

Box 4.2: Use of silage to prolong the life of fodder

Use of silage to prolong the life of fodder

Some farmers have adopted the use of silage which is able to stay for longer periods without getting spoilt. 55 years old Mr. Mwaura a farmer from Gikara, Lari works together with his wife and son in preparing silage during the school holidays. He works away from home, so his wife takes care of their cows. They have five cows three of which were being milked producing about 20 litres of milk in a day, and their land is about one and a half acres. With the silage, the labour reduces, and she does not need to hire a labourer. The storage for silage consists of five polythene wrapping shelters that are placed on the ground that can each take the quantity of a pickup. They also have two wooden cubicles that have been lined with polythene wrapping that can accommodate a three-tonne lorry/ canter. The silage takes three weeks to mature and ferment and can last about six months. He indicated that the silage does not spoil so long as it is sealed. They get the napier grass for the preparation of the silage from their *shamba* with assistance from hired labourers, and also purchase napier grass from other farmers when it is in plenty. The napier is then chopped with a chaff cutter, mixed with molasses and maize germ to aid in fermentation, and then it is compacted in the polythene wrapping shelters and cubicles. The chopping and compacting has to be done the same day to produce a good quality of the silage. However the napier could be left to wither in the *shamba* for a day. The silage in the polythene wrapping shelters can each last one month, while the one stored in the cubicles can each last three months. When extracting the silage to feed the cows in the morning and evening, the wrappings are unsealed and the portions needed are taken, then the wrappings are sealed again. This is done to keep air out and prevent spoilage. Because their farm is located next to Kereita forest, the wife escorts the cows to graze in the forest everyday reducing the quantity of silage that is fed to the cows. The farmer uses the silage in the dry season to allow the napier grass to grow because it takes time to grow during the dry season.

Source: Author.

Box 4.3: Storage of hay by Mrs. Muchai.

Storage of hay by Mrs. Muchai

Mrs. Muchai a dairy farmer from Ndathini, Githunguri has 11 cows, and one acre of land. She leases out an additional two acres of land in the neighbourhood. She is assisted by two labourers and her husband who is more engaged in their poultry farm. She indicated that she had a passion for her keeping cows. Her cows produce 300 litres of milk daily at an average of 27 litres per cow which she takes to Githunguri Dairy FCS Ltd. To supplement the supply of napier grass

from her farm and the leased land, she buys hay from Nakuru when it is in high supply between August and November. She indicated that during this period, the hay is green and leafy and is also offered at a cheaper price. She buys a bale of Boma Rhodes grass at Ksh. 150 and Lucerne grass at Ksh. 170 which the producers transport to her farm. She tried to lease land to grow her hay in Nakuru, but the long distance between Githunguri and Nakuru made supervision and follow up difficult, hence she prefers to buy it from the growers in Nakuru. The prices of hay increase during the dry season from November to February to as high as Ksh.300 which is twice the price she gets her hay for. The quality of the hay at this period is also low because it has fewer leaves and more straw. *“The trick is to start making or buying fodder [hay] when there is a lot of green forage available that the animals can eat.”* She has a store that can accommodate 5,000 bales of hay. During the rainy season she relies on the napier grass that is in high availability to feed her cows at that time.

The hay is chopped with a chaff cutter, soaked in water and mixed with napier grass to make it more appetizing for the cows. She indicated that as a result of having adequate storage and giving her cows quality feeds throughout the year, she is able to sustain sufficient production of milk throughout the year with no reduced production during the dry season as experienced by other farmers.

Source: Adapted from (Farm Radio International, 2019)

Storage space is not only essential for farmers but also for retailers and milk processors. The higher the storage space the less travelling that is needed. Even though transportation in bulk is much cheaper, the retailers need sufficient storage facilities to accommodate the volume of goods that are transported to the outlets. Mr. Kang’ethe business was getting affected by limited storage space *“The business potential is there. I need space for storage. I might not meet the demand of customers. I could not sell pineapple pulp because of lack of space to store it.”* A look at the outlets selling animal feeds in Githunguri town shows the constraints in storage space. The feeds are displayed on the streets and taken back into the shops in the evening. Some traders are already developing warehousing facilities to store their supplies.

4.6 Optimisation strategies

These are the strategies that commuters use to make their commutes more efficient, reduce wastage and save on costs. This is through choosing routes that save on time and are in good condition to reduce wear and tear of the vehicles; choosing the appropriate means of transportation, limiting the number of trips they make, using codes to communicate and lastly concealing their commutes.

Choice of Routes

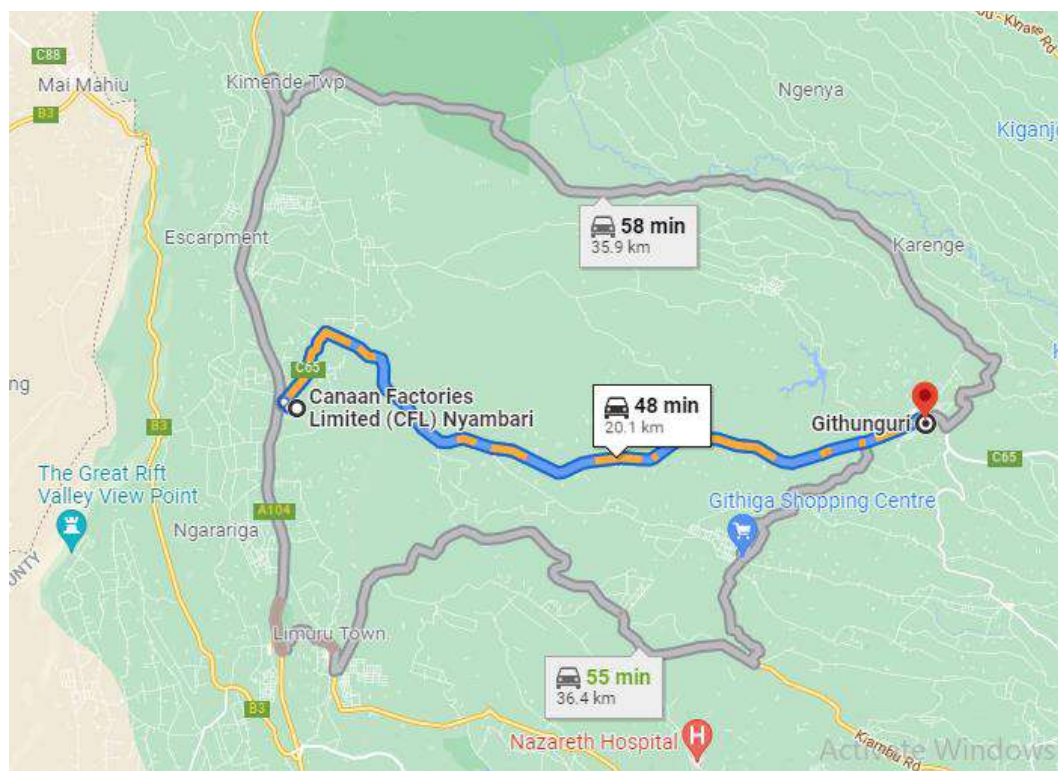
In an ideal situation, a commuter would choose a route that takes the shortest distance possible. *“Farmers need to travel the shortest possible motorable distance. The more you go the more the cost.”* Indicated Mr. Njihia from Gathanji, who emphasised on the need to optimise on getting products in the closest location possible. However commuters have to make choices on the routes to use depending on various conditions which are discussed in this section. *“I have no specific route. When the dairy board has a roadblock, I change the route”* This was the statement by 55 years old Mr. Waiganjo a milk vendor from Kiganjo, Gatundu South. It illustrates the dynamism in the choice of routes that farmers use to travel depending on circumstances. This section outlines the determinants of the choice of routes. The dilapidated condition of the Ruiru to Uplands road at the beginning of this research caused the farmers to alter their routes when using it. The road connects to other secondary and tertiary roads that vary in type from earth roads, murrum/ gravel roads and tarmac roads. The Githunguri to Kiambu road and the Kwamaiko/ Ngewa to Kiambu road were in good tarmac condition, and offered an alternative but longer route while travelling to Ruiru and Nairobi.

The rehabilitation of the Ruiru to Uplands road was launched on 22 June 2018 and the contractor was China Guansu Engineering Company under the supervision of KENHA. The road was previously tarmacked in 1997, but due to poor maintenance, the thin layer of tarmac had gotten worn out over the 20 years span. The construction of the road began in June 2018 after the launch and by December 2019 the section between Ruiru town to Kwamaiko/ Ngewa market centre had been tarmacked. There was delayed construction between January to July 2021 after which the construction resumed and by December 2021, the road had been tarmacked up to Githunguri. The construction from Githunguri to Uplands village centre was still ongoing at the time of writing this thesis in March 2022.

The time it takes to move from one place to another using several alternative routes varies depending on issues like the quality of the road, the amount of traffic and the availability of the means of transport. Thus, depending on the time required to move from one place to another, a commuter can substitute one route for another. This was the case for commuters using the Ruiru to Uplands road before the road was rehabilitated. Mr. Nyaga a 38 years old extension manager at Canaan Factories Ltd located in Uplands village centre travelled daily to the milk processing factory from Githunguri town where he resided. The factory is located along the Ruiru to Uplands transect, about 20 kilometres from Githunguri town. The dilapidated condition of the road between Githunguri town and Uplands village centre forced him to use the route through Githiga, Ngorongo, and Limuru town that was tarmacked. The other option he had was to use

the Githunguri Kimende road via Kagwe centre because it had also been rehabilitated, except for a small section between Kagwe and Kimende (see map 4.4).

Map 4.4: Githunguri to Canaan Factories Ltd in Uplands.



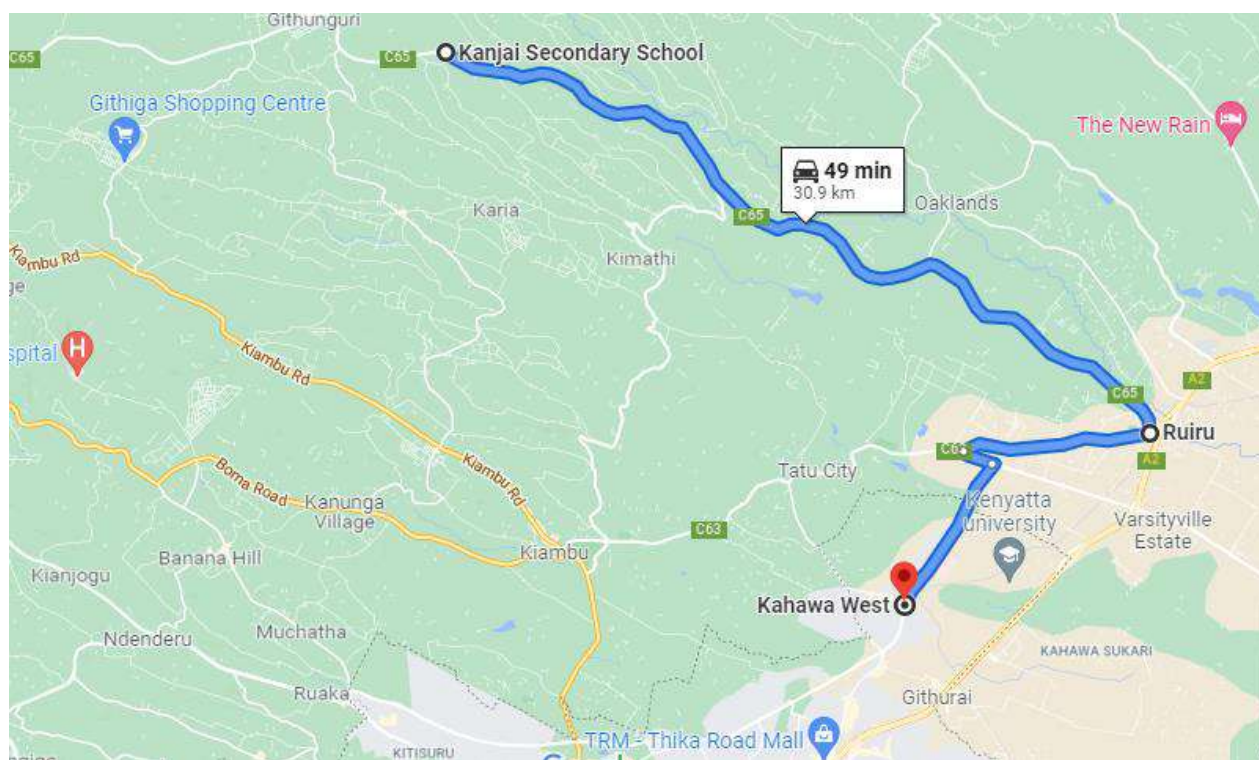
Source: Google maps, 2021.

The route he uses increases the distance of travel by about 30 kilometres for a return trip. Mr. Nyaga's reason for not using the Githunguri to Uplands road was that due to the dilapidated condition of the road, it would take a longer time to travel, the security was also not guaranteed due to fewer vehicles using the road and also given that the a section of the road passes through the Uplands forest. He also felt that it would lead to wear and tear of his vehicle and cause mechanical problems. He opts to spend much more money on fuel in order to keep his car in good mechanical condition. The longer route also gives him peace of mind because he does not fear that the vehicle could get spoilt.

An interview with another commuter 49 years old Mrs. Kinuthia who resided in Kahawa West (10 kilometres from Ruiru town) and worked as a teacher at Kanjai secondary school along Ruiru to Uplands transect illustrates the experience of using a *matatu* along the transect. Her trip between Ruiru and Kanjai was problematic. A journey that normally takes 40 minutes to one hour by car took her two hours. She indicated that the *matatu* took long to fill up at Kwamaiko/ Ngewa market centre and was also overloaded carrying eighteen instead of fourteen passengers who were squeezed together in order to fit, making the journey uncomfortable. She

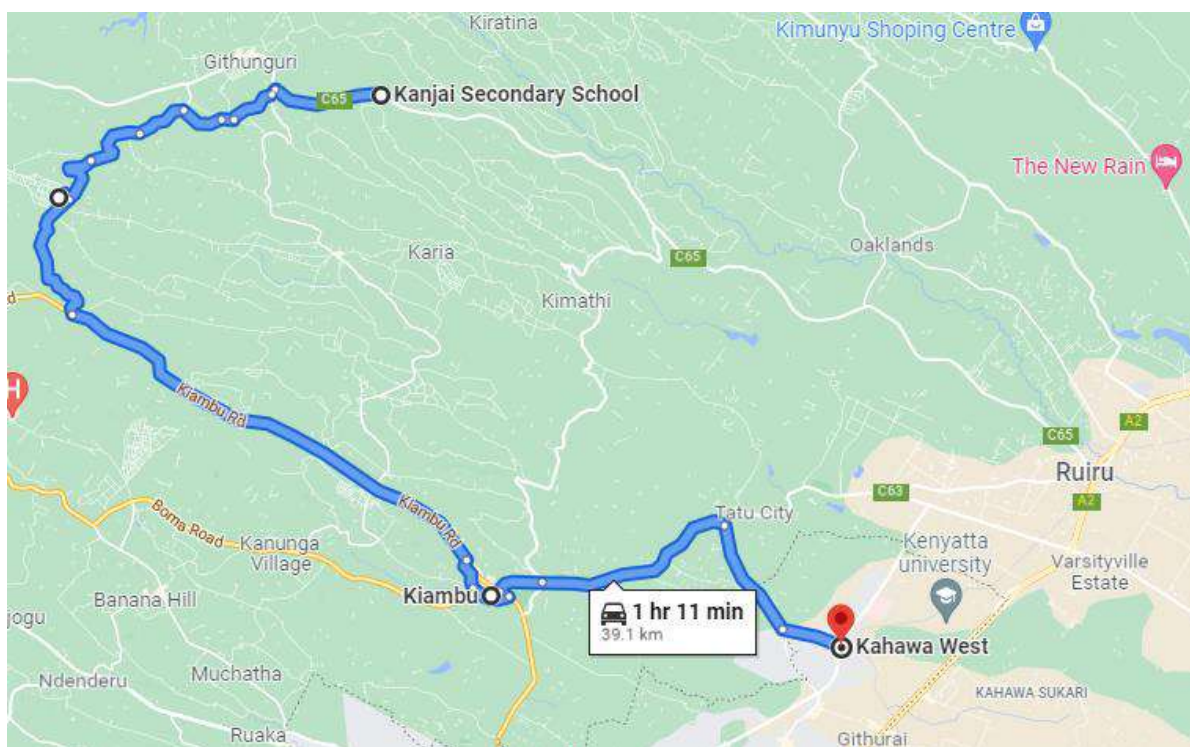
indicated that the *matatus* plying that route were old, and also took long intervals to arrive at the *matatu* stops. Additionally the *matatus* stopped for long at almost every stop further delaying the journey. As a result of the poor condition of the road, she described it as “*bad and dusty.*” So while she used the Ruiru – Kanjai route in the morning to work (see Map 4.5), she took a longer route in the evening through Githunguri and Kiambu towns before connecting to Kahawa west (see map 4.6). During the rainy weather, she used a taxi further increasing her commuting expenses. The chairman of the NAGIRU *matatu* Sacco which operates between Nairobi, Ruiru and Githunguri who was interviewed at the onset of the construction of the Ruiru to Uplands road on 02 February 2018 revealed that due to the dilapidated condition of the road, commuters were using other routes to reach Ruiru. The commuters were opting to use longer routes to access Ruiru. He also indicated that as a result of the condition of the road, the investors in the Sacco had reduced. The Sacco had only 26-27 vehicles using the route out of the 30-40 registered members, with the owners of new vehicles opting to have their *matatus* in other routes leaving only old vehicles to use the Ruiru to Githunguri route. The chairman of the NAGIRU Sacco was hopeful that when the construction of the road was completed, the volume of traffic would increase.

Map 4.5: Kanjai secondary school through Ruiru town.



Source: Google maps, 2021.

Map 4.6: Kahawa West to Kanjai secondary school through Kiambu town.



Source: Google maps, 2021.

The dilapidated Ruiru to Uplands route posed a vicious cycle of events that led to reduced traffic of vehicles and people along the route. As a result of the poor condition of the road, the investors choose to invest in other routes thus reducing the number of vehicles operating along this route, with the remaining vehicles being the old dilapidated ones. The road was also dusty making it uncomfortable for the commuters to travel through on their way to work. As a result, the commuters opted to use other routes when travelling to Ruiru and Nairobi: either the Githunguri - Kiambu – Ruiru/Nairobi road, or the Kwamaiko - Riabai - Kirigiti - Kiambu – Ruiru/Nairobi road. The reduced traffic in turn caused neglect, isolation and abandonment of the village and market centres along the route and a decrease in the number of customers. The dilapidated condition of the road additionally reduced the attractiveness of the areas adjoining that route to investors, including those investing in the transport service business due to the inefficient travel conditions and cost of maintenance of vehicles. The choice of the route thus has implications on the growth of towns, market and village centres such that when commuters avoid certain routes because of the reasons listed above, it leads to their stagnation and decline (see Figure 4.3).

In their mobility from one place to another, a farmer can chose to use a longer distance to avoid certain mobility obstacles or barriers (discussed in the previous section). This study identifies a number of reasons that farmers made in choosing the routes to use. Before the rehabilitation of

the Ruiru to Uplands road, the farmers going to buy *machicha* at EABL headquarters in Ruaraka, Nairobi avoided the Ruiru to Uplands road and used alternative routes that were more motorable. Motorbikes and bicycles were still able to use the route even with the bad condition. As the construction of the road continued, farmers changed their routes and started using the newly tarmacked sections of the road. This is illustrated by the journeys of Mr. Maina and Mr. Wachira following a series of interviews.

Mr. Maina a farmer residing near Ha Donga in Githunguri had various options of going to EABL, Ruaraka to get *machicha*. He could use:

Route one: Ha Donga – Kwamaiko – Ruiru – Ruaraka

Route two: Ha Donga – Kwamaiko – Kamiitu - Ngenga road — Tatu City - BTL – Thika road - Ruaraka

Route three: Ha Donga – Riagithu – Riuki – Ruturu road – Tatu City - BTL – Thika road – Ruaraka

Route four: Ha Donga – Riagithu – Riabai - Kirigiti – Kiambu road – Northern by pass – Garden estate – Ruaraka

02 February 2019, Mr. Maina was using **route four** to get *machicha* because the roads along that particular route were tarmacked all the way from Riagithu to Ruaraka, thus it was faster and suitable for his vehicle. He was departing at 0900 Hrs. He used the same route back to the farm. During this interview he indicated that he was considering using route three because he had gotten information that Ruturu road had been graded. He indicated that he stopped using **route two** because the area near the bridge along Ngenda road was rough and in a dilapidated condition. That section had protruding rock and gulleys as a result of erosion causing it to be difficult to use especially for vehicles carrying a heavy load. The motorbikes were however still using that particular road. He avoided dilapidated sections of the road to prevent mechanical problems given his vehicle was old. Mr. Maina also indicated that if **route one** through the Ruiru to Uplands road was in good condition, he could use it because its distance was shorter. At the time of that interview, it was still under construction, and the contractor was making culverts in different sections between Kwamaiko and Ruiru. The contractor had further put diversions along the road that were causing vehicles to get stuck in the mud during the rainy season. It was additionally dusty during the dry season (See 4.20).

Figure 4.20: A diversion during the construction of the Ruiru to Uplands road on 13 December 2018



Source: Field work, 2018.

In an interview on 06 May 2019, he was departing at 0230 Hrs to get *machicha* still using **route four**. He left early because there were few vehicles on the road at that time so he that he could not encounter glare from vehicles at night. He also wanted to ensure that he got a suitable parking space in Naivas supermarket to avoid getting stuck on the muddy sections that were not suitable for parking and he further wanted to avoid the morning traffic jam. During an interview with him on 10 February 2020, he indicated that he was at the time using **route one** through Riagithu, Kwamaiko, Ruiru, Thika road, because the section between Ruiru and Kwamaiko towns had been tarmacked and was in good condition. However because the section between Kwamaiko and Ha Donga had not been tarmacked, he was using the murrum road from Ha Donga to Riagithu, then the tarmac road from Riagithu to Kwamaiko, and he was still departing at 0230 Hrs to ensure that he was in Ruaraka in time.

An interview with the farmer on 5 June 2021, he revealed that whereas he was no longer going to get *machicha* in Ruaraka, he was using **route three** when going to Tatu City to get grass because Ruturu road had been tarmacked (route three) between 2020 and 2021. In regard to getting *machicha* from Githunguri town when sale of *machicha* was decentralised after COVID -19, he revealed that because the section between Ha Donga and Githunguri along the Ruiru to Uplands road was still under construction, he only used it during the dry season because the road was muddy, skiddy and not motorable during the rainy season. He recalled that at one time when he had tried to use it, it became slippery and impossible to drive through forcing him to

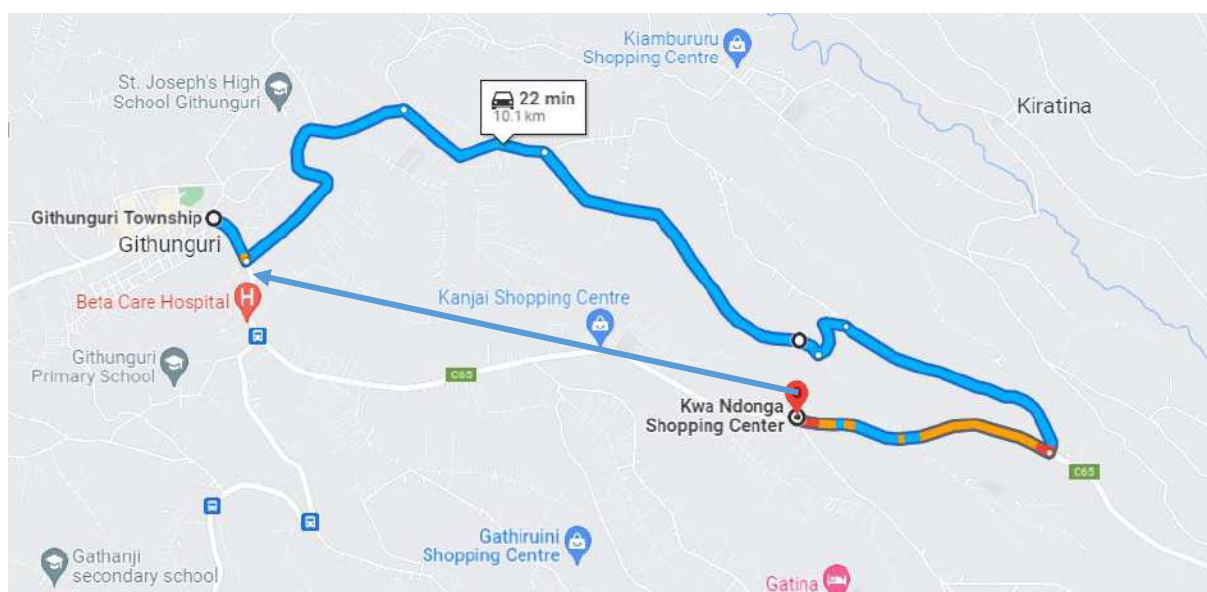
make a detour along the way to a longer route through Miguta, Karweti and Kanjuko to connect to Githunguri which was twice as long (see Figure 4.21 and Map 4.7).

Figure 4.21: Slippery section between Ha Donga and Githunguri on 12 May 2021



Source: Facebook.

Map 4.7: Ha Donga to Githunguri through Miguta, Karweti and Kanjuko



Source; Google maps, 2021

56 years old Mr. Wachira resides in Membley, Ruiru town but has a farm in Riuki village, Githunguri. He did not have a challenge on the journey to pick *machicha* because his home is two kilometres from Thika road and about 16 kilometres to Ruaraka, Nairobi which were in good condition. However the farmer had various options for the journey to his farm in Riuki from Ruaraka, which he chose depending on various circumstances outline below.

Route one: Ruaraka – Thika road - Ruiru - Kwamaiko – Riagithu – Riuki

Route two: Ruaraka – Thika road – Northern by-pass – BTL – Tatu City - Ngenda road - Kamiitu – Kwamaiko – Riagithu - Riuki

Route three: Ruaraka – Thika road – Northern by-pass - BTL – Tatu City– Ruturu road – Riuki

Route four: Ruaraka – Garden estate– Kiambu road – Kirigiti - Riabai – Riuki

In an interview on 31 January 2019 Mr. Wachira indicated that he was using **route three** through the Ruturu road when going to get grass in Tatu city or Kamiti forest along Ruturu road because the grass was lighter, and was also gotten along the route. However, for *machicha*, the farmer was using **route four** which was longer but more motorable. He indicated that if Ruturu road was made, it could shorten the distance that he needed to get *machicha* to the farm. The farmer also indicated that since the Ruiru to Kwamaiko road was being rehabilitated, it would be a shorter route that he would prefer to use in future.

During a follow-up interview with him on 12 June 2021, although *machicha* was no longer being dispensed at Ruaraka, Nairobi, he was getting the *machicha* at the Windsor outlet which is along the Northern by-pass, then he would pass through Kahawa West, BTL, Tatu City to Ruturu road which is a version of **route three**, the shortest route to his farm. “*I stopped using the route through Kiambu road when getting machicha after the Ruiru Uplands road reached Kwamaiko [Ngewa] in 2020. But now the road through Ruturu is faster.*” He indicated that to visit his farm from his home in Ruiru to Riuki, he had stopped using a section of **route four** from Ruiru to Kiambu to Kirigiti to Riuki road in December 2020 because it was longer after the Ruiru to Uplands road had been constructed up to Kwamaiko/ Ngewa market centre. He was using a section of **route one** from that period until when the Ruturu road was constructed upon which he started using **route three**. “*I have now gone back to using Ruturu road when going to Riuki because it is now rehabilitated. The journey is fast and it takes me only 20 minutes to get to the farm.*” He exclaimed. However he occasionally uses **route one** between Ruiru and Kwamaiko/ Ngewa when he needs to buy maize germ at Kwamaiko/ Ngewa which he considers to be of good quality and is offered at a fair price.

A journey to get *machicha* with Mr Wachira on 14 February 2019

We met at Clay works, along Thika road at 0720 Hrs and left to get *machicha*. He was concerned that we were getting late to get the *machicha*, and had planned to depart by 0700 Hrs. Mr. Wachira's home is two kilometres from Thika road and 16 kilometres to the EABL factory in Ruaraka, Nairobi, but his farm was in Riuki, 25 kilometres away. We experienced a bit of traffic jam at Garden Estate intersection as vehicles were heading towards the City centre. We arrived at 0800 Hrs and to our surprise, there were no other farmers that day. Unfortunately there was no *machicha* that day. Mr. Wachira had not checked the SMS service by Amani feeds to show that *machicha* was not available that day. We were referred to Amani feeds shop at Garden estate roundabout, opposite Naivas supermarket or the Amani feeds warehouse in Ndumberi, Kiambu where he bought two units (20 buckets at Ksh. 75 each) of *machicha* at Ksh. 1,500 which was Ksh. 128 more than the price at EABL, Ruaraka. The *machicha* was watery and was sold in buckets. Fortunately Mr. Wachira had carried a 210-litre container that was filled with the *machicha*. He normally carried it so that in case he missed the *machicha* from EABL, he could source it from the other Amani feeds outlets. The two units he got were less than the eight units that he had intended to get that day, so he had to look for additional feeds. We then proceeded to Ndumberi, off Kiambu town at the Amani feeds warehouse. We were not stopped by the police on the way, and he indicated that it was because he was using a double cab pickup which is not classified as a commercial vehicle but rather a passenger vehicle, therefore it was not required to undergo an annual inspection to verify if it is road worthy, and so the police do not regularly check to see if it has an updated inspection certificate. At Ndumberi, Mr. Wachira bought 120 kilograms of dry sorghum *machicha* that was put in sacks (This was sourced from EABL in Kisumu and transported using trailer trucks). We also bought three sacks of dairy meal at Greenfield Millers in Kiambu town where he preferred buying his feeds. He indicated that the miller, allows the farmer to choose the processed feeds that they prefer and then the supplier mixes it for them. We were already past Kirigiti where we could have accessed Kirigiti to Kwamaiko road that is tarmacked and leads to his farm and because it had not rained, Mr. Wachira decided to use a short cut through Maigotha, Ngemwa. This was a narrow hilly road that cut through the valleys, and as such it had steep slopes that led to the shaking of the liquid *machicha* inside the container. Luckily there was a lid, and the spilling was minimized. On the way we gave a lift to a lady since that route does not have many vehicles and there were no *matatus*. We did not meet a vehicle on the way. This was a relief because meeting a vehicle on the way would necessitate one of the motorists to give way (usually the one going uphill given

the weight that it is carrying) because the narrow road cannot accommodate two vehicles to pass each other. We arrived at his farm at 11 am.

Source: Author.

Commuters' decision on the choice of route to use also depends on the time of the day. 45 years old Mr. Waruiru a milk vendor who was transporting milk from Kwamaiko and Gathigi and selling milk to Ruiru town and Kahawa West indicated that he often used the Ruiru to Uplands road when taking the milk to Ruiru town and Kahawa West at night around 0400Hrs, but uses the Ngenda Road when going back home around 1100 Hrs. The reason for changing his route is because of security concerns during the night.

The farmers also avoid certain routes because of the police presence. 55 years old, Mr. Waiganjo from Kiganjo, Gatundu South indicated that he had no specific route to get to Ruiru town from Kiganjo. "*When the dairy board has a roadblock, I change the route.*" This dynamic change of route is crucial for the milk vendors to sustain their mobility and consequently their milk vending business. The routes used depend on the time, season, occasion or event. The perceptions of the police on the road vary with time, where at night they are considered a form of security because carjackers and other criminals cannot use the routes where there are police roadblocks, while during the day the commuters fear police harassment as police conduct 'operations' to check the compliance of vehicles to traffic regulations.

The experience of the commuters illustrated above shows that farmers have to make rational choices of taking a longer route and spending more on fuel, versus higher maintenance costs as a result of the dilapidated section of the road. Due to the heavy loads that the vehicles carry, it takes a longer time to pass through the dilapidated roads than to pass through the tarmacked roads. The choice of the routes used also depends on the weather conditions, and the time of the day because some routes may be motorable during the dry season, but muddy during the rainy season. Additionally, the commuters avoid certain routes during the night because of security reasons. The research shows that commuters change routes to avoid certain barriers to movement. The determination of the choice of means of transport arises from certain standards and expectations in the course of the journey which includes: efficiency, comfort, image, safety and convenience. It is also determined by the personal attributes of the individual who intends to make the trip that includes: income, behaviour, attitude, culture and habits. These are summarised in figure 4.22 below:

Figure 4.22: Preferences in choosing a route.



Source: Author.

Choice of means of transport

The choice of means transport depends on the nature of mobility needs to be achieved. This may include the amount of products that need to be transported, the distance that needs to be travelled, and the time that needs to be taken on the trip. The time required to get from point A to point B may vary depending on the urgency, convenience or reliability that needs to be achieved. For instance, a veterinary doctor needs a reliable means of transport to visit as many farmers as possible, but also needs to consider the nature of the roads he/she will encounter during the visits. Various means of transport are suitable for certain activities and play varying roles and functions along the milk value chain. They are supposed to facilitate efficient and cheap transportation during the production to distribution of milk. *Machicha* being fluid in nature, requires containers or container like means of transport so that it does not spill during transportation. Pickups and lorries were the optimal modes of transport that were used for this kind of mobility by the farmers who used to buy *machicha* from EABL, Ruaraka. In the decentralised locations, farmers could use a range of other means of transportation like wheelbarrows, bicycles, *boda bodas*, tuk-tuks, saloon vehicles, hand carts, pickups or lorries.

Del Monte Kenya Ltd sells pineapple pulp only to farmers and vendors using lorries, causing the other farmers who are only able to purchase it in smaller quantities to buy from vendors. Wheelbarrows, bicycles, hand carts, motorbikes, pickups, canters and lorries are used in the transportation of fodder depending on the quantity being transported, the distance to the source, the topography, the number of cattle a farmer has, and affordability among others. Delivery of milk to the collection centres utilizes non-motorised means of transport given the short distances and small quantities involved. Farmers also use wheelbarrows, bicycles and handcarts in the delivery of milk.

The majority of the pickup vans that the farmers use are old and not reliable for long distance transportation. 52 years old Mr. Mburu a farmer from Githurai, Ruiru town indicated that the choice of means of transport used depended on the distance to be covered and the bulkiness of the load. For shorter distances, the farmers can rely on their pickups, but they hire out lorries for longer distances. Mr. Mburu owned another farm in Gatundu about 30 kilometres from Githurai, where he opted to hire out a canter or lorry to get napier grass instead of using his pickup in order to reduce the number of trips and to carry a heavier load. Due to the distance, insufficient capacity of their pickup vehicles, as well as the road unworthiness of their vehicles, farmers from the Githunguri area do not utilize their pickups to go to Narok or Naivasha, which are over 100 kilometres away, to buy hay. They instead prefer to buy the hay from middlemen. 65 years old Mr. Njihia a farmer from Gathanji indicated that he is only comfortable using his pickup over short distances.

Farmers who do not own pickup vehicles use other means of transport to ferry animal feeds to their farms. Motorbikes are a convenient means of transport for smaller quantities of feeds. Farmers who do not own a motorbike, pay *boda boda* riders to transport the feeds for them and then use M-Pesa to pay the suppliers so that they do not have to physically be there to undertake the transaction. I observed *boda bodas* picking feeds from Githunguri town, from stores at the milk collection centres and picking vegetable waste from Githurai market.

Suppliers use trucks to transport goods in bulk from distant locations. 45 years old Mr. Kang'ethe of Baraka feeds Githunguri who sources feeds from Uganda and Tanzania indicated that he uses his trailer truck to get feeds from outside the country. The milk processors also utilize bulk transportation using trailer trucks to distribute milk to depots across the country. Liquid products like molasses or milk are transported using large capacity tankers.

Figure 4.23: Preferences in choosing the means of transport.



Source: Author.

The outputs or what various means of transport can deliver varies. Farmers pointed out the efficiency of the pickup vans in their dairy businesses. “*Without a car, dairy farming is difficult*” pointed out 56 years old Mr. Wachira, from Riuki, Githunguri. The farmer indicated that his dairy business had improved since he acquired the pickup in 2009. “*Without a car (pick up) I cannot keep cows.*” He emphasized that it would be difficult to sustain his dairy business without the vehicle. He relied on it to get grass and *machicha*. Mr. Ngige from Gathaiti, Githiga indicated that: “*Initially I had a personal (saloon car), but this (pickup) vehicle makes a difference.*” Mr. Karanu 37 years old farmer from Githunguri town uses the pickup vehicle in ferrying milk, animal waste to the *shamba* and to get feeds. He was of the view that “*with means of mobility [vehicle], it reduces the costs and makes it reliable and effective to keep cows.*”

Mr. Karanja in an earlier interview indicated that he preferred his station wagon vehicle because it is concealed and the police did not notice it thus he rarely got stopped by them. “*A saloon car is not stopped by police. Although a saloon car should not carry animal feeds.*” He hired a lorry

or pick up when he needed to get a large quantity of napier grass. In a later interview on 04 May 2020 he had acquired a pickup van and indicated his reasons for purchasing a pickup were that it can transport larger quantities of goods. “*With this pickup, I will expand my dairy business.*” He pointed out

Limiting the number of trips taken

Planning effectively for a trip can help reduce the cost of transportation. Farmers identify the amount of feeds they require in a week or a month and plan accordingly when to source them or to make combined trips to undertake certain activities. To optimise on the efficiency of the trips that they make, they ensure that on a single trip along a certain route, they accomplish several activities, even if not related to dairy farming. Mr. Mburu a 52 years old, a farmer from Githurai, Ruiru saves on transportation costs by combining various farm related activities. He has a farm in Gatundu where he keeps bees and also grows fodder. He ensures that as he makes the trip to inspect his bee farming project, he can carry fodder on his way back to his farm in Githurai. He additionally sources maize from Mwea in Kirinyaga, where he hires a lorry to carry the maize cobs together with the maize stalks, then sells the maize in Githurai market while he uses the maize stovers to feed his cows. 55 years old milk vendor from Kigumo, Githunguri supplies bananas and arrow roots to food vendors operating in Ruiru on demand to supplement the returns from her milk vending business, while 56 years old Mr. Wachira from Riuki, Githunguri combines his weekly trips from his residence in Ruiru town to Riuki to purchase farm inputs and to also visit his ageing mother. A regular female customer of 65 years old Mr. Mucheru who sells chicken waste feeds in Githunguri town buys three sacks of the chicken waste feeds from him and then she combines the trip to also purchase processed feeds which she hires a pickup truck to transport it altogether. Mr. Karanu a 37 years old farmer from Githunguri town buys 7-14 bales of hay per week from Githunguri town and stores them in his farm. He ensures that he gets weekly provisions to prevent incidences of making numerous and wasteful trips.

The farmers additionally ensure that the trips are well planned to avoid wastage of time and delays so that they can be able to undertake several activities in a day. Mr. Wachira from Riuki, Githunguri who gets grass from Tatu City communicates with the labourers who cut the grass for him over the phone and makes arrangements for the work to be done before he goes to pick it up so that he saves on the time that he would have taken to wait for the grass to be cut. The farmers also pick *machicha* on a weekly basis and ensure that they pick it up early in the morning so that they can undertake other activities during the day.

Through the combination of social, administrative and agricultural trips, farmers can achieve several objectives during a single trip. An interview with GIKAKI *matatu* Sacco revealed that there is more commuting between Kagwe village centre to Githunguri town during market days. Farmers would combine the activities of buying and selling goods at the market with other tasks including buying of animal feeds. The convergence of the rural population into the town and market centres helps to increase their growth and encourages the clustering of business activities that complement each other.

Concealed mobilities

This is a form of strategy during mobility that is characterized by concealing of the activities being undertaken and making use of hidden verbal, visual messages or signs to communicate directions or certain messages. During fieldwork, I came across twigs dropped strategically from the main connecting road to the feeder road leading to a farmer's home. On inquiry, I was informed that the twigs are used to direct veterinary doctors from Githunguri Dairy FCS Ltd who make a circuit around the whole of Githunguri constituency every day to provide farmers with artificial insemination services. Githunguri dairy FCS Ltd has five veterinary technicians and 15 farm extension/ training workers. Four of the veterinary technicians make a trip along a specified route every day to ensure that they are within the reach of all farmers who deliver milk to the company. Each of the veterinary technicians offers artificial insemination services to an average of 15 farmers per day, but this varies to 14-32 farmers in a day, with the majority of the visits being carried out during the dry season.²⁹ A route could pass through about 10 village and market centres. The 'runs' or trips are such that the veterinary technicians are usually at a specific place at a certain time within the course of their journey. The fifth veterinary technician is left in the office and could use a motorbike to offer the services to farmers who may be left out during the course of the 'runs'. The farmers communicate to the company the request for the AI service by calling or giving the instructions at the milk collection centre with a draft route and direction to their farm. Some of the farmers opt to wait for the veterinary technicians along the route when the technicians are making the 'runs'. Others mark the route to their farms with the twigs to avoid waiting along the road. If located along the main road, they could plant a *githigi*/ twig at the entrance of their farm. This is a form of non-verbal or coded communication between the veterinary doctor and the farmer. This arrangement works for the farmers and technicians because for a first visit by the veterinary doctor, it may not be easy for him to identify the farm where he/she is going to visit, and thus this visual signage assists in directing him/her, saving costs of follow up calls to get the direction and loss of time in the

²⁹ The veterinary technician could not give an explanation of the reason for the increase of visits in the dry season

eventuality of getting lost thus optimising on the trip. The twigs are also used in cases where the farmer had not made a prior appointment with the veterinary technician which may be necessitated by the dynamic needs for artificial insemination services where a cow may urgently need such services.

Figure 4.24: Twigs placed on the access road to direct veterinary doctors.



Source: Field work, 2018.

Another example of a coded message used in the course of a commute, was noted while accompanying 56 years old Mr. Wachira from Riuki, Githunguri to source his weekly supply of grass near Tatu city in Ruiru town, I witnessed a labourer (grass cutter) stationed at the road side near Tatu City who upon seeing the approaching pickup truck started waving and whistling at us to check if Mr. Wachira needed his services to cut grass for him at the fields. We stopped and gave him a lift, but he was told that Mr. Wachira had already communicated to another labourer to cut for him grass earlier ahead of the trip. The labourer was able to spot the pickup vehicle from a distance and had in the past cut grass for Mr. Wachira. The 33 years old labourer, Jonny was residing in the BTL area and worked as a freelance labourer who is hired by the pickup owners to cut grass for them in Tatu City. This form of coded communication between Mr. Wachira and Jonny is only identifiable by the two of them.

Coded communication necessitates an understanding of the codes used by both parties involved in the communication. At times the codes may be secretive to ensure that other people do not understand the coded information. Twigs are also used to convey other information in the area. For instance, there is the use of banana trunks and some flowers to mark the directions to

wedding and burial venues so that those travelling to these events can identify the venues. Additionally, the use of white lime dust was observed along the roads which upon inquiry it was revealed that it is used to show directions during weddings and funerals, but at times it brings confusion when there are similar events within proximity, and the villagers have to indicate the names of the subjects of the events to avoid confusion and misdirection. Arrows showing the direction to the venues are marked along the secondary and tertiary access roads from the main tarmac roads to direct people. More recently people are using smart phones to share Global Positioning System (GPS) coordinates referred to as ‘pins’ of the locations where people are supposed to meet. 55 years old Mr. Mwaura a veterinary doctor indicated while Google Maps might be useful in future, the challenge is that some of the roads have no names and the farms have no physical addresses.

Figure 4.25: Marking of the road with chalk dust to show direction.



Source: GSV, 2018.

Beeping and flashing headlights is another form of coded communication while driving along the roads. The *matatus*, *boda bodas* and pick up vans make use of this coded communication to signal the presence or absence of a police roadblock along a road. The oncoming vehicle flashes the headlights to the other vehicles and then waves their hand to signal if they encountered police along the way. If there is a roadblock ahead, the commuters can change the route or terminate the journey if they are not confident that they have fully complied to pass through the police check or crackdown for vehicles that are not roadworthy. *Matatus* that have overloaded also request some of the commuters to alight to avoid flouting the traffic regulations, and the commuters who have not fixed their seatbelts are warned before the *matatu* approaches the

roadblock. The milk vendors also warn each other if there is a KDB crackdown along the routes. Through this communication, commuters can avoid routes where police are stationed, save the cost of bribing them and avoid prosecution. The milk vendors using motorbikes beep at the farmers' residences to signify that they have arrived so that the farmers can deliver the milk if they are not already at the location.

The actors who feel threatened by the police also ensure that they are disguised and concealed to avoid identification in the course of the commute. Easy identification would increase the chance of being traced and arrested. In the course of the fieldwork, I interacted with 55 years old milk vendor Mr. Waiganjo from Kiganjo Gatundu South who was very careful to reveal his identity for fear of arrest. When I first met him, he wore a hooded jacket while supplying milk during the day, and on booking an appointment with him, he revealed to me that I may not be able to recognize him when he is delivering milk in the evening because he would be wearing a white religious turban. He indicated that wearing a turban during the day would make him to be easily spotted and thus more vulnerable to arrest and harassment by government authorities. In addition he also revealed his secret disguise to me after ascertaining that I would not use the information to harm his business or get him arrested. 52 years Mr. Karanja from Membley Ruiru, was using a station wagon vehicle when transporting animal feeds, revealed that personal vehicles are rarely stopped by police along the road. Thus he prefers using the station wagon because it is concealed and the police do not notice that he is carrying animal feeds, and thus he is rarely stopped.

A covered lorry and a double cabin vehicle are also less frequently stopped by police along the road. Commuters additionally tint the windows of their vehicles to conceal the identity of the goods that they are transporting. This is part of a livelihood adaptation measure to evade mobility barriers as a result of harassment by government authorities. Assche & Hornidge (2014) reveal the presence of similar hidden mobilities in their study of Soviet and post-Soviet Uzbekistan and Tajikistan where spatial and social mobility is done in secrecy as a livelihood strategy to counter the mistrust between formal and informal institutions in a context where the government is authoritarian. During the COVID-19 restrictions, when a cessation of movement was imposed by the president of Kenya to reduce the movement in and out of the Nairobi metropolitan area, commuters used '*panya/rat*' routes, passing through coffee and pineapple plantations to conceal their movements as they travelled across the metropolitan area.

In Gachoire, Lari constituency, I observed jerry cans that had been placed by the roadside without the presence of the farmers attending to them. The farmers usually leave them there to avoid wasting time waiting for the milk collectors to pick the milk. They leave them together

with their membership cards so that the person collecting the milk can record the quantity of the milk. Notably, the placement of the single jerry can on the left side of the road signifies that the owner supplies milk to a different company or vendor (See Figure 4.26). In this case, the coded communication is between the farmer and the milk collector. This is a tea-growing zone which requires intensive labour to pick the tea leaves, thus the farmers cannot afford to waste time waiting for the milk to be picked. A similar form of communication is used by milk vendors, who collect milk from various farmers along a certain routes. Because of the heavy weight of the jerry cans, they strategically place a few jerry cans at certain points along the main road, then hire *boda bodas* that pick them and takes them to the *matatu* stops. Some of the milk vendors also make arrangements with the *matatus* so that they can pass by picking the jerry cans along the road.

Figure 4.26: Milk jerry cans along the roadside awaiting milk collection.



Source: Field work, 2021.

4.7 Political strategies

Dealing with Police

As discussed in the section on barriers to mobility, commuters complained of harassment by the police in the course of their journeys. Commuters have developed various strategies on how to deal with the police along the road. The presence of police especially during the crackdown of vehicles is a determinant of the roads that the farmers and milk vendors use to go collect feeds and sell milk respectively. Farmers avoid routes that have police roadblocks or choose to

befriend them to ease their movement along these sections. This is because they own old vans and trucks which police could identify a fault and classify them as un-roadworthy. The strategies include bribing them, being friendly to them or avoiding them by changing routes or the course of travel. During the fieldwork various commuters gave their experiences of their encounter with the police. 76 years old Mr. Maina indicated that:

“Police do not worry me. I give them Ksh. 50. Police stop these old vehicles. In most cases, I negotiate with them, or build a rapport with them. I crack jokes with them so that they let me go.”

He indicated that he tells them he is a *mzee* (old man) and like their dad and he has white hair, so they let him go. Bribing was the common solution adopted to deal with the police. *“To get machicha is not a problem. Only ‘government’ that we give 50”*. Indicated 76 Years old Mr. Kuria a farmer from Githurai, Ruiru town. The respondent refers to the police as ‘government’ meaning that they exhibit state power and authority, and thus the commuter has no otherwise but to cooperate with them. The bribe ranges from Ksh. 50 to 200 and depends on the means of transport. Pickups usually give Ksh. 50, *matatus* Ksh. 100, and lorries between Ksh. 150 to 200. This is given to the police unconditionally whether the car is in good condition or not.

“They will not leave you because they need something (a bribe). They will say you have overloaded. Then you tell them kuna chai [there is tea] they let you go. Even if the car is in a good condition you need to give something, otherwise mobility will be a problem.” 65 years Mr. Mucheru, a chicken feeds trader.

Mr. Mutembei an official with Githiga *matatu* Sacco indicated that they have to part with the bribe to remain on the road. Being in disagreement with the police would mean that one is not able to operate along a certain road. The commuters have to cooperate with the police or be pushed out of business:

“We are forced to bribe the officers because if you refuse they brand you their enemy and there is no way you are going to survive on this road unless you quit your job. I have been in this business for a number of years. A traffic cop will arrest you for no offense and fabricate charges if you bring kichwa ngumu (become hard headed) and refuse to bribe,” Mr. Mutembei an official with Githiga *matatu* Sacco (Kamau, 2015)

If the police discover a fault in the vehicle, they demand a larger amount of money, failure to which the farmer or commuter will have to accompany them to the police station. Once at the police station, the farmer or commuter could have his/her vehicle detained, licence taken and

could be required to pay bail (which at times does not have a receipt). Mr. Nderitu a 52 years old farmer and mechanic from Miguta, Githunguri indicated that some farmers do not have the annual inspection 'sticker' because of financial issues. The annual inspection of vehicles is done to attest that they are roadworthy and motorists are issued with an inspection certificate/ 'sticker' that is displayed on the vehicle windscreen. It costs Ksh. 1,000 for booking and an advance tax of Ksh. 2,400. The vehicles are taken for inspection in Thika town or Nairobi Likoni road for those located along the transect.

“If you meet police they tell you what they ‘want’ or your car is taken to the police stations and may cost like Ksh. 3,000 to have it out. So long as the car is motorable the farmers use it, irrespective of whether it has a ‘sticker’ or not. Even mine stayed for like two years without a sticker, but I still have to go and bahatisha (try my luck). I can go to areas like Mitahato [3 kilometres from his farm]. I have to go when the police are not there. I cannot go to Ruiru, I fear that I would get arrested, so. I can get napier grass from near my home in areas like Karweti [2 kilometres away from his farm] near Miguta. There are other farmers who drive without ‘stickers.’ They commute when police are not there.” Mr. Nderitu a 52 years old farmer and mechanic from Miguta, Githunguri.

Farmers with vehicles that have not complied with traffic regulations for instance with no insurance or inspection certificates travel over short commutes within their neighbourhoods to get fodder illustrating the necessity to move. They prefer the roads near their locality because they are familiar with the police in those areas. In rural areas and rural roads police have more tolerance for old vehicles compared to the busy urban areas which have a higher number of vehicles on the roads. The motorists closely monitor the presence of the police to avoid any encounter with them. They seek information from other commuters about where the police are stationed so that they can avoid those routes. It is like a hide and seek game with the police. This mainly affects the *matatus* and the pickup vans. However, if caught by the police, it can be costly for them because the police can demand a higher amount of bribe or ask them to drive the car to the police station.

When going for inspection, a motorist has to ensure that their vehicle is in good condition. They may also need to replace among others: the tyres, brakes, hand brakes, seat belts, head lights and have the car re-painted. The replacement of these spare parts is costly for the farmers and some are not able to afford it. Mr. Nderitu indicated that when he repairs the farmers' vehicles and advises them on what to replace, they do not have a problem getting the inspection certificate.

One of the transporters [name withheld] indicated that he had to pay a protection fee of Ksh. 2,000 monthly at one of the police stations for his vehicles to operate without being stopped by the police. This is irrespective of whether his vehicles were in good condition or not. This arrangement though it costs him a lump sum amount saves his drivers the challenge of being delayed while commuting because the police know his vehicles, and because he has paid the bribe in advance, the vehicles are not stopped along the road. When they are waved at by the police, they just flash the lights and the police let them proceed with the journey. However, this arrangement is only with a particular police station, and when the vehicles are in another location, he has to make other arrangements. During the police crackdowns, the transporters make every effort to avoid the locations where police are stationed by changing routes or abandoning the journey. Only the motorists who are confident that they have complied with the various requirements proceed with the journey.

Figure 4.27 shows *matatus* driving in the opposite direction to access the service lane along Thika road in an attempt to escape a police ‘operation’ in Kihunguro, Ruiru town. The action by the *matatus* caused confusion, traffic congestion and delays along the busy four-lane highway and also endangered the lives of the commuters in the *matatus* and the other motorists. The *matatus* additionally blocked the exit to Thika road from Ruiru inconveniencing other motorists and causing a traffic jam.

Figure 4.27: *Matatus* evading a police operation along Thika road at Kihunguro, Ruiru town.



Source: Field work, 2021.

Solidarity

Cooperative movement

Due to the challenges faced during commuting and in the course of the dairy businesses, farmers and milk vendors work in solidarity. Groups of similar interests get together to articulate common issues that affect them. These groups range from informal ones composed of a few persons to formal groups such as self-help groups or cooperatives that are registered with the government. The solidarity among farmers is evident in the existence of dairy milk cooperatives. The dairy cooperatives rally the farmers together and are able to get leverage on economies of scale in buying inputs, processing and marketing their produce. Cooperatives operate in several sectors including agriculture, finance, insurance, transport and housing. They directly employ over 300,000 people in Kenya and 1.5 million people indirectly (Wanyama, 2016). Otieno (2019, p. 8) argues that “*cooperatives have the capacity of realizing industrialization in rural areas through the value addition of agricultural products and marketing.*” Through the cooperatives, members can negotiate with external actors like suppliers, banks and distributors and negotiate for competitive rates. They are also able to buy inputs in bulk and sell them to the customers at a cheaper cost.

Githunguri Dairy FCS Ltd was formed in 1961 with 31 members but now has over 26,422 members as at October 2021. It offers support in the collection, processing and distribution of milk. In addition it also supplies the farmers with processed feeds, hay and household goods against their supply of milk. It also gives loans to farmers based on the milk they produce and provides AI and farm extension services to its members. It is the third-largest dairy cooperative after the Kenya Cooperative Creameries (KCC) that was formed in 1925. However, some of the cooperatives have been faced with challenges of mismanagement leading to their collapse. This was the case of the Gatamaiyu (Kagwe), Kereita (Kimende), Kamahia (Kamburu/ Kagaa) and Kinare milk cooperatives in Lari constituency that collapsed in 2013 as a result of mismanagement exposing the farmers to challenges of marketing their milk. As a result of the collapse of the four cooperatives, the farmers were exploited by milk vendors before Uplands PD&F Ltd formed a private company and processed the milk from that area according to 38 years old Mr. Kagema a manager at the factory. Brookside Dairy Ltd the largest milk company in Kenya buys milk from 300 milk cooperatives from all over the country. The company’s milk procurement and manufacturing director, John Gethi pointed out that farmers were best placed to benefit from cheaper costs of production and markets for their produce by being members of cooperatives (Mureithi, 2017, 2021). The KDB also encourages dairy farmers to be members of groups and cooperatives.

All *matatus* and *boda boda* operators are also supposed to be members of a corporate body or Sacco that is licenced to operate within a certain route by the NTSA. The formation of the Saccos was an effort by the government to assist in the transition of the *matatu* industry from an informal to a formal business. Even before the existence of the Saccos, there existed informal associations with their own set of rules of how certain routes operated. While the government has had some limited success in the regulation of the *matatu* industry following the implementation of the “*Michuki traffic rules*,” they have not been able to enforce the regulations governing the *boda boda* operators. The solidarity among the *boda boda* operators is so strong that in case of an accident between a *boda boda* operator and a motorist, the *boda boda* operators mob around the accident site and harass the motorist. As a result of a sexual harassment incident in March 2022, the government gave the *boda boda* operators 60 days to get registered with government, with one of the requirements being membership in a Sacco or corporate body (see Box 4.1) and Appendix III).

Building social capital

Cooperation is at different levels, with the lowest level of cooperation being the association among close friends undertaking similar activities. The farmers and milk vendors cooperate in the daily course of their activities. For instance, when a farmer’s pickup vehicle gets stuck on the road or has a mechanical problem, that farmer can call their colleagues’ to assist in towing the vehicle. Mr. Maina, 76 year old farmer from Ha Donga at one point had his vehicle in the garage, and he called his colleague to get him *machicha* using his vehicle. Mr. Nderitu a 52 years old farmer and mechanic from Miguta, Githunguri assists some of the farmers when their vehicles have mechanical problems in the course of their commutes at a fee.

“If a farmer is on the way to get machicha or animal feeds, and the car spoils, I go to repair the car from the spot. Usually I take a motorbike or matatu to where the farmer is, but towing may be necessary. I may use a breakdown or request another farmer to assist. I towed the car for Koine from his home to Ruiru using my vehicle for repair in my garage in Ruiru. Many farmers have had their cars spoil along the way when getting animal feeds and I have often gone to repair their vehicles.”

Another form of assistance among the farmers is to use the slots allocated to them to get *machicha* from EABL Ruaraka for their colleagues in case they already have had enough for themselves. This solidarity is developed through interactions in the course of their dairy farming activities like getting *machicha* and fodder for the cows. Indeed when the farmers gathered to get *machicha* in Ruaraka early in the morning, their first duty was to jointly pray, which shows some sense of solidarity. They also participated in their colleagues’ social events like burials

and weddings, and had organized themselves and chosen a leader who coordinated them to avoid confusion and ensure all the farmers got an equal chance while getting *machicha*. The work of the leader was to ensure there was order while getting *machicha*, by calling out the farmers in the sequence which they collected the *machicha*. This form of cooperation to resolve some of the problems they encountered at the lowest level is an indication that the cooperative spirit exists at the lowest level among a few individuals. In the course of these interactions and networking, the farmers and milk vendors share ideas, information and their experiences in milk production resulting in knowledge transfer. Mr. Mburu a 52 years old farmer from Githurai town emphasised that “*to sustain the business, we do networking.*” He meant that farmers have to rely on information from their colleagues on where to get animal feeds at a fair price.

The farmers also work together in resolving local community challenges like repairing muddy sections of their roads. The neighbours join together and contribute labour, equipment and materials to repair those sections. In May 2020, a landslide blocked the road between Machani - Kijabe Mission in Lari and cut off the connection between the two areas for a week. The residents of the area tried to reach the area Member of County Assembly (MCA) with no success and they then resolved to rehabilitate the road themselves as reported by a concerned lady through Facebook (see Figure 4.28).

Figure 4.28: Joint action by residents to clear a section of a road blocked by a landslide.



Source: Facebook, 2020.

The milk vendors also have associations or work together to assist one another. 55 years old milk vendor Mr. Waiganjo from Kiganjo Gatundu South is part of a welfare association that has 12 milk vendors from Gatundu, Githunguri and some from Murang'a who all met in Ruiru town while selling their milk. He indicated that *“one cannot work on their own. Those ahead communicate with the others in case of any issue.”* Thus when vendors encounter police harassment or the KDB along the way, they inform the other members. The members have managed to save money together and had already bought a plot which they planned to sell and share the profit among themselves after it appreciates. In future the group aspired to purchase a pasteurization machine and they were already saving money towards that goal.

Protests

The community also act in solidarity to demonstrate and also to express their anger in regard to the poor condition of the roads. This is through physical protests and complaints raised through social media to exert pressure on government officials and elected leaders to take action. Mitra (1992, p. 141) avers that these demonstrations are an indication of the *“growing assertiveness of previously powerless groups.”* Due to the poor state of the Ruiru-Uplands road, the residents on several occasions expressed their anger through demonstrations. During one of the demonstrations on 20 February 2014 the residents ‘planted’ banana stalks on the large ‘pot holes’ along the road to signify that the road was like a *shamba*, and to emphasise the depth of the potholes. Their anger was also expressed on social media:

“Am hearing today Githunguri residents will pour in hundreds to plant on Ruiru ~ Githunguri ~ Uplands Road. If you use Routes 160 & 140 leo hakuna kazi (today there will not be work), massive demonstration expected today, that seems to be the only language these leaders can hear. Mimi nachanga fertilizer (I will contribute fertilizer)...wewe unachanga nini (what will you contribute)....?” Complainant 1, Facebook post, February 20, 2014

“I support that demonstration by residents along the Kwamaiko-Githunguri road. That section is an utter scandal. The section of the road from Ruiru-Kwamaiko was re-carpeted last year but the section to Githunguri is a nightmare. I passed there about 5 years ago and was horrified. I decided to use the road again about two months ago and I could not believe it. The potholes can swallow a car. A section that would take about 15 minutes took almost an hour. You can't believe you are in Kiambu.” Complainant 2, Facebook post, February 16, 2014

Figure 4.29: Residents ‘plant’ a banana stalk along the Ruiru – Uplands road.



Source: Facebook, 2014.

The residents of Gitiha, Githunguri along the Ruiru to Uplands road also protested about the condition of the road on 09 May 2016 after the section of the road was cut off, and they had to walk to cross the muddy section to take another *matatu* while connecting to Githunguri (Mugo, 2016). A similar demonstration was done to protest about the condition of the Githunguri to Kagwe road, on May 2018, where the residents closed off the road with branches of trees and lit bonfires at sections of the road to express their anger (See Figure 4.30).

The condition of the roads in Kiambu County was politicised because President Uhuru Kenyatta’s rural home is located in the county (Gatundu South sub-county). The residents of Kiambu County voted for him during the 2013 and 2017 elections and they felt entitled to benefit from infrastructure projects in their area during his first and second term in government. There were sentiments that the president was developing more roads in his rural area of Gatundu South sub-county while neglecting the other parts of Kiambu County. Former Lari Member of Parliament (M.P) Mburu Kahangara in an event attended by the Deputy President in Lari constituency on 24 May 2016 indicated that:

“We have been in the opposition for many years. Today residents ask a difficult question – we are in government and our roads are still in a poor state while others are being built and reconstructed in other areas?” (Mugo, 2016)

Figure 4.30: Residents demonstrate about the condition of the Githunguri – Kagwe road.



Source: Facebook, 2018.

Mumbi wa Leah from Kambaa village complained that the health facilities were experiencing home deliveries because the pregnant mothers could not make it to the hospital or health centres due to the condition of the road despite being in the county where the president hails from. *“We are so sad because our county is home to our able President Uhuru Kenyatta and next to Nairobi city and we are still delivering babies at home”* (Mugo, 2016). The feeling of being left behind in development created resentment towards the government which is evident in the protests on social media and the physical demonstrations. The agitation about the condition of this road dates back before President Uhuru Kenyatta began his second term in office in 2017. The agitated residents compelled the then member of parliament of Githunguri constituency (2008-2017), Njoroge Baiya, the Governor of Kiambu County (2013-2017), William Kabogo and the president to intervene and have the road rehabilitated. The road was a key agenda in the 2017 local, regional and national elections. Some of the complaints from Facebook posts are highlighted below:

“The residents of Githunguri have had enough of bad roads that can only be equated to shambas and today they have decided that they will pour out in hundreds

to plant on Ruiru- Githunguri - Uplands Road. Governor Kabogo and Mheshimiwa [honourable] Njoroge Baiya, where will you be watching this from?” Complainant 3, Facebook post, February 20, 2014

The social media bloggers and ‘demonstrators’ piled pressure on the policymakers by ‘tagging’ them in their posts, and also directly writing on their social media pages. In a direct post to the then Governor of Kiambu county, William Kabogo one of the complainants impressed on the Governor to take action to ensure that the road is upgraded:

“Mheshimiwa (Honourable), kindly repair the Ruiru-Githunguri-Uplands road to the standards of this road that hosted Kiambu T.T. Ring. This road has been in pathetic conditions since 2003. It is now 11 years of suffering for your good tea, poultry, coffee and dairy farmers. We count on your county government and Uhuru's national government to upgrade this road to a by-pass or highway linking Thika Superhighway to the Nairobi-Naivasha-Nakuru Highway. Thanks in advance!” Complainant 4 to William Kabogo Gitau

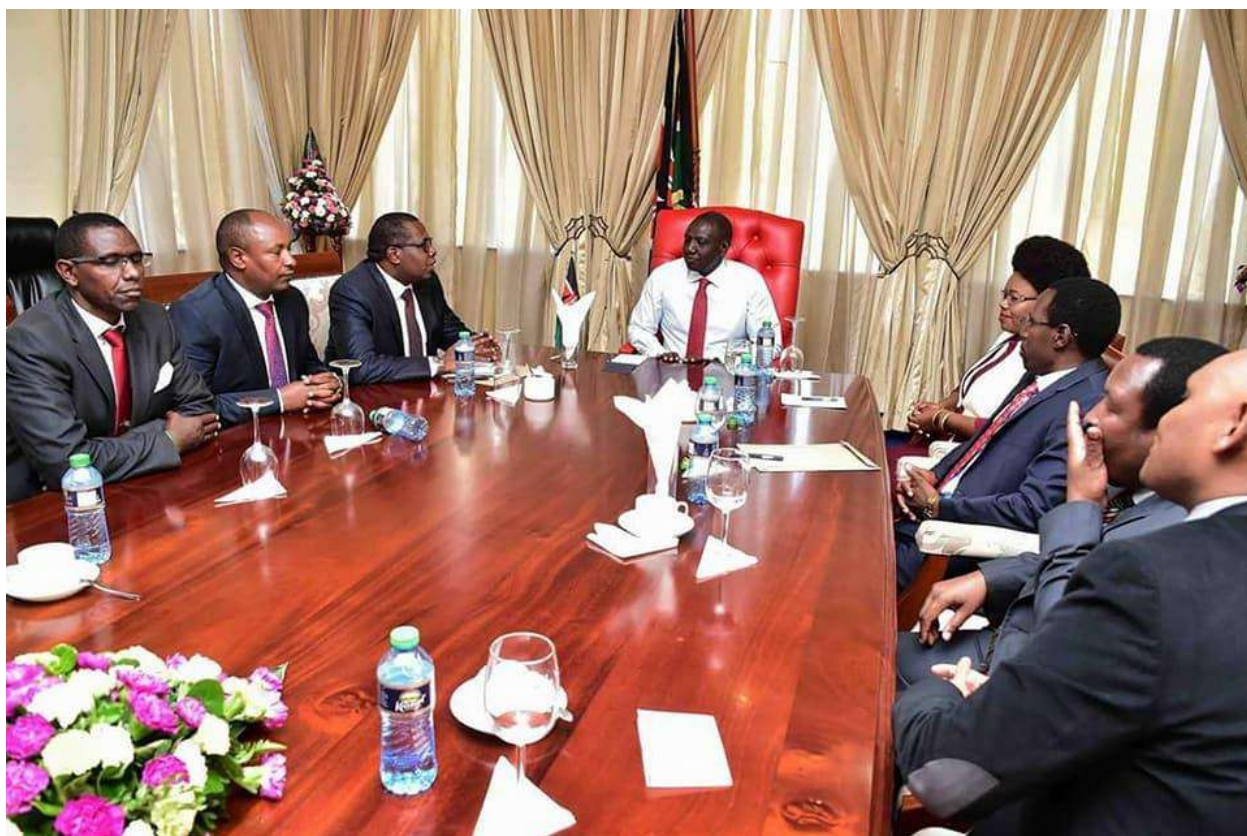
During a campaign tour in Kiambu County in March 2017, President Uhuru Kenyatta accompanied by his Deputy President William Ruto pledged Ksh. 20 Billion to rehabilitate roads in Kiambu County including the Ruiru to Uplands road and the Githunguri – Kagwe – Kimende road. In a coincidence a week before his visit, KENHA had advertised the tender for the construction of the road. Despite this statement from the head of state, the residents were not assured of the construction of the road and kept pressing the leaders to act. Public announcements especially during campaigns are not an assurance of the implementation of projects:

“This is a section of Ruiru to Githunguri uplands road (Along Kanjai).The road is impassable. The president himself promised that the road would be built but up to date, it remains in a filthy state. On Jan 27 [2018],Githunguri M.P, Kago wa Lydia lied that the road would be built in a month’s time but hardly did we know that he was trying to whip our emotions and make us shower some blind praises to him. Not even the county government has shown an interest in the construction of that road.

What’s funny in all these ‘kasheshe’ (noise) is that Moses Kuria, little known Kago and co are busy campaigning for the deputy president's 2022 bid. They have been promised direct tickets for their 2022 re-election while our cars are stuck in muddy and pathetic roads. It hurts me!!” Complainant 5, Facebook post, April 23 2018.

After the 2017 presidential elections, the road became an agenda for the 2022 presidential elections. The members of parliament from Kiambu County followed up with the deputy president who was positioning himself strategically to take over from President Kenyatta after his final term in 2022 about the state of infrastructure in the county. They held a board room discussion which was reported (shared) on the social media pages of the Deputy President and the various members of parliament including the M.P of Githunguri. The process of road delivery through board room discussions and political campaigns signifies a form of service delivery that is leveraged on political power and patronage in resource distribution. By bringing development to residents of Kiambu, the deputy president expected that they would vote for him in return.

Figure 4.31: Discussions between deputy president William Ruto and Kiambu members of parliament.



Source: Twitter, 2018.

The Githunguri M.P Gabriel Kago Mukuha indeed expressed his hope after the outcome of the meeting that the project would be implemented, and assured the residents that the Deputy President would fulfil his promise:

“Earlier today we had a consultation meeting between Kiambu County Parliamentarians and his Excellency the Deputy President William Ruto at his

Karen office. This was to ensure election pledges are fulfilled, among the developments in Githunguri constituency are Githunguri Level 4 hospital, Komothai Technical and Training Institute, Ruiru - uplands Road which is ongoing and Moi Road [Githunguri – Kagwe road] which will start in two months.”

Githunguri M.P Gabriel Kago Mukuha, Facebook post, February 27 2018

The launch of the project was done with lots of publicity. The statement above by the M.P. that the Ruiru Uplands road construction had already begun shows that the launch of the project on 22 June 2018 was done when the construction had already commenced (See Figure 4.32). The Githunguri – Kagwe – Kimende road was commissioned on 30 August 2018.

Figure 4.32: Commissioning of the Ruiru- Uplands road on June 22 2018.



Source: Facebook, 2018.

The event and the statements made during the launch of the Githunguri to Kagwe road showed the politicisation of the road project. In his statement, the Githunguri M.P Gabriel Kago Mukuha indicated that while past regimes had ignored the construction of the roads project, it was finally been implemented during his term in office:

“Today we commissioned the 28Km, Githunguri- Kagwe Kimende road (Moi road) which politicians have been using as a campaign tool over the years. All regimes have ignored the road but the suffering of our people has to come to an end. The

construction of the road has started and we expect the contractor to complete it on time.” Githunguri

M.P Gabriel Kago Mukuha, Facebook post, August 30 2018

The politicisation of the road project continued even during its construction. Despite the implementation of the class B road being under the national government through KENHA, the local M.Ps take credit for the delivery of road projects for political mileage. The politicians continually post the progress of the projects and indicate the interventions they have made to ensure that the projects are on course.

There is ‘ownership’ of development projects by the local politicians:

After my intervention to have the contractor fast-track the construction of Ruiru-Githunguri-Uplands road. This morning I checked on the progress of the construction and [it is] good to note that the contractor has begun laying and compaction of GCS base from Kwamaiko (Kwa Mboga) - Miguta stretch. Similar works will commence from Githunguri (Githiga Junction) towards Kambaa.
Githunguri M.P Gabriel Kago Mukuha, Facebook post July 22, 2020

In addition, the mistrust due to unfulfilled promises forces the residents to continue pressuring the administration during the implementation of projects. There has been previous cases where projects were initiated and not completed. The advertisement by KENHA during the launch of the road indicated that the construction works began in January 2017 way before the commissioning of the project on 22 June 2018 and the road was supposed to be finalised on January 2019. The residents complained in February 2019 that the road was dusty during construction and that the contractor had removed the tarmac and abandoned further construction at the time (Mugo, 2019)

“We are suffering more than we used to when it was tarmacked with potholes. During the dry season, the road is dusty. Women living next to the road wash clothes and hang them inside since the dust makes them dirty again,” Mr. Peter Kimani a motorist. (Mugo, 2019)

The residents of Magomano village, Githunguri near the junction of Kiambu Githunguri road and Uplands decried the poor condition of the road through a Facebook post highlighting the muddy state of the road during the long rains on 17 May 2021. They complained through a group called “*Ruiru Githunguri Uplands Road 2017 Agenda*” and posted photos of the state of the road at that time. They also ‘tagged’ the ministry of transport and infrastructure Facebook page, to get the attention of the Secretary of Roads, James Wainaina Macharia (see Figure 4.33).

The photos posted showed children sliding while going to school, a *matatu* that was stuck in a ditch, and cars that were being pushed after getting stuck in the mud. The muddy section of the road had made the road impassable, and vehicles were being forced to use longer alternative routes to avoid getting stuck in that section of the road. The challenges of mobility during the construction of the Ruiru to Uplands road were also highlighted by 76 years old Mr. Maina a farmer from Ha Donga, Githunguri who pointed out that the section between Ha Donga and Githunguri was muddy, skiddy and not motorable during the rainy season and thus he was using a longer route connect to Githunguri.

Figure 4.33: Online protest on the state of the construction of the Ruiru – Uplands road.



Source: Facebook, 2021.

The online space and digital technology have created room for civic and political participation, especially among the youth (Loader & Mercea, 2012; Pickerill, 2010). Through Facebook, WhatsApp, Twitter, blogs and other social media platforms that the youth are familiar with, they can voice their individual and collective concerns on issues that concern them. Through this form of communication, even the urban elites who grew up in the villages join hands with their rural counterparts irrespective of the distance to push for a certain agenda. The urban dwellers maintain their networks with the rural dwellers through social media and follow up on

the issues concerning the villages through these networks. As much as they do not use the roads often like their rural relatives, they occasionally visit them and have to endure the poor state of the roads. Pickerill (2010) points out the power of virtual communication in social mobilisation:

“Computer-Mediated Communication (CMC) has facilitated the mobilisation of participation (for virtual actions and served to strengthen the existing movement networks for physical action. Furthermore, it has been possible using CMC to mobilise those who are already within movement networks without face-to-face contact with them. CMC is simply quicker, cheaper and more global method of utilising these networks. While CMC has the potential to provide a new method of recruitment, mobilisation remains reliant upon the integration with existing networks; and at present CMC is consigned to the role of a strengthener (in terms of reducing the importance of the elements of time and space in communication) of the existing linkages” (Pickerill, 2010, p. 172).

The protest are usually coordinated by administrators of the social media platforms or bloggers, who mobilise others and lobby government actors and politicians to take action. They use the platform to communicate messages touching on the issues concerning them. For instance, if it is an issue of poor road conditions, visual communication of the poor state of the roads is shared in these platforms. The dates of when and where the protests will take place are also shared and the actual protest could be broadcasted through live stream options in these online platforms for members who are not able to attend to ‘participate’ online by making comments and venting out their anger. The outcome of the protest and follow up is also communicated so that members are aware when interventions are made, and whether they are implemented in time, failure to which subsequent protests could be planned. These online leaders could have political aspirations, or eventually emerge as political leaders depending on the success of the mobilisation. Therefore to some extent online platforms are part of citizens’ virtual civic engagement.

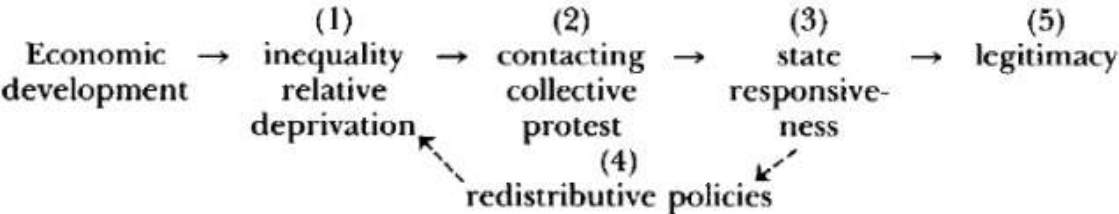
Social media comments, citizen-reporting platforms and data streaming from mobile phone sensors work in many ways like voting – not as in a general election but more like a public hearing process or a public consultation meeting (Carillo, 2014, p. 30)

Road construction is a political process in Kenya from the lobbying and agitation for the projects to the initiation, launch and implementation and handover of the projects. The politicians take credit when roads are constructed during their tenure. This approach to communities agitating for development projects through protests shows that these local communities have been

excluded from the decision making process of road development and they result in using social media or public protests to voice their concerns. It demonstrates the need for more inclusion in the process of conceptualising development projects.

The place of social protests in the implementation of development projects is outlined in Mitra (1992, p. 213) “*rational protest model of participation.*” In this model, the state is seen to intervene as a result of protests by the local community in regard to situations of “*unequal distribution of benefits of development.*” These protests could be through social media, lobbying, physical (sometimes violent) that portray government in bad light and intensify the pressure on government to act. The government consequently intervenes to ensure that it does not lose political support and so that it seems to be offering a solution to the existing problems affecting society. This approach is reactive as opposed to pro-active, where by the government waits for a situation to occur to amend it rather than put in measures to prevent such situations to occur.

Figure 4.34: A rational protest model of participation.



Source: (Mitra, 1992).

A similar reaction by government as a result of an online protest is highlighted in appendix III which shows the inconsistencies of the government in addressing the issue of reforms in the *boda boda* sector following a sexual harassment incident involving a female motorist where the government first ordered a crackdown of *boda boda* operators and later changed the approach to one that was more consultative and participatory. The model highlights that failure to act on the demands from the protestors’ only aids in making the protests more severe and radical. In the contrary, interventions by government, perceived or real “*enhance the legitimacy*” of the government and prevent the growth of a revolution (Mitra, 1992, p. 213). In the case of the government’s reaction after the sexual harassment incident, the government may have wanted to exercise its power through the crackdown. The government’s change of tactic from that of a crackdown to a more consultative one could also have been because it feared that the *boda boda* operators could re-group and protest against the national crackdown. Further, a statement by the Deputy President, William Ruto that the *boda boda* operators should storm police stations

and get the motorbikes that had been held by the police was viewed as inciting and the government in turn decided to release the motorbikes to their owners to avoid confrontation with the *boda boda* operators who had started holding protests in some parts of the country.

The protestors aim is to catch the national or county government’s attention, ignite change and highlight the magnitude of the problem. The use of social and mainstream media in highlighting the issues at hand is evident from the protests that took place along the transect in regard to the state of the road and the online protest as a result of the sexual harassment of the female motorist. The social media activists and bloggers could tag the relevant actors like the political leaders, KENHA, KURA in their write-ups to get their attention. The dramatization that is witnessed in the ‘planting’ of banana stalks on the road to signify that the road has become a *shamba* is meant to magnify the nature of the problem. The demonstrations also entail the closure of roads which attracts the intervention of the local police to open up the road. This is often met by resistance from the demonstrators further attracting the attention of the mainstream media and actually signifying a ‘success’ in the political protest.

The various classes of roads in Kenya have been allocated to four government agencies to manage their development and maintenance as follows:

Table 4.1: Categories of roads in Kenya and responsible government authorities.

S No.	Authority	Class of Road/ Role
1.	Kenya National Highways Authority (KeNHA)	National Trunk Roads in Classes S, A and B.
2.	Kenya Roads Board (KRB)	Management of the Road Maintenance Levy Fund (RMLF)
3.	Kenya Urban Roads Authority (KURA)	Urban Roads in Cities and Municipalities classes UA, UB & UC)
4.	Kenya Rural Roads Authority (KeRRA)	National Trunk Roads in Class C
5.	Kenya Wildlife Service (KWS)	Roads in National Parks and National Game Reserves
6.	The 47 County Governments	County Roads (Classes D and below

Source: (Kenya Roads Board, 2020).

The process of selection of the roads as per section 19 of the Kenya Roads Board Act, 1999 begins with the KRB indicating the funds that are likely to be available for construction of roads, the priority it has in the allocation of the funds and the criteria that it plans to apply in the allocation of the funds. The various road agencies are then required to submit to the KRB their annual roads programme six months before the commencement of every financial year outlining the roads they plan to rehabilitate, maintain and the estimated cost of the projects. The KRB then reviews the submitted agencies' annual work programmes and consolidates them into an annual public roads programme. This is then submitted to the two ministers in charge of roads and finance for approval (Government of Kenya, 1999). This illustrates a centralised approach to the selection of roads that does not outline the role of public participation in the process. Section 6 sub-section 2(d) outlines how the KRB should distribute resources:

“(d) determine the allocation of financial resources from the Fund or from any other source available to the Board required by roads agencies for the development, rehabilitation and maintenance of the road network to ensure that the allocation of funds is pegged to specific categories of roads and not less than– (i) twenty-four per cent of monies from the Fund is allocated equitably to District Roads Committees; and (ii) sixteen per cent of the monies from the Fund is allocated equally to all constituencies in the country” (Government of Kenya, 1999, p. 5).

A slight amendment of the Kenya Roads Board Act, 1999 was done in 2019, but the revisions outline the limit of the funds allocated to KERRA for rural roads to 10 per cent. This is irrespective of the fact that most of the roads that are unpaved are located in rural areas. A study by Odongo, Rambo, & Odundo (2014) spells out the limitations in awareness and participation in the prioritization of the projects funded by the KRB at the constituency level. The study also highlights the existence of political interference, inconsistency in the disbursement of funds, delay in external auditing and corruption during the implementation of these road projects. Mayienda (2020) in a study on the level of public participation in projects implemented by KURA showed that the public is involved in the planning, tendering, feasibility, design and project implementation of road projects. However, the level of participation is through informing, consulting, involving, collaborating and empowering; signifying a power imbalance *“whereby citizens may indeed hear and be heard but they lack the power to ensure that their views will be heeded by the powerful”* (Mayienda, 2020, p. 47). The research did not highlight existence of participation in the selection and prioritization of projects to be implemented. This

may not be equated to participation but could instead be considered as consultation where the public is merely informed but is not involved in making decisions (Dalal-Clayton et al., 2003). All road projects require that there should be an Environmental and Social Impact Assessment (ESIA) to establish the impacts of the road projects to the beneficiary communities. The ESIA process usually involves public consultations in regard to the project. However the consultants who undertake the ESIA's are normally hired by the financiers or developers of the projects, hence some inclination towards the interests of the hiring authority, and finally the ESIA's rarely lead to design changes (Dalal-Clayton et al., 2003).

Governments especially in developing countries have had limitations in ensuring that there is meaningful public participation. "*Participation has been seen as a means to ensure the more efficient implementation of preconceived plans, often through existing government structures*" with the outcomes of this being "*stage-managed participation, then distrust and greater alienation*" (Dalal-Clayton et al., 2003, p. 95). Additionally, due to external funding of infrastructure projects, donors have an influence in the "*planning, feasibility studies, engineering design and road construction*" (Klopp, 2012, p. 10).

Due to the limitations in participation during the identification and implementation of road projects, various interested parties including public, political and the private sector actors lobby for the rehabilitation of roads which are of interest to them, and their success in the lobbying process is pegged on their position of power, allegiance to major political parties or actors and their relation with the ruling elite. This has been illustrated in the process of implementation of roads along the transect. There is usually a perceived entitlement among the ruling party that the areas where they have support should benefit more from government projects. This in turn leads to resentment and general disquiet from other areas that are under the opposition who feel left out and disenfranchised leading to politics of exclusion and divide and rule. It is as a result of this exclusion in development projects that inspires political competition from the national to the local level so that voters elect '*mtu wetu/ our own.*' Burgess et al. (2010, p.15) describe the phenomenon of favouring home regions with development projects as being driven by the patronage effect whereby the ruling ethnic communities feel that "*it is our time to eat*" in the same way that the previous regimes favoured other ethnic communities. President Uhuru Kenyatta on 14 September 2016 said that:

"Nyinyi ni kutafuta sisi tumekalia na hatuna haraka ya kuondoka. eee Si namna hio?... Niliambiwa nikiwa pwani niliona mswahili mwingine akitaja hapa akasema, watu waelezwe - kumeza mate sio kukula nyama kwa hivyo wenzetu endeleeni kumeza mate lakini nyama tutakula"

Translated as:

“You continue looking, [for the presidency] us we are in government and we are not in a hurry to leave. Yes. Is that not so? I was told when I was at the Coast where I saw a Swahili person saying here – let people be told, to swallow saliva is not to eat meat, so let the opposition continue to swallow saliva because we shall eat meat”

In the above statement that was made during the burial of a former prominent Maasai politician William Ole Ntimama in the presence of the then key presidential contender in the 2017 presidential elections Raila Odinga, the president emphasised that it was their turn to govern the country as the opposition watched. In the last part he added that it was their turn to ‘eat’ as the opposition watched. Mitra (1992) outlines the resultant effects of exclusion of certain groups in the allocation of resources:

“Radical protests differs from institutional participation in the sense that it begins by questioning the rules that constitute the basis of allocation of resources within the local arena. These rules are seen as discriminatory because they give a systematic advantage to some groups over others. The rules that come under challenge are not only the rules of normal political transaction but also the normative basis of politics such as the right to property, attitudes towards law and order and membership of the political community” (Mitra, 1992, p. 152).

Some of the elected leaders ensure that there are adequate funds allocated for development projects in the areas where they got the most votes. Burgess et al. (2010) report that African leaders use public funds to fund development in their regions of origin or their ethnic communities, resulting in: regional disparities in development, political unrest and in the long-term it could result in riots and civil unrest. Election victory is considered a way out from exclusion in development projects giving rise to highly contested elections whose loss could lead to political protests and violence. Mitra (1992) points out that political protests and violence are a case of political competition that takes place beyond the confines of established legal frameworks. While (Burgess et al., 2010, p. 5) points out that:.

“Ethnic redistribution can fuel the "our turn to eat" game, thus undermining nation-building and encouraging civil conflicts. This is best illustrated by the ethnic riots of the 2007-2008 presidential elections in Kenya, where the Luo and Kalenjin opponents accused the Kikuyu-led government of only serving the interests of the Kikuyu areas.”

Protests in the *matatu* and *boda boda* industry

Protests in the arena of mobility are not relegated to the construction of roads only but also in the use of the roads. There have been protests by groups and stakeholders involved in public transportation including *matatu* associations, *boda boda* associations, and truckers associations. There are three main *matatu* associations namely the Matatu Owners Association (MOA), the Matatu Welfare Association (MWA) and the Matatu Drivers and Conductors Association (MADCOWA). The three organisations represent the interests of the *matatus*, through lobbying and advocating for their interests. These “*solidarity groups*” have political influence and have been used by politicians to advance their political interests (Khayesi & Nafukho, 2016, p. 31) with local and national actors rely on their support for political mileage. During the elections the *matatus* display posters of various political actors on their exteriors and. The relationship between the state, society and the actors in the *matatu* industry is “*long-standing, mutual, beneficial and sometimes exploitative*” (Khayesi & Nafukho, 2016, p. 8). While the government and society appreciate the efforts played by the sector in transportation and job creation, the government and society on the other hand view the *matatu* and *boda boda* operators as unruly, informal, rude and reckless.

The *boda boda* operators are also a target of political interests due to their increasing numbers and grassroots connection. Kenya has 1.4 million *boda boda* riders of whom 75 per cent are youth and six per cent female. They make about 22 million rides per day with each rider making about 15 rides per day (Iraki, 2020; Theuri & Mohammed, 2020). During campaigns, politicians use them to display political messages imprinted on their life saver jackets to act as ‘moving advertisements.’ The politicians post images on social media taken with *boda boda* riders or riding *boda bodas* in an attempt to show their commitment to the common '*mwananchi*'/ citizen. The politicians also build structures at the *boda boda* assembly points and have their names inscribed visibly on the structures to show that they are associated with them. Iraki (2020) and Theuri & Mohammed (2020) were of the view that due to their numbers and their influence among the electorate, politicians will show a renewed interest in regard to their welfare during the 2022 presidential elections. There are several national *boda boda* associations including the United *Boda Boda* Association of Kenya (UBA) and the *Boda Boda* Association of Kenya (BAK). UBA was formed in 2012 and has 800,000 registered members.

Through their influence, the *matatu* and *boda boda* associations have protested government regulations imposed on them by the central government through the various government bodies like the NTSA and the Kenyan police. “*The matatu industry employs both confrontational and diplomatic strategies in its negotiation with the state*” (Khayesi & Nafukho, 2016, p. 8). In 2010

the stakeholders in the *matatu* industry resisted the proposal by the then Minister of Transport, Amos Kimunya to phase out the 14 seater *matatu* vehicles and replace them with the 25 and 38 seater mini-buses. They indicated that the initiative would lead to job losses and loss of livelihoods, and that they were not financially prepared to undertake the investment. The then minister of Finance, Uhuru Kenyatta who was a presidential candidate in the 2013 elections advised the government to consider postponing the initiative because it could have led to job losses. The move by Uhuru Kenyatta would have been because he wanted the support of the *matatu* sector during the 2013 elections (Khayesi & Nafukho, 2016).

The most infamous protest by the *matatu* operators was during the national police crackdown that was enforced in February 2004 under the leadership of the late Minister of Transport Mr. John Michuki. He introduced the 'Michuki rules' that required vehicles to carry specified number of passengers, install seat belts, speed governors and paint a yellow stripe on their vehicles. The drivers and conductors were supposed to wear uniforms and undergo a background check to ascertain that they were not previously involved in crime. While the 'Michuki rules' were welcomed by the commuters for the comfort and safety they brought, the transport operators have continually resisted to embrace them. During the enforcement of the rules in 2004, commuters had to walk for long distances to work, as the vehicles kept away from the roads before slowly complying and resuming operations. The rules are enforced from time to time through crackdown of non-compliant vehicles. The crackdowns are enforced from the 'top' management led by the senior police officers and may include the officers from NTSA, leaving the junior officers with no chance to negotiate with the transport operators. When caught with a fault during the crackdown, the transporters have to pay huge fines in court or face arrest. During the crackdowns, there is no negotiation with the police in form of bribes, and if at all it takes place the bribe demanded will be higher. (Habyarimana & Jack (2012, p. 4) indicate that as a result of the Michuki rules, bribery was "*more remunerative*" because the police had "*a variety of additional dimensions on which drivers and conductors might be found in non-compliance.*" Pushed to their limits, the *matatu* operators usually protest the crackdowns and harassment by the police. In June 2013 *matatu* operators threatened to go on strike citing extortion and harassment by the police (Wangui, 2013). In November 2018 the *matatus* went on strike because of the enforcement of the 'Michuki rules' (Osongo, 2018). During the 2018 strike, the chairman of the *Matatu* Owners Association Mr. Simon Kimutai complained that the *matatus* were being impounded for minor offences but later charged for more serious offences that the *matatu* operators did not commit (Kinyanjui, 2018). Resistance by the *matatu* operators is a form of protest on the imposition of rules on them by the government without meaningful prior consultations. Protesting is a tool used by those without power to get a space in the

negotiating forum/ 'table' where they can voice their concerns. It is a forceful entry and forced participation in development activities as a result of exclusion. The situation arises when a particular stakeholder that wields power in this case government excludes and oppresses the other stakeholders. By protesting and resisting, "*top-down power is dislocated by bottom-up power that emerges from the participation and voice of people who have been placed at the margins of communicative systems of decision making*" (Dutta, 2012, p. 141). By demonstrating the populace is able to dislodge the power from those in authority to the people. At an international scale, the Arab 'spring' are an example of how the populace have used protests to dislodge power from the government.

4.8 Summary

The research findings show that commuters devise strategies to overcome barriers encountered in the course of mobility in order to make their commutes more efficient, reduce wastage and save on costs. The use of mobile phones for messaging, calls and payments exemplifies use of space shrinking technologies. M-Pesa is particularly useful to smallholder operators who send and receive small amounts of money. Its application in financial transactions along the milk value chain shows evidence of how it has aided in enhancing connectivity between rural and urban areas. Retailers can receive money from their customers and send it to the bank with their mobile phones reducing the need to travel to the bank. The farmers utilised both voice calls, messaging services and mobile money transfer system M-Pesa to ease their mobility. The farmers could order for goods and then pay them through M-Pesa and hire pickup or *boda boda* transporters to ferry the goods to their farms. This reduces the necessity of commuting, and saves on the cost that the farmer could have incurred to travel to the town, market or village centre.

Technology has played a role in overcoming the barriers due to perishability of milk through use of milk coolers, jacketed milk tankers and pasteurisation of milk. These technologies are facilitated by industries that play a role in overcoming these barriers through value addition that enables raw materials from rural areas to be transported over longer distances strengthening the spatial flows. Modification of means of transport is another technological strategy that is used to ease mobility. The farmers have modified their wheelbarrows and handcarts to aid in the transportation of milk to the collection centres while the milk vendors have modified their motorbikes to accommodate about 50 jerry cans of milk carrying about 200 litres of milk. They have also devised a strategy to ensure that the cans are labelled to enable tracing of the farmers who supply them with the milk so that in case it gets spoilt they can locate the specific farmer who supplied that milk.

Commuters have developed strategies to optimise on the commutes they make. The mobilities are not 'static' but they evolve and change over time, through the seasons and at different times of the day. Various towns, village, and market centres offer a variety of goods and services that influence the decision of the commuter in choosing the destination. The results show that the commuters avoided using the Ruiru to Uplands road before it was rehabilitated, choosing to use longer routes when getting *machicha* at the EABL headquarters in Ruaraka, Nairobi because these roads were tarmacked and in good condition. The research shows that commuters change routes to avoid certain barriers to mobility like muddy sections of the roads, insecurity, topography, police presence among others. Additionally, the results show that the determination of the choice of means of transport arises from certain standards and expectations that one expects in the course of the journey which include efficiency, comfort, image, safety and convenience. It is also determined by personal attributes of the individual who intends to make the trip that include: income, culture and habits. To optimise on the efficiency of the trips that they make, the farmers get their farm supplies periodically while utilising the maximum capacity of their means of transport to reduce the number of trips they make. They also ensure that on a single trip along a certain route, they are able to accomplish several activities, even if not related to dairy farming. Lastly the commuters make use of coded messages or signs to communicate directions or messages to other commuters to avoid barriers that may be incurred in the course of their trip like encountering police or getting lost.

The study has shown that commuters develop coping strategies to deal with government regulators. They bribe or befriend the regulators to avoid harassment which is considered a normal occurrence without which mobility would be made difficult. Additionally to address common challenges faced during commuting and in the course of the dairy businesses, farmers and milk vendors work in solidarity informally through networking a few colleagues or formally through milk cooperative societies or self-help groups. Building social capital is a strategy of overcoming barriers in mobility. Lastly the research has shown how the community also act in solidarity to resist, protest and also to express their anger in regard to the issues facing them including poor condition of the roads and imposed government regulations. This is through physical protests and complaints raised through social media to exert pressure on government officials and elected leaders to take action. The research has shown that limitations in public participation in the selection and implementation of road projects and political interference leads to feelings of disillusionment, exclusion and could eventually lead to protests by the community. Similar findings by Mayienda (2020) showed that there was existence of political interference, inconsistency in the disbursement of funds, delay in external auditing and corruption during the implementation of these road projects.

5 Impact of mobility patterns on urban-rural linkages

This section discusses the spatial implications of the mobility patterns identified along the transect on urban-rural linkages. It looks at the nature of linkages created between urban and rural areas and the place of the village, market and urban centres in facilitating the linkages between urban–rural, rural–rural and urban–urban areas. The section shows how the urban-rural interactions also occur across the rural–urban continuum from the rural areas to the peri-urban rural space, peri-urban urban space the urban centres (see Figure 2.5) that is exhibited in the character of human settlements along the transect from the village, market to the small and intermediate centres.

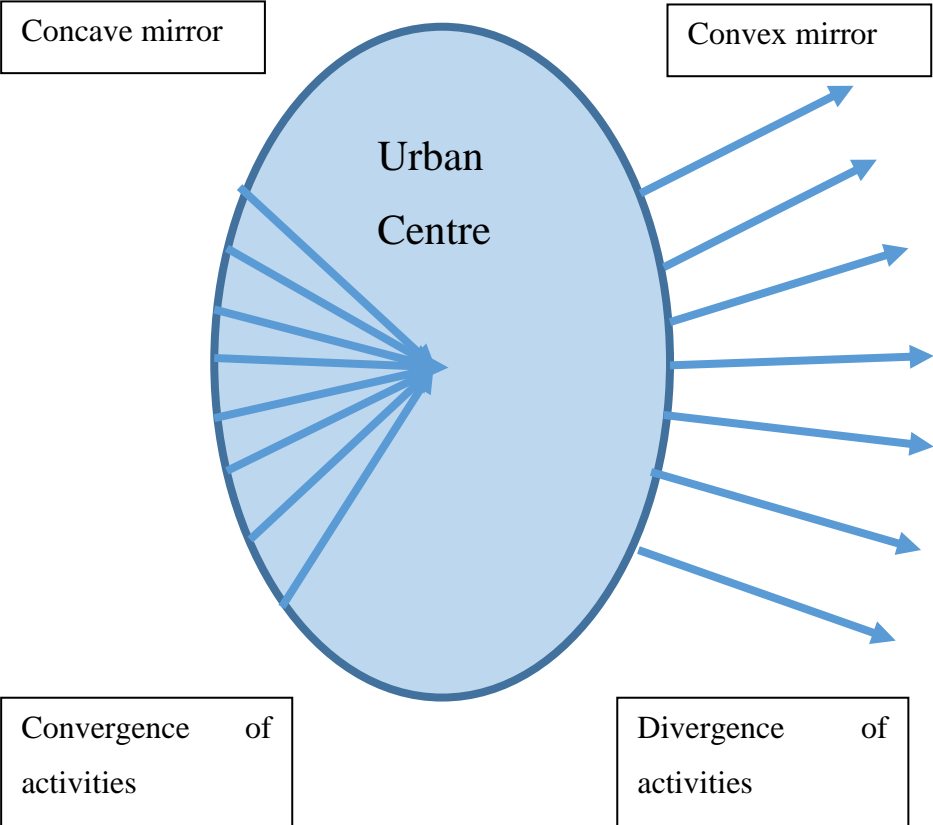
5.1 Urban-rural links and de-links

The patterns of movement along the milk value chain from urban centres to the rural areas, rural areas to other rural areas and urban to urban areas create a circular link between and urban areas. The bi-directional flow of goods and services along the milk value chain either results in convergence or divergence of activities and goods in the urban centres. The convergence movements are those that are towards the town centres, while the divergent movements are the ones that disperse from the urban centre to other centres or to the rural areas. Just like concave and convex mirrors serve the function of convergence and dispersal of light respectively, the urban centre serves the dual function of facilitating both convergence and divergence of activities. The centres act as the connecting link between the rural areas and the urban areas as a points of convergence and divergence activities. Concave mirrors have the mirror surface recessed inside and are called the converging mirrors. When light hits them, the inward curve leads to a concentration of light at a focal point. Convex mirrors on the other hand are curved outwards and are known as the diverging mirrors. When light hits them, it is reflected outwards (See Figure 5.1).

The convergence activities make the centre act as the focal point and concentration of activities. A combination of activities just like a convergence of rays in a concave mirror leads to the role of the centre which acts as the focal point of human activities. The convergence of goods into the urban centres for subsequent sale to the customers creates linkages between the urban centres and other centres and also rural areas. Urban centres are conduits from which the goods arrive after which they are dispersed to other locations. As discussed in section 3.2 on the direction of movement, various inputs are sourced from various locations both in Kenya and other countries. The urban centres receive for sale various kinds of animal feeds including: processed feeds, supplements, by-product feeds (brew waste/ *machicha*, pineapple pulp,

chicken waste, molasses, and vegetable waste from markets). The urban centres additionally receive for sale farm machinery and equipment. The urban centres are also points of convergence of various actors including: farmers, wholesalers, retailers, service providers, and processing industries. This is discussed more in section 5.3 on clustering of business activities.

Figure 5.1: An urban centre as a concave and convex mirror.



Source: Author.

The milk collection process creates a convergence of the raw material from the surrounding rural areas to the village and market centres where the collection points and centres are located from where it is transported to the processing plants (see Map 3.8). Milk collection occurs in two levels; both localised and inter-regional. The localised milk collection is where milk is collected from the surrounding rural areas and then it is transported to the milk processing industry. The milk collection and cooling centres act as dispersal points of the raw materials from the village and market centres from where the raw materials converge at the factories. This is the model that is used by Githunguri Dairy FCS Ltd and Uplands PD&F Ltd. The inter-regional milk collection involves localised milk collection by the dairy cooperatives located in various parts of the country, from where the milk is stored in coolers and then transported to various processing plants that are located in other parts of the country. This is the model that is used by Brookside Dairy Ltd, Uplands PD&F Ltd and Canaan Factories Ltd. Brookside Dairy

Ltd collects milk from 300 milk cooperatives from all over the country (Mureithi, 2017). The milk converges to its factory that is located in Ruiru town creating two-levels of linkages, one between urban, market and village centres where the 300 dairy cooperatives are located, and at the local level between these 300 cooperatives to their rural hinterland.

Divergence or dispersal of activities entails the flows from the centre or focal point to the rural areas or other urban areas, creating urban-rural linkages and urban – urban linkages. Mainet & Edouard (2017, p. 37) point out that as a result of rural-urban interactions, small and intermediate towns emerge as “centres for all sorts of mobility, from and to rural zones.” Divergence of activities also includes the flow of farm inputs from the urban centres to the rural areas through sale of inputs to the farmers. Provision of services also creates divergent links between the urban centre and the rural areas. For instance Githunguri Dairy FCS Ltd provides AI and farm extension services to its 26,422 members as at October 2021. Everyday five veterinary technicians and 15 farm extension officers tour Githunguri constituency where their members are located. Each veterinary technician visits about 15 farmers per day while the 15 farm extension officers visit various farmers everyday.

Dispersal activities additionally include the distribution of milk products to various parts of the country. The milk processing companies distribute the processed milk products to different parts within and outside the country creating links between the urban centres where they are located to other urban centres. In this case the urban centres act as the dispersal points of these processed products. Uplands PD&F Ltd distributes its milk across the county through 22 depots located in different parts of the county (see Figure 3.24). These depots further distribute and disperse the milk to the retailers and finally the milk gets to the consumers. This flow of goods and services between urban centres creates urban – urban linkages and a system of cities that mutually relate to each other. Roberts (2014) argues that these endogenous intercity interactions as opposed to a focus on global interactions is more important in ensuring the growth and competitiveness of small and intermediate towns. He argues that exogenous, export-driven trade benefits the primate cities as opposed to the small and intermediate towns that struggle to compete at that scale.

Table 5.1: Convergence and divergence of activities to and from urban centres.

Convergence activities	Divergence activities
Flow of farm inputs from surrounding centres and industries to the urban centre	Flow of farm inputs to rural areas and other centres

Flow of farmers to centres to purchase farm inputs	Artificial insemination services to rural areas
Collection of milk at collection centres	Veterinary clinical services to rural areas
Collection of milk at cooling centres	Extension/ training services to rural areas
Collection of milk at processing industries	Distribution of milk by the milk vendors
Sale of milk by milk vendors	Distribution of milk by milk processors

Source: Author.

The convergence of inputs into the town and the dispersal of the processed product out of the town are also in the form of forward and backward production linkages. The backward linkages are created by the demand for inputs and services during milk production from processed feeds, sale of hay, veterinary services and other inputs that create linkages with other industries and sectors of the economy. Forward linkages are as a result of use of the raw milk in the manufacture of other related products like ghee, cheese, yoghurt, powdered milk, chocolates and butter. Due to the diminishing land sizes that necessitate the purchase of animal feeds the backward linkages are more compared to the forward linkages because processed milk is not used as an input to many industrial processes. Forward linkages are also in the form of the transport services that are needed in the distribution of milk.

The convergence and divergence activities take place at the urban centres which act as the heart beats of the rural region in facilitating the linkages between the urban and rural areas and urban and other urban centres. Lowe & Moryadas (1984, p. 55) visualise the centres as the “*sinks*” (*destinations*) of all types of interactions.” The authors emphasise that without the “*people or the places, there is no interaction.*” In addition, without the presence of road and communication networks, there can be no meaningful interaction. In this case it could be both road and communication networks. The road networks are the arteries that act as the conduits or pipelines that allow the flow of goods and services from the heart to other parts (body). Like the heart, the town is the heartbeat of the region, and facilitates the flows from other parts of the country to the town and additionally facilitates the flow of the processed products out of the town to other parts of the country. This movement to and from the city creates a cyclic flow:

“Urban and rural communities do not live in isolation from one another. The flow of people, goods, services and transport, for example, does not go in one direction only. In fact, there is a repeated and reciprocal circular movement across the urban-rural continuum that connects these areas and generates a synergy that is greater than the sum of the parts, and that contributes to functional, integrated

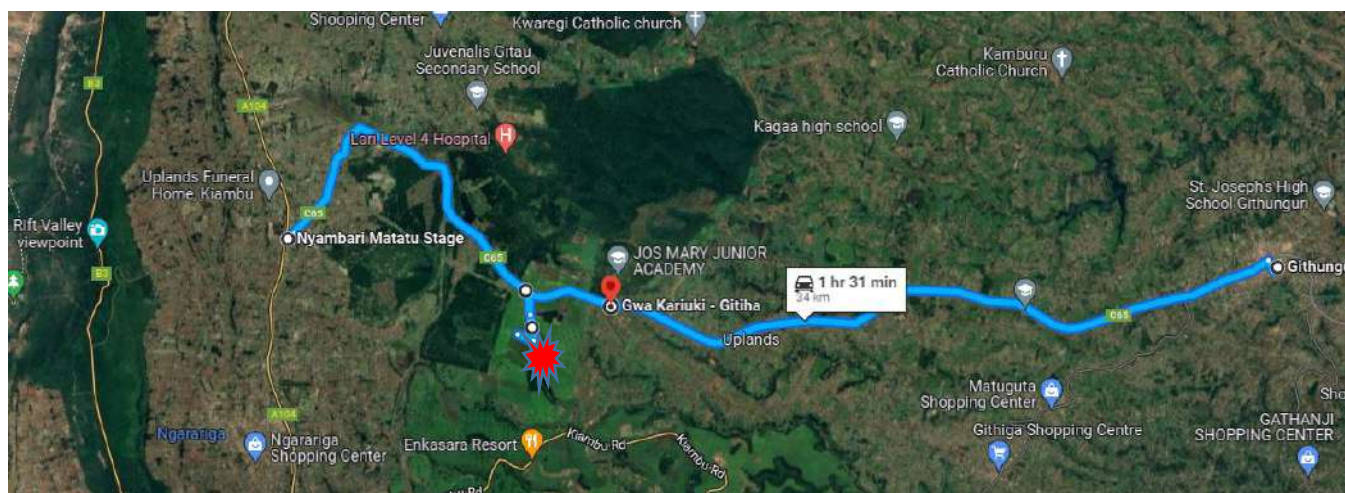
territories and regions.” Maimunah Mohd Sharif, Executive Director UN-Habitat (Sietchiping et al., 2019, p. viii)

It is notable that the territorial changes taking place along the transect are shaped by the activities of the milk value chain that take place in space and particularly converge and disperse from the town. The milk value chain creates an emergence of new centralities from village, market to town centres that are driven by these linkages.

Effect of mobility on linkages

There are factors that lead to the ‘breakage’ in linkages. If the road arteries are ‘punctured’, it leads to a disconnection. This was the case for the connection between Githunguri and Uplands village centre where the section at Gitiha (see Map 5.1 and Figure 5.2) was cut off during the rainy season due to a dilapidated section along the Ruiru to Uplands road; de-linking Uplands centre area and Githunguri town. The chairman of Ginyali Sacco that operates along the route between Githunguri, Nyambari, Uplands and Limuru town, Mr. Nyoike Mungai indicted that the *matatus* have to drop the passengers at Gwa Kariuki, one side of the dilapidate section, then the passengers would walk through the one kilometre section to Gitiha Polytechnic where they could pick another *matatu* to Githunguri town (Mugo, 2016). This break in a circulation causes a disconnection between Githunguri and Uplands village centre.

Map 5.1: Map of Githunguri to Uplands/ Nyambari village centre



Source: Google maps, 2021.

The disconnection of the circulation or the artery connecting Uplands and Githunguri caused Uplands village centre to re-orient itself and identify with other towns and centres in the sourcing of farm inputs, services and markets for its products. Mr. Nyaga a 38 years old extension manager at Canaan Factories Ltd located in Uplands village centre indicated that the

milk vendors who operate from Nyambari in Uplands sell their milk in the centres located along Nairobi – Naivasha road and also in Nairobi and Mai Mahiu towns. Canaan Factories Ltd also rely on service providers from Nairobi and not Githunguri town, and also rely on Limuru town for accommodation and conferencing facilities. Mr Nyaga who resided in Githunguri town had to travel an extra 30 kilometres return journey through Githiga, Ngorongo, and Limuru town to get to his work place in Canaan Factories Ltd every day (See Map 4.4).

Figure 5.2: Dilapidated section at Gitiha village along Ruiru Uplands road.



Source: (Mugo, 2016)

Effective commuting has been known to be a critical factor in the enhancement of spread effects. Enhancement of communication networks is critical in enhancing linkages. Hale (1967, p. 442) notes that “*commuting is one of the important positive factors involved in the mechanics of the spread effects.*” He adds that the cost of transportation is key in firms budget decision making and “*transportation systems shrinks economic distance and by so doing warp and modify market organisation*” (Hale, 1967, p. 437). Myrdal (1957) also notes the importance of transport and communications in strengthening the “*centrifugal spread of economic expansion or to remove the obstacles for its operation*” (Myrdal, 1957, p. 34). Thus the barriers to mobility that limit movement would consequently have an effect on the spread effects. Corruption and bribery during the cause of mobility, poor road infrastructure, issues of affordability, strict government regulations, and insecurity would have an effect in reducing the impact of the spread effects.

If cities are not well connected by hard and soft infrastructure (i.e., roads, rail, air services and political, social, and business networks), the flows of materials, people, trade, goods, services, and information are slowed down, and the prospects for sustainable local economic development are minimal” (Cities Alliance, 2019, p. 37).

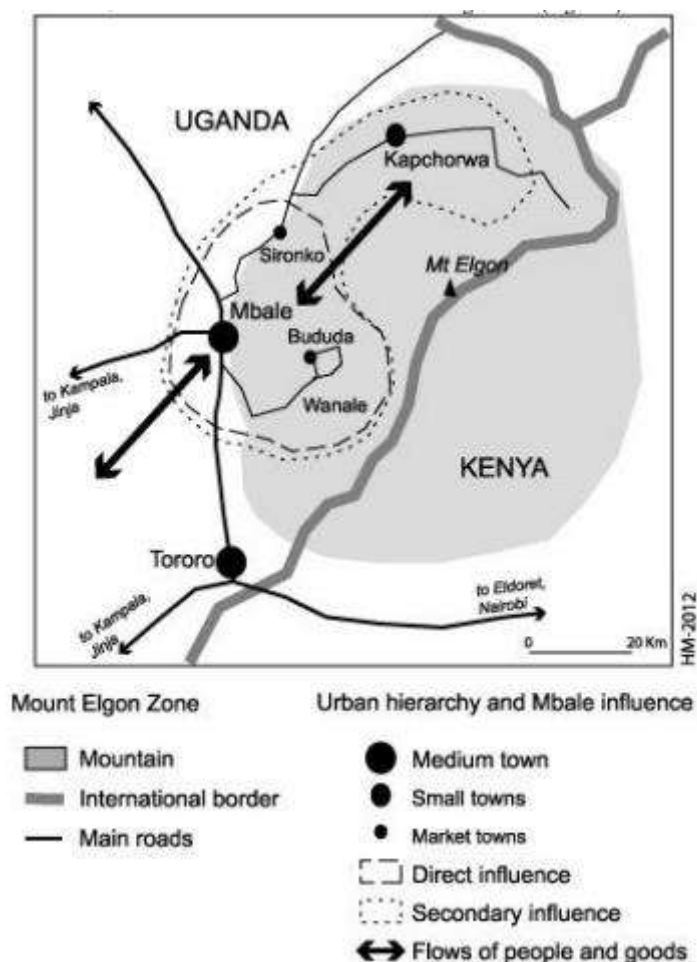
Using empirical data from OECD small regions, OECD (2013) and Veneri (2014) demonstrate that spread effects are affected by the proximity to urban areas. They indicate that the spread effects are better felt in regions closer to the urban areas and diminish as the distance increases. This research study has shown that urban centres have an area of influence in regard to the provision of services and sourcing of goods that is determined by the distance between the service providers and suppliers on one hand and the farmers on the other hand. This distance is determined by the economical transportation costs which the service providers or the farmers are able to incur and still make a margin out of the commute. The research has shown that commutes whose distance was beyond this area attracted middlemen who facilitated the flow of products between distant towns and locations to the centre or directly to the farmers creating another level of linkages and a system of interaction between the villages, urban centres and other urban centres. These regional interactions created by the small and intermediate towns are not only between the towns and rural areas but also the towns and other towns. Veneri (2014) notes the influence of the commuting distance on the intensity of rural-urban interactions:

Physical proximity can approximate the intensity of urban-rural relationships for several reasons. People move daily across a limited amount of space, which is usually defined by the boundaries of the labour market and those of the space of consumption and recreation. Physical distance to a particular facility (e.g., a service facility or a place of work) is a first basic measure of accessibility. In addition, it also gives an idea of the physical extent of commuting patterns. (Veneri, 2014, p. 165)

Perroux (1950) pointed out that firms have an economic zone of influence that is different from the administrative boundaries that emanate from the centres (poles or foci) and exert force attraction forces towards it (centripetal forces) and repulsive forces outwards (centrifugal forces). These forces exhibit similar characteristic with the convergence and dispersal activities that urban centres facilitate as discussed in the previous section. These forces create an economic space which Perroux differentiates with ‘genomic/ banal space that is a result of “genomic relations between points, lines and volumes” (Perroux, 1950, p. 92). The genomic space represents the physical attributes of space as show in maps while the economic space

illustrates the functional space as a result of economic interactions on genomic space. Lowe & Moryadas (1984, p. 56) indicates that “each node has a ‘field’ or ‘action spaces’” within which most of its interactions occur. They argue that the level of specialisation of the node determines the field of interaction. The interaction could be localised, national or international. Mainet & Edouard (2017) in a research in Mbale town in Eastern Uganda which is similarly located in a mountainous area revealed that the specialised shops in this town had an area of influence within a radius of 40-50 kilometres. The authors additionally differentiated between the direct and secondary influence of Mbale town to the surrounding small towns as shown in Map 5.2 below.

Map 5.2: Mbale influence zone in the Mount Elgon area (Uganda)



Source: (Mainet & Edouard, 2017, p. 34)

Mainet & Edouard (2017) also show a similar influence zone in Mbeya town in Tanzania that extends beyond the national boundaries creating economic linkages with Zambia and Malawi. This illustrates the need to differentiate between the genomic/ banal space and the economic space. Lowe & Moryadas (1984, p. 9) define economic space as the “area over which a certain economic activity or activities prevail” They also relate this term with that of “sphere of influence.” This area of influence is what creates a functional region whose boundaries are

“usually different from the administrative boundary – in which a specific territorial interdependence (or function) occurs” (OECD, 2013, p. 22). Veneri (2014, p. 162) define a functional region as the *“geographical space with strong socioeconomic, cultural, or environmental relationships that generally cover the territory of contiguous and interdependent administrative units (e.g., municipalities).”*

The economic zone of influence of a town like Githunguri that has developed as a result of the milk value chain can be established by identifying the various economic linkages created at different levels of the value chain at the local, regional and international levels. Raw materials can be sourced from the locally, from other regions or other countries showing the production zone of influence. Distribution of raw and processed milk links Githunguri to other counties showing the distribution/ market economic zone of influence. This creates local functional areas where the towns exert their influence, and regional functional area where the region exerts its influence. The type of mobility at these two levels is also different as illustrated by this research. The local level flows are in relatively small quantities, mainly using non-motorised means of transport, bicycles, motorbikes and pickups, and are carried out directly by the farmers. The regional flows use lorries and trucks and include the participation of middlemen.

The consideration of economic space serves as a reason of viewing urban and rural areas as a continuum that surpasses the geographical boundaries between these two spaces. It makes it imperative that planning of these two spaces should be harmonised through regional development plans.

5.2 Symbiotic relationship between rural and urban areas

The movements and links between urban and rural areas that are facilitated by mobility build relationships, collaboration, interactions and partnerships between the two areas and also between various actors located in both urban and rural areas based on mutual interests. The urban centres located near rural areas contribute to the growth of the surrounding rural areas including agricultural activities, while on the other hand robust rural activities which are mainly agricultural activities contribute to the growth of urban centres. These interactions are based on mutual complementarity as illustrated by Lowe & Moryadas (1984, p. 10):

“In order for movement to occur between two places, there must be a demand for a particular product in one region, and another region must be capable of supplying that particular product. This is known as specific complementarity...The reciprocal relations between urban industrial regions and rural agricultural regions are based on mutual complementarity.”

This research reveals how Githunguri town has supported the growth of the dairy industry and in turn the growth of the dairy industry has led to the growth of this town creating a symbiotic relationship. This is elaborated in the next section on the role of the small and intermediate towns in supporting the milk value chain. Mr. Mwaura a 55 years old veterinary doctor who has been in business in Githunguri for over 22 years viewed Githunguri town as a service centre that supports the dairy industry. “*Githunguri has grown with the dairy industry. It services the dairy industry.*” This is a two way relationship where the town provides the inputs and support services to the milk sector as it gains growth driven by the thriving milk sector.

The interaction between urban and rural areas is not only between the urban centres and their rural hinterland, but also more directly between the processing industries and the farmers. The milk processing companies including the private ones which are mainly located in the urban centres support the farmers to boost their productivity. This represents a form of collaborative and partnership effort at the local level that facilitate efficiency along the milk value chain. Through the cooperatives like the Githunguri Dairy FCS Ltd, farmers are able to achieve economies of scale in the production, collection, transportation, processing, marketing and distribution of milk. Individually, the farmers would have faced challenges especially in the processing, marketing and distribution of the milk. The farmers also have better leverage working as a large group to compete with other milk processors. According to this study, farmers are exploited by middlemen in regions where cooperatives are absent or declining, such as the Lari constituency, and they also lose money due to milk spoilage. The cooperatives additionally give the farmers stronger negotiating power in sourcing inputs, setting prices for the processed products and in relating with government actors and regulators for instance in the formulation of regulations. The collaboration through the cooperatives is part of community solidarity efforts in solving the issues that they face as discussed in section 4.7. At the production level, the cooperatives provide farmers with farm inputs (including processed animal feeds, hay and milking salve) which they buy from wholesalers cheaply in bulk and sell to their members on credit. Githunguri Dairy FCS Ltd and Uplands PD&F Ltd offer training support to the farmers to build their capacity and increase milk production. Githunguri Dairy FCS Ltd in addition offers artificial insemination services to upgrade the breeds of the cows that farmers keep which is eventually aimed at increasing milk production. By supporting the farmers to improve milk production, the companies benefit from increased supply of raw materials and retention of the farmers. This is important because the processing companies need a large pool of farmers to sustain availability of the raw material given that most of the companies are at 46 per cent of their production capacity (Mwita & Adhiambo, 2022). The companies additionally train the farmers in financial management to ensure that they are able to successfully manage

their dairy enterprises as a business venture. The farmers are also linked to financial institutions that provide them with loans secured by the milk they supply. Through this training support, Uplands PD&F Ltd has managed to boost its milk productivity from four to 15 litres (Kago & Nganga, 2021) benefitting both the milk processor and the farmers. Although Uplands PD&F Ltd is a private enterprise, it has a similar symbiotic relationship with over 5,000 farmers who deliver milk to the company, which then processes and distributes it. The milk processing companies additionally engage transport operators (lorries, pickups, motorbikes and bicycles) in the collection and distribution of milk; some of whom are sourced from the locality.

Figure 5.3: Partnerships created by the milk processing cooperative.



Source: Author.

Githunguri town is a case where there is interaction between the urban and rural areas creating a growth whereby the town’s development is not detrimental to the growth of the surrounding hinterland – it instead contributes to the growth of the rural agricultural activities. This may be because the town is small and the demands of the town have not led to backwash effects. Ruiru town unlike Githunguri town is oriented towards real estate and industrial development. The character of Ruiru as a satellite town of Nairobi provides a ready market for milk, and this was evident in the number of milk vendors operating in the town. While Githunguri and other small towns along the transect mainly support the production and processing part of the milk value chain, Ruiru town supports the processing, distribution and consumption of milk. The high

population in Ruiru offers market for processed and raw milk that is sold in super markets, shops, restaurants, milk ATMs and milk parlours. The town is also a source of vegetable waste from Githurai and Ruiru markets that farmers use to feed their cattle.

The expanding city

The rural fringes of urban agglomerations are the cities of tomorrow. Given the rapid pace of horizontal urban growth and the increasing number of industrial and infrastructural projects mushrooming in these areas, peri-urban zones will be rapidly absorbed by expanding cities. (Schlimmer, 2021, p. 8)

The growth of the urban centres may lead to a decline in agricultural activities. Ruiru town is expanding into the agricultural land. Tatu City is a 5,000-acre new town that is being developed on land previously used for coffee farming. Ruiru will also host Northlands City that will cover 11,576 acres of land previously used for ranching. This expansion of the town to rural areas that is driven by demand for housing is ‘eating’ into the rural agricultural activities (see map 3.5 that shows the expansion of Tatu City). The smallholder farmers who relied on the patches of land in between the coffee plantations to cut grass for their cattle indicate that the grass is diminishing:

“I used to get grass from Ruiru at the ‘weru’ (rangeland) in the coffee plantations. The grass is reducing. The shambas have been sold in Tatu City, and the buildings have come up.” Mr. Nderitu a 52 years old farmer and mechanic from Miguta, Githunguri.

The construction of Tatu city has also led to the increase in the price which the farmers pay to gain access to the farm to cut grass. Tatu City raised the fee for anyone cutting grass on their farm from Ksh. 800 in 2019 to Ksh. 1,500 in 2020. This was because the grass patches in between the coffee plantations were no longer idle land as it was before, but had become prime real estate land that was being sold to developers. Mr. Nderitu indicated that as a result of the high cost of getting the grass from Tatu City he had resulted to buying hay from suppliers who source it from other parts of the country. Mr. Njaramba a 46 years grass cutter from Raiyani, Kwamaiko who had been in the business of cutting grass for the last 17 years indicated that he was no longer cutting grass from Tatu City and was recommending the farmers who hire him to venture into other farms like Oaklands, Waguthu, and Bibirioni (Pavillion estate). The expansion of towns into the high productive agricultural areas lead to vegetation and soil loss threatening food production (Bartke et al., 2021; Sietchiping, et al., 2014). While the expansion of Ruiru into agricultural land will consume prime agricultural land, it will on the other hand

increase the market for rural products from the surrounding rural hinterland. It will also be a source of non-farm activities for the farmers. The expansion of Tatu City to Ngewa/ Kwamaiko market centre is likely to enjoin the centre and transform it to a town to support the ongoing real estate and industrial activities. This could have detrimental effects as the farmers are enticed to sell off the agricultural land to give way to real estate development. Just like Ruiru is a dormitory town of Nairobi, Ngewa could also become the dormitory town of Tatu City and will offer low cost housing for the workers in the construction sites and industries in the new town development. Thus the force of urbanisation is likely to extend upwards along the transect. Symbiotic relationships are based on reciprocity; in the case of Ruiru town, the benefits that the town takes away from the rural region are detrimental for the growth of agricultural activities including milk production. While it may offer market for the milk produced, depletion of land which is the backbone for agricultural activities could lead to the decline of the milk industry.

This expansion of Ruiru town towards the rural areas is a manifestation of backwash effects created by an expanding core (Nairobi) that has led to the demand for land for the town's expansion, 'eating' into the rural land towards Ruiru and Githunguri sub-county. Myrdal (1957) demonstrated that the cumulative causation process if left to market forces without any policy control, would lead to the growth of one locality and underdevelopment of another locality creating a core and periphery. In the case of Ruiru town, the spread effects are in the form of a market for the raw and processed milk from the hinterland. However, the rate of expansion of Ruiru town and its inclination to Nairobi signifies higher backwash effects as compared to spread effects. OECD (2013, p. 25) points out this disparity in the growth of the core and the periphery:

A large urban core has the potential to generate strong positive spill-over effects on its surrounding territory, benefiting the entire functional region. However, it can also generate tensions and competitive relationships with smaller surrounding areas, whose interests may not always be aligned.

Box 5.1: The core-periphery model

The core-periphery model

Friedmann (1969) developed the model to explain polarization between the core and the periphery. As a result of his analysis he developed a four stage transition of a regions' urban system, from a system of homogenous centres during the pre-industrial stage, which transforms to emerging dominant centres at the second stage as industrialization begins to take place at certain centres. At the second stage, the backwash effects outweigh the spread effects, and

growth is oriented towards the emerging cores. He deduces that in the third stage, as a result of mobility, interactions and diffusion and spread effect effects, growth spreads to the other growth centres. Eventually there emerges a balanced spatial system of different hierarchy of towns and cities with different specialization and comparative advantages. This is the case of post-industrialized nations where populations are moving to secondary cities.

The pre-industrial stage is characterized by isolated and dispensed agricultural centres with low levels of mobility. At the second stage, the transition stage, an emerging core appears driven by increased trade, migration to urban areas, mobility and industrial growth. At the third stage, the industrial stage, other centres emerge as a result of high costs of production at the core. These emerging cores interact with the core through linkages facilitated by transport infrastructure. At the post-industrial stage, there is fully integration of the urban system and reduced inequalities. It is characterized by intense flows, division of labour and specialization within the system.

This systematic development of regions in the case of developing countries which are in the second stage of industrial growth is characterized by backwash effects as the dominant cores take prominence, with limited spread effects. This eventually creates huge disparities between regions (De Jong & Gardner, 2013). Kenya experiences a kind of core-periphery dichotomy characterized by the primacy of the City of Nairobi that takes a significant share of the national urban population and also contributes to over half of the Country's Gross Domestic Product. The expansion of Ruiru town which is an extension of the City of Nairobi is also taking the shape of strong backwash effects.

In the section below, the research outlines how the shape of Nairobi metropolitan area relates to that of the capital cities of the neighbouring counties – Kampala and Dar es Salaam.

Source: Author

The National and local government should intervene and ensure that there is the existence of spatial plans, enforcement of development control and delineation of the boundaries of the urban centres to protect the rural areas and rich agricultural land. However, the backwash effects of Ruiru town's expansion are minimised by the growth of industrial activities Githunguri town. The growth of this small town reduces the attachment of the periphery to Nairobi and its satellite town - Ruiru. As Myrdal (1957, p. 31) notes that these outcrops of industrial activities away from the core can become "*another line of centrifugal spread effects... if the expansionary momentum is strong enough to overcome backwash effects.*"

The planning of Githunguri 'milk town' and its surrounding area should also be put in the context of the growing milk industry. The growth of the dairy sector in Githunguri is likely to

lead to an increase in the number of cows that farmers keep, given that the more the cows that farmers have, the more profitable the dairy enterprise is. The number of cows is also likely to grow as the population in the area increases. Consequently given that land is constant and is in effect becoming unproductive due to subdivision and conversion to residences for the growing population, there will be a further reduction of available fodder to feed the increasing number of dairy cows, thus the farmers will have to undertake intensive agriculture to sustain their livestock, which will further increase mobility between the town and rural areas and increase the demand for livestock feeds in urban areas and consequently lead to further growth of Githunguri town. Eventually as the town grows as a result of the robust milk industry and the growth of the retail sector, it will demand land and the town is likely to expand into the surrounding rural areas. This is likely to lead to land use change from agricultural to among others residential, commercial, and industrial uses that compete with the existing rural functions of milk production and the back wash effects will begin taking effect.

If spatial planning, development control and zoning are not enforced, eventually the demand for land for urban use especially housing given that Githunguri is in a peri-urban area will overrun the dairy activities currently taking place in the town leading to further sprawl of Nairobi to the surrounding metropolitan region. The expansion of the town should be such that there is compact development to optimally utilise the limited land resource in the area. Thus the symbiotic relationship between urban and rural areas exists better if there is proper spatial planning and development control. Uncontrolled urban development could eventually lead to unbalanced growth in the surrounding rural hinterland. This relates to Myrdal (1957) model of cumulative causation that explains the existence of uneven growth in regions as a result of growth ignited by industrial development. It also relates to the current growth of Ruiru town to the surrounding agricultural land. Bryceson (2011) in a study of a small emerging town called Katoro located in Tanzania notes that the expansion of the town will lead to challenges of governance and a destabilizing effect of the market forces. She highlights that the growing towns could have excess labour supply compared to the demand and also a pressure in delivery of services.

“Small market towns can be harmonious places to live and work at their early stages of development because labour supply is better calibrated to demand and market innovation is generating means of provisioning goods and services relatively readily. But this observation, which appears to be true for Katoro at the time of our survey in 2005, is far from being guaranteed for the future. Rapid growth of an African town-cum-city necessitates the evolution of malleable forms

of governance capable of being responsive to the changing needs arising from each stage of scalar development” (Bryceson, 2011, p. 289).

Ruiru, Githunguri and the other surrounding towns should focus on developing collaborations and partnerships rather than competing with each other. Roberts (2014, p. 87) points out that secondary cities should develop collaborative rather than competitive advantage:

“Secondary cities should collaborate, reciprocate in trade, investment and development, and leverage their resources make it possible to overcome the economies of scale possessed by larger cities and out-compete them.”

The uncontrolled expansion of the capital City of Nairobi into the peri-urban zone poses risks to the environmental, social and economic outcomes that could be created. The County has not set a limit of the minimum portion of agricultural land that can be sub-divided in the area, and currently in Kiambu County land can be subdivided to a minimum of an eighth of an acre irrespective of the land use leading to rapid sub-division of land, especially near the village and urban centres. Whereas article 86 of the constitution of Kenya gives parliament the power to enact legislations governing the minimum and maximum land sizes, currently no law has been legislated to actualise this provision. Section 56 of the physical and land use planning act, No. 13 of 2019 gives the county governments the power to among others “*control and prohibit the subdivision of land*” (Government of Kenya, 2019a). Notably, the maximum and minimum land holding was largely informed by the Sessional Paper No. 3 of 2009 on the National Land Policy which had already gone through consultations in regard to land reforms in the country. The sessional paper noted and recommended that:

“Population growth and the demand for land have resulted in excessive fragmentation of land into uneconomic units. At the same time, a number of people own large tracts of land which are not utilized optimally. The Government shall ensure that all sub-divisions of land are tied to land use sizes specified for different ecological zones. To facilitate the attainment of this objective, the Government shall: (a) Put in place a system to determine economically viable minimum land sizes for various zones; and (b) Promote conformity of land subdivisions with the set minimum economically viable land sizes.” (Government of Kenya, 2009)

The National Land Policy also recommended for establishment of settlement clusters for ease of provision of services and to stop “*uncontrolled subdivision of land*”. This has not been implemented to date. The Physical Planning Handbook recommends a minimum land size of an eighth of an acre, which is followed by counties. The setting of the minimum and maximum

land holdings remains a politically sensitive issue in Kenya, given that there are individuals owning large tracks of land and setting a limit to the maximum land sizes would affect their investments. In addition, highly populated areas like Kiambu where land is mainly freehold already have parcels that are already sub-divided below an eighth of an acre. In 2015 a draft minimum and maximum land holding acreages bill, 2015 was developed, but it was referred back to the MLHUD for further consultations and alignment to other legislations. During a consultative forum on the draft bill, the acting cabinet secretary, MLHUD Fred Matiang'i commented that:

“The issue of minimum and maximum land holding was one of the catalysts used by the proponents of the 2010 constitution to promote it, and this is one of the clauses that has now come back to haunt us... This is the time we have to speak to each other sincerely, honestly and without political malice... How can a community that wants to move forward, prescribe 100 acres to someone able to own 1,000 acres? Land owners are the same people developing major real estate projects and ranches, and there is a need for the public to understand what effects such a legislation can contribute to development in the country” Fred Matiang'i, acting cabinet secretary, MLHUD (Wairimu, 2015)

Peri-urban zones face unique planning and governing challenges because of their location at the interphase between the city and rural areas, land speculation, lack of land documentation, political interference, changing land uses, varying land tenure regimes, different planning jurisdictions and the limited capacity of adjoining rural areas to plan these areas (Bartke et al., 2021; Schlimmer, 2021; Sietchiping et al., 2014).

in peri-urban areas, authorities from different administrative levels intervene and their responsibilities sometimes overlap. Customary authorities, decentralized or deconcentrated administrators, municipal decision-makers and central government stakeholders interact and sometimes compete over the legitimate authority over land and other peri-urban issues. (Schlimmer, 2021, p. 4).

The effect of the expansion of the city on the rural population should also be put into consideration. Does the rural population have the capacity to benefit from urbanization without being negatively affected? Will the rural populace be ready to undertake urban activities? Do they have the skills to take up the urban job opportunities? Tensions could erupt if the local communities perceive that "outsiders" have more opportunities than they do. The issue of gentrification is also likely to take effect due to the demand for land for residential and industrial use. The proximity of the city raises the value of land making it more profitable to put the land

into residential, industrial use than agricultural use. Consequently, the developers buy land from the smallholder farmers especially those who do not optimally utilize their small parcels of land or those with limited capital to undertake commercial agricultural activities. This phenomenon of gentrification in the peri-urban land is taking place in a similar pattern in the outskirts of the Kampala, Uganda where “*Tenant’ farmer families are gradually being replaced by an emerging middle-class looking for titled properties, occasionally farming.*” (Chalin et al., p. 570). The city’s sprawl is taking place in a pattern that is leading to a buy out of the plot holders (tenants)³⁰ who are mainly involved in farming activities and denying them proper compensation. There are incidents of dispossession of plot-holders where they have to surrender and exchange a portion of their land to the title-holders (landlord) in exchange for a freehold title. This has an effect in terms of the farmer losing a bit of the land, increased fragmentation of land, and also a reduction of the land under agriculture given that the land that is given up may not be necessarily used for agricultural purposes. The expansion of Kampala into the peri-urban area is in a context where land prices are increasing, investors are involved in land speculation and resale of land, housing projects are in the rise, and titled land is more valuable. (Chalin et al., 2015).

In Dar es Salaam, Tanzania, Bartke et al. (2021) indicate that the middle income segment of the population, and the rich and politically connected individuals are keen to buy land in the peri-urban areas of the city for speculation. The authors indicate that the indigenous villagers in the peri-urban zone of Dar es Salaam are selling land for diverse reasons including: quick monetary gains to finance household needs, to build their homes, establish businesses or buy land in cheaper zones. In a similar pattern like the case in the peri-urban zones of Kampala and Nairobi, the reasons for buying land in the peri-urban zones of Dar es Salaam is for speculation, housing and investment. Similarly to the other two cities discussed above, Dar es Salaam is facing challenges of poor regulation of land, subdivision and conversion of land use from agricultural to residential and commercial uses. Like the situation in Kampala, there is an imbalance of power and knowledge between the indigenous populations selling the land, and the speculators buying the land, leading to the sellers disposing of the land at prices below the prevailing land values a situation that is fuelled by land brokers (Bartke et al., 2021).

in peri-urban areas, land is gradually absorbed by cities and agricultural land is subdivided and transformed into residential or commercial plots. As a nexus between urban centers and the rural hinterland, these areas are preferred by

³⁰ “When referring to their patron–client relationship in the mailo system, we prefer to use these terms (‘tenants’ and ‘landlords’). However, when referring to present time dynamics, we choose to use ‘plot-holder’ and ‘title-holder’.” (Chalin et al., p. 571).

investors and developers to implement large-scale agricultural and infrastructure projects, but also industrial parks and special economic zones. The result is a mosaic of land uses confronting subsistence economies with capitalistic and commercial projects (Schlimmer, 2021, p. 3).

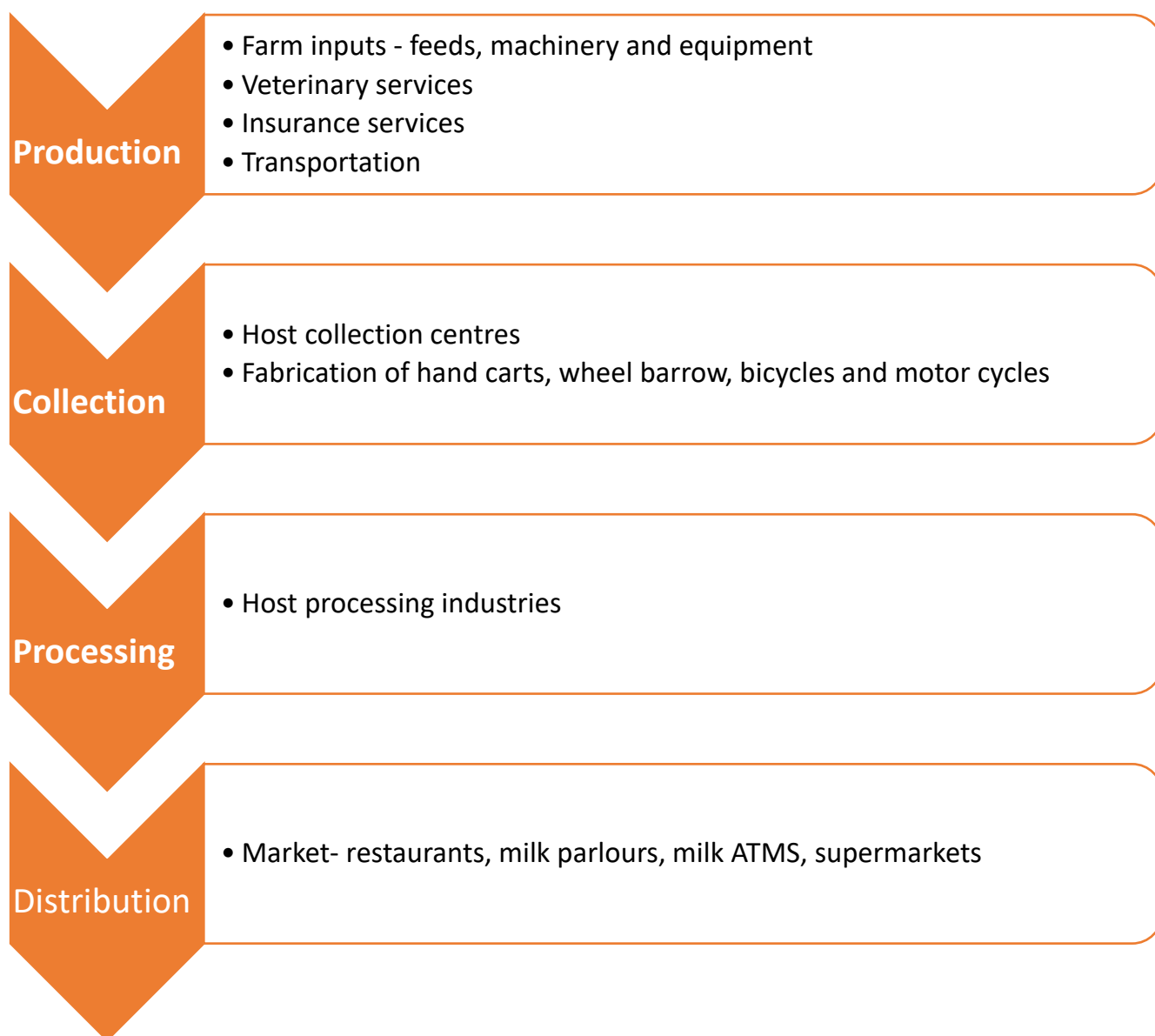
Bartke et al. (2021) indicate that the above risks of gentrification have not been addressed by urban and land policies and propose hybrid forms of land administration and governance, and an integrated approach to territorial planning across the rural to urban continuum. Schlimmer (2021, p. 8) emphasises that there is need “*to plan and anticipate the patterns of spatial urban growth.*” Contribution of small and intermediate towns to the milk value chain

Role of small and intermediate towns in agricultural growth

The relationship between the rural and urban areas has been discussed in the previous section; this section discusses the particular role played by the small and intermediate towns in supporting agricultural activities with a focus on the milk value chain. The small and intermediate towns create an enabling environment for the growth of agricultural activities. Ngewa (Kwamaiko) market centre, Githunguri town, Uplands/ Nyambari village centre and Kagwe village centre show the roles that they are serving in supporting the production of milk. It also shows the diverse services that are available in the three centres. Ruiru town is located in the peri-urban zone of Nairobi and supports in the processing and marketing of milk products due to its large population. All the informal milk vendors interviewed were selling their milk in Ruiru town. For example, 52 years old Mr. Nderitu who operates a motor vehicle repair business in Ruiru town and a small scale dairy farm in Miguta, Githunguri while comparing his non-farm engagement in Ruiru to his dairy farming business in Githunguri indicated that “*My engagement in Ruiru has nothing to do with farming. I just go to work.*” In comparison between Ruiru and Githunguri towns, Ruiru offers the market and industrial support while Githunguri offered production and industrial support.

Section 3.1 outlined the patterns of mobility in terms of the directions of the flow of goods and services along the milk value chain. The flow of goods shows the interconnection between towns and rural areas as farmers, suppliers, retailers, processors, service providers (veterinary doctors, veterinary technicians, farm extension workers, transporters), and distributors sourced the goods from one rural area to another rural area, rural areas to the urban areas and vice versa, and from one urban centre to another. The urban centre emerges as the linking point between the urban and rural areas and facilitates the conduit of the flow of goods and services. The significance of the town in the provision of goods and services emerged from these patterns of mobility. The support role of small and intermediate towns is classified as follows:

Figure 5.4: Summary of support functions offered by urban centres along the transect.



Source: Author.

Source of farm inputs

The surrounding village centres and small towns are the sources of farm inputs including animal feeds for the farmers. On a tour of Githunguri town one will note the presence of traders selling various kinds of processed feeds and other farm inputs like chaff cutters for chopping fodder, aluminium and plastic jerry cans, milk salve, wheelbarrows among others. Mr. Kiama 46 a years old livestock officer in charge of Githunguri sub-county indicated that due to economies of scale, the prices of farm inputs are cheaper in Githunguri because the merchants procure them in bulk. He indicated that farmers from other regions travel to Githunguri town to buy chaff cutters. The concentration of many businesses selling related products could also lead to competition resulting in cheaper prices. The availability of goods and services in towns reduces

the need for farmers to travel to distant locations in search of these goods, thereby reducing the cost of production.

Service Provision

The urban centres also host services providers that support the dairy industry including AI, veterinary, insurance, banking, conference, and transport services. According to Mr. Mwaura, a 55 years old veterinary doctor operating in Githunguri town, the urban centre has approximately three veterinary doctors, 100 veterinary technicians and 100 agrovets outlets operating at different scales in size and personnel. These service providers are spread out even in the market and village centres, with some operating from their homes due to the demand for their services. The agrovets offer clinical, artificial insemination, consultation, training and insurance to the farmers. The veterinary doctors make visitations to the farmers in the surrounding area for provision of these services using vehicles and motorbikes. Mr. Mwaura who operates Peak Agrovet had a data base of 10,000 clients and has 3,000 active clients. He has two veterinary technicians who assist him, and in total his practice makes about 30-40 AI and clinical visits per day using two vehicles and two motorbikes.³¹ His agrovet sells animal drugs, mineral supplements and semen among other products sourced locally or imported from other countries.

The restaurants located in the towns provide the farmers with conferencing facilities. A number of training activities organized by financial institutions, milk processors, insurers and other organizations that provide services to farmers hold their sessions in the towns. NGOs, CBOs and self-help groups (*Chamas*) also hold their meetings in the towns. The extension services seminars are held in conference facilities in town thus creating a demand for these facilities. The urban centres additionally provide transportation services to facilitate the movement of both people and goods. Facilitating mobility between one urban centre to another and between the urban centre and the hinterland is key in sustaining the urban-rural linkages. It is also in the urban centres that *matatu* terminuses are located, from where different connections to various places disperses to and connects to. Along the Ruiru-Uplands transect, there are two *matatu* terminuses: one in Ruiru and the other in Githunguri town. Within the terminus, there are different routes that are operated by *matatu* Saccos registered by NTSA. In addition to the terminus, the towns have various informal locations where *boda bodas* and pick up vans for hire are stationed.

³¹ At the time of the interview, one of the veterinary technicians who assists Mr. Mwaura had left after working for him for several years.

Finance and credit institutions are important in the growth of the sector. Farmers require money in the acquisition of capital to expand their dairy enterprises. This could be the purchase of a high breed cows, means of mobility, or expansion of the zero-grazing structures. Farmers also get credit to undertake personal activities like paying school fees for their children and the construction of their homes. Finance and credit institutions have linked up with the dairy processing companies like Githunguri FCS Ltd and Uplands PD&F Ltd offer loans based on the milk a farmer produces. Insurers have introduced animal insurance policies that were not available before. In addition, the lending institutions like Tai Sacco Society Ltd, K-Unity, Dimkes Sacco Ltd, and Fariji Sacco require that farmers insure their animals before they are offered loans. Consequently, farmers need to have their animals valued by the veterinary doctors before getting the insurance. This illustrates a kind of networking within this agro-based cluster.

Processing

Processing of agricultural raw materials mostly takes place in the urban areas, although some industries could be located in the rural areas like the Uplands P&F Ltd that is located in Kagwe village centre. Industries normally choose to locate in the urban areas because of the presence of the necessary soft and hard infrastructure to support their growth. These include communication networks, human resource, security, financial services, insurance services, and market for the produce. The significant role played by the private and public (milk cooperatives) processors was discussed in detail in section 5.2 on the symbiotic relationship between the urban and rural areas in particular the role played by the milk processing cooperatives. The industries create a link with the market and enable farmers to sell their milk collectively as a group. In addition, through economies of scale the farmers are able to negotiate for good prices. The value addition on the raw materials also raises the value of the product and leads to higher returns.

Market

The large urban population in the urban centres are a source of market for rural agricultural products including milk. With a population of 490,120 Ruiru offers more opportunities for the sale of raw and processed milk compared to Githunguri town that has a population of 10,615 people (KEBS, 2020). Mr. Kuria, a 76 year old farmer from Githurai, Ruiru sells his milk directly to the customers from a stall that he has constructed at the edge of his farm. He sells the raw milk at Ksh. 70 per litre (May 2019), which is almost double the cost which the rural farmer gets from selling milk to the milk processing companies at Ksh. 36.50 per litre (May 2019). This makes his earnings a relatively higher than that of a rural farmer. *“The benefit of*

the town centre is I can sell directly to the customer.” Mr. Kuria was of the view that the town farmer has an advantage because of the ready market. He indicated that rural farmers are affected by revenue fluctuation depending on the seasons because the factories may change the prices of milk when it is in plenty. In comparison, he indicated that the urban market is available throughout, provided the farmer provides quality milk. Mr. Kariamburi a 65 years old farmer who operates a milk parlour and restaurant in Ruiru town and resides along Kenyatta road indicated that *“the town is important because of the concentration of the working population.”* 52 years old Mr. Karanja a farmer from Membley, Ruiru had a similar sentiment. *“The urban farmer has the advantage of a ready market.”*

The milk vendors also exist because of ready market for raw milk in the towns. They sell the milk to restaurants, milk parlours, milk ATMs, general shops, and directly to individual consumers. Mr. Ndirangu a 54 year old farmer and small scale processor from Ngochi, Githunguri who is licenced by the Kenya Dairy Board operates two milk ATMs, one in Githunguri and the other one in Kiambu town where he sells pasteurized milk. He indicated that *“The nearby towns are populated so consumption is high. Most of my consumers are tenants.”* He makes higher returns by processing his own milk. The market of milk is not limited to the towns along the Githunguri transect because processed milk can be marketed to other parts of Kenya. Uplands PD&F Ltd has depots in major towns from where the company distributes the milk to the areas surrounding these towns such as Kisii, Lamu and Lodwar.

5.3 Clustering and specialisation of related business activities

The interaction between urban and rural areas is not only between the farmers and the firms but also among the firms located in the area. The Ruiru to Uplands transect has a cluster of milk processing industries located in the area. The largest milk processing industry in Kenya – Brookside Dairy Ltd is located in Ruiru town while the third-largest milk processing company – Githunguri Dairy FCS Ltd is located in Githunguri town. Uplands PD&F Ltd, Palmhouse Dairies Ltd, Elite Dairies Ltd and Canaan Factories Ltd are emerging medium-scale milk processing companies that are also located along the transect. The land use activities in Githunguri town are in particular oriented towards milk production (see Map 5.3 and Figure 3.4). This is evident in the number of businesses that are related directly or indirectly to milk production. The business firms located in Githunguri town depict a cluster of dairy enterprises consisting of production, collection, processing and distribution of milk.

Map 5.3: Dairy farming related business activities along Market Street in Githunguri town.



Source: Adapted from Google maps, 2018.

This phenomenon of agglomeration of industries was noted in the 19th century whereby the location of a certain industry was seen to attract other related industries and businesses to provide specialized inputs, leading to linkages between the industries and suppliers (Coe et al., 2010; MacKinnon & Cumbers, 2011; O’Flaherty, 2005; O’Sullivan, 2009). Marshall (1920) observed that there was a phenomenon of localisation and specialisation of industries from the early days of civilisation that was driven by the division of labour. He observed that clusters exhibited these three forms of ‘economies of scale’ whose evidence in Githunguri is discussed in this section in the context of a small town: knowledge spillover, a large pool of skilled labour and availability of specialised inputs and services. The research also looks at the agricultural-based cluster that is defined as follows:

“An agro-based cluster (AC) is simply a concentration of producers, agribusinesses and institutions that are engaged in the same agricultural or agro-industrial subsector, and interconnect and build value networks when addressing common challenges and pursuing common opportunities.” (Galvez-Nogales, 2010, p. x)

In analysing the milk values chain cluster along the Ruiru to Uplands transect, the study focuses on the socio-economic interactions among the actors involved in the value chain or the milk industry³². The actors involved in the production of the milk include the input suppliers, the processors and the service providers. In the distribution of milk, the milk processors, transporters and retailers are mainly involved. The support sector includes: regulators, service providers including the transporters, veterinary doctors, warehouse facilities providers, conference facilities, financial institutions, and research institutions. Then finally, the consumers are the final link in the value chain. In the case of Githunguri town, the functioning dairy value chain that is supported by the existence of the Githunguri Dairy FCS Ltd processing industry drives the growth of related businesses. These include suppliers of various inputs and service providers supporting the growing dairy production.

In contrast with suppliers of computer and vehicle industries who provide components for assembling the final manufactured products in such industrial clusters. The supply cluster in the milk value chain is more pronounced among those selling the inputs to the farmers producing the milk compared to the sale of inputs towards the processing of milk. This is because the processing of milk does not require major inputs given that it just undergoes transformation to give it longevity through pasteurisation. The supply of inputs and provision of services creates linkages between urban and rural areas because farmers are mainly located in the rural areas and suppliers in the urban areas. The supply cluster thrives through the backward linkages created by the efficient utilisation of milk by the processing companies that keeps the farmers in business and enables them to sustain their milk production. The supply cluster also thrives due to the diminishing land holding in the area that creates a reliance on processed feeds.

The existence of the factories also leads to the growth of the service sector, especially the transporters who offer their services in the production, collection and distribution of milk. In Githunguri town, transport operators for instance those using pickup trucks, *boda bodas*, tuk-tuks and three-tonne lorries (canters) cluster near locations selling animal feeds so that they can get customers in need of such services. While the transporters in Githunguri town mainly deal with the transportation of farm produce, those in Ruiru mainly deal with transportation of

³² In this case the dairy industry is considered in its entirety from production to distribution of milk.

building materials. At the roads adjoining the Githunguri Dairy FCS Ltd factory there is convergence of lorries and tankers delivering the raw milk and also lorries awaiting to transport milk to various parts of the country. There is a similar occurrence near Uplands PD&F Ltd whereby at Kagwe village centre, located one kilometre from the factory, where car wash businesses are thriving because the lorries which transport milk have to be cleaned every day to ensure adherence to good hygiene standards.

Within the larger milk industry cluster, there is also existence of sub-clusters of various business activities like animal feeds outlets, transportation activities, chicken waste feeds, and pineapple dispensing outlets that locate their businesses adjacent to each other. 65 years old Mr. Mucheru operates his chicken waste business alongside four other chicken waste suppliers at the junctions of Ruiru Uplands road and Moi road, an indication of the high demand for the product that is able to sustain a cluster of similar businesses (see Figure 3.16). Clustering of businesses creates agglomeration economies that reduce the cost of production due to the proximity of the related businesses in the same locality. Firms located close to each other share raw materials, labour and equipments (MacKinnon & Cumbers, 2011; O’Flaherty, 2005; O’Sullivan, 2009). Clustering additionally creates economies of scale because products are sold at a cheaper price due to the volumes of sale. The traders can make little margins, but trade in large volumes. The competition created within the cluster also makes the suppliers to improve on the quality of the products. This is the case of chaff cutters that are cheaper in Githunguri compared to other locations.

Clustering of related businesses also leads to spill over of knowledge and skills through interaction and networking of the labour force (Coe et al., 2010; MacKinnon & Cumbers, 2011; O’Sullivan, 2009). Like other global specialised urban centres, given the existence of four large milk processing companies located along the transect, there is evidence of knowledge transfer among the industries. During the course of the field work (between 2018-2021), one of the managers interviewed had worked for three companies in the area and was a consultant in setting up of dairy processing companies and an expert in the procuring of milk from the farmers, a highly needed expertise given the competitive nature of acquisition of raw milk among the milk processors. The sharing of specialised labour force by the companies and the movement of labour leads to transfer of specialised skills across the companies. When a new firm³³ is set-up along the transect, it can ‘poach’ workers from the nearby industries when building its human resource capacity. “*Localised interaction of firms is meant to be particularly important in the transfer of ‘tactic’ knowledge*”, which unlike codified knowledge that can be

³³ For instance, Canaan Factories Ltd was set up in 2019.

shared through books, this ‘tactic’ knowledge can only be transmitted through “*untraded social and cultural interactions of a locality.*” This knowledge can leak or be transmitted through “*staff turnover, shared suppliers, firm births and deaths, informal collaboration, industry gossip and observation*” (Coe et al., 2010, pp. 139,141 & 143). Mobility facilitates this human interaction that enables the flow of knowledge between firms and between urban and rural areas.

“soft infrastructure connectivity in public and private sector services to support the flows of knowledge, innovative ideas, information, and data in second-tier cities has a significant impact on economic performance and growth, especially in advanced service-sector employment” (Parkinson et al., 2012, as cited in Cities Alliance, 2019, p. 38)

The milk processing companies play a role in knowledge transfer within the cluster. The conferences, seminars, exchanges and farm extension visits that they conduct facilitate in the spread of knowledge and technology related to milk production. Githunguri Dairy FCS Ltd has 15 extension workers who travel daily to the farms to train the farmers on approaches and innovations that can boost their dairy production. The private processing companies also undertake these farm extension activities. The spread of knowledge is not limited to the local level but also cuts across other regions through visits by farmers from other regions who travel to the milk processing company to learn how the milk processing cooperative works. The local and international universities are also involved in knowledge development through research and training. This includes the Wageningen UR (University and Research) that has collaborated with Kenyan research institutions and other stakeholders in the dairy value chain on various research projects (van der Lee et al., 2016). Tegemeo Institute of Agricultural Policy and Development which is a policy research institute affiliated with Egerton University's Division of Research and Extension has also carried out research on various issues pertaining to the dairy value. Some of the research work undertaken by the two institutions have been used in this study.

In addition, there is also knowledge transfer through interaction and mobility of farm labourers during milk collection and also as a result of job mobility from one farm to another. The existence of knowledge transfer is also evident through the sale of heifers and high quality dairy cow breeds to other parts of the country. Mr. Muiruri 45 years old farmer from Githunguri town has gotten into the business of keeping heifers which he buys when they are young from dairy farmers along the transect and sells them when they are older. His business venture is driven by the high demand of heifers from the area given the ‘brand’ Githunguri has created as a dairy producing area. 48 years old Mr. Muriuki, a farmer from Kambaa, Githunguri also indicated

that he was transforming his dairy enterprise from keeping dairy cows to keeping heifers because they are less demanding in terms of labour and medical costs and they are in high demand.

An observation of the central business district of Githunguri town shows the presence of shops concentrating on supply of processed feeds, supply of hay, and agroveter shops. The duplication of these similar retail facilities is an indication of the high demand for these products and orientation of this town towards agriculture and in particular dairy farming. The clustering of milk-related businesses is not relegated to Githunguri town only, but is also shaping the structure of the surrounding market and village centres. Kwamaiko/ Ngewa and Githiga market centres and Kagwe village centre are also experiencing a similar growth pattern, exhibiting the presence of animal feeds shops, chicken waste, *machicha* and sale of hay along the connecting roads.

Further, industries create a magnetic effect and ignite and attract other business activities around it. Githunguri Dairy FCS Ltd operates 86 milk collection centres which are centres of attraction of related businesses around them. This multiple ripple effect leads to rural transformation. The presence of the industry that is located in the urban area is felt in the surrounding small towns and village centres through the presence of the milk collection centres.

The clustering of the firms also attracts specialist service providers like the veterinary doctors or insurance agents who offer these services to the large pool of farmers located along the transect. McCann (2011) notes that specialist services are expensive when sourced individually by firms, but these costs reduce when there are numerous firms within the same locality. In the case of Githunguri sub-county along the Ruiru to Uplands transect, the large pool of farmers are able to share the services of the specialists located in the town. The cluster of milk processing industries also attracts specialised transport services providers for instance those transporting milk through tankers from other parts of the country to the factories along the transect. Additionally Githunguri town and the surrounding villages have been able to attract the services of special input suppliers like those selling *machicha*. Amani feeds that supplies *machicha* was able to decentralise its business services from the dispensing point in Ruaraka Nairobi, to over 15 outlets in various locations in Githunguri and Lari sub-counties. This is an illustration of how robust the milk industry cluster in Githunguri has grown such that it is able to attract investors. Clusters thrive in an environment where there are economies of scale. Through such economies of scale, the large pool of farmers located along the transect are able to attract bulk suppliers of various products. For instance trucks of hay transported from other parts of the country transverse the villages as they sell the hay to the farmers. Githunguri town

also attracts and builds the capacity of their skilled labour. The specialised mechanics located in the town are able to modify wheelbarrows and hand carts to effectively carry aluminium cans during milk collection. The technicians are also specialised in welding and repairing the aluminium cans.

Mobility in supporting the clusters

Clusters thrive in proximity, thus when actors are accessible to each other, it enhances the interaction among them. Farmers, processors and in some cases, consumers should be able to access the products in close proximity. This is enabled by suppliers being able to sell the goods in nearby markets, or suppliers setting up depots in the clusters or appointing distributors of their products. The issue of proximity and the interconnectivity between urban and rural areas is noted by an empirical study by the OECD (2013, p. 31) that showed that:

“positive and negative externalities of local economic processes are stronger between contiguous areas, and socio-economic interdependences are strongly affected by distances between urban and rural areas.”

The proximity of firms close to each other leads to cheaper “*transportation, communication, information exchange*” and marketing costs because firms do not have to travel far in search of goods and services since they are clustered together (Coe et al., 2010, p. 137). Firms also benefit from economies of scale accrued from bulk transport of inputs to the cluster. For instance Githunguri Dairy FCS Ltd is able to benefit from bulk purchase of animal feeds which it in turn sells to their members at a fair price. Additionally, close proximity of suppliers of varying inputs and service providers enables farmers to undertake various activities during one trip, thus reducing transportation costs.

Clusters are anchored on interconnectivity between firms and flow of specialised inputs, information and services. For this to take place there has to be in place efficient mobility within the cluster. A break in mobility and links between the firms will reduce these flows. The poor road connection between Githunguri town and uplands centre affects spatial flows between the two locations along the transect.

“The development of ACs depends critically on investments in rural infrastructure (e.g. irrigation, roads, transport, power, and telecommunications), as well as on investments in markets, rural finance, and research and extension. The magnitude of the infrastructure gap in the agriculture sector is the most obvious, and possibly the single greatest deterrent to the development of ACs. Inadequate irrigation,

distribution, storage and handling systems represent fundamental barriers to production development and value-chain integration” (Galvez-Nogales, 2010, p. 70).

The diffusion of ‘new’ knowledge and innovation is facilitated by transport and communication networks from the primate cities or urban centres to the other regions through linkages between the two places. This takes place in such a way that the areas close to the urban centres adopt the innovations or knowledge development prior to those located further. Thus “*physical distance or proximity becomes more important to the diffusion process than does either the hierarchical position or functional distance*” (Lowe & Moryadas, 1984, pp. 229 & 230). This further reinforces the argument by OECD (2013) and Veneri (2014) that spread effects are affected by the proximity to urban areas.

However, proximity alone cannot be effective in building the interactions within the cluster. The quality of infrastructure within the cluster affects the interactions. The proximity benefits require the prerequisite road, energy, technological and communication infrastructure. Maunder et al. (2001, p. 3) emphasise the need for this infrastructure to facilitate mobility: “*proximity to a road system without access to vehicles conveys little or no benefit. Similarly, some vehicles, but not necessarily the less sophisticated, cannot function without a road in reasonable condition.*” Additionally, for a region to attract the participation of all the actors in the cluster, the right business environment has to be put in place. This requires supporting policies and infrastructure to attract investment into the area. As illustrated in the previous chapter, barriers to mobility including poor road infrastructure can impede mobility within the cluster. Cnaan Factories Ltd located in Nyambari, Uplands does not benefit from skilled labour from Githunguri town due to poor mobility as a result of ‘broken’ road infrastructure that disconnects the two areas at Gitiha. The processing company has to rely on steel welders from Nairobi to repair their boilers. Poor road infrastructure posed a logistical challenge in the collection and distribution of milk by the Uplands PD&F Ltd which the proprietor described as ‘difficult’ especially before the construction of the Githunguri to Kagwe road. The location of the processing company in a rural area, although close to the raw material, misses some of the infrastructure services for the efficient functioning of the industry. Lowe & Moryadas (1984) point out that there exist barriers that deter the speed of the flow of innovations, slowing down and prolonging the diffusion process. These could be topographical/ physical barriers like mountains, ridges, international boundaries or lakes or strong cultural barriers that isolate communities and prevent the flow of innovation. The authors also point out that there exists “*absorbing barriers which stop the diffusion of an innovation completely in a direction; reflecting barriers that change the direction of the wave of innovation and permeable barriers*

that act as either filters which modify the innovation, or screens, which slow down the spread of innovation” (Lowe & Moryadas, 1984, p. 261)

Githunguri - the specialised ‘milk’ town

“Scale and specialisation are also enabled through the proximity and connectivity” that is facilitated by the agglomeration effects of urbanisation and clustering (Simpson, 2021, p. 68). The clustering of activities related to the milk value chain makes Githunguri town emerge as a ‘specialised’ town. Therefore, just like Silicon Valley in Northern California which specialises in high technology and innovation and is the global centre for recent ICT advancements, Githunguri town specialises in milk processing, distribution and supporting milk production. Although the scale between the two is significantly different, it shows that small towns can also specialise in certain industries and economic ventures. In the case of Githunguri, the milk production activities are reflected in the specialised nature of the town and the surrounding village and market centres. Just like clustering, *“specialisation makes production cheaper and smoother”* (O’Flaherty, 2005, p. 17)

Unlike Githunguri town that has created a localisation economy based on the milk industry, Ruiru town has an urbanisation economy that thrives on unrelated industrial activities and as a growing satellite town of Nairobi with a cluster of businesses that related to its function of hosting the population working in the City of Nairobi. Evidence of activities related to this function is a cluster of hardware outlets that sell construction materials and also a cluster of carpentry shops that sell furniture to the residents of the town an indicator of the demand of these kinds of products in the town (see figure 5.5).

Figure 5.5: A cluster of carpentry shops along Ruiru to Kamiti road in Ruiru town

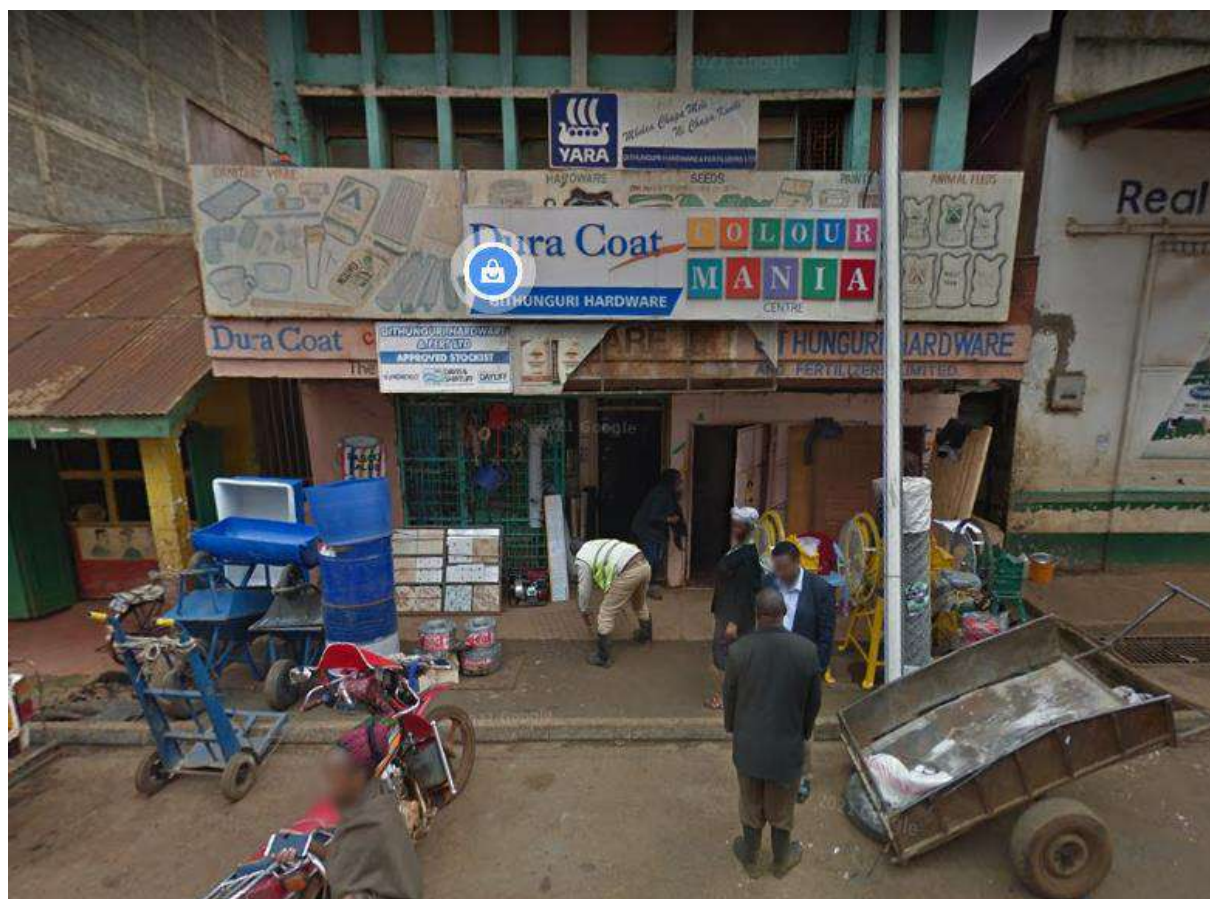


Source: GSV, 2018

The urbanisation economy in Ruiru town that is characterised by high population however benefits the milk industry in Githunguri and other parts of the surrounding rural hinterland through creation of a reliable market to purchase the milk produce. Ruiru town has a depot selling products from Githunguri Dairy FCS Ltd.

In addition the hardware shops in Githunguri specialise on dairy farming equipment like chaff cutters, milking cans, drinking troughs and wheelbarrows (see Figure 5.6).

Figure 5.6: Hardware shop along Market Street, Githunguri town



Source: GSV, 2018

5.4 Emerging growth centres: Rural urbanization and industrialization

The interaction between urban and rural areas as illustrated in the previous section leads to the growth of both the urban and rural areas. This is because the human interactions take place in space and a concentration of these human interactions especially those activities that are of urban character like residential, industrialisation and commercial activities lead to urbanisation. *“The more interdependent an economy is, the more important transportation becomes as a support and a factor shaping this interdependence”* (Rodrigue et al., 2013, p. 66) This section

interrogates how these rural-urban interactions as anchored in mobility give rise to the growth of towns and village centres. The underlying question is whether it is the movement that ignites the growth of the urban centres or whether it is the urban centres that ignite the movement? Haggett (1966, as cited in Lowe & Moryadas 1984, p. 54) developed a model where “*movement is the starting point as well as the source of energy sustaining and propelling the system [growth]*” He argues that the movement and interaction leads to the development of networks and nodes. However Lowe & Moryadas, (1984, p. 54) argued that nodes can exist even before the development of movement but emphasised that “*there is no inherent contradiction between the two.*” Transportation networks influence the growth and form of human settlements and vice versa (Rodrigue et al., 2013; UN-Habitat, 2013). The nature and quality of the transportation networks in turn determine the commuting patterns as illustrated by this research in the section below. UN-Habitat (2013, p. 102) highlights that:

“just as urban form and land-use patterns shape transportation, transportation investments shape urban form. The opening of a new road or public transport line influences the locations, intensities and types of development as well as the value of land.”

Growth poles

Investment in an infrastructure project like a road in a locality or development of an industry can increase the intensity of interactions between rural and urban areas as discussed in the previous section and lead to the growth poles. This section discusses the extent to which mobility along the transect and the rural industrialisation has contributed to the growth of urban centres along the transect.

Industries create agglomeration effects, benefit from economies of scale and contribute to spread effects in a region. The growth pole theory developed by Francois Perroux in 1950 posits that development of a region does not take place in equilibrium but is instead concentrated in poles or clusters of industries that create linkages with suppliers and customers. The effect of industries in spurring development advanced by Perroux relates to the process of cumulative causation that results from the location of an industry in a particular area that was advanced by Myrdal, (1957). The location of the industry leads to development of a chain of suppliers, increase in employment and consequently demand for products from surrounding businesses, attracting investors and spurring local development. The forward, backward and consumption linkages as a result of the industry induce development in a region by attracting other related investments in an area.

Growth pole theory

The application of the growth pole theory is based on the belief that governments can induce economic growth and welfare by investing heavily in capital-intensive industries in large urban centres or regional capitals. The assumption is that this growth can eventually then spread to the rural areas in a process of regional development (Rondinelli, 2019). It is assumed that the goods produced in the growth pole would be sold to the country's metropolitan centre and abroad. Additionally, other manufactured goods would come from the metropolitan centre to the growth pole and the free operation of market forces would create 'ripple' or 'trickle-down' effects that would stimulate economic growth throughout the region. Investment in industry at the growth pole would be the 'engine of development' for agricultural and commercial activities.

The growth pole theory was applied in several developing countries including in Kenyan secondary towns through the 'Growth Centre Policy', but achieved limited success. The approach was to decentralize industries to these growth poles that would lead to trickle-down effects. However, while the government concentrated industrial development in designated areas, there was a lack of integration with the surrounding rural areas (Obudho & Aduwo, 1990; Otiso, 2005; Rondinelli, 2019; Rondinelli & Ruddle, 1978). Some of the challenges of the development model included the failure of the industries to establish themselves in these locations, limited demand for products from these industries, limited services and infrastructure investment, and politics in the selection and allocation of investments. Ethiopia implemented the GTP II (Growth and Transformation Plan) which was a national five-year development plan implemented between the years 2015 and 2020. It intended to create industrial zones in secondary towns to boost export-led growth and create a balanced development. Like the Kenyan case, the GTP II had limited success due to limited funding for the necessary infrastructure to boost connectivity to global supply chains (Simpson, 2021). The Italian government implemented a project in the 1960s known as the Cassa per il Mezzogiorno to reduce the regional disparity between South and Northern Italy. This project initially targeted the revitalization of the agricultural sector and infrastructure development, but later in the 1960s targeted industrial development to spur growth poles in the Mezzogiorno region. While the project achieved an increase in agricultural production by 15 per cent, a decrease in illiteracy levels by 20 per cent, development of industrial complexes and road infrastructure by the 1970s, there was a slight increase in employment and agglomeration effects, but the government did not resolve the regional disparities as intended (Knapp et al., 1994).

Growth pole strategies did not yield much development in rural areas, something that (Rondinelli, 2019; Rondinelli & Ruddle, 1978) attributed to a lack of spatial structure to promote the spread of development, but which instead was leading to primacy of cities. Kenya is an example of a county whose spatial pattern is characterized by the primacy of the City of Nairobi.

Source: Author.

Rural Urbanisation and industrialisation

Different meanings are given to the term rural urbanisation. Ofori-Amoah (2017, p. 1) defines it as the “*process by which rural areas become urbanized.*” He highlights that this can take two forms, one that is planned through government interventions, and one that is unplanned through the process of agglomeration. Roberts (2016, p. 3) indicates that it “*involves the progressive expansion and transformation of the urban fringe,*” while Sietchiping et al. (2014) refer to this phenomenon as urbanizing of the rural. Zhijun (2004, p. i) refers to it as the “*process of the integration of rural & urban productive means, rural & urban life styles, and the integration of rural & urban civilizations.*” He points out the five indicators of the transformative process as:

“First, the differentiation of vocation, i.e. the increased ratio of non-agricultural labour forces, and the change of family structure. Secondly, the diversification of economic and revenue structure, i.e. the ratios of the secondary industry and the tertiary industry rise gradually. The third, the urbanization of life styles. The fourth, the prevalence of mass media using. The fifth, the modernization of values and the enhancement of educational level” (Zhijun, 2004, p. 4).

François (2017) defines rural urbanisation as the urban dynamics of the rural region. He makes this observation in the description of Moshi town whose growth is influenced by changing dynamics of the rural Mt. Kilimanjaro region. He notes that the change in the Chagga countryside as a result of the crisis of the coffee sector, tourism activities, use of ICT, and diversification of agriculture contribute to shaping Moshi town and its relationship with the rural hinterland. From the definitions, rural urbanisation is a transformative process and it is difficult to delineate the boundaries between urban and rural areas because the transforming regions exhibit characteristics of both urban and rural areas. The transformation could be gradual, sudden, explosive or sporadic. The sudden transformation of rural areas could be as a result of a policy change by various actors that lead to spurred growth within a short period. This could be as a result of a commercial or an industrial investment by the private sector. The development of Tatu City in Ruiru for instance has led to the conversion of coffee estates

surrounding Ruiru town to commercial, residential, educational and industrial activities. The third schedule of the Physical and Land Use Planning Act, No. 13 of 2019 provides the guidelines for the Counties to process change of use from agricultural to other land uses, which is a policy factor leading to transformation from rural activities to urban activities.. *“If any development application requires subdivision or change of use of any agricultural land, the county government shall require the applicant to obtain consent from the relevant Board.”* (Government of Kenya, 2019a)

This section is divided into five sub-sections discussing what attracts rural industrialisation? Why people go to towns? What attracts rural investment? Lastly the section discusses the process of transformation of a village to a town.

Smith (1992, as cited in Bryceson, 1996, p. 105) defines rural industrialization as *“a transition stage between peasant agriculture and modern industry, and also as the vehicle for affecting both the necessary primitive accumulation of capital from the agricultural sector, and its subsequent investment in industrial activities.”* This study defines rural industrialisation as the transformative process through which industries develop or relocate to rural areas. Village, market, small and intermediate urban centres host agricultural processing industries that are driven by the agricultural activities in surrounding rural areas. Ruiru-Uplands transect hosts a cluster of milk processing factories. Githunguri Dairy FCS Ltd located in Githunguri sub-county gets 270,000-280,000 litres of milk per day from that catchment area. The company had over 26,422 farmers who take milk to the factory as at October 2021. The presence of the processing industries in rural areas has boosted rejuvenation of the rural towns and the surrounding region. In the case of Githunguri town the industry has ignited the growth of the town and other surrounding towns and village centres. Uplands PD&F Ltd began its operations in 2014 and relies on Lari as the milk catchment zone. The company grew following the collapse of Sundale milk in 2012 that was run by an agglomeration of four small cooperatives: Gatamaiyu operating in Kagwe; Kereita in Kimende; and Kamahia operating in Kamburu and Kagaa and finally Kinare milk cooperative which collapsed as a result of mismanagement creating a missing link in the marketing of their milk. The Uplands PD&F Ltd was collecting milk from 5,000 farmers in 2019. The location of Canaan Factories Ltd in Uplands which started operations in 2019 is leading to transformation of the village and boosting some commercial activities. The milk processing industries while supporting the agricultural activities through strengthening of the milk value chain create a need for support services that drives the growth of related investment in these locations.

What drives the location of milk processing industries along the transect? Githunguri emerges as a resource-based town that is driven by the robust milk value chain, especially the processing of milk produced from the rural hinterland, while Ruiru town emerges as an industrial and market-oriented town where the raw materials are sourced from different parts of the Country and processed. Brookside Dairy Ltd is a market-oriented firm located far from the rural areas where the milk is produced and closer to the market. Rural industries like the ones along the transect rely on the adequate supply of the raw materials at an economical cost. Thus transportation and distance to the raw materials normally dictate the location of processing industries either closer to the raw materials or to the market. A processing firm will ideally have its location at either of the two locations or an intermediary location between the two depending on the one which has the minimum transportation costs (O'Sullivan, 2009). The cost of bulk transportation of raw milk at an average cost of Ksh. 1 per litre of milk from cooperatives within a distance of about 200 kilometres is cheaper as compared to the cost of transportation of milk sourced from the surrounding rural hinterland along the transect at Ksh. 3 per litre according to Mr. Nyaga a 38 year old manager at Canaan Factories Ltd during an interview on June 2021. This signifies that there is no comparative advantage of setting up an industry near the source. Thus Brookside Dairy Ltd is able to locate its processing plant about 200 kilometres from the milk cooperatives where it sources the raw milk. The location of industries is also dependent on the perishability of the produce, whereby firms locate close to the perishable products (O'Sullivan, 2009). While milk is a perishable product, technological advancement plays a role in ensuring that it is cooled and transported through jacketed tankers. Without this technological advancement, the location of the milk processing industry would have to be near the raw material. The minimal change in the weight of the raw and processed milk also means that there is no significant added cost in sourcing and transportation of the product.

Githunguri Dairy FCS Ltd and Uplands PD&F Ltd relate directly with the rural farmers hence their location near the rural areas assist in enhancing these connections. Brookside Dairy Ltd on the other hand has limited direct contact with the farmers along the transect because it buys milk from cooperative societies with the exemption of a few large scale producers located near the factory. The processing of milk within the agricultural region in the case of Githunguri Dairy FCS is likely to create spread effect as a result of proximity and the backward and forward linkages that are localised in the producing region as compared to the case where by raw materials are produced in one area and 'exported' to another area which is the model used by Brookside dairies that is likely to spur growth in the region where the industry is located and less growth or stagnation in the region where the product is extracted creating a core-periphery effect.

The location of industries in rural areas needs the right infrastructure and support facilities to thrive. Transport infrastructure is essential because of the reliable movement of goods and services to and from the industry. The proprietor of the Uplands PD&F Ltd indicated that the *“access road to the factory is through a difficult terrain and a neglected road whose tarmac has worn off almost completely”* Because of this difficult terrain and poor state of the road, transportation costs of getting milk from the rural hinterland was higher compared to getting milk from milk cooperatives located in other regions. The dilapidated roads raise the cost of maintenance of the vehicles and cause losses as a result of delays in transportation of the raw milk to the factory. The lorries get stuck during the rainy season, while the dusty roads during the dry season affects the hygienic conditions of the milk. In addition, *“the hilly region leads to spillages during the transportation of the milk and the vehicles are not utilized to capacity to avoid over loading given the rough terrain.”* Indicated 38 years old Mr. Kagema a manager at the Uplands PD&F Ltd. In the hilly and dilapidated sections of the area, the company hires motorbikes to collect the milk because they are able to manoeuvre through that terrain.

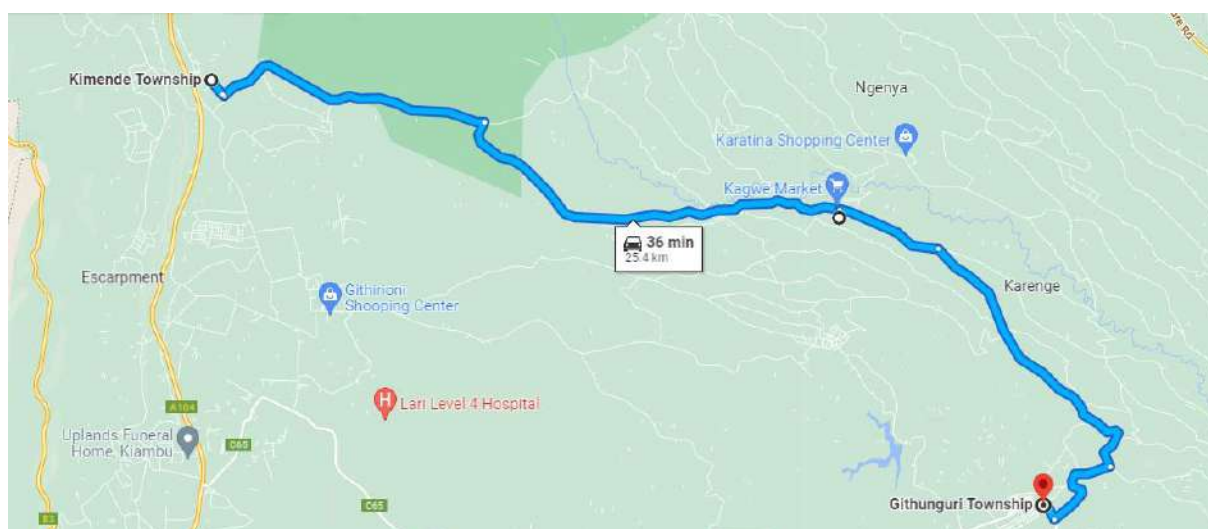
The location of the industries in rural areas also requires the necessary supporting hard and soft infrastructure and services to thrive. These include transport, financial, conferencing, security, insurance, electricity, communication, and motorable roads. The companies also require a reliable supply of human labour because milk production is labour intensive. To attract the labour force, adequate facilities like accommodation, schools, health, and other administrative services need to be provided. These services are usually located in the urban centres, hence industries choose to locate in the urban centres which is imperative that local, regional and national government need to invest in such infrastructure to attract industrial investments and spur rural industrialisation.

Towns as the drivers of mobility and urban–rural linkages

Towns are centres are characterized by a concentration of activities such as commerce and service provision that create centripetal and centrifugal forces as people, goods and services converge and disperse from them. Urban centres become points of convergence of activities as producers, farmers, veterinary doctors and other actors converge to do business. The demand for trade in goods and services in the urban centres can lead to increase and decrease of mobility to the urban centres. In section 3.1 the drivers of mobility in the milk value chain was outlined, while section 3.2 looked at the direction of movement and section 5.2 discussed the contribution of small and intermediate towns in agricultural productivity. People move to towns for educational, health, work, trade, administrative, political, social, religious, cultural, and entertainment functions. Farmers flock the towns in vans, motor bikes and bicycles moving to

get fodder for their animals. This is necessary for the survival of their dairy cattle that has increasingly become the source of livelihood. An interview with 45 years old Lilian and 48 years old Mr. Kimata of GIKAKI *matatu* Sacco which operates between Kagwe village centre and Githunguri town revealed a pattern of inter-linkages between the two areas driven by the market days. Githunguri has its market days on Monday, Thursday and Saturday, while Kagwe has its market on Wednesday and Friday. On Wednesday and Friday, during the market days in Kagwe the traders from Githunguri travel to Kagwe to sell their produce in that market and return to Githunguri market on Thursdays and Saturdays. During the market days there is increased mobility and flow of goods between the two areas. The hierarchy of human settlements in the area from the village centres, market centres, small towns, intermediate towns and finally the cities correspond to the type of functions, goods and services that each of these centres are able to provide in hierarchical order. Commuters move across that rural to urban continuum to fulfil their varying needs at the various centres depending on the complexity of these needs. Kagwe only has micro-finance institutions and one bank (TAI Sacco), a health centre, and no magistrate’s court. Thus residents of Kagwe commute to Githunguri town for access to banking services, health, education and administrative services. *“Market days are busy as people are travelling to towns for other services like going to the hospital, lands offices and courts.”* Indicated 45 years old Lilian of GIKAKI Sacco. Further, while the administrative headquarters of Lari is in Kimende Township that is located along the Nairobi to Naivasha road and 14.6 kilometres from Kagwe village centre, Githunguri town is 10.8 kilometres from Kagwe.

Map 5.4: Kimende to Kagwe to Githunguri town



Source: Google maps, 2020

The direction of movement to a certain town is dependent on what it offers. The towns, market and village centres along Ruiru Uplands offer a range of goods and services. Some of them are sub-county headquarters, milk collection centres and others intersections/ nodes. The distance and accessibility to an urban centre also affects the flow of people to that urban centre and in turn the growth of that urban centre as discussed in previous sections. Additionally the prices of goods and services at a particular urban centre will affect the flow of people to it. Thus an urban centres' attractiveness and robustness depends on its ability to offer a range of goods and services and its accessibility.

There is also a surge of movement to the urban centres during the dry season, at the end of the month and during tea or milk bonuses pay-outs, in the morning and evening as people are travelling to and from work and also during school closures or opening days when students from boarding schools are travelling across different locations. These patterns of mobility influence business operations that re-adjust to accommodate the flow of people to the urban centres. The increase or decrease in mobility affects the growth of an urban centre. For instance, the surge of mobility during the dry season as the farmers source animal feeds results in increased business for the traders.

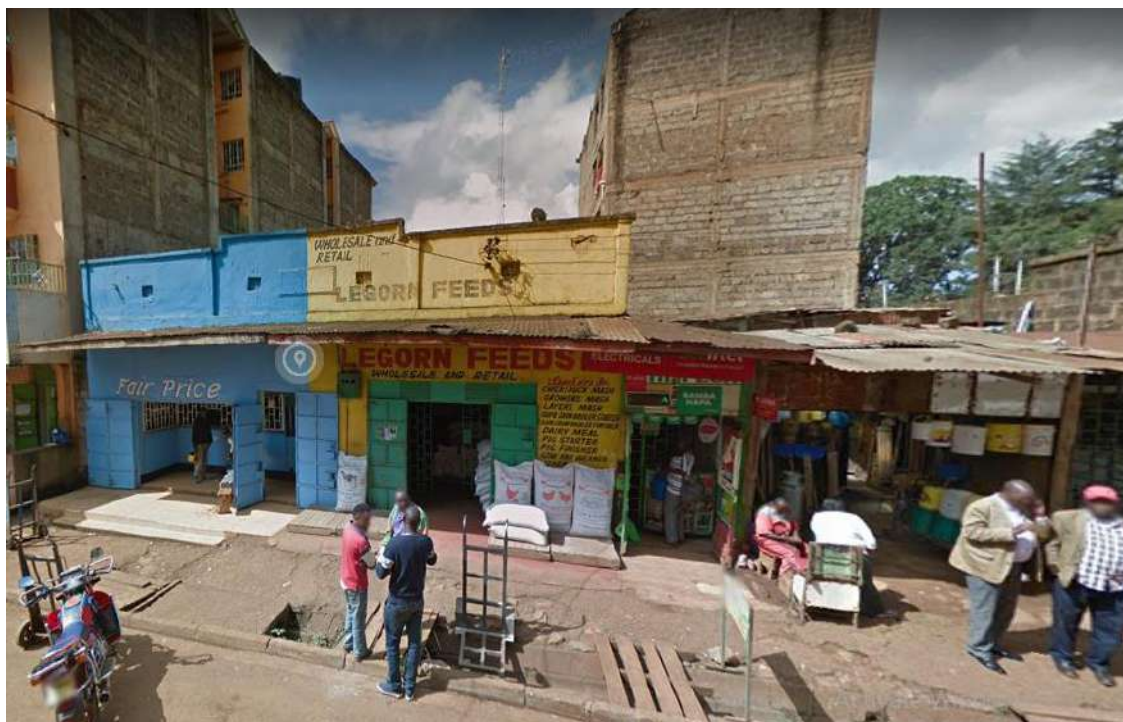
The drivers of rural investment

There are factors that boost a town's ability to attract investment. In view of the field data on the location of the milk industries along the Ruiru to Uplands transect this section outlines the reason why businesses and industries have set up their locations in this area. The growing milk industry in Githunguri and its environs creates backward linkages which attract investors to the area. 45 years old Mr. Kang'ethe of Baraka feeds Githunguri outlined his reasons for setting up his business in Githunguri. He revealed that there was an adequate market for sale of animal feeds in Githunguri town that is driven by the robust dairy farming activities. He indicated that his company did a "*research*" that showed that almost every household in Githunguri has a cow. He additionally was of the opinion that the animal feeds offered to farmers were not of "*standard quality and do not give the desired results in increasing milk productivity.*" He intended to provide quality feeds to fill this gap. He also noted that farmers did not have adequate means of transport and thus were not able to go to Ruaraka to get *machicha*, so by supplying *machicha* close to the farmers, he would expand the business to reach farmers with limited means of transportation and also those who could not afford to buy it in large quantities. He noted that there was potential for business and that he could not even meet the demand from the customers because he did not have enough storage. This was indeed the case because during the research, customers were observed queuing early in the morning to wait for *machicha* at his

outlet. He planned to expand the business by importing two machines from China to manufacture his own feeds. He had also been appointed as the distributor of Safi feeds in Githunguri. The market for the farm inputs and services creates opportunities for investment. *“The market is there. The farmers have cows.”* Indicated Mr. Mwaura a 55 years old veterinary doctor who operates in Githunguri town.

The setting up of the distribution outlets for the sale of *machicha* from Ruaraka, Nairobi to different parts of Kiambu County, especially Githunguri by Amani feeds was in view of the location of their customers who were mainly from Githunguri town. 38 year old Mr. Kibe of Amani feeds indicated that the company had a data base of the location of farmers and the number of cows that each farmer kept. They had noted from this data base that the farmers were mainly from areas in Kiambu. *“Because of concentration of farmers we set up the distribution points. We were serving three hundred farmers a day in EABL headquarters in Ruaraka, Nairobi.”* The business was relocating from the city to where the farmers were located. The large number of farmers served acted as a magnet for investors to sell various inputs and provide various services to them. The thriving dairy business in the area is driving the growth of Githunguri town. Knapp et al. (1994, p. 170) points out that *“it is helpful for firms with similar interests to be located together. In this way they can attract suppliers through collectively creating a big enough demand.”*

Figure 5.7: Legorn feeds international depot along Market Street Githunguri.



Source: GSV, 2018.

Legorn Feeds International Ltd is a company that manufactures and distributes animal feeds all over Kenya. The company's factory was set up in 2008 and is based in Thika town from where it distributes its products. In addition to its headquarters in Thika, the company has set up two depots to aid in the distribution of its products. The first one is in Kairi Shopping centre, Gatukuyu, Mangu, Kiambu County. This is a cluster of small scale poultry farming and where Mr. Mucheru a 65 years old businessman who sells chicken waste feeds in Githunguri town sources the product. The other depot is in Githunguri town along Market Street at the centre of the town from where the company distributes its products. The setting up of the depot is an indication of business attractiveness at the centre. It is an indication that the volumes being sold in Githunguri town warrant the setting up of a distribution centre. A future step could be the company or other companies like that of Mr. Kang'ethe setting up a factory in the area if the volumes increase to such a magnitude. The field data above shows that rural investment is anchored on available market for the products that are supplied. In addition, the customer base should have buying power for the goods. The consistent customer base for dairy farming inputs and services from the rural areas surrounding Githunguri town is a driving factor for attracting investment into the small town and sustaining its growth. The stages for the relocation of specialised suppliers to a rural town like Githunguri can be summarised as follows: First a demand for goods attracts suppliers/retailers who source goods from various manufacturers, then increased sales lead to the manufacturers identifying appointed distributors for their products that are based in the rural towns; thirdly a further increase in sales drives the manufacturers to set up depots for supply of their goods to exclude the retailers, and finally if the sales are sustainable the suppliers set up industries in those urban centres.

From village, market centres to small towns

Urban centres located near rural areas are critical in the sustenance of agricultural activities in their areas of influence, while on the other hand these urban centres rely on thriving agricultural or other human activities to grow as discussed in section 5.2 on the symbiotic relationship between urban centres and rural areas. Urban centres form a series of interaction among themselves, with the surrounding market centres, village centres and villages. They are centres of activities and sources of opportunities, as people migrate there to do business and make profit. The kind of growth and transformation that is witnessed along the Ruiru to Githunguri transect is driven by a shift from subsistence to commercial farming. As discussed in section 3.1, commercial farming is a driver of mobility along the value chain.

The industrial growth pole located in Githunguri town is linked to the growth of the surrounding village and market centres through the milk collection centres, and as the milk industry grows,

it contributes to their growth. This growth could have contributed to the transformation of Ngewa/ Kwamaiko, Ikinu, and Githiga from village centres to market centres. Kagwe village centre whose population is less than 2,000 people is also transforming to a market centre driven by the presence of Uplands PD&F Ltd. Canaan Factories Ltd is also influencing the transformation of Uplands/ Nyambari village centres. The growth of these village centres is anchored on the connectivity between them and the milk processing industry. Additionally the clustering effects associated with supply of inputs, knowledge spill over and a pool of skilled labour is being experienced at the villages, market and urban centres. Depending on the rate of growth of the village and market centres, they eventually transform to town centres and attract industries to them.

All farmers relate to village and market centre in one way or another. They are the first point of interaction in form of milk collection centres, *matatu* stops, *boda boda* stops, shops, animal feeds outlets, restaurants, and information centres. These centres are mainly located at the junction of connecting roads, usually a secondary road and a primary road, or two secondary roads. Githunguri Dairy FCS Ltd and Uplands PD&F Ltd collection centres are located at the village and market centres. An observation of the activities taking place at the Ha Donga milk collection centre, revealed that labourers and farmers were relaxing at the village centres after delivering milk. The farmers and labourers gathered at the restaurants to either take lunch or a cup of tea as they socialized. The presence of these large numbers of people promotes business activities at these village and market centres. The farmers and labourers also combine the milk delivery trips with purchase of household goods at these centres and also to pick household goods and farm inputs from the collection centre on credit after the 1300Hrs – 1400 Hrs milk collection. Ha Donga has become a busy centre with two butcheries, three restaurants, four general shops, an animal feeds outlet, a posho mill, a barber shop and a saloon. The restaurants and general shops operate from 0300 Hrs to target the customers delivering milk to the collection centre early in the morning between 0300 Hrs – 0500 Hrs.

38 years old Mr. Kagema a manager of Uplands PD&F Ltd indicated that as a result of the presence of the milk processing plant in Kagwe village centre, and the revival of the dairy sector in Lari sub-county, the “*village centres are now revived and are becoming vibrant due to the increase in returns from milk production since the company began its operations in the year 2014.*” He pointed out that the increased cash flow as a result of diversification into dairy farming has strengthened the buying capacity of at the village centres leading to growth of non-farm activities. The village centres had attracted businesses like restaurants, animal feeds shops, agrovets, hay businesses, chicken waste businesses, welding, and carpentry shops. He further explained that Kagwe being a tea zone, had experienced a drop in tea prices, and dairy farming

had brought in more cash flow. This is an indication that the milk industry is leading to consumption linkages that are driving the growth of non-farm activities and consequently rural urbanisation. The consumption or demand linkages brought about by increased incomes from the dairy value chains are contributing to transformation of village, market and urban centres along the transect. Watkins (1963) indicated that as per the staple theory, demand linkages are induced by consumption patterns brought about by increased revenues from the exploitation of a staple. These demand linkages could increase and even become more important than the staple leading to diversification and reducing the risk of reliance on the staple for economic growth.

The importance of the village and market centres is also visible in the setting up of distribution outlets selling animal feeds at these centres. Amani feeds that distributes *machicha* has distribution points located in the village and market centres. Mr. Kang'ethe a distributor of molasses in Githunguri town has appointed distributors who sell the product in the village and market centres. This shows that these centres are linked to towns and regions. Products can be sourced directly from the village centres. Sale of hay which is gotten from distant locations across the country is sold at the village centres and also distributed with lorries to the farms.

Rostow (1959) published the "*Stages of Economic Growth*," where he outlined five stages that all nations must go through to develop: Traditional society is the first factor, followed by take-off conditions, take-off, drive to maturity, and finally age of high mass consumption. The first stage of growth is that of a traditional society with a self-sustaining subsistence economy with limited trading and application of technology. During the second stage – the pre-conditions for take-off, use of modern science emerges, specialised production, higher level of trade and mechanisation of agriculture. North (1955) indicates that this emergence of trading activities that is driven by mobility and local specialisation. The take off stage is characterised by industrialisation and intensive growth, while the drive to maturity stage which happens over a long period of time is characterised by high standards of living, high technological and economic growth. The final stage of development was that of mass production and high consumption which he considered to be what 'developed' countries were witnessing.

While Rostow's economic growth model has been criticised for its linear growth which cannot be applied universally across the World given the differing contextual issues, it is relevant in analysing agricultural inspired growth such as the one taking place along the Ruiru to Uplands transect driven by commercial agricultural activities. The first three stages of development as outlined by Rostow are visible. There is transition from a subsistence to an intensive agriculture, transition of village to market centres driven by trading activities, and the development of

agricultural industries and increased inter-regional trade. The development model makes justification for agri-processing based driven growth.

5.5 Summary

The flow of goods between urban and rural areas creates a convergence and divergence in urban centres making them focal points for human activities in rural areas and enhancing urban-rural linkages. This is likened to the concave and convex mirrors that converge and disperse light respectively. In addition, the divergence of processed goods from the urban centres links them to other urban centres creating urban to urban links and a system of cities. These activities make urban centres function as the heartbeats of the rural region in facilitating the linkages with rural areas and other urban centres. The connecting road networks in turn act as the arteries or conduits that create connections and facilitate the flow of goods and services. Thus puncturing of the road networks leads to disconnection between urban and rural areas. In turn the commuters from sections that are cut off have to either spend longer distances to travel to Githunguri or identify other urban centres where they can source these goods and services. It is notable that the territorial changes taking place along the transect are shaped by the activities of the milk value chain that take place in space and particularly converge and disperse from the town. The milk value chain creates an emergence of new centralities from village, market to town centres that are driven by these linkages.

This research shows evidence that urban centres have an area of influence in regard to provision of services and sourcing of goods that is determined by the distance between a service provider or a supplier to the farmer. This distance is determined by the economical transportation costs which the service provider or the farmer is able to incur and still make a margin out of the commute. This creates the existence of local functional areas where the small towns exert their influence within the locality, and regional functional areas where the towns exerts their influence within the region. The commutes within the local functional area are done directly by the farmers while the commutes within the regional functional area involve the sourcing of farm inputs by middlemen. Closely related to this findings, a study by OECD (2013) and Veneri (2014) that showed that spread effects are better felt in regions closer to the urban areas and diminish as the distance increases. The effective commuting distance between rural areas and the urban centres determines the interactions between the two areas creating a functional area whose extent is not confined to the administrative boundaries.

The study also reveals the existence of a symbiotic relationship between the urban and rural areas whereby rural areas provide the raw material – milk, while the urban areas provides goods

and services and host the industries that undertake the processing of the raw materials. Urban areas also provide market for the processed goods. In further strengthening the relationship and interactions between rural and urban areas, the planning of these regions should not be done in isolation but should instead enhance integration. OECD (2013, p. 35) proposes a model of developing rural and urban regions by building partnerships between them. This approach builds on complementarities, “*shared interests, commonalities and interdependencies*” between rural and urban areas to create areas of joint collaboration as opposed to isolated initiatives in either of the two areas. The rationale of the approach is that urban and rural areas have unique resources and opportunities to offer that can be utilised collectively through joint partnerships. The relationships between urban and rural areas should build collaboration and cooperation as opposed to competition. It should be such that both areas are seen to benefit from one another. Efficient mobility serves in enhancing the integration of the two areas thus strengthening urban-rural linkages.

The presence of a robust dairy value chain that is boosted by the presence of a milk processing industry leads to increased cash flow, raising the buying capacity of various goods at the village, market and towns centres leading to growth of non-farm activities and emergence of a milk industry cluster. This is especially the case of Githunguri that emerges as a specialised ‘milk’ town. The findings show that the industrial cluster in Githunguri town serves as a magnet that attracts suppliers and service providers leading to further growth of the town. This is evident in the decentralization of sale of *machicha* from the EABL headquarters in Ruaraka, Nairobi to various village, market and urban centres in Kiambu in March 2020 creating more access to these goods and services at the local level without considerable change in the price of the product. It is also evident in the setting up of depots by animal feeds manufacturers an indication of a growing customer base. Lastly animal feeds companies have appointed distributors of their products in Githunguri town to enhance their sales.

The duplication of similar retail facilities is an indication of a high demand of these products and orientation of this town towards agriculture and in particular dairy farming. The clustering of milk-related businesses is not relegated to Githunguri town only, but is also shaping the structure of the surrounding market and village centres. Knapp et al. (1994, p. 170) points out that “*it is helpful for firms with similar interests to be located together. In this way they can attract suppliers through collectively creating a big enough demand.*” Additionally McCann (2011) notes that specialist services are expensive when sourced individually by firms, but these costs reduce when there is collective sourcing by numerous firms within the same locality.

Marshall (1920) observed that clusters exhibited these three forms of 'economies of scale' whose evidence is discussed in this thesis: knowledge spill overs, large pool of skilled labour and availability of specialised inputs and services. Knowledge spillover in Githunguri is evident through the farm extension workers, conferences, networking and staff mobility within the cluster. The existence of the factories also lead to the growth of the service sector, especially the transportation providers who offer their services in the production, collection and distribution of milk. The transport providers' offer specialised transport in form of jacketed tankers for the transportation of milk within and beyond the cluster. The specialist service providers like the veterinary doctors or insurance agents offer these services to the large pool of farmers located along the transect.

6 Impact of mobility on rural and urban livelihoods

Spatial mobility has a contribution to social and economic mobility as illustrated in this section. This section reviews the gains of mobility and how it has led to the transformation of the individual dairy businesses of the respondents and consequently their economic and social capital. It answers the questions: Is there a shift in the livelihood strategies that is connected to the proximity to urban areas and the linkage between rural and urban areas, and how has the community been able to make use of these linkages and adapt to the shifting livelihood strategies? The section also discusses the shift from cash crop (coffee and tea) centred livelihoods and the adaptation to other livelihood ventures such as dairy farming and the non-farm activities that have been created by the dairy industry, rural urbanisation and industrialisation. The section discusses how mobility supported agriculture and non-farm activities impact on livelihoods. De Bruin et al. (2021) highlight the importance of mobility in the improvement of livelihoods:

“physical and communication infrastructure, the spatial pattern of urbanisation, and social networks connecting farmers to markets are identified as important enabling factors for the improvement of rural livelihood outcomes” (de Bruin et al., 2021, p. 781).

6.1 Non-farm activities

The thriving dairy sector along the transect offers opportunities for non-farm activities. These non-farm activities entail mobility, especially to urban areas. Non-farm activities are those activities that are not part of primary agricultural production and do not involve farming as a source of income. They include: construction, manufacturing, transporting, communication, trade and mining among others. From the definition of non-farm activities, the milk value chain activities that take place before and after milk production from supply of farm inputs and services, processing, transportation and distribution of milk are non-farm activities. The non-farm activities can be categorised into backward and forward production linkages. Backward production linkages are those non-farm activities that involve inputs and supplies that are geared towards milk production while forward production linkages are those that deal with the collection, processing and distribution of the milk (Winters et al., 2002). In addition there are demand linkages as a result of consumption resulting from increased cash flow. There is an emergence of large and cottage industries involved in the processing of feeds, milk, and fabrication of equipment along the transect. In line with the staple theory, these are the linkages created by the milk value chain.

Figure 6.1: Sale of jerry cans in Githunguri town.



Source: GSV, 2018.

The existence of non-farm activities gives rise to the growth of towns and cities. Small and intermediate towns create business opportunities for the surrounding population in their area of influence. Farmers are able to undertake their farming activities alongside businesses in the urban areas supplementing their sources of income, building livelihood diversification and resilience to vulnerability as a result of reliance on agriculture and creating employment. The need for diversification is also driven by the diminishing land sizes that limit the revenue that the farmers get from dairy farming.

Milk production-related farm and non-farm business activities

There exist numerous businesses supporting milk production. These are primarily those that sell farm inputs and provide services to farmers. The diminishing land sizes and growing commercial dairy farming will lead to increased demand for processed feeds along the transect. Kenya has a large deficit of processed animal feeds and forage, with the deficit of hay being 3.6 billion bales, illustrating the magnitude of demand for this product (USAID-KAVES, 2017, as cited in Auma et al., 2018). The animal feeds outlets are mainly located in the town centres, with smaller shops in the village centres and other road side locations. The business premises are usually private or leased shops in the urban centres or informal businesses along the road. There is also direct supply of animal feeds to the farms which is mainly undertaken by transporters. A study by Auma et al. (2018, p. 6) showed that small scale animal feeds processors made “*market margins ranging from 20-44 per cent, while livestock feed-ingredient*

traders' margins ranged between 26-71 per cent." The service providers are also mainly located in the urban centres and these include those providing direct services like veterinary, transport, conferencing, training, farm extension and artificial insemination services. There also exist service providers offering indirect services like financial, mechanical and insurance services. The high incidence of diseases affecting the dairy cattle, especially mastitis (Tegemeo Institute, 2021) creates a demand for veterinary doctors and technicians, and also a need for training of the farmers on disease prevention.

The transportation sector has been one such business that is driven by the flows in the milk value chain. While some of the actors own the means of transportation for their travel needs, some have to rely on hired services. *Boda bodas* are an emerging sector that offers employment opportunities especially among the youth. Farmers hire these service providers to transport farm inputs from the town to the farms. Transportation of *machicha* has also created a business opportunity where farmers and individuals transport and sell *machicha* to the other farmers. When *machicha* was being dispensed in EABL headquarters in Ruaraka, the company that sells the *machicha* recognised them as *transporters* and allocated them specific days when they can get the *machicha*.

The supply of fodder has created a business for farmers to grow enough fodder for their animals and also sell the excess fodder to other farmers. Farmers who do not keep cows grow fodder (mostly napier grass) and sell it to the dairy farmers. The sale of fodder is not only at the local level but has created inter-regional linkages whereby farmers in the Rift valley regions where the land sizes are larger grow fodder and sell it to the farmers in the highlands.

"Fodder production, aggregation, transportation and trade is a new business opportunity in some project counties, as demand for hay increases due to an increasing population of dairy animals in the pre-commercial dairy areas and increased frequency of prolonged dry periods, as well as the effects of climate change. Production, aggregation, packing, transportation and trade in pastures seeds is a big business opportunity in semi-arid counties" (Auma et al., 2018, p. 39)

Auma et al. (2018, p. 6) further add that these are "*viable business opportunities which have not been fully exploited.*" Mrs. Muchai a farmer from Githunguri buys hay from Nakuru to supplement the available supply of napier grass fodder from her farm:

"I buy baled grass from farmers in Nakuru between August and November when the prices are low and the grass is good quality. I have established good working

relations with some of the farmers there and I am able to get a bale of Boma Rhodes grass to my farm for 150 Kenyan shillings (US \$1.50). Sometimes I lease land and grow the grass. But this is difficult because of the distance between my dairy farm in Githunguri and the leased lands in Nakuru, so I prefer buying grass that is already baled. Mrs. Muchai a farmer from Ndathini village, Githunguri” (Farm Radio International, 2019)

Mr. Chesingei is a farmer who has taken up the business of growing Boma Rhodes grass in Koisamo village, Rongai Sub-County, Nakuru County on a 20-acres farm. He indicated that unlike Githunguri, milk prices at his locality are not good. He was introduced to the hay growing business by a friend who told him that there was a good market and returns from it. He grows the hay two times a year unlike if he was producing maize which grows once a year. He usually sells the hay at Ksh. 150, and Ksh. 300 during the dry season. One acre of land produces about 200 bales of hay weighing about 15 kilograms. He has a tractor to reduce labour costs due to the large farm (Farm Radio International, 2019).

“A friend from another village told me there is a market for baled Boma Rhodes grass. I tried it and the returns have not been as disappointing as raising cows for milk. We get two seasons of rainfall here: April-August and October-November. We harvest two seasons of grass and only one season of maize. We still have large tracts of land and the demand for grass from dairy farmers in the highlands near Nairobi is high. We sell Boma Rhodes grass for 150 Kenyan shillings (US \$1.50) to as high as 300 shillings (US \$3) per bale when we store for the dry season. It is good business” (Farm Radio International, 2019).

Silage production is also an emerging business opportunity. This includes hiring of silage choppers to farmers who do not own them, as well as transporting the silage from the source to the farms. In addition to hiring out the silage choppers, the vendors who have forage choppers make and sell silage with either maize cobs or without maize cobs. A 10-tonne lorry without maize is sold at Ksh. 30,000 while one with maize is sold at Ksh. 50,000. Once the buyer buys the silage, they are required to use their means of transport or hire out transport it to their farms. There are also traders located at Githunguri town and the small emerging market centres like Ikinu, Ting’ang’a, and Githiga who buy silage in bales from the Rift Valley region and sell it to farmers in Githunguri at Ksh. 10-14 per kilo. There exist silage vendors even in the small emerging market centres like Ikinu, Ting’ang’a, and Githiga.

Milk processing and distribution-related non-farm activities

The emergence of large and small scale milk processors is an indication of the non-farm opportunities offered by the thriving dairy industry along the transect. The industries not only provide direct employment opportunities but also give rise to indirect business ventures. The opening of Uplands PD&F Ltd in Lari sub-county has played a role in the growth of the surrounding village centres, especially in Kagwe village centre located one kilometre away. The business opportunities directly linked to milk production and processing include car wash businesses because the lorries have to be washed daily. Cash flow has increased, which is evident in the flow of people to shops and butcheries in the village and market centres creating consumption/ expenditure linkages. Transporters have also been brought on board since the Uplands PD&F Ltd depends on hired transport. There are 11 lorries, 17 pickups and 10 motorbikes that are hired for milk collection. Restaurants with conferencing facilities have also come up to accommodate meetings and training activities. 38 years old Mr. Kagema a manager of Uplands PD&F Ltd indicated that employees from the company residing in Kagwe and its environs have contributed to an increase in business opportunities. The presence of the factory creates a housing demand to accommodate the workers and provides rental revenue to landlords and in addition the presence of the workers creates expenditure linkages, boosting the retails market. The company has linked the farmers to financial institutions who are able to offer credit based on the milk supplied, with the payment being done directly to the Saccos. Mr. Kagema noted that the loan remittances to these Saccos had increased over the period the company had been in operation an indication of increased in cash flow. The table below summaries the specific ways in which the dairy industry has transformed the village centres and the surrounding rural areas.

Table 6.1: Transformation of village centres

Situation before	Situation after
To farmers	
- Milk was bought by milk vendors	- Formal processing of the milk
- Frustrated farmers	- Assurance of payment to farmers
- Payment weekly – affecting cash flow	- Monthly payments
- No access to loans on milk supplied	- Check-off loans on milk supplied

- Returning of spoilt milk	- No return of spoilt milk
To the area	
- Dormant shopping centres	- Revived village centres as a result of the increased cash flow. - Increased employment opportunities. The company directly employs over 200 people in the factory at Kagwe some of whom are staying at nearby village centres

Source: Author.

The non-farm employment opportunities created by the milk processing companies are not only felt in the locality but also in other regions where milk is distributed creating forward linkages. Uplands PD&F Ltd has 22 depots across the country. These depots provide direct and indirect employment. Milk is distributed from the depots to the retailers through several means of transport including: pickup trucks, motorbikes and bicycles. Canaan Factories Ltd set up its operations in Nyambari, Uplands in 2019. In the two years of operation, the effects of the company were already being felt in the previously ‘sleepy’ village of Uplands which had declined as a result of the collapse of: the bacon factory, Kenya Railways Corporation and pyrethrum farming. 38 year old Mr. Nyaga a manager at the factory indicated that the presence of the factory had attracted business activities around it. The company was processing 50,000 litres per day, but has a capacity of processing 80,000 litres per day. It employs about 199 workers in the factory, out of which casuals are about 100. The land use adjacent to the factory has started changing, and three plots next to the factory have fully constructed residential buildings and there was ongoing construction of two buildings nearby. These developments are driven by the demand for housing. Cash flow among the farmers has improved, and they were able to get loans and fulfil their household needs like taking their children to school.

Milk processing ranges in scale from cottage industries to medium and large scale industries. Smallholder farmers like Mr. Ndirangu have been able to set up cottage milk processing enterprises where they produce, process and retail the milk. The advantage of undertaking all the business processes in the milk value chain is that the returns are higher. Mr. Ndirangu has set up two milk ATMs, one in Kiambu and the other in Githunguri. The Kiambu milk ATM opens at 0700 Hrs- 2400 Hrs, while the Githunguri milk ATM that is run by his wife operates between 0700 Hrs and closes at 2300 Hrs. He employs two female assistants at the Kiambu

milk ATM and he also has a farm labourer who takes care of the cows and does the milk production. Mr. Ndirangu is licenced by the KDB to operate the cottage milk processing industry and the two milk ATMs. He was previously a milk vendor, and his transformative growth is an evidence that small scale operators including milk vendors can progressively transform their business from informal to formal ones.

There is an emergence of milk ATMs at the urban centres including in most of the supermarkets. The customers buy the milk in containers, saving on the cost of packaging and making the milk available at a cheaper price. The milk ATM operators also stock other related items that go hand in hand with selling milk. Mama Jimmy who formerly operated a milk parlour in Kahawa Sukari, Ruiru town sold cakes, bread, sodas, chips, and other snacks in addition to the milk. Because the milk is usually consumed early in the morning for breakfast, during the day she could sell the milk and snacks to casual labourers who substituted that snack for lunch. She also sold airtime, polythene bags³⁴ and tea. The need for diversification to sell the other products was *“because during the day when sale of milk is slow there are other items that can be on sale.”* Like Mama Jimmy, Mr. Ndirangu has a general shop adjacent to his Githunguri milk ATM operated by his wife where she sells cakes, biscuits, and buns and other snacks that customers buy and take with milk. The shop also stocks other general household items.

Medium-scale milk processing companies exist. One such company is Palmhouse Dairies Ltd that is located in Githunguri. This company produces about 10,000 litres of milk and markets its products to hotels and institutions, rather than through retailers who normally sell to individual consumers. These include coffee chain Java House, Windsor Golf and Country Club, Muthaiga Country Club, Nairobi Hospital and the Nairobi Serena Hotel, among others (Mulupi, 2016). Other medium scale companies include Atlas Dairies Ltd located in Riagithu near Ngewa/ Kwamaiko market centre, and Elite Dairies Ltd located in Ruiru town.

Like processed milk, sale of raw milk has created business opportunities for small scale informal milk vendors who buy the raw milk from farmers, transport it to the urban centres and sell to retailers or individual consumers. Their customers include restaurants, institutions that consume larger quantities of milk and also general household shops. The farmers located in the urban areas produce and sell the milk directly to the consumers. Mr. Kuria a 76 years old farmer from Githurai, Ruiru town has a milk kiosk at the edge of his home/farm where he sells the milk directly to his customers.

³⁴ This was before the use of polythene bags was banned.

The sale of milk in urban areas creates related businesses. 47 years old Mama Kimani operates a tea kiosk at the Ruiru *matatu* terminus, where she sells tea, *chapati* and eggs. She operates the business between 0600 Hrs – 1200 Hrs. Her target customers are mostly commuters who arrive early in the morning, and need to take breakfast. She buys 10 litres of raw milk daily at 0500 Hrs from a specific milk vendor whom she can trust³⁵. “*You can’t know good and bad milk, so you have to stick to one person*”. The cost of the milk is Ksh. 50 per litre, and she sells each cup of tea at Ksh. 20, with a litre of milk she can produce about ten cups of milk. She has operated the business for the last seven years, and through it, she was able to educate her children in college and high school. “*It provides for my daily needs. I do not borrow and I do not lack.*” In future she would like to start “*a big restaurant. Restaurant customers look for you instead of you looking for them.*”

40 years old Mr. Kimotho operating Amani Restaurant in Ruiru town uses 70-80 litres of milk per day which he buys from five milk vendors between Ksh 45-50. The milk is delivered to the restaurant between 0400 – 0800 Hrs with the restaurant operating 24 Hours. The restaurant owner revealed that sale of tea (with milk) brought more revenue to his restaurant business compared to sale of other food products. The tea is served with arrow roots, bread, French toast, eggs, *chapatis*, and *mandazis*. The vendors usually drop the jerry cans of milk at the restaurant, then pick them after they are emptied. There is preference of raw milk because it is considered fresh and cheaper. Mr. Kimotho relies on trust in getting assurance of the quality of milk supplied by the milk vendors. However, he is also able to identify the specific jerry can supplied by each particular vendor for tracing in case of spoilage. He indicated that the business had enabled him to educate his children and build his house. The restaurant employed nine people and had been in operation for six years.

65 years old Mr. Kariamburi a retired civil servant operates a milk parlour and restaurant in Ruiru town. He sources 150 litres of milk from his own farm located along Kenyatta road where he keeps 20 cows of which five were being milked. The size of his land is 100 feet by 100 feet and it is where his home is also located. He also gets about 100 litres of milk on a need-basis from another farm near Kiganjo, which he transports with his pickup truck. The milk is sold to individual consumers, other restaurants and institutions. The milk parlour was the core business, with the restaurant complementing it and consuming about 50 litres of milk daily.

³⁵ This trust is gained with time, as the milk vendor supplies the milk without incidences of spoilage

Livelihood diversification through multi-job farm and non-farm activities

The study also revealed that farmers and milk vendors are engaged multi-job farm and non-farm activities to supplement their income. 55 years old mama Wambui, a milk vendor from Kigumo indicated that she sells bananas and arrow roots to her customers in Ruiru on demand. She transports these products together with the milk in the morning using a *matatu*. She also keeps two cows producing 8-10 litres of milk daily. Engagement in this additional job provides her with more income. Like mama Wambui, 40 years old mama Wambugu a milk vendor from Kigumo revealed that to supplement her income, she kept cows and pigs. 76 years old Mr. Kuria a farmer from Githurai, Ruiru town also kept pigs to supplement his income. He indicated that the pig business was sustained by income from dairy farming. Consequently, he was able to accumulate capital from the sale of pigs.

The involvement in a combination of farm and non-farm activities cushions the farmers and milk vendors from low returns in their other businesses and makes them resilient in case of shocks. By having a combination of farm and non-farm activities risk of low returns are spread between the various activities making the farmers resilient (Bryceson, 1996). Farmers involved in several activities along the milk value chain did not complain about financial challenges compared to farmers who relied entirely on dairy farming. The farmers who had diversified had more stable income and were resilient to fluctuations experienced in the dairy industry. These include: 54 years old Mr. Ndirangu who has a cottage milk processing plant and two milk ATMs, 47 years old Mr. Kagwe who is engaged in the transportation and sale of *machicha*, 52 Years old Mr. Nderitu who works as a mechanic in Ruiru town, and 50 years old Mr. Ngige who is engaged in sale and purchase of dairy cows and heifers.

Migrant workers

Due to the labour intensive nature of the dairy farming activities, the farmers hire labourers to assist them on a daily or full-time basis. The day labourers work from 8.00 Hrs to 1300 Hrs and are hired on need basis with daily wages ranging from .Ksh. 300-500. The day labourers are mostly women and men from the local area. The second category are the full-time labourers who are housed in the farms and are paid between Ksh. 7,000-10,000 in the rural areas and Ksh. 10,000-15,000 in the urban areas. The full-time labourers are mostly men from Western Kenya and Uganda because they are deemed to be more dependable and hardworking. These labourers sometimes live with their families and are housed in temporary structures constructed near the cowsheds. The men work in the dairy farm while their wives search for daily labour opportunities in the surrounding farms to supplement their income. The unemployed youth from

the area dislike getting employed to work in the farms and aspire to work in other sectors like retail and transportation. Cases of alcoholism in the area have also made some of them unreliable in providing labour in the farms. The labourers and the farmers agree verbally on the terms of contract, and usually the farmers keep the identification documents of the migrant workers as a form of security to ensure that they do not leave work without informing them.

The farmers complained that getting farm labourers was difficult, and there was a high turnover of the labourers. 76 years old Mr. Maina from Ha Donga who relies on one labourer had employed three labourers in one year. He further pointed out that one of the former workers had poor hygiene leading to mastitis infection among some of his cows. 56 years old Mr. Wachira, from Riuki, Githunguri indicated that *“there is a shortage of good labourers. I would not keep cows if I did not have a good labourer.”* The labourers found in urban centres demanded higher wages because of the diverse job opportunities in these centres. 76 years old Mr. Kairu whose farm is in Githurai, Ruiru indicated that he was paying his labourer a higher daily wage so that he does not abandon the work for other opportunities in the town. *“If you do not pay well, they leave. My labourer is an alcohol addict who normally asks for an advance payment and upon receiving it, he disappears and comes home drunk.”* As a result, Mr. Kairu who has no other choice but to retain this labourer only pays him in the evening.

The farmers as well as labourers hang around the village, market and urban centres for socialization as they network and share knowledge. This is done mostly in the evening after completing the daily farming activities and also briefly after delivering milk at the collection centres. During this time, the labourers inquire about better job opportunities with higher wages while the farmers without workers find out possibilities of getting them from the migrant workers and other farmers.

The migrant labourers are sometimes of questionable character, and are blamed for house-breakage incidences, brewing and selling illicit brew. These drinks have made the male members of the population unproductive and caused death. During the funeral of a 43 years old man who had died after consuming the drink, the local population through their political and religious leaders threatened to storm into the drinking dens, pour out the poisonous drinks and evict the migrant workers. They were further agitated that these businesses were operated by foreigners who were ‘poisoning’ their youth while they did not consume the illicit brew themselves.

This case illustrates linkages created by labour movements and the tensions as a result of interactions among the migrant workers and the local population.

Profitability and high cost of feeds

The dairy industry is considered a vibrant and growing sector that is boosted by a local and international market contributing 14 per cent of the agriculture GDP (Tegemeo Institute, 2021). However, despite the growth of the sector the farmers complained that they experienced high cost of production especially due to the cost of animal feeds that reduces their profit margins. This is in agreement with a study by Tegemeo Institute (2021) and Ndambi et al. (2017) that pointed out that the cost of production and fluctuations of prices affect profitability in dairy farming. The report also indicated that while the production and consumption prices were increasing, the farm-gate prices seemed to remain static. Further, the smallholder farmers have no much influence in the determination of the milk prices. *“The pricing of the commodity is determined by the marketers/processors. Farmers are price takers and often receive prices that are low relative to production costs”* (Tegemeo Institute, 2021, p. 33). Animal feeds (including fodder) accounts for 60-70 per cent of the production costs in the livestock industry (ABS TCM, 2013; Auma et al., 2018; Tegemeo Institute, 2021), thus an increase in their cost significantly affects the profit margins of milk production.

Profitability is dependent on a number of factors including the cost of feeds, use of own labour or hired labour, availability of own fodder (large parcel of land), distance to available source of feeds, breeds reared, diseases among others. There are different opinions on the number of cows that one needs to keep in order to ensure profitability in dairy farming. 46 years old Mr. Kiama Livestock officer, Githunguri sub-county indicated that two animals are enough to break-even. He further indicated that for a farmer who employs a labourer at a cost of between Ksh. 7,000-10,000 needs to keep about four cows to break-even. 37 years old Mr. Karanu a farmer from Githunguri town was of the view that to break-even one needs about three cows so that if one goes dry, the others can sustain the cash flow. He also stated that a farmer who has a labourer requires at least five cows if externally sourcing fodder, and about three cows if they have their own fodder. He said that he planned his dairy enterprise such that different cows go dry alternately on a monthly basis to avoid cash flow issues. TechnoServe Kenya (2008) indicated that for a farmer to make a 10 per cent profit while practicing *zero grazing*, they needed to keep at least 6 cows, and if they were using semi-grazing, they would require to keep at least 10 cows. The Technoserve Kenya report additionally indicated that a farmer needed to produce at least 15 litres of milk per day to break-even and noted that as a result of low production farmers make minimal returns and poorly feed their cattle creating a poverty trap.

The farms along the transect are mainly dependent on outsourced feeds due to the small land sizes, resulting in the high cost of production due to the cost of transporting the feeds to the

farms; which has an impact on profitability. A further elaboration of the TechnoServe Kenya (2008) poverty trap as a result of cash flow issues, indicated that for a farmer to increase the number of animals that they can keep, they need enough feeds for those animals. However, due to the constraints of the small parcels of land, the farmers need to move to get cheap animal feeds, which necessitates a reliable means of transport that can move animal feeds in large quantities. Further, to keep more cows, farmers require to hire a labourer, and for them to sustain the labourer, they need to keep at least 4-6 cows. Tegemeo Institute (2021) found out that the total cost of production increased with the intensity of the dairy production such that zero-grazing system had the highest cost of production at Ksh. 27.30, semi-zero grazing Ksh. 23.00 while open grazing had the least cost of production at Ksh. 17.24. The table below shows the varying cost of production and returns in various counties in Kenya.

Table 6.2: Costs and returns in Ksh. per litre of milk for zero grazers

Item	Machakos	Meru	Embu	Nakuru	Muranga	Nyeri	Kiambu	Average
Milk revenue per litre	60.00	30.00	32.17	31.16	32.79	30.00	35.00	35.87
Total variable direct costs (TVDC)	21.05	10.67	16.60	13.48	14.04	23.60	25.25	17.81
Gross margin	38.95	19.33	15.57	17.69	18.74	6.40	9.75	18.06
Total cost	26.40	26.39	19.22	25.92	35.56	29.68	27.93	27.30
Milk profit	33.60	3.61	12.95	5.24	-2.77	0.32	7.07	8.57
Gross margin/TVDC ratio	1.85	1.81	1.33	1.31	0.27	0.39	0.94	1.13
Gross margin rate (%)	64.92	64.42	48.41	56.76	57.17	21.34	27.85	48.70

Source: (Tegemeo Institute, 2021).

The research also noted that with the use of family labour and own fodder the cost of production for zero grazers was reduced to Ksh. 17.81 which reduces the cost by about a half. The impact of hired labour and reliance on animal feeds on profitability was also noted in this research:

“The market is not so good. We sell the milk between Ksh. 35-38. If one has few cows and has a labourer there is no profit. The cost of hiring a labourer is Ksh. 8,000, then there is the cost of dairy meal, bran, and drugs. Sometimes it is a loss.”

Mr. Ngare 60 years old farmer from Gikara, Lari sub-county.

The report notes that *“as land sizes decline, more farmers are likely to shift towards more intensive dairy production systems. However, as the study results show, this shift will come at higher costs and lower returns”* (Tegemeo Institute, 2021, p. xii). The report proposed solutions for increasing profitability including: improvement of breeds, regulation of the quality of feeds, good animal nutrition, government interventions to reduce the cost of feeds, use of own fodder,

reduction in hired labour, price regulations and lowering of processing costs. Mr. Muigai a farm extension officer in Githunguri proposes the following measures to improve dairy productivity:

“There are three important factors to consider for a dairy farm to be successful. The first is quality management. The second is quality feeding, and the third is quality genetics. Quality management includes all the routine requirements, including housing, to make the animal comfortable and free of pests and diseases. Quality feeding means providing the animal with a balanced diet to maintain key bodily functions such as growth and reproduction, and to support good milk production.

Quality genetics involves improving the genetic potential of the animals in order to produce high volumes of milk. For zero-grazing systems like Mrs. Muchai’s farm, it makes economic sense to rear animals that have the potential to produce at least 20 kgs of milk per day. We advise farmers to use semen from certified artificial insemination technicians and providers. Using village bulls does not guarantee improvement of the cow’s genetic potential to produce milk.” Mr. Matthew Muigai, farm extension officer, Githunguri (Farm radio International, 2019)

The farmers who have ability to commute more and to further distances are able to overcome the limitations of the small parcels of land that are prevalent in Kiambu county where the transect is located. They are able to keep more cows and commercialise their dairy businesses. Farmers with a means of mobility like lorries, pickups and motorbikes are able to expand their dairy businesses and overcome the challenges of affordability. They are able to source products at a cheaper price and travel over longer distances.

The high cost of feeds prompted Uhuru Kenyatta, the president of Kenya to direct the Ministries of Agriculture and Finance to find a solution to the high cost of animal feeds in the Country on 20 October 2021. The Association of Kenya Animal Feeds Manufacturers (AKEFEMA) had on 30 August 2021 urged the Government of Kenya to allow them to import GMO products and yellow maize so as to reduce the cost of inputs of processed feeds manufacture. They also wanted the government to reduce the VAT on processed feeds supplements. AKEFEMA had indicated that the cost of feeds and the ingredients for processing the feeds had gone up by 65 per cent and that 20 animal feeds processing companies had closed down (Kenya News Agency, 2021). Following the president’s directive, the ministry of agriculture responded by making the following three recommendation to the ministry of finance: waiver of duty on yellow maize, exclusion of import duty on ingredients for processed feeds manufacture like the cotton and sunflower cakes, and leasing out of government land for local production of these ingredients

(Andae, 2021). These recommendations have not yet been implemented at the time of writing the thesis.

The research revealed that as a result of the high cost of production, the farmers had cash flow problems especially when their cows were dry.

“My dairy enterprise is not profitable. Two cows are being milked and three are dry. I can get about 30 litres per day. If all are milked I can get to 100 litres per day. Profit will increase when cows give birth. When cows are dry there is a challenge in making profit.” Interview with Mr. Maina 76 years old farmer from Ha Donga, Githunguri on 02 February 2019.

An earlier interview on 18 August 2019 he was producing about 70 litres per day. This showed that profitability fluctuates depending on the season and the reproductive period of the cows. To resolve the cash flow challenges, some of the farmers use the money they get from dairy farming to support other farming activities like rearing heifers, chicken or pigs which they sell when in need of money. As a result of the challenges in dairy farming, some farmers are opting to rear heifers and sell them when they are fully grown. This initiative is boosted by the fact that the area along the transect is considered to have high quality breeds of dairy cattle, thus the prices of cows in the area is quite high between Ksh. 120,000 – 200,000. Farmers engaging in this kind of initiative buy young calves at about Ksh. 15,000 – 20,000, then rear them for about one and a half years to the age of maturity, after which they sell them when they are pregnant at a much higher price. The rearing of heifers for sale also helps in boosting the cash flow of the farmers and cushioning them from shocks such as prolonged dry seasons. The research also revealed that farmers who participate in the whole value chain from production to distribution make more profit. This is the case especially for the urban farmers who sell the milk at Ksh. 70 which is almost double that of the rural farmers. The demand for milk in the urban areas is high giving them an opportunity to sell it at a higher price.

The farmers also attribute the low returns to the farm gate price offered by the milk processing companies. They are of the opinion that the amount that the dairy processors buy the milk is lower compared to the consumer price of milk. The companies buy the milk between Ksh. 35-40 per litre, while the price of an equivalent litre of processed milk is about Ksh. 90 which is twice the price. There are differing estimates of the calculation of the percentage of profits that the processor gets. Ndambi et al. (2017) estimate the price of raw milk accounts for 34 per cent of the processed products, transportation 11 per cent, processing accounts for 17 per cent, while distribution, marketing and retailing account for 23 per cent. Therefore the processor makes a profit of 15 per cent. An earlier estimation by TechnoServe Kenya (2008) placed the cost of

raw milk at 50 per cent , and estimated the profit margin by the processors to be 10per cent for pouch packaging and 20 per cent for transcontinental packaging. The report estimated the cost of production to be Ksh. 12 - 16 per litre excluding packaging, and the cost of packaging at Ksh 1.45 for pouch packaging and. Ksh. 8.6 transcontinental packaging. Given the high proportion of the cost of raw milk, researchers argue that a decrease in the production cost would increase the profit margins of both the producers and the processors (TechnoServe Kenya, 2008; Tegemeo Institute, 2021). The Dairy Industry (Pricing of Dairy Produce) Regulations 2021 were put in place to protect the interests of the milk producers, the investments of the milk processors and traders, and to protect the consumers. Through these regulations, the government through the Cabinet Secretary of Agriculture can set the minimum farm gate price.

6.2 Livelihood transformation.

Motives of engagement in dairy-related businesses

The farmers interviewed gave varied reasons for engaging in the dairy farming business, which varies with age. The younger and middle aged respondents indicated that they undertake dairy farming as a businesses to gain income and educate their children, while the older respondents some of whom have retired from formal employment indicated that they practice dairy farming to keep themselves occupied and busy. This is a challenge to the future of farming in Kenya because the average age of farmers in Africa and in particular Kenya is over 60 years whereas 60 per cent of the population in Africa is below 60 years (Ouko et al., 2022; FAO, 2014, as cited in Nandi & Nedumaran, 2021). In addition 65 per cent of the youth population in Kenya prefer to engage in other business activities and not agriculture (LaRue et al., 2021, as cited in Nandi & Nedumaran, 2021).

“Working in the agricultural sector is largely unattractive for young people and most have a negative perception of anything to do with farming. Among the main problems affecting youth participation in agriculture, including but are not limited to; inadequate access to land, difficulties in accessing agricultural financing and insurance, insufficient information, skills, and extension services, and poor technologies and accessibility to markets” (Njora & Yilmaz, 2022, p. 3)

The elderly have fewer dependents because they have already paid for their children's education and are not likely to be living with them, which could explain their lack of drive to expand their milk enterprises. 76 years old Mr. Maina a farmer from Ha Donga, Githunguri has been persistent in the business despite the low returns. *“It provides for my dairy needs, but has not been so well. When I get money, it is taken up by cow’s sicknesses. Feeds are expensive and not*

to standard. I do the business to keep myself busy.” 76 Years old Mr. Kuria a farmer from Githurai, Ruiru town has been in the milk production business for 16 years since his retirement and he indicated that he is “*still surviving*”. He further indicated that he that he is in the business because he has a passion for it, and commercial reasons to some extent. “*At my age I need something to occupy me. It helps me to interact with people at the market. I spend 2-3 hours a day in Githurai market.*” This was observed during the fieldwork as he was undertaking his daily routines in Githurai market. He enjoyed picking the maize waste and engaged the maize vendors in social conversations as he bargained the cost of the waste. He was additionally happy that by buying the waste from the vendors, he contributed to improving their livelihoods. The business gives him a sense of fulfilment and achievement.

“For most Kenyan farmers, even though dairy is an important source of income, it is not seen as a business where the aim is to maximize income and minimize costs. For many producers keeping cattle is cultural and meets the need for domestic consumption while providing some cash flow. Most smallholder farmers view dairy as subsistence farming and not as a business, therefore generating a poverty trap. With low production comes low income, preventing investment in good feeds and animal health. Lack of investment leads to low production, and so on. Smallholder farmers are estimated to sell an average of 3 to 5 litres per day; calculations in this report estimate that 15 litres per day is the required production to bring a family over the poverty line” (TechnoServe Kenya, 2008).

Mr. Kariamburi a 65 years restaurant and milk parlour operator from Ruiru town indicated that this was not a business that he could rely on. The sales were too low to make meaningful income, and he sometimes used his other personal resources to sustain the business. Initially when he started the business he was selling 450 litres of milk which was good, but this has reduced to 250 litres of milk. “*When I started this milk business, I was working. Now I have it as a social place where I meet people and talk to them*”. He was also involved in consultancy on animal nutrition which is his profession as a way of boosting his income. His future aspiration was to expand the restaurant.

The younger and middle aged actors involved in milk-related businesses indicated that they were able to provide for their families and in particular fund the education of their children. 48 years old Mr. Muriuki, a farmer from Kambaa, Githunguri indicated that through the business, he was able to fund the education of his daughter up to college. “*The business can enable me to take a loan, without collateral. It helped educate my daughter up to college, which needed more money*” 47 years old mama Kimani, a tea vendor at the Ruiru *matatu* terminus indicated

that the business is able to sustain her livelihood “*The business helps me to educate my children in college and high school. It provides for my daily needs. I do not borrow and I do not lack.*” She has been able to employ two ladies, one who assists her with household work, and the other who sells tea at a construction site. She operates the tea selling business at the *matatu* terminus between 0600 – 1200 Hrs from where she joins her employee at the construction site to sell lunch to the construction workers.

The farmers are also able to grow their social capital through the formation of cooperative societies, self-help groups, and WhatsApp groups where individuals with collective interests join to address their welfare and resolve underlying challenges. Through these networks, the members are able to mobilise resources, assist each other in times of adversity, acquire knowledge and search for markets for their produce.

Achievements and future aspirations

The livelihood transformation was not only assessed based on the returns on investment, but also on the social mobility of the actors and their ability to achieve their livelihood outcomes. “*Livelihood outcomes are the achievements or outputs of livelihood strategies*” (Tao & Wall, 2009, p. 147). The section looks at the social transformation of the respondents and how the milk-related businesses have transformed their lives. It focuses on the sense of accomplishment among the actors in what they term as key milestones and achievements in their lives that they associate with their dairy business. The achievement that the respondents pointed out included paying for their children’s education and acquisition of assets like land, houses, motorbikes or vehicles. The responses indicate that the respondents can meet their basic needs such as the provision of food and have in addition managed to acquire assets as per their aspirations.

This research further inquired about the future aspirations of the respondents. Aspirations can be used to assess the well-being of an individual. High aspirations are an indication of optimism for a good future while low aspirations may inhibit an urge by an individual to improve their existing living conditions. Aspirations are also an indication that individuals can visualise beyond the barriers that may exist and also take risks to achieve those aspirations (Aring et al., 2021; Dalton et al., 2016; Nandi & Nedumaran, 2021). Dalton et al. (2016, p. 165) argues that “*poverty can exacerbate the effects of this behavioural bias leading to aspirations failure and hence, a behavioural poverty trap. Aspirations failure is a consequence of poverty, rather than a cause*”. This research inquired about the future aspirations of the respondents, which showed that they plan to expand their dairy-related businesses, an indication that they have confidence in the milk-related business activities in which they were involved in. Aspirations are also

influenced by an individual's past experiences and reflect their livelihood strategies to improve their existing conditions:

“Probing changes through a livelihood strategy lens will help to reveal how local people have adapted to past change, develop new goals, aspirations or orientations and, furthermore, to determine what their future livelihood strategies are for themselves and their children. It also provides a means for examining social change in terms of a process of development and growth” (Tao & Wall, 2009, p. 146).

55 years old Mr. Waiganjo a mild vendor from Kiganjo, Gatundu South indicated that he started as a farm labourer in Kagaa, Githunguri where he used to produce charcoal. Comparing how he started off to what he was able to undertake at the time of the interview, he viewed it as a huge transformation. He additionally indicated that when he started the milk vending business, he was selling the milk on foot and then bought a bicycle, the motorbike he used to transport his milk and a personal car. Mr. Waiganjo related his growth of the milk business to the acquisition of the means of mobility from walking to the motorbike he was currently using. Through the milk vending business, he was able to provide for his family. He considered his transformation remarkable because despite his low level of education where he did not proceed beyond primary education:

“I am an employed person with something to do. I have been able to get cows, zero grazing, buy plots and I have bought three acres of land collectively with a group where I am a member. I did not have a bicycle, now have a motorbike, a car and a house (constructed a house). I have risen through the milk vending business.”

Mr. Waiganjo indicated that he planned to acquire a pickup which he would use to supply milk because the demand for milk was high. It is notable that the milk vendors also aspired to enhance their mobility through acquisition of higher capacity means of transport. The progression of ownership of means of mobility shows how affordability and ownership of a means of mobility directly relates to the rate of expansion of the milk related business. He also indicated that through the welfare group consisting of other milk vendors, they intended to buy a pasteurisation machine in future and that they were already saving money towards that venture. 40 years old mama Wambugu milk vendor from Kigumo, Githunguri indicated that she has operated the business since 2009, and that through the business she is able to cater for the needs of her family. It has helped take their children to college.³⁶ Mama Wambugu and her husband are occupied in the business, although she also does pig farming. Her husband assists her in

³⁶ In Kenya there is free primary and secondary education, therefore college education requires monetary contribution by households.

collecting the milk from the farmers with a motorbike. She indicated that she planned to open a milk bar in Ruiru where she could supply more milk. 47 years old mama Kimani a tea vendor operating a mobile kiosk at the Ruiru matatu terminus indicated that she intended to start a 'big' restaurant.

52 years old Mr. Mburu a farmer from Githurai, Ruiru town indicated that dairy farming was his main livelihood. His other engagement was sourcing and selling maize in Githurai market. He started the dairy farming business in 2003, and it has enabled him to build a three storeys rental house with a total capacity of 14 single room units in the same plot (50 feet by 100 feet) where he keeps his cows. It has also enabled him to buy two vehicles, one for his personal use and a pickup for his dairy business. He has also bought a two acres piece of land in Gatundu where he planned to expand the dairy farming business. Mr. Mburu indicated that he intended to do value addition, in form of production of yoghurt and pasteurization of the milk that he produced. 50 years old Mr. Ngige, from Gathaiti, Githunguri indicated that the milk delivered to the Githunguri Dairy FCS Ltd which enabled him to get loans from which he had been able to purchase a piece of land. His wife takes care of other businesses. He started with one cow and now had 19 cows. He was additionally involved in the buying and selling of heifers and dairy cows. Ability to get loans is an important element in boosting the cash flow of the farmers, and enabling them to acquire capital to expand their dairy business through buying land, leasing land, buying means of transportation among others. This is not the case when farmers are selling their milk to vendors because, they get the money in small bits through daily or weekly payments which they use for their daily needs, affecting their cash flow. The farmers selling their milk to vendors are also not cushioned from fluctuations of income especially during the dry season.

42 years old Mr. Wanyoike, a milk vendor from Kiganjo Gatundu South indicated that through the business he had been able to buy two plots, a *matatu* van and a motor bike for his business. He also indicated that he pays for his children's education through the business. He planned to buy a pickup in future which he could use to supply the milk. He indicated that "*the demand for milk is high.*" 38 years old Mr. Kimotho, operating Amani restaurant in Ruiru town indicated that "*The hotel [restaurant] business enables me to educate my children, and has helped me build my own house.*" His aspirations were to in future invest in a "*bigger and classic*" restaurant from his savings.

6.3 Summary

Spatial mobility has a contribution to social and economic mobility as illustrated in this section. Mobility supported agriculture and non-farm activities has impact on people's lives. This section has reviewed the benefits of mobility and how it has led to the transformation of the individual dairy businesses of the respondents and consequently their economic and social capital. The milk value chain creates non-farm opportunities through backward production linkages that involve inputs and supplies that are geared towards milk production and forward linkages that deal with the collection, processing and distribution of the milk. The study identified non-farm activities in supply of farm inputs, service provision, milk processing and distribution that were brought about by backward, forward and demand linkages as a result of the increased cash flow and presence of processing factories and collection centres.

The study also revealed that farmers and milk vendors engaged in other non-farm activities to supplement their income. These non-farm activities entail mobility especially to urban areas. The involvement in a combination of farm and non-farm activities cushions the farmers and milk vendors from low returns in various sectors of their businesses and makes them resilient in case of shocks is in line with previous studies (Bryceson, 1996, 1999, 2002; Owuor, 2006; Sietchiping et al., 2014; Tacoli, 2003). By having a combination of farm and non-farm activities risk of low returns are spread between the various activities making the farmers resilient (Bryceson, 1996). Farmers involved in several related business activities including transportation, selling *machicha*, selling heifers, and animal feeds did not complain about financial challenges compared to farmers who relied on dairy farming. They had more stable income and were resilient to fluctuations experienced in the dairy industry. The research also revealed that farmers who participate in the whole value chain from production to distribution of milk in urban areas make more profit. This is the case especially for the urban farmers who sell the milk at Ksh. 70 which is almost double that of the rural farmers, and also the farmers who process their milk and sell it through milk ATMs.

The research also showed that the younger respondents indicated that they undertook dairy farming as a businesses to gain income and educate their children, while the older respondents some of whom have retired from formal employment indicated that they practice dairy farming to keep themselves occupied and busy. The older people have less dependants, and in turn less responsibilities, which could be the reason for their lack of motivation for growing their milk businesses. This is a challenge to the future of farming in Kenya because the average age of farmers in Africa is over 60 years whereas 60 per cent of the population in Africa is below 60 years (FAO, 2014, as cited in Nandi & Nedumaran, 2021). In addition 65 per cent of the youth

population in Kenya prefer to engage in other business activities and not agriculture (LaRue et al., 2021, as cited in Nandi & Nedumaran, 2021).

Lastly the research also looked at the social transformation of the farmer and the milk vendors. There is a sense of accomplishment among them in terms of what they termed as key milestones and achievements in their lives which they associate with their dairy business. The achievements that the respondents indicated included paying for the education of their children and acquisition of assets like land, homes, motorbikes and vehicles. The responses give an indication that the respondents are able to meet their basic needs such as provision of food and they had gone further to meet their other aspirations.. It is notable that the milk vendors had acquired assets that boosted their mobility and increased the capacity of milk or fodder that they could carry, an indication of the importance of mobility in supporting milk related businesses. This research inquired about the future aspirations of the respondents, which showed that they plan to expand their dairy related businesses and acquire better means of transport than what they were using, an indication that they have confidence in the milk related business activities which they were involved in, and also an indication that they were aware that with better means of mobility their businesses would expand.

7 Conclusions and recommendations

Summary of emerging issues

The drivers of mobility along the Ruiru to Uplands transect are driven by the decreasing parcels of land that necessitate mobility in search of animal feeds for the dairy cows. Additionally commercial dairy farming requires farmers to keep at least six cows (TechnoServe Kenya, 2008), and the larger the herd the more fodder that is required, necessitating mobility. Further, the type of dairy farming along the transect is zero-grazing where the animals are enclosed. Lastly the perishability of milk is a key determinant of how it moves especially when it is in its raw form.

The directions of movement are towards places where service providers and farm inputs are located, or where the services are needed in the case of veterinary and artificial insemination services. The farm inputs and service providers are located in the urban centres and a few in the village centres. The direction of the raw milk is towards the urban centres for processing. This creates a symbiotic interaction between the two areas spurring urban–rural linkages where the urban centres become focal points for human activities in rural areas and heart beats of the rural region in facilitating the linkages with rural areas and other urban centres. This is likened to the concave and convex mirrors that converge and disperse light respectively. In addition, the divergence of processed goods from the urban centres links them to other urban centres creating urban to urban links and a system of cities. Transport networks work as the conduits for the flow between urban and rural areas, and efficient mobility facilitates this flows, therefore ‘puncturing’ of the road networks leads to disconnection between urban and rural areas.

Through these rural–urban interactions, Githunguri town in particular emerges as a ‘milk’ town that specialises in milk production, collection, processing and distribution given the concentration of businesses oriented towards the dairy value chain. It emerges as an industrial cluster of business associated with the dairy value chain. Rural industrialization plays a critical role in overcoming the barriers due to perishability of milk whereby through processing, milk can be transported over a longer distance strengthening its flow along the value chain. The opportunities created in the industrial cluster in from of backward and forward linkages assist in diversification of the rural economy from a dependency in agricultural activities to non-farm activities that boost the incomes of the rural population and make them more resilient and less susceptible to shocks brought about by low agricultural productivity or reliance on a single source of income.

The findings show that the small and intermediate towns play a role in the provision and access to agricultural inputs and services within an economical distance. This is demonstrated by the decentralization of sale of *machicha* from the EABL headquarters in Ruaraka, Nairobi to various village, market and urban centres in Kiambu creating more access to these goods and services at the local level without considerable change in the price of the product. It is also evident in the setting up of depots by animal feeds manufacturers in Githunguri town an indication of a growing customer base and robustness of the milk industry cluster. Lastly animal feeds companies have appointed distributors of their products in Githunguri town to enhance the sale of their products.

Additionally, in the provision of goods and services, the distance that farmers can directly travel to access them is determined by the economical transportation costs which the service provider or the farmer is able to incur and still make a margin out of the commute. Beyond this distance the goods are sourced through retailers and middlemen. This creates a local functional area where the small towns exert their influence within the locality, and regional functional area where the town exerts its influence within the region. Closely related to these findings, a study by OECD (2013 and Veneri (2014) showed that spread effects are better felt in regions closer to the urban areas and diminish as the distance increases. Perroux (1950) pointed out that firms have an economic zone of influence that is different from the administrative boundaries that emanate from the centres (poles or foci) and exert force attraction forces towards it (centripetal forces) and repulsive forces outwards (centrifugal forces). These forces serve in creating an economic space which Perroux differentiates from 'genomic/ banal space that is a result of "*genomic relations between points, lines and volumes*" (Perroux, 1950, p. 92).

The research also identifies a variability of mobility with seasons, days of the week and time. During the dry season, there is increased mobility as farmers travel to urban areas in search of fodder and processed feeds. The farmers also travel further in search of animal feeds during the dry season. The price of fodder during the dry season also rises, while milk production decreases due to poor nutrition, limited fodder availability and the high cost of production. The findings are consistent with previous studies that have shown that the quality of feeding during the dry season is poorer compared to the rainy season (Auma et al., 2018; Njogu, 2017, Nyaata et al., 2000; Omore et al., 1999). Additionally, as indicated in previous research findings the price of milk sold by the retailers and vendors also increases. The price of processed milk usually faces adjustment by the milk processing companies during the dry season, but rarely translates to the an increase in the farm gate price (Tegemeo Institute, 2021). The urban centres additionally witness higher mobility during the market days as farmers combine travel needs to reduce costs. Milk collection occurs early in the morning and in the afternoon, while milk vendors deliver

their milk early in the morning. The seasonal change in mobility has an influence on space such that service providers, shopkeepers and suppliers adapt to these patterns to meet their customers. Shops open at night as the farmers are delivering milk to the urban centres.

The nature of transportation networks have an influence on the growth and form of human settlements and economic development (Lowe & Moryadas, 1984; Rodrigue, 2020; Rodrigue & Notteboom, 2012; UN-Habitat, 2013). As per the study, the nature of the transportation networks and the barriers associated with certain routes determine the commuting patterns and the choice of routes and towns visited making commuters to have preference to travel to certain locations and abandon others. As a result of these patterns of mobility and preference of certain routes and locations some urban centres are affected by stagnation because of fractured mobility that cuts off the connection from one town to another or between a town and a rural area. It also leads to presence of fewer *matatus* plying that route due to increased maintenance costs further affecting the reliability of travel. The deserted towns become dormant, as customers decrease and businesses closed down. Therefore, dilapidated roads lead to cumulative causation process that Mrydal (1957) outlined; that has effects on other sectors of the rural economy.

While ‘hard’ infrastructure is key to connectivity it is not an assurance of efficient mobility, and should be integrated with ‘soft’ infrastructure to enhance connectivity (Cities Alliance, 2019; Lindfield & Roberts, 2021; Simpson, 2021; UN-Habitat, 2013). There are socio-economic and political factors that affect mobility. The distance that a farmer is able to travel corresponds to his affordability of a means of transport, such that farmers owning a wheelbarrow would travel a short distance compared to a farmer owning a pickup or motorbike. Thus at various instances, farmers are required to hire out means of transport that they do not own, which is expensive especially over long distances compared to fuelling their own vehicles. The limitation of not owning a means of transportation with a bigger capacity is that the farmers have to buy in smaller quantities making more trips and spending more on fuel. The research also reveals that among the milk vendors, there were striking differences in the way the male and female vendors transported milk. It is not easy for the women to use the motorbike with a heavy load, and no women were observed transporting milk with a motorbike or bicycle. The women preferred to transport the milk using *matatus*. The research additionally reveals that along the milk value chain, women travel a less distance compared to the men. These is in agreement with Katothya (2017) findings that point out that women travel less distance due to limitations of capital, physical endurance, competing domestic roles, access to means of transport, engendered roles where men own and manage the dairy businesses, security, and skills.

The study outlines the effects of state policies on mobility. The KDB mandated by section 17 of the Dairy Industry Act CAP 366 to “to organise, regulate and develop the efficient production, marketing, distribution and supply of dairy produce.” Due to the strict rules that govern the handling and transportation of milk, the milk vendors operated illegally and they avoid routes where the KDB with the support from the Kenya police service conduct crackdowns. The study also outlines the limited public participation in policy development. The KDB developed draft regulations for the regulation of the dairy industry in 2018 that prohibited the sale and consumption of raw milk at the farm level and outlawed the milk vendors. The regulations were seen to favour the milk processors and a form of state capture and creation of dominance by the milk processors and in particular Brookside Dairy Ltd that is owned by President Uhuru Kenyatta’s family (Karecha, 2019; Muli, 2019; Muyesu, 2019; Ndi, 2018, 2020; Nyamuta, 2019). Following public rejection of the regulations, KDB indicated that it had withdrawn them to ensure there was more consultation with stakeholders. In second scenario, the COVID-19 restrictions had limited stakeholder involvement in decision making. For instance the religious institutions were involved in the self-regulation of the sanitation regulations, but bars owners, restaurant operators and public service vehicle operators were not involved, yet the restrictions had detrimental impacts on their businesses. The third scenario was the implementation of the Michuki rules that showed use of authoritarian approaches where the government failed to negotiate and consult the *matatu* operators and imposed deadlines resulting in resistance during the implementation of the regulations. Lastly, the study also illustrates the knee jerk reaction by the government as a result of the sexual harassment incident of a female motorist perpetrated by some *boda boda* operators in Nairobi, whereby the government imposed a crackdown on all *boda boda* operators resulting in a crisis in mobility and disruption of livelihoods that depended on that particular means of mobility. As a result of this crisis, and the negative political repercussions, the government reversed the approach from that of a crackdown to one which was inclusive, and called for consultations with the *boda boda* operators.

It was evident from the research findings that the selection of road projects to be implemented faced limited consultations and those with political power had an influence in decision making. Rehabilitation of roads features as a key agenda in the election campaigns, with politicians giving promises or highlighting the development projects that have been implemented under their tenure. The politicians have to ‘push’ for projects to be implemented in their areas of representation. Additionally, the citizens agitate for rehabilitation of dilapidated roads through their elected leaders, through online protests and physical protests. The government reacts to protests by taking action or promising to take future action. Political allegiance to the

government in power is a determinant in the identification of roads projects which are 'rewarded' to collaborators. Similar findings by Mayienda (2020) showed that there was existence of political interference, inconsistency in the disbursement of funds, delay in external auditing and corruption during the implementation of these road projects.

The research also shows that commuters develop mechanisms to counter these barriers to mobility through 'adaptations to the barriers to mobility' which include technological strategies, optimisation strategies and political strategies. The use of mobile phones for messaging, calls and payments exemplifies use of space shrinking technologies. M-Pesa is particularly useful to smallholder operators who send and receive small amounts of money. Its application in financial transactions along the milk value chain shows evidence of how it has aided in connectivity between rural and urban areas. Technology has played a role in overcoming the barriers due to perishability through use of silage to prolong fodder life, coolers, jacketed milk tankers and pasteurisation of milk. Commuters also have strategies to optimise on the journeys they make. The choice of routes and towns they make is dynamic and depends on the existing circumstances during the trip and the intended outcomes expected at the destination. They also make use of coded messages or signs to communicate directions or messages to other commuters to avoid barriers that may be incurred in the course of their trips. Commuters develop coping strategies to deal with government regulators. They bribe or befriend the regulators to avoid harassment and also act in solidarity to resist, protest and also to express their anger in regard to the poor condition of the roads.

The study also outlines the contribution of non-farm activities to the livelihoods of rural and urban dwellers and growth of urban centres. The study also revealed that farmers and milk vendors are engaged in other farm and non-farm activities to supplement their income cushion them from low returns in various sectors of their businesses and makes them resilient to shocks. By engaging in a combination of various farm and non-farm activities, the risk of low returns is spread between the various activities making the farmers resilient (Bryceson, 1996). The research also revealed that farmers who participate in the whole value chain from production to distribution make more profit.

The research shows that younger and middle-aged respondents practice dairy farming as a business to earn money and educate their children, while older respondents, some of whom have retired from formal employment practice it to keep themselves occupied and busy. The respondents expressed a sense of accomplishment in what they described as major milestones and achievements in their lives that they linked to their dairy business. The respondents' achievements included paying for their children's education and acquiring assets such as

property, homes, motorcycles, or vehicles. The incremental acquisition of the means of mobility from bicycles to pickup vans which aid in increasing the capacity of the loads that they can carry is directly related to the growth of their milk businesses. Lastly, it was notable that the future aspirations of the respondents was to expand their dairy-related businesses and enhance their mobility, an indication that they have confidence in activities which they were involved in, they appreciated the fact that higher capacity means of transport would boost their businesses. Aspirations are also an indication that individuals are able to visualise beyond the barriers that may exist and also take risks to achieve those aspirations (Aring et al., 2021; Dalton et al., 2016; Nandi & Nedumaran, 2021).

Conclusions

The research sought to assess the mobility patterns along the milk value chain and their impact on urban rural linkages. The research shows patterns of mobility of people moving from rural areas towards the locations where goods and services are located mostly in the urban centres, flow of raw materials to urban centres, and also the flow of goods and services from the urban centre to the rural areas. Further, the research provides evidence on the viable distance that farmers and service providers can directly commute into and out of the urban centres to source goods and services while still achieving profitability in their dairy-related businesses creating a local functional area. Regional flows are facilitated by middlemen who source products from other regions in bulk creating a regional functional area. The patterns of mobility also exhibit seasonality such that during the dry season, there is increased mobility and longer distance of travel. The patterns of mobility also show that commuters change routes to avoid barriers like poor road conditions, police crackdowns, unreliable transport and ‘difficult’ topography.

The second objective sought to assess the barriers and adaptations of mobility along the milk value chain. While the main barrier of mobility identified in this research is the poor condition of the roads, it was however notable that there exist other underlying factors that also limit mobility along the milk value chain including: affordability, culture, gender, topography, and governance. A similar observation was made by UN-Habitat (2013, p. 3):

“Mobility is not only a matter of developing transport infrastructure and services, but also of overcoming the social, economic, political and physical constraints to movement. These constraints are influenced by factors such as: class, gender relations, poverty, physical disabilities, affordability, etc.”

While ‘hard’ infrastructure in form of the roads is key to connectivity it is not an assurance of efficient mobility, and should be integrated with ‘soft’ infrastructure to enhance connectivity

(Cities Alliance, 2019; Lindfield & Roberts, 2021; Simpson, 2021; UN-Habitat, 2013). The research shows evidence of stagnation of towns as a result of dilapidation of roads, as people, and investors prefer to use other routes leading to decreased business activities through a process of cumulative causation.

The research also sought to assess the impact of the mobility patterns on rural and urban linkages in the small and intermediate towns. Evidence from the research shows that the flow of goods between urban and rural areas creates a convergence and divergence of activities in urban centres making them focal points for human activities. The connecting road networks in turn act as the arteries or conduits that create connections and facilitate the flow of goods and services. The study also reveals the existence of a symbiotic relationship between urban and rural areas whereby rural areas provide the raw material – milk, while the urban areas provides goods and services and undertakes the processing of the raw material. This rural-urban interactions leads to a robust dairy value chain that is boosted by the presence of a milk processing industry, increased cash flow, raising the buying capacity of various goods at the village centres, market centres and towns leading to growth of non-farm activities and an emergence of a milk industry cluster and specialisation in Githunguri town. The findings additionally show that the industrial cluster in Githunguri town serves as a magnet that attracts suppliers and service providers leading to further growth of the town.

The last objective was to assess the impact the mobility patterns on livelihoods. Evidence from the research shows that spatial mobility contributes to social and economic mobility. Mobility supported agriculture and non-farm activities have an impact on the livelihoods. The farmers with ability to commute over longer distances are able to overcome the limitations of the small parcels of land. They are able to keep more cows and commercialise their dairy businesses. The study also reveals that farmers and milk vendors engaged in other non-farm activities to supplement their income. These non-farm activities involve frequent mobility especially to urban areas. The involvement in a combination of farm and non-farm activities cushions the farmers and milk vendors from low returns in various sectors of their businesses and makes them resilient in case of shocks, which is in line with previous studies (Bryceson, 1996, 1999, 2002; Owuor, 2006; Sietchiping et al., 2014; Tacoli, 2003) . The research also revealed that farmers who participate in the whole value chain from production to distribution of milk in urban areas make more profit. In terms of livelihood transformation, the research shows that there is a sense of accomplishment among farmers and milk vendors in what they termed as key milestones and achievements in their lives which they associate with their dairy business. The achievements and future aspirations also showed that they plan to expand their dairy-related businesses and improve their means of mobility, an indication that they have confidence in the

milk-related business activities in which they were involved in, and they are aware that by increasing the capacity of the means of mobility they are able to expand their businesses.

Recommendations

Application of technology in agricultural production

The application of technology in terms of modification of the means of transport, bulk transportation, and use of jacketed trucks underscores the need for commercialisation and modernisation of agriculture that capitalises on technological innovations and efficient mobility. It was evident that the farmers who own a means of mobility are able to source agricultural inputs at a cheaper cost and travel longer distances in search for fodder, and are thus able to sustain a larger herd of animals increasing their productivity and profits. In addition to transportation of farm inputs in bulk, there is need for application of technology in the storage of fodder to ensure the farmers are not adversely affected by seasonal changes of weather during the dry season. The use of silage can prolong the life of fodder, while large storage capacity can enable farmers to acquire and store fodder when it is in plenty for future use especially during the dry season. Application of technology in mobility is also useful in the collection of milk and in the distribution of the processed products. It is important to educate and empower farmers to make use of technologies that prolong the life of milk and fodder. This training and dissemination of knowledge can be through extension officers who are already available through ministry of agriculture and the private sector through the milk processing cooperatives. The rationale for use of technology in agricultural production is in line with Rostow's economic development model that points out that transition from subsistence to commercial agriculture driven by technology, mobility and trade is a critical component in economic growth. While the adoption of technology may lead to reduced labour requirements in a particular sector for instance milk production, it may not lead to unemployment because this may be compensated by economies of scale or demand for employment in another sector for instance milk processing.

Additionally, to cushion farmers from the fluctuation of hay prices that has exposed farmers to higher production costs especially in the dry season, the milk processing cooperatives can hire land in the hay growing regions and cultivate hay and sell it to their members at cheaper prices as a viable solution in reducing costs of production. The research found out that this has been carried out successfully by Ndumberi dairy cooperative society located 15 kilometres from Githunguri town in partnership with Nyala Daily cooperative located in Nyandarua County that have leased 1,180 acres of land in Nyahururu, Laikipia County where they are able to grow

quality hay and sell to their members at a cheaper price. However given the distance between the transect and the hay producing regions, good management practices need to be put in place to ensure efficient production. In addition the farmers need to employ bulk transportation of the hay to reduce transportation costs which may require capital investment.

Resilient infrastructure

Adequate road infrastructure is essential in the transformation of rural areas and in creating linkages between rural and urban areas. Roads need to be resilient to seasonal changes in weather condition to ensure efficient flow of goods and services throughout the year and facilitate mobility in all seasons. Earth roads are the most affected, thus the need for rehabilitation of these roads to all-weather roads with at least a murrum or gravel surface to ensure mobility throughout the year. Rural industrialisation needs to be accompanied by the prerequisite infrastructure investment for the industries to thrive in rural areas. In addition, clusters thrive in efficient connectivity and intercommunication within the cluster and also with other regions (Cities Alliance, 2019; Coe et al., 2010; Galvez-Nogales, 2010; Lindfield & Roberts, 2021; Lowe & Moryadas, 1984; Maunder et al., 2001). Adequate road infrastructure facilitates the access to farm inputs, access to raw materials by the processing factories and the distribution of processed goods to the market. However, road infrastructure alone cannot enhance connectivity, and the integration of both hard and soft infrastructure through use of smart technologies is also key in increasing efficiency in mobility (Lindfield & Roberts, 2021). Investment in road infrastructure is likely to spur economic development in an areas through the process of cumulative causation. However if the investment and growth is not controlled through physical planning, it may lead to negative effects like sprawl or formation of informal settlements.

With the widening use of smart phones and other smart devices, there is potential for application of smart mobility systems in Kenya and their application in agricultural production. This builds on the study's findings on how mobile phone technology has facilitated mobility. This can be further applied to enhance the connectivity between farmers, suppliers and their customers. Efficient communication networks shrinks' geographical distance and can reduce costs of production because farmers can acquire inputs at cheaper prices by reducing the necessity to travel, and also strengthen markets and ensure higher returns by linking the farmers with markets. This is through elimination of middlemen who could exploit the farmers.

Capacity of small and intermediate towns to support agriculture

The study underscores the role played by small and intermediate towns in rural areas, thus the need to strengthen their capacity to support agricultural activities and contribute to rural development. The functions played by Githunguri ‘milk’ town demonstrates how small towns can influence the transformation of rural areas and boost specialisation and growth of industrial clusters. The kind of rural urbanisation and industrialisation taking place in Githunguri town that largely relies on milk from Githunguri constituency to sustain the third-largest milk processing factory in Kenya can be replicated in other market and urban centres to ignite the transformation of rural areas. This can be through mapping of resources that can sustain the localisation economies, value addition through rural industrialisation and provision of the necessary hard and soft infrastructure. This kind of resource-driven urbanisation can reduce the reliance of rural towns on primate cities and create growth centres and also encourage the transition from subsistence to commercial agriculture. Proper physical planning of these small and intermediate towns and investment in infrastructure will ensure that they are adequately placed to ignite rural development. These towns should have efficient links to the surrounding rural areas to ensure connectivity. They should also be able to attract investors like suppliers of farm inputs and other services providers thus making them easily accessible to the farmers.

Physical planning and development control

Unlimited growth and sprawl of towns into rural areas can be detrimental to the transformation of rural areas. Inadequate planning, zoning and development control in peri-urban areas which are associated with urban sprawl and high demand of land for residential, commercial and industrial use can reduce the land under agriculture. Urban sprawl is already taking place in Ruiru town and other peri-urban areas surrounding the City of Nairobi. Ruiru is expanding towards the edge of Githunguri Sub-county and is ‘eating’ into the agricultural land. There should be planning and enforcement of development control to set the limits of the towns in order to reduce backwash effects. If proper planning does not take place, eventually the land conversion at the peri-urban zone will replace the agricultural activities. The expansion of the towns should be such that there is compact development to optimally utilize the limited land resources.

Encouraging adaptation to barriers of mobility

Interventions towards enhancing rural mobility can build on the adaptation to barriers to mobility or resilient measures that local communities are already accustomed to in guiding the policymakers to identify appropriate solutions. The approach used in the study of analysing the barriers and enablers of mobility provides an opportunity of resolving other rural challenges

whereby solutions offered build on resilient and adaptation measures that the communities are familiar with creating more ownership, impact and success in the interventions undertaken. A similar approach has been used by the World Bank that has developed “*adaptation principles a guide for designing strategies for climate change adaptation and resilience*” to guide the ministries of finance and economy to resolve adaptation challenges. Priority area 1 of these principles takes note that households and firms have “*an incentive to increase their resilience and adapt to climate change*” but they face constraints in their adaptation, and therefore the report recommends that “*governments need to minimize these obstacles to maximize the economy’s adaptive capacity*” (Hallegatte et al., 2020, p. 6). A similar approach could be used by policy actors in building on some of the adaptation strategies of the commuters in eliminating or reducing the barriers to mobility.

Inclusive policy formulation and implementation

Government regulators and enforcement agencies including the police, NTSA, KDB, KERRA, KURA and KENHA need to re-think their approach in the development, enforcement and implementation of policy regulations to ensure that they accommodate public concerns. In the incident involving the sexual harassment of a female motorist by *boda boda* operators on 04 March 2022, the government at first imposed a crackdown and later opted for an inclusive and consultative approach. Blackmore et al. (2015) recommend an inclusive approach in supporting informal actors to transition to the formalisation of their businesses:

“A heavy handed approach to formalisation will not work. Light-touch approaches that require minimal policy changes — such as voluntary training and certification schemes — can improve food safety and help the informal sector move along a pathway towards formalisation. Such approaches are more affordable and acceptable than trying to make radical, structural changes to the food sector”
(Blackmore et al., 2015, p. 3).

The KDB could engage the vendors in a more constructive way through for instance capacity building and training of the vendors on hygiene standards and appropriate ways of transportation of milk that is appropriate for the vendors and which does not compromise the standard of the milk. In addition there should be participation of relevant stakeholders in the development and implementation of regulatory frameworks to create ‘ownership’ and enhance the stakeholders’ adherence to the regulations. Tjandradewi & Roberts (2021) argue that governance post-COVID-19 calls for collaboration as opposed to the centralised directives that characterised the COVID-19 prevention strategies. Local-level actors at the counties and sub-counties need to be empowered to respond to emergencies and service delivery including

construction of roads. Collaborative governance involves the consultation of a wide range of stakeholders with varying interests, sharing of information, resources, plans, designs and budgets (Tjandradewi & Roberts, 2021). Collaborative governance can be applied in the development of policies and legislative frameworks and also in the formulation and implementation of projects.

As illustrated by the case of Mr. Ndirangu, there is potential for the milk vendors to transform their business ventures incrementally into either cottage industries or milk ATMs. For the government to achieve commercialisation of the agriculture industry and encourage the development of cottage processing industries, which have the potential to create employment opportunities and boost incomes, the exclusion of the milk vendors may hinder this objective. Tegemeo Institute (2021, p. xiii) advocates for the accommodation of milk vendors in the dairy value chain:

Since the informal markets are playing a role in linking producers to markets and improving profitability of dairy production, there is need to explore innovative ways of co-opting this segment of the market and bringing it into the formal sub-sector. This would entail setting standards for the segment, registering the actors in the segment and enhancing surveillance and enforcement of the standards. The result will be the creation of an enabling environment for increased private sector entrepreneurship in milk marketing and will generate employment directly and through linkages with other actors in the dairy value chain.

In addition, the government should reduce the bureaucratic requirements for setting up an industry through a one-stop agency that coordinates the registration process instead of the piecemeal registration with various government authorities. The government should also support industrial start-ups in progressive compliance to regulatory requirements by agencies like the KDB, KEBS and KRA to encourage development of cottage industries like that of Mr. Ndirangu.

Building rural-urban partnerships

The existence of functional economic areas serves as an impetus for viewing urban and rural areas as a continuum that surpasses the administrative geographical boundaries between these two spaces. It makes it imperative that planning of these two spaces should be harmonised through regional development plans. The unique roles that are played by urban and rural areas and the interactions between the two create avenues for their collaboration and partnerships. *“Partnerships and other forms of cooperating among government agencies, civil society, and*

the private sector are becoming an increasing form of decentralisation” (Cheema & Rondinelli, 2007, p. 14). For instance the growth of Ruiru town creates a reliable market for the milk produced in Githunguri. However, the expansion and sprawl of the town could lead to depletion of agricultural land. The complexity of these forms of collaborations and partnerships arises from the possibilities of differing administrative regions that call for flexible governance mechanisms. It calls for political settlement among the leaders of differing political regions, ideologies and development of a common vision for the region that encourage cooperation rather than competition. Local and regional collaborations and partnerships can be institutionalised to cut across rural areas, urban centres and regions in the formulation and implementation of joint projects that cut across various administrative jurisdictions. This could be in form of joint spatial planning ventures at various levels for instance city to city cooperation, metropolitan development authorities or regional development authorities. It could also be through collaboration in the formulation, financing and implementation of projects that cut across administrative jurisdictions including road, water, and energy projects. Such partnerships ensure that planning is not done in a silo, but cuts across both urban and rural areas.

The development of agricultural clusters also calls for partnerships and collaboration among the actors in the value chain. There is need for strong links among the actors involved in the milk value chain. The relationship between the actors should be that of collaboration rather than that of competition and that of partnerships rather than individualism. The cooperative societies have illustrated that collaborative efforts and rural partnerships can spur the growth of rural areas. The sustained growth of agricultural clusters including that of the milk industry depends on positive collaboration among the actors, such that the welfare of the other participants is put into consideration. For instance, if the suppliers of animal feeds sell them at high prices, they risk raising the cost of production to unsustainable amounts driving the farmers out of business. While market forces are expected to regulate themselves, collaboration of actors in the regulation of the pricing of various inputs and products along the value chain can ensure that the welfare of all actors is put into consideration. The pricing of milk by the processing companies affects the profit margins the farmers get. *“Milk price was found to be an important determinant of the economic performance of the dairy sub-sector”* (Tegemeo Institute, 2021, p. viii). While the price of the processed milk changes, the price of raw milk rarely changes (Tegemeo Institute, 2021). Regulation of the milk prices will ensure that the farmers do not incur losses and abandon their dairy ventures. Galvez-Nogales (2010, p. xii) refers to this kind of relationships as *“‘co-opetition’ where actors within the cluster demonstrate a balance between competition and cooperation.”* However, this is not easy to achieve because actors have differing goals especially the private actors who are geared towards profit maximisation.

The synergies between urban and rural areas also provide an impetus for the application of the urban-rural linkages approach to ensure that the planning of urban and rural areas is not undertaken in isolation but instead promotes the integration of the two areas. According to Alam (2014, p. 27) “*the urban-rural linkages development approach is a mutually supportive approach to the development of urban and rural areas.*” The development plans should focus on building synergies, collaboration and partnerships between the two areas.

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APPENDIX I: Questionnaires

Questionnaire to Farmers & Labourers

Name _____ Age _____ Gender _____
Location _____ Means of transportation _____ Farm
size _____ Form of land ownership _____ Rented
land _____ Farm Location _____ Respondent Farmer/
Household head/ Labourer _____

1. What is the source of feeds for your animals?
2. Does the farmer have a labourer? Does the farmer have alternative source of income?
3. How important is mobility in sustaining their dairy farming business
4. How is the character of mobility related activities they engage in towards sustaining their milk production?
5. What are the major challenges in the milk production sector?
6. Main challenges in mobility in the dairy industry?
7. What are the movements the farmer has made related to milk production in a week?
8. What are the means of movement during mobility?
9. What are the directions of movement during mobility? Which are the areas that are visited?
10. Which services and products do you get from the nearby town or shopping centres?
11. How is mobility different during the: Dry season and Rainy season?
12. What are the barriers to movement?
13. Where do you sell the milk?
14. How much milk do you produce on average?
15. How profitable is the milk farming activities?
16. What are the causes of increase and decrease of profit?
17. What are the main challenges in the milk production?
18. How has the milk business improved your livelihood?
19. What has the milk business helped you to achieve?
20. What are the future prospects of your milk business?

Questionnaire to the milk vendors

1. What is their source of milk? / Who supplies you with milk?
2. From which area do you collect the milk from? Do you have collection centres? [Map out the milk collection pattern]
3. How do they collect this milk? – Milk collection points and their location?
4. What is the means of transportation of their milk to the selling points? Pickups/ Motor bikes?
5. When do you pay your customers? Daily/ Weekly or Monthly?
6. What are their hours of operations?
7. How much milk do you deal with on average?
8. Who are their customers?
9. Where is the location of their customers?
10. What are the barriers to movement?
11. Are they engaged in other business/ agricultural sectors?

12. How has the milk business improved your livelihood?
13. What has the milk business helped you to achieve?
14. What are the future prospects of your milk business?

Questionnaire with Milk ATM operators/ Milk parlour/ Bar Operators

1. What is the source of your milk? Your farm/ other farmers?
2. Do you produce your own milk? What is the quantity of milk? [refer to the farmers questionnaire for extensive interview on milk production]
3. How do you collect this milk? How is the milk transported to and from the collection centres?
4. In what kind of containers is the milk supplied/ transported to you?
5. How much do you buy? And sell the milk?
6. What quantities of milk do you handle/ operate/ deal with?
7. What are the challenges/ barriers in getting the milk to the ATM/ Milk parlour?
8. What time does the milk get to you?
9. What are the hours of operation of your milk ATM/ Milk business?
10. Are there other items you sell in your milk business apart from milk?
11. How many distribution centres do you have?
12. Who are your customers?
13. Do your customers prefer raw milk?
14. Why do your customers prefer raw milk?
15. What do your customers use to collect the milk?
16. What are the required regulatory frameworks of running this business?
17. What are the challenges of running your business?
18. How has the milk business improved your livelihood?
19. What has the milk business helped you to achieve?
20. What are the future prospects of your milk business?

Questionnaire to pickup/ boda boda operators

1. Who are your main customers?
2. Which products do you mostly transport?
3. How much do you charge your customers?
4. Which areas do you transport the products to?
5. What are the main barriers to movement?
6. How do you deal with the barriers to movement?
7. What is the means of communication with the customer?
8. Do you have customers who call you and instruct you to go collect feeds somewhere?

Questionnaire with Agrovets/ Veterinary Doctors

1. What services and products do you offer/ sell?
2. Who are your main customers? Are there customers who call and then you make arrangements to visit their farms?
3. How often do you visit farmers in a day and in a week?
4. Which are the areas you visit?
5. What are the means of transportation to visit the farmers?
6. Which geographical locations do you cover?
7. What are the methods farmers use to feed their cows?

8. Which are the common products/ services sought out by the farmers?
9. What are the main ailments that affect cows in this area?
10. What are the main challenges in the dairy industry?

Questionnaire with Restaurant operators/ Tea Sellers

1. What is the source of milk for your business?
2. Do you supply some of the milk you use in your business?
3. How important is selling tea for your business?
4. How many people deliver milk to your business?
5. How much do you buy the milk?
6. What is the quantity of milk you use in your business?
7. What time does the milk arrive at your business?
8. What are the challenges of getting the milk in your business?
9. Why do you prefer raw/ packet milk?
10. What are the hours of operation of your business?
11. How many people do you employ in your business?
12. How long have you operated this business?
13. How has the milk business improved your livelihood?
14. What has the milk business helped you to achieve?
15. What are the future prospects of your milk business?

Questionnaire to Milk Processors/ Factories

1. When was this company formed?
2. What necessitated the formation of the company?
3. How was milk distributed before the formation of the company?
4. What were the market gaps and needs in terms of source of raw materials and sale of produce?
5. What is the number of registered farmers with the company?
6. How do you collect the milk from producers? What is the arrangement with the farmers?
7. How does the milk get to the factory?
8. Milk being a perishable product, what are the challenges in getting the milk to the factory?
9. How many collection centres do you have?
10. What is the geographical distribution of the collection centres?
11. Which routes are used to get the milk to the factory?
12. What is the geographical extent of the collection area?
13. Is there a boundary of the coverage/ collection catchment area?
14. How is the milk transported from the milk collection centres?
15. How many lorries/ pickups/ motor bikes are required to get milk from these collection centres?
16. Who owns the lorries and pickups used to collect the milk? Are they leased out?
17. What is the quantity of milk collected from these centres? Per day?
18. What are the major challenges of milk collection?
19. What is the mode of payment of milk to the producers? Monthly/ Weekly?/ Daily? Is there a loan or bonus mechanism?
20. Is there a framework of sourcing feeds for the farmers?
21. How does the milk get to the customers? How are the distributors? Are they from the area?
22. Which routes do you use to get the milk to the customers, and what determines the routes you use?
23. Milk being a perishable product, what are the challenges in getting the milk to the customers?

24. What is the logistical framework of getting milk to the customers?
25. What is the geographical locations of the distribution of the milk across Kenya?
26. What is the quantity of milk that is sold in these geographical locations?
27. What are the transportation challenges/ barriers in transportation of milk across the networks?
28. How has the nature of infrastructure affected the distribution and collection of milk across the networks?
29. What is the functional role of the town and shopping centres located near the neighbourhood of the factory and collection points?
30. What are the livelihood impacts of the business?
31. What are the livelihood impacts of the company and how has it benefitted the community?
32. Are there increased remittances to the customers?
33. How many registered farmers are there?
34. Is there an impact on the cash flow of the farmers?
35. Is there an impact on increase of loans given to farmers?

APPENDIX II: Research authorization



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No. **NACOSTI/P/19/74456/27805**

Date: **27th February, 2019**

Jackson Matheru Kago
University of Bordeaux
FRANCE.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *“Mobility patterns and their impact on urban-rural linkages in Small and Intermediate Towns in Kenya – a dual transect analysis”* I am pleased to inform you that you have been authorized to undertake research in **selected Counties** for the period ending **27th February, 2020.**

You are advised to report to **the County Commissioners and the County Directors of Education of the selected Counties** before embarking on the research project.

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

A handwritten signature in blue ink, appearing to read 'G. Kalerwa', is positioned above the typed name of the Director-General/CEO.

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

Copy to:

The County Commissioners
Selected Counties.

The County Directors of Education
Selected Counties.

Appendix III: Government reaction to the sexual harassment incident involving *boda boda* operators in March 2022

S no.	Date	Event
1.	4 March 2022	<ul style="list-style-type: none"> • A female motorist is involved in an accident with a <i>boda boda</i> operator along Wangari Mathai Road (formerly Forest road) Nairobi. The motorist was a Zimbabwean diplomat, giving the incident attention by government.³⁷ • The <i>boda boda</i> operator is reported to have abruptly driven ahead of her leading to a crash in which he sustained a broken leg according to the statement she recorded at Parklands police station.³⁸ • Following the accident she stopped nearby and that is when the other <i>boda boda</i> operators surrounded her and attempted to steal from her. • As a result she drove off, and the <i>boda boda</i> operators chased her vehicle and blocked her a few kilometres away from the scene of accident. • They then sexually harassed her and stole money and other valuables from her, accusing her of attempting to escape from the accident scene. • The incident was recorded by one of the <i>boda boda</i> operators on video and shared on social media. Some of the operators were recorded in the video tearing off her clothes as they attempted to get her out of the vehicle while she screamed for help. • A policeman on patrol who was alerted by the members of the public saved her from further harassment from the violent <i>boda boda</i> mob.
2.	04- 07 March 2022	<ul style="list-style-type: none"> • The video was shared on various socio media platforms enabling it to reach a wide audience and eliciting reactions from the public and leaders. A video shared by <i>Ma3Route</i> a twitter handle that posts news and issues affecting motorists on 07 March 2022 had 92,000 views and 449 retweets, and 237 quote tweets by 11 March 2022³⁹ • The video created a public anger and condemnation of the incident who called for action to be taken against the rogue <i>boda boda</i> operators, and for the industry to be regulated.
3.	07 March 2022	<ul style="list-style-type: none"> • The government reacted to the incident, with the National Police Service tweeting that: <i>“Our attention has been drawn to a distasteful video circulating on social media of boda boda riders attacking a motorist after an alleged road traffic accident. The rowdy gang went ahead and stripped the lady off her clothes. The matter is under active investigations. We have since identified some of the perpetrators and they will be presented before a court of law upon completion of investigations.”</i>⁴⁰ • Interior cabinet secretary, Fred Matiang’i while condemning the incident said <i>“I am shocked and disgusted by a viral video clip of a female motorist being molested by suspected boda boda riders along Wangari Maathai /Forest Road. We must protect our roads from such vile and reprehensible</i>

³⁷ <https://www.tuko.co.ke/kenya/446038-forest-road-new-video-shows-woman-diplomat-talking-riders-outside-car-before-being-attacked/>

³⁸ <https://www.the-star.co.ke/news/2022-03-07-manhunt-launched-after-bodaboda-sexually-assaulted-female-motorist/>

³⁹ <https://twitter.com/ma3route/status/1500776554170920962?lang=en>

⁴⁰ https://twitter.com/NPSOfficial_KE/status/1500821155963453445

		<i>acts of aggression.</i> ” He ordered for the arrest of the perpetrators of the incident. ⁴¹
4.	07 March 2022	<ul style="list-style-type: none"> On the first day of police crackdown on illegal operations by <i>boda boda</i> operators in the Nairobi Central Business District, police arrested over 200 <i>boda boda</i> operators who were to be charged with various offences as reported by the Inspector General of Police Hillary Mutyambai. 16 of the <i>boda boda</i> operators identified to have carried out the incident were also arrested and presented in court.⁴²
5.	08 March 2022	<ul style="list-style-type: none"> The President of Kenya, Uhuru Kenyatta condemned illegal activities that had been perpetrated by the <i>Boda bodas</i> in the past including driving on pedestrian walkways, breakages of vehicles, “<i>drive-by shootings</i>”, harassing motorists along the road, and “<i>to strip and remove dignity from our women.</i>” He ordered for “<i>a crackdown on all boda boda operators starting here in Nairobi and moving across the country</i>” and directed that all <i>boda boda</i> operators would need to be registered afresh. He also predicted that his statement could be politicized to show that he was against the operations of small scale business operators and indicated that his government was not against the <i>boda boda</i> operators and in the contrary was committed to supporting their businesses. “<i>We want to work together with you. We want to help your business prosper. But you must also do your bit, kwa sababu wateja wenu ni hawa akina mama (your clients are these women.)</i>”⁴³ The Chief Justice of Kenya, Martha Koome condemned the incident and hoped that the “<i>perpetrators will be apprehended and processed through the criminal justice system in a systematic manner and in accordance with the Constitution and the rule of law.</i>”⁴⁴ The Director of Public Prosecutions (ODPP), Noordin Haji indicated that: “<i>The ODPP strongly condemns this barbaric act and we await the completion of investigations by the police in order to commence prosecution of those culpable. We wish to caution the public against taking the law into their hands thereby infringing the rights of others.</i>”⁴⁵ The Governor of the City County of Nairobi, Ann Kananu condemned the incident “<i>archaic, barbaric and outdated and should not be allowed to happen at this day and age in this great city of Nairobi! It is embarrassing and inhumane when grown up men assault a helpless woman.</i>” She gave the <i>boda boda</i> operators seven days to reach out to her for engagement.⁴⁶
6.	08 March 2022	<ul style="list-style-type: none"> A group of women organised a peaceful demonstration outside the National Police force headquarters in Nairobi condemning the sexual harassment incident during the World Women’s Day. They presented a memorandum to the Interior Cabinet Secretary, Fred Matiang’i and the Inspector General of police Hillary Mutyambai. The protest was organized by FIDA (Federation of Women Lawyers), an organization that fights against women discrimination. The protestors called for the setting up of

⁴¹ <https://www.capitalfm.co.ke/news/2022/03/14-suspects-arrested-over-sexual-assault-of-woman-on-forest-road/>

⁴² <https://www.the-star.co.ke/news/2022-03-08-over-200-riders-arrested-after-assault-of-female-motorist-in-city/>

⁴³ https://www.youtube.com/watch?v=lu_x51kf8fM

⁴⁴ <https://www.the-star.co.ke/news/2022-03-08-haji-koome-condemn-harassment-of-female-motorist-in-city/>

⁴⁵ https://twitter.com/ODPP_KE/status/1501087283415592964

⁴⁶ <https://ghettoradio.co.ke/governor-kananu-threatens-to-oust-boda-boda-operators-from-town/>

		<p>a special police unit to streamline the operations of the <i>boda boda</i> operators in line with the law.⁴⁷</p> <ul style="list-style-type: none"> • The Interior Cabinet Secretary, Fred Matiang'i assured the protestors that the government was committed to implementing reforms in the <i>boda boda</i> sector. <i>"You know we had a boda boda task force that came up with several recommendations of things we need to do to streamline and bring order in the boda boda sector... Nothing short of a very ruthless and radical reorganization of that boda boda sector is going to solve it."</i> The Cabinet Secretary said that he had formed a multi-sectoral task force to ensure collaborative engagement in reforming the <i>boda boda</i> sector. The task force included officials from the Ministry of Interior, Ministry of Transport, NTSA, and <i>boda boda</i> operators.⁴⁸
7.	08 – 11 March 2022	<ul style="list-style-type: none"> • As a result of the crackdown, <i>boda boda</i> operators withdrew their services for fear of getting arrested. This had an effect on mobility as customers who relied on the <i>boda bodas</i> for movement were inconvenienced and had to seek other alternative means of transportation. This included the <i>boda boda</i> operators who ferry goods through courier services. It also led to loss of livelihood for the <i>boda boda</i> operators.⁴⁹
8.	09 March 2022	<ul style="list-style-type: none"> • As a follow up to the president's directive, Interior Cabinet Secretary, Fred Matiang'i during a meeting with <i>boda boda</i> representatives indicated that the government had given them 60 days to get registered and that the President of Kenya, Uhuru Kenyatta had waived the registration fee of Ksh. 5,800. • The registration of the <i>boda boda</i> operators was to take place at all <i>Huduma</i> centres countrywide. • Upon registration, the <i>boda boda</i> operators would be issued with a smart rider's license and unique identifiers including stickers for their motorcycle and badges which they would be obligated to display during their operations. • <i>"The boda boda operators would be required to undergo competency training TVETA institutions and the National Youth Service, they will have to re-register and have smart licenses within 60 days ensure vetting of operators and to be registered in Saccos."</i> Indicated Mr. Matiang'i⁵⁰ • During the engagement, the National Chairman/President of the <i>boda boda</i> Safety Association of Kenya apologized to the President on behalf of the <i>boda boda</i> operators. He indicated that with the right support and the right operating environment the <i>boda boda</i> operators would reform and undertake their business operations in a legal way.⁵¹ • <i>Boda boda</i> operators in the Nairobi Central Business District displayed posters on the back of their jackets indicating that <i>"We are sorry."</i> Chara George, a blogger who shared the photos of these images commented that <i>"Please the powerful connected middle and upper class, forgive them. They are brothers, sons, fathers and husbands. They serve the less fortunate and honest constituency who can't afford a car but has families to feed on daily wages."</i>⁵²

⁴⁷ <https://nation.africa/kenya/news/gender/women-leaders-demand-justice-for-motorist-assaulted-by-boda-boda-riders-3742202>

⁴⁸ <https://www.youtube.com/watch?v=fFfQKOZXDxE>

⁴⁹ <https://www.the-star.co.ke/sasa/2022-03-10-customers-hit-hard-amid-massive-boda-boda-crackdown/>

⁵⁰ <https://www.citizen.digital/news/bo-n294143>

⁵¹ <https://www.the-star.co.ke/news/2022-03-09-we-are-sorry-boda-boda-riders-say-amid-crackdown/>

⁵² <https://www.the-star.co.ke/news/2022-03-09-we-are-sorry-boda-boda-riders-say-amid-crackdown/>

9.	10 March 2022	<ul style="list-style-type: none"> • <i>Boda boda</i> operators demonstrated across the country to protest the crackdown of police. They cited that they were being harassed by police and their motorbikes impounded because of an isolated incident. They also indicated that they had lost their income since the crackdowns had begun. This included a demonstration in Githurai, Ruiru in Kiambu County where the motorists closed off Thika road.⁵³
10.	10 March 2022	<ul style="list-style-type: none"> • Former prime minister and 2022 presidential aspirant, Raila Odinga condemned the action by the <i>boda boda</i> operators, but called on the police to stop harassing innocent <i>boda boda</i> operators. He indicated that all <i>boda boda</i> operators should not be condemned because of the actions of a few offenders. This was a shift from the President’s directive on the crackdown of the <i>boda boda</i> operators. Being a presidential aspirant, Raila Odinga would not have wanted to be seen as acting against the welfare of the <i>boda boda</i> operators who constitute a potential voting bloc.⁵⁴
11.	12 March 2022	<ul style="list-style-type: none"> • Raila Odinga indicated that he intervened to prevent the harassment of innocent <i>boda boda</i> operators who were earning their income by the police. He said that only the operators involved in criminal activities deserved punishment and urged for civic education to be provided to the <i>boda boda</i> operators. He indicated that he had spoken to the president who had on 08 March 2022 ordered a national crackdown on all <i>boda boda</i> operators.⁵⁵
12.	12 March 2022	<ul style="list-style-type: none"> • The Deputy President of the Republic of Kenya and a 2022 presidential elections aspirant, William Ruto criticized the national crackdown on the <i>boda boda</i> operators. He indicated that the <i>boda boda</i> business was a legitimate one and like any other business and it was wrong for the police to criminalize the <i>boda boda</i> business. He indicated that the role of the police was to arrest the criminals and they should leave the <i>boda boda</i> operators to carry on with their business activities.⁵⁶
13.	12 March 2022	<ul style="list-style-type: none"> • The Kenya Police suspended the national crackdown on the <i>boda boda</i> operators and indicated that it would only remain in effect in Nairobi Central Business District where the incident had occurred. <i>“To effectively coordinate the implementation of the exercise with minimum disruptions to services offered by compliant boda boda operators, the government has suspended the operation. This will allow the multi-sectoral committee coordinating it to develop a suitable implementation framework. The suspension shall not apply to the Nairobi CBD where the ban remains in force.”</i> Bruno Isohi Shioso, Spokesperson, National Police Service.⁵⁷
14.	12 March 2022	<ul style="list-style-type: none"> • In a change of tactic on the engagement with the <i>boda boda</i> operators from that of harassment or crackdown, the police officers encouraged the engagement of the <i>boda boda</i> operators. • <i>“The National Police Service understands what an organised boda boda sector will bring in our pursuit for safety and security in our neighbourhoods. An efficiently regulated boda boda sector will translate to fewer road traffic accidents, organised movement of traffic, respect to other road users, respect to road and traffic signs, reduced crime, and</i>

⁵³ <https://www.capitalfm.co.ke/news/2022/03/boda-boda-riders-protest-against-police-crackdown/>

⁵⁴ <https://www.the-star.co.ke/news/2022-03-10-stop-harassing-innocent-boda-boda-operators-says-raila/>

⁵⁵ <https://www.standardmedia.co.ke/national/article/2001440126/i-intervened-on-behalf-of-boda-boda-riders-raila>

⁵⁶ <https://www.capitalfm.co.ke/news/2022/03/ruto-tells-police-to-stop-harassing-boda-boda-operators-deal-with-criminals/>

⁵⁷ <https://www.kbc.co.ke/govt-suspends-ongoing-crackdown-on-boda-boda-operators/>

		<p><i>compliance to laws and regulations of the country. The NPS being part of the multi-sectoral stakeholders in the reorganization of the boda boda sector as a means of public transport, continues to conduct road safety campaigns to equip the operators with useful information on their businesses. Earlier today, the OCS Bomet Police Station and his team held a sensitization workshop for riders at 77 Hotel, Bomet County. Some of the concerns addressed at the meeting include; ethical conduct of a rider, road safety laws and regulations, overview of the Traffic Act and other regulations, common causes of accidents, and the process of registering boda boda sacco. The meeting was attended by 55 chairpersons of boda boda groups from across the county. We hail other commanders who continue to engage boda boda entities across the country to be fully compliant, responsible and responsive to the expectations of their customers by adhering to road safety rules and other requirements put in place by the government.” National Police Service Twitter Handle.⁵⁸</i></p> <ul style="list-style-type: none"> • <i>In a response to the twitter message some of the comments hailed the approach by the police, while some indicated that due to an end of the operation, police had lost opportunities for bribery.</i> • <i>“There's an orderly manner to do this. Not catching everyone in a manner of harassment despite whether they're compliant or not to ask for the 10-30k release coins from poor pockets. How y'all harassed them to a point one was publicly beaten to near death bleeding & others. It's pathetic, save us the hogwash PR. There has never been order in handling issues with you guys. Never at all. Just blatant public harassments etc. The rogue ones must be justifiably be brought to book but not a mass harassment of sons of Kenyans trying to provide for their kin” Commenter 1</i> • <i>“That eating period given to Kenya police was short but sweet wasn't it.” Commenter 2.</i>
15.	15 March 2022	<ul style="list-style-type: none"> • <i>The Deputy President of the Republic of Kenya, William Ruto indicated that the business people including the boda boda operators who are considers hustlers (small scale business operators) were victims of the ruling elite who were harassing them because they did not hold the same political views as those of the ‘handshake’ (between the President of Kenya and the 2022 presidential aspirant Raila Odinga). He was of the view that government institutions were harassing business people who were supporting him politically.</i> • <i>“I want to thank the many leaders who have had to suffer a weaponized fight against business a weaponized fight against leaders... Their crimes was only to be members of the ‘hustler’ nation... The weaponisation of the DCI [Directorate of Criminal Investigation], EACC [Ethics and Anti-Corruption Commission] and KRA [Kenya Revenue Authority] is not limited to this leaders it goes to many businesses enterprises that have been crippled and destroyed by a weaponized by the DCI and KRA. ... today it is not just the big business... even the boda boda today are victims of a weaponized fight against people who do not share the belief of those who hold the labours of power today and I want to promise them that power is transient and the people of Kenya will overcome”⁵⁹</i>

⁵⁸ https://twitter.com/NPSOfficial_KE/status/1502663273996554242

⁵⁹ https://www.facebook.com/watch/live/?ref=watch_permalink&v=5304724312873817

16.	16 March 2022	<ul style="list-style-type: none"> The Deputy President of the Republic of Kenya, William Ruto indicated that <i>“This Nairobi is a city of ‘hustlers’... Those boda bodas operators whose motorbikes were taken and they were charged fines that were not legal, should go and pick their motor bikes at the police stations and also get a refund of the fines because they are legal business people. Criminals are those who break the law, they are the ones who assaulted the lady in Forest road and should be the ones arrested and take to the police to face the law. But boda boda operators should not be harassed because of other people’s crimes. All law breakers should face the law.”</i>
17.	17 March 2022	<ul style="list-style-type: none"> The Governor of the City of Nairobi, Ann Kananu ordered the City Inspectorate Department to unconditionally release all of the <i>boda bodas</i> that had been confiscated during the crackdown on rogue operators. There were over 1000 motorbikes that had been detained by the city county. The governor indicated that all <i>boda boda</i> operators would need to be registered members of Saccos and they would also register at the sub-county levels upon which they be given unique identification codes and stickers with different colour codes for each of the 17 sub-county in the city for ease in identification.⁶⁰ She however insisted that the <i>boda boda</i> operators should not operate in the CBD of Nairobi. The Governor who was seeking re-election during the August 2022 elections could have given this declaration to ensure that she does not lose votes from the hundreds of <i>boda boda</i> operators in the City of Nairobi.
18.	18 March 2022	<ul style="list-style-type: none"> The president of Kenya, Uhuru Kenyatta criticized those that had politicized the <i>boda boda</i> reforms, a statement seen to have been directed to the deputy president, William Ruto. He indicated that he had predicted that the reforms could be politicized when he called for the crackdown. The president indicated that the government had no problem with legal business operators, and that he would call for a meeting with <i>boda boda</i> operators to plan strategies on how the business would operate within the confines of the law, and with respect to other citizens including the women and the elderly. He emphasized that there must be law and order and that there is no country can thrive without order. <i>“In the near future I will call you for a meeting we sit as elders to agree, and am sure that we will not fail to agree.”</i> This was a departure from his approach of a crackdown on the operators which he ordered on 08 March 2022 to that of engaging the operators.⁶¹
19.	23 March 2022	<ul style="list-style-type: none"> Interior Cabinet Secretary, Fred Matiang’i in a meeting attended by 290 <i>boda boda</i> representatives from all the constituencies in Kenya and organized by BAK ordered for the immediate release of <i>boda bodas</i> impounded during the crackdown ordered by the president of Kenya. Kevin Mubadi, the chairman of BAK had indicated that the <i>boda boda</i> operators had not been able to access their motorbikes despite the order by the end of the crackdown. Mr. Matiang’i also indicated that representatives of <i>boda boda</i> operators should be involved during local and regional security meetings. <i>“The people who are in the boda boda sector are genuine people, real people who are raising their families from this business. We do not want them to be interfered with by criminals by drug dealers and by all manner of funny people... let us organize the sector, work with us, government is not even your opponent or your enemy,</i>

⁶⁰ <https://nairobi.go.ke/kananu-orders-release-impounded-boda-bodas-calls-quick-installation-biometric-plates/>

⁶¹ <https://www.youtube.com/watch?v=dJ5pKFuVwpg>

		<p><i>government is your strongest ally and strongest friend.” Said Mr. Matiang’i.</i></p> <ul style="list-style-type: none"> • <i>“The government's unwavering resolve to work with boda bodas to reform the industry is in recognition of the contribution made by over 2.4 million operators in driving our economy. There are no intentions to burden riders with additional taxes through the proposed registration drive. Our appeal to youth in the sector is to embrace self-regulation through Saccos to not only root out criminals who have infiltrated the industry but be ambassadors of peace who welcome divergent political views expressed in a mature democracy like ours.” Indicated Mr. Matiang’i.</i>⁶²
20.	24 March 2022	<ul style="list-style-type: none"> • The president of Kenya, Uhuru Kenyatta gave a directive to the Ministry of Transport to work with the St. John Ambulance Kenya association which promotes emergence response in training <i>“at least 200,000 boda boda riders on first aid and structured approach to major medical incidents to boost first responder capacity in our country.”</i> This would be carried out in collaboration with the Ministry of Health to incorporate the support of 26,000 volunteers from the association.⁶³
21.	26 March 2022	<ul style="list-style-type: none"> • NTSA issued the guidelines for registrations of <i>boda boda</i> operators. They would be required to visit any of the <i>Huduma</i> centres (government one stop-shop service delivery centres located countrywide) between 28 March 2022 – 24 June 2022. The <i>boda boda</i> operators would be expected to produce their original identity cards (IDs), a copy of Kenya Revenue Authority Pin number and a mobile phone with an active number registered under their name. Upon registration, the riders would receive a smart driving license. As an incentive to encourage registration, the first 200,000 operators would be offered a free 12 month National Hospital Insurance Fund (NHIF) cover.⁶⁴
22.	28 March 2022	<ul style="list-style-type: none"> • Registration of <i>boda boda</i> operators was rolled out country wide in 52 <i>Huduma</i> centres located across the Country⁶⁵

⁶² <https://www.facebook.com/watch/?v=65554122224488>

⁶³ <https://www.citizen.digital/news/president-kenyatta-directs-training-of-200000-boda-boda-riders-on-first-aid-n295150>

⁶⁴ <https://www.kenyans.co.ke/news/74306-ntsa-lists-requirements-all-boda-boda-registration-after-uhuru-directive>

⁶⁵ <https://www.kenyanews.go.ke/nationwide-bodaboda-registration-kicks-off/>

APPENDIX IV: Historical factors leading to decline of Uplands area

Lari Massacre

During the colonial period, Lari was at the centre of the Mau Mau resistance with the most violent attack known as the “*Lari Massacre*” taking place in Kirenga and Githirioni village in Lari near Uplands. During the massacre, 84 members of the local Kikuyu population were brutally murdered and 31 seriously wounded on the night of 26 March 1953. Cows were also slaughtered and huts set on fire. The attack was executed by 400 Mau Mau fighters who had earlier hidden in the Aberdare forest and descended into the villages at night (Baker, 1954). This attack targeted the villagers who were perceived to collaborate with the colonial government. The resentment towards the perceived collaborators had its roots in the displacement of the villagers at the beginning of the 20th Century when the European settlers decided to settle at Tigoni and Limuru. The colonial government decided to relocate the villagers from Tigoni to Lari, a move that was resisted by among others one of their leaders Luka Kahangara. However, when Mr. Kahangara realised that he could not win the resistance to relocate, he agreed to cooperate with the colonial authorities and convinced the people to move. The people were moved to Kimende, Kwaregi, Githirioni and Kirenga villages in 1939. The name Kwaregi means a place of resisters. As a result of the cooperation, he and his relatives were allocated prime land in Lari and he was also appointed the chief of the area. This led to a bitter resentment from the other villagers, especially in the way that he and the local African police referred to as home guards or *ngati* treated the local people harshly when collecting taxes (Kiereini, 2019b). He could seize the land and cattle of those who had defaulted in paying the taxes, and he used the colonial power to enrich himself and oppress his people. Thus he became a target of the Mau fighters. In the previous year on 07 October 1952, the Mau fighters had also murdered another perceived collaborator Chief Waruhiu, the chief of Githunguri through an ambush in Gachie, Kiambu leading to a declaration of a state of emergency two weeks after.

The day after the attack, even after the Mau fighters had disappeared into the Kereita forest, the colonial government arrested thousands of villagers resulting to the loss of 400 lives in a revenge attack. They were executed in public in Githunguri and Uplands to create fear among the local population. The days that followed involved torture as the colonial administration through the home guards tried to identify the perpetrators of the violence leading to the death of about 5,000 people in the neighbouring Lari, Kimende, Uplands and Githunguri areas (Mwaura, 2011). The residents consider this to be the real Lari massacre. This attack caused trauma to the survivors of both the Mau Mau and the retaliatory attack by the colonial administration. The bitterness between the families of the home guards and that of the other population is felt to date. Monicah Nyambura indicated that she could not forgive the home guards because as a result of their oppression; her parents had died and their family land was grabbed (Mwaura, 2011):

“They beat my mother and her one-year-old son to death. My father, whose ribs were broken, died a month later. Our land was grabbed and I live in rented premises. There is no way I can forgive them as I continue to suffer,” Monicah Nyambura (Mwaura, 2011)

This history of the Mau resistance to colonial rule is being reconstructed through the construction of the Mau Mau road that is supposed to go across the Aberdare range from Kiambu County to Nyeri County, recreating a historical reconstruction of the routes used by the Mau Mau fighters who transversed the Aberdare forest during the resistance.

Collapse of the Uplands bacon factory

The other setback that Uplands centre faced was the collapse of the Uplands Bacon Factory in 1986 that was famous for bacon production and pig keeping. Uplands Bacon Factory began in 1906 when a London based company – East African Estate Ltd was allocated an initial 248 acres of land in Uplands for bacon production (Huxley & Curtis, 1980). On 7 January 1946 Uplands Bacon Factory (Kenya) became a public limited company through the enactment of the Uplands Bacon Factory Act - Cap 362. As per the Act, the Pig Industry Board had one ordinary share of the company and had a representative in the management with voting rights (Government of Kenya, 2012d). The Pig Industry Board had earlier been set up on through a Government Gazette notice on 17 April 1945. According to the Kenya National Assembly Official Record (Hansard) Jun 11 - Jul 31, 1986 (Government of Kenya, 1986), the assistant minister of Agriculture and Livestock Development Mr. Muthura, in responding to a question by Mr. P.T. Mungai who sought to know whether instead of the company closing down, if it would be possible to hand it over to the farmers so that they can revive it; indicated that the Uplands Bacon Factory was handed to its owners the Uplands Pig Suppliers Association on 01 September 1985. Mr. Mungai additionally sought to know whether the government could have waived the debts that had accrued and were threatening the company. Mr. Muthura indicated that the government had been the trustee of the factory through its one ordinary share through the Pig Industry Board while the rest of the ordinary shares were owned by the Uplands Suppliers Association, whose shares were also held in trust by the Kenyan Government. He also indicated that the government had terminated its trusteeship and made available Ksh. 15 million to revive the company. He also added that prior to 1978 the Standard Chartered Bank had held the share on behalf of the Pig Industry Board as a result of the loan (Government of Kenya, 1986). The ownership of the company was not clear because although the government had indicated that they had terminated the trusteeship and handed the company back to the farmers through the Uplands Suppliers Association at the same time, the government was still the trustee of these shares held by the association.

In a Hansard report in Kenya National Assembly Official Record (Hansard) 1 July 2008 (Government of Kenya, 2008), the minister of Industrialisation Mr. Kosgey while responding to the Mr. Mwaura, the Member of parliament of Lari, on the measures been taken to revive the factory following its closure, indicated that the Uplands Bacon Factory got into financial and management problems in 1987 and also faced competition from two competing companies – Farmers Choice Ltd and Nairobi Airport services

that took control of 50 per cent of the market. The government tried to revive the company by injecting a total of Ksh. 42 million, but despite these efforts, the company went into receivership in September 1987. The industrialisation minister indicated that while seeking funds from African Development Bank, an evaluation of the viability of the project showed that it would be expensive to revive it and that the machines were obsolete and would require new ones. He indicated that the receiver sold Uplands Bacon Factory to Lonrho Agri-Business, who in turn sold it to Farmers Choice Ltd on January 2000. Farmers Choice Ltd operates the company to date.

The transfer of ownership from the Uplands Bacon Factory to Lonrho Agri-Business is questioned by residents of Uplands. While the government in the above statement claimed that the receiver sold the land to Lonrho, there are claims that Lonrho acquired the Uplands Bacon Factory as part of compensation for land it owned in Eldoret that was acquired by the Government of Kenya to pave way for the construction of Eldoret International Airport. Lonrho Agri-Business owned 3,000 acres that were valued by a government valuer at Ksh. 160 million, and a private valuer commissioned by Lonrho at Ksh. 310 million. The government chose to go with the private valuer's figure. It is reported that the government did not have the full amount of Ksh. 310 million, and paid Ksh. 200 million and transferred Uplands Bacon Factory to cover the rest of the amount (Kamau, 2019; Mbaria, 2020).

The government through the Cabinet Secretary for Trade and Industrialisation, Peter Munya and the Governor of Kiambu County, James Nyoro visited the factory on 25th October 2019 to familiarize themselves with the challenges the company was facing and find ways of reviving it. The two representatives of the national and county government acknowledged the current ownership of the Uplands Bacon Factory by Farmers Choice Ltd. They noted the challenges that the pig production industry was facing in terms of access to cheaper quality feeds, access to markets and lack of affordable credit. The Cabinet Secretary did not engage on the issue of the historical ownership issues that the company faced. This is evident from his Facebook post:

“CS Peter Munya seeks to revive the largest bacon factory in East Africa after 33 years of dwindling fortunes.

CS Peter Munya was today conducted on familiarization tour of Uplands Bacon Factory to learn what can be done to revive the bacon/pork value chain and how best the government can support farmers to increase production. The facility, currently owned and operated by Farmers Choice, has 300 employees and a supportive program for pig farmers.

This value chain has a ready local and export market. It has also a great potential of creating jobs and enumerable opportunities, especially for those in the peri-urban areas that have limited land space.

An integrated and innovative approach will be useful to address the constraints such as cost and quality of feeds, access to both EAC and other export markets and the access to

affordable credit for SMEs in this niche.” Peter G. Munya Facebook Post on 25 October 2019.

However, the Governor of Kiambu County, James Nyoro in his Facebook post stated that the County Government was looking for a solution to revert the company to the County Government:

“Together with Cabinet Secretary for Trade, Industry and Cooperative, Hon. Peter Munya, we visited Uplands Bacon Factory in Lari in order to familiarize ourselves with the production processes, listened to the challenges facing the revival of the factory and the best way to revert the land to the County government. We shall engage with the operators on the land with the support of the National Government to get a solution” James Nyoro, Governor Kiambu County Facebook post on 25 October 2019.

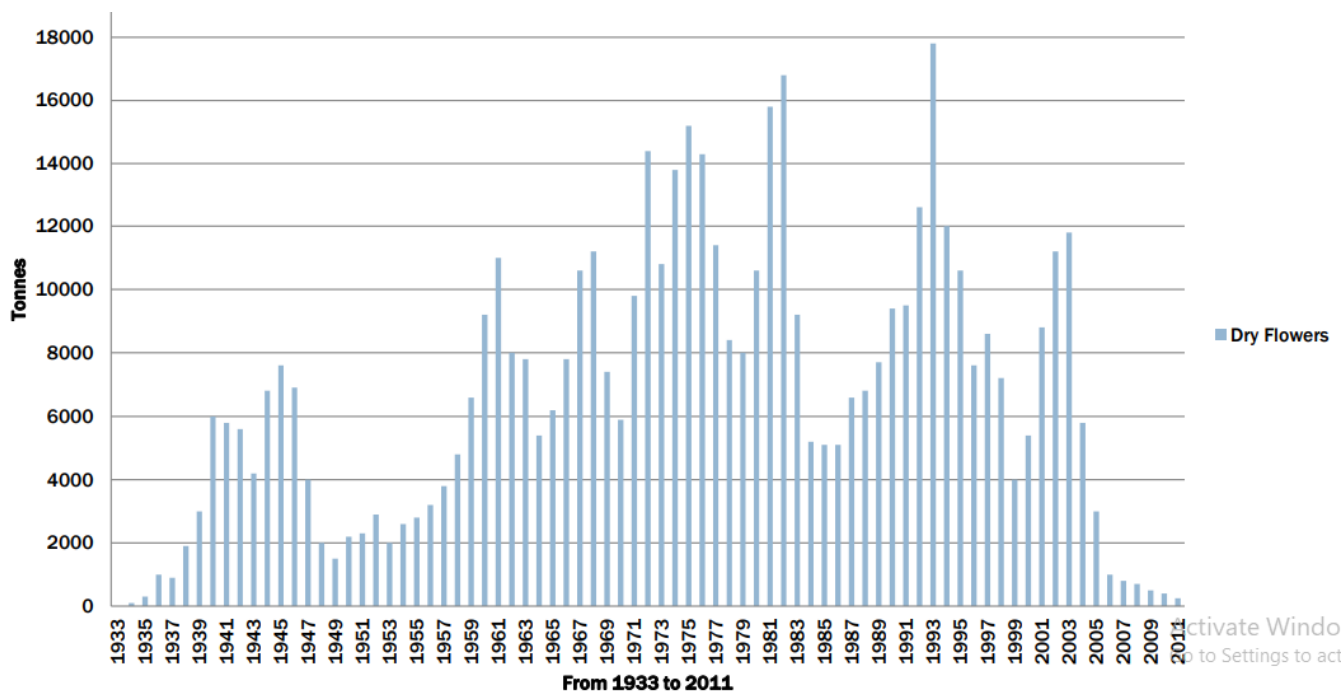
The issue of the contestation of the land between the community and the current operator of the factory – Farmers choice has over time slowed investment into the area leading to its stagnation. The local community through six representatives lodged a complaint to the National Land Commission (NLC) through the Kiambu County Government. Kiambu County in turn wrote to the NLC on 26 September 2018, requesting for the land to be reverted to the community and held in trust by the County. On 01 March 2021, the NLC ordered that the land reverts to Kiambu County through a Kenya Gazette Notice No. 1/03/2019. Farmers Choice Ltd on the other hand maintains that they own the land through a 90-year lease (Mbaria, 2020).

Decline of the pyrethrum industry

The third sector that affected the growth of Uplands was the decline of pyrethrum growing in Kenya. Uplands was among the pyrethrum growing areas like Nakuru, Nyandarua, Nyamira and Kisii. According to the Kenya National Assembly Official Record (Hansard) 28 July 2004 by 1945, Kenya was producing 60-70 per cent of the World’s pyrethrum and in 1963, pyrethrum was among the four major cash crops in Kenya (Government of Kenya, 2004). The peak of pyrethrum production was in 1993 when 18,000 tonnes were produced by over 200,000 smallholder farmers and supporting the livelihood of over two million people. The pyrethrum industry earned Kenya Ksh. 2 billion in 1996. The government was mainly exporting the raw product as dried flowers to the United States of America (USA) (Government of Kenya, 2004). However the sector declined in the late 1990s due to mismanagement of the Pyrethrum Board of Kenya (PBK), leading to delayed and lack of payment to farmers for the pyrethrum delivered. The farmers in turn stopped delivering pyrethrum to the PBK leading to the collapse of the sector. The sector also had to contend with marketing and competition from emerging pyrethrum producers, as well as the production of synthetic pyrethrum. The production of pyrethrum declined from 18,000 tonnes in 1993 to three tonnes in 1999. As a result of the decline in production, the traditional markets of Kenyan pyrethrum especially the United States were concerned about the ability of Kenya to sustain production and started venturing into the use of synthetic insecticides which were cheaper leading to decreased demand (Government of Kenya, 2004). However,

from 1999 to the year 2003, production improved from the three tonnes in 1999 to 10,930 tonnes in 2003 (see Figure 0.1), but the marketing of the product remains a concern. However, there is renewed hope for the revival of the sector following its liberalisation. On August 2018, President Uhuru Kenyatta signed an investment agreement with Kentegra Biotechnology Holdings for the firm to invest Ksh. 400 million in the production of pyrethrum. The firm among the leading private processing companies contracts over 3,000 farmers from Nakuru, Molo, Eburru, Kuresoi, Naivasha, Nyahururu and Kisii (Kamau et al., 2019; Kiereini, 2019a).

Figure 0.1: Production of pyrethrum between 1993 to 2011.



Source: (Monda, 2014)

Collapse of the Kenya Railways Corporation (KRC)

Lastly, Uplands was affected by the collapse of the Kenya Railways Corporation (KRC). The one-metre gauge Kenya to Uganda railway passed through Uplands centre making it strategically located at the junction of Nairobi to Malaba road and in close proximity to the Mai Mahiu to Kisumu road. Anderson & Anderson (2005) described the rail network in the 1950s as a source of opportunity for commercial farmers since it opened the area to other markets:

“At Uplands or Escarpment stations, its commercial farmers gained access to a wider world of market opportunities. In the fields round about, the day was regulated by the sound of the trains approaching and departing – a reminder of the passage of time, and of the proximity of a colonial economy”(Anderson & Anderson, 2005).

The strategic location of the Uplands or escarpment station as it was also referred during the colonial period next to the Aberdare forest was useful in the extraction of timber and bamboo from the forest

and transportation through the rail network during the colonial period. The Kenya to Uganda railway construction began in Mombasa in 1896, and reached Nairobi in 1899 where a railway depot and camp for the railway workers gave rise to the present City of Nairobi. The railway proceeded and reached Nakuru in 1900, Lake Victoria (Kisumu) in 1901 and Kampala in 1931. The railway facilitated the growth and exportation of cash crops like tea and coffee to Europe from Kenya and Uganda. However, the railway line deteriorated due to lacked proper maintenance and suffered neglect but continued to operate at a minimal scale. The passenger service between Nairobi Kisumu and Malaba was discontinued in the 80s, reason being that the locomotive's engines and coaches were constrained to provide both cargo and passenger service along that route. KRC also indicated that there was decreased demand for passenger transport due to alternative means of transport as per the Kenya National Assembly Official Record (Hansard) 12 Mar 1987 (Government of Kenya, 1987).

KRC maintained short distance train services between Nairobi to Kijabe but discontinued the passenger service to Uplands, Matathia and Kijabe railway stations between 1994-1995 according to Kenya National Assembly Official Record (Hansard) 29 Nov 1995 (Government of Kenya, 1995). The reason for its discontinuation was the lack of sufficient demand among the commuters. The KRC had also complained that the passengers were boarding but making no payments, which was an issue of lack of enforcement of payment by the corporation as mentioned by Mr. Gitonga during parliamentary proceedings on 29 November 1995. The assistant minister of Transport then Mr. Ahmed had indicated then that the operation of the line then was not commercially viable because between 1992 and 1993, it had only generated Ksh. 75,000 along that route (Government of Kenya, 1995).

The Kenyan and Ugandan governments made plans to revive it by giving a concession to Rift Valley Railways Consortium a South African firm in 2006. The company was supposed to operate the Kenya to Uganda railway for 25 years, but the concession was terminated by the Ugandan government in 2016 and the Kenyan government in April 2017 due to mismanagement and unmet expectations. President Uhuru Kenyatta's government initiated a new standard gauge rail line that runs almost parallel to the old line from Mombasa to Nairobi on 28 November 2013. Civil works were completed in November 2016 and the new line began passenger transit operations on 31 May 2017. The line was later extended from Nairobi to Suswa in 20 October 2016 after the President Uhuru Kenyatta announced the extension of the connection to the old one-metre gauge line from Mai Mahiu to Naivasha was launched the same year. The Nairobi to Kisumu line that was rehabilitated and re-opened on 17 December 2021.

APPENDIX V: Respondents

- 21 farmers;
- 8 milk vendors (using *boda bodas* and *matatus*;
- 4 milk parlour and ATM operators;
- 4 restaurant operators;
- 5 workers/ owners of processing factories/ industries;
- 2 labourers – farm assistants and those who cut grass in the grasslands;
- 3 veterinary doctors/ technicians/ agroveter operators;
- 2 hay suppliers;
- 1 *machicha* transporter;
- 1 officer ministry of agriculture livestock officer, Githunguri
- 6 *matatu* operators

List of people interviewed (Not their real names)

S No.	Name	Location	Age	Size of land	Mobility means	No. of cows & production	No. of labourers
Farmers							
1.	Mr. Ngure	Kanjai, Githunguri	52	1.2 acres	walking	2 heifers	-
2.	Mr. Wachira	Riuki, Githunguri	56	1 acre	double cab pickup	7 grown cows, 4 being milked, 3 heifers, 3 calves; 52 litres	1
3.	Mr. Kinyanjui	Riuki, Githunguri	47	1 acre	walking	2 Calves	-
4.	Mr. Karagu	Githunguri Town	42	1 acre	saloon car	Former milk farmer	-
5.	Mr. Kuria	Githurai, Ruiru	76	0.375 acres	pickup and bicycle	6 cows, 4 milked, 2 dry; 50-60 litres	1
6.	Mr. Maina	Ha Donga, Githunguri	76	1.2 acres	pick up	2 cows being milked, 3 dry; 5 heifers 100 Litres	1
7.	Mr. Karanja	Membley, Ruiru	53	¼ acre	station wagon	2 cows & 1 male calf; previously 5	1

						cows;16 litres	
8.	Mr. Ndirangu	Ngochi, Githunguri	54	¼ acres bought 2 additional acres	pick up and station wagon saloon	6 cows. initially had 13 cows; 100-150 litres, previously 300 litres	2 female ATM operators & 1 casual
9.	Mr. Gathumbi	Githiga, Githunguri	54	2 acres	lorry	6 milked, had 30 cows; 100-110 litres, previously 300 litres	2
10.	Mr. Kagwe	Miguta, Githunguri	47	1 acre, leases 2 acres	lorry and pick up	5 cows previously 10; 120 litres	1
11.	Mr. Ngige	Gathaithi, Githunguri	50	½ Acre and rents 2 ½ acres	pickup	19 cows – buys and sells cows; 220- 250 litres	2
12.	Mr. Karanu	Githunguri Township	37	¾ acre and rents ½ acre	pick up	15 cows and 5 heifers; 230 litres	1
13.	Mr. Mburu	Githurai, Ruiru	52	1/8 acre	pickup and saloon car	20 cows, 12 milked; 150-200 litres	3 for picking waste at the market
14.	Mr. Kariamburi	farm in Kenyatta road hotel in Ruiru town	65	¼ an acre	Pickup; milk delivered by seller by pickup	20 cows 5 milked own source 150 litres, buys 100 litres hotel – 50 litres	2 people (one in farm and 1 in hotel)
15.	Mr. Muriuki	Kambaa, Githunguri	48	2 ½ acres	pickup	4 cows and 13 heifers 50-60 litres	1

16.	Mr. Njihia	Gathanji, Githunguri	65	¼ acres (100X10 0 plot) has rented ¾ of an acre	pick up and saloon vehicle	3 cows and 2 heifers. produces 30 litres per day	1
17.	Mr. Muiruri	Githunguri town	45	1 acre	personal saloon car; hires out a lorry occasiona lly	In an initial interview – no cows. later 15 heifers	1
18.	Mr. Mwaura	Gikara village, Lari	55	1 acre	pick up	5 cows 3 being milked	-
19.	Mr. Ngare	Gikara village, Lari	60	1 acre	saloon vehicle	4 cows in total. 2 being milked and 2 are heifers	1
20.	Mr. Nderitu,	Miguta, Githunguri	48	1 acre	pick up	four cows being milked and four heifers	1
21.	Mr. Nduati, veterinary doctor (Githunguri	38	¾ acre, bought another ¾ acre and rents a ¾ acre	father's pick up	3 cows and one heifer	1
Milk processing factories							
S No.	Name	Location	Age	Size of land	Mobility means	No. of cows & producti on	No. of labourer s
22.	Mr. Kage manager, Uplands PD&F Ltd in charge of collection and farmer extension	Kagwe, Lari	38	not indicate d	62 vehicles in total	N/A	200 factory - 320 hired
23.	Chairman, Uplands PD&F Ltd	Kagwe, Lari	52	not indicate d	62 vehicles in total	100 cows; produces 3000 litres of milk	200 factory - 320 hired

24.	Mr. Ndirangu	Ngochi, Githunguri	44	not indicate d	pickup and station wagon	N/A	2 female ATM operators ; 1 Casual
25.	Mr. Kinuthia Logistics Manager, Uplands PD&F Ltd	Kagwe, Lari	35	not indicate d	62 vehicles in total	N/A	200 factory - 320 c
26.	Mr. Nyaga, in charge of collection and farmer extension Canaan Factories Ltd	Nyambari, Uplands	38	not indicate d	9 lorries	N/A	199 workers in the factory; about 100 casuals
Milk Vendors							
S No.	Name	Area of collection	Age	Extent	Means	Milk capacity	Employee es
27.	Mr. Waiganjo	Kiganjo Location, Gatundu South	55	5 kilometr e radius	motor bike and saloon car	300 litres from 30 farmers	2
28.	Mama Wangechi	Kigumo, Tiri, Gathugu, Githunguri	50	2 kilometr e radius	Uses <i>matatu</i>	60 litres from 20 farmers; 4 cows producin g 100 litres that she takes to Githungu ri dairy	1
29.	Mr. Wanyoike	Kiganjo, Gatundu South	42	4 kilometr e	Owens a motorbik e but uses <i>matatu</i> and motorbik e on Sunday	200 litres from 20 farmers	none
30.	Mama Wambui	Kigumo, Gatina, Githunguri	55	3 kilometr e	<i>Matatu</i> to Ruiru & <i>Boda</i> <i>boda</i> for collection	150 litres from 10 farmers	none
31.	Mama Wanjira	Nembu, Gatundu South	50	Farmers bring to her home	<i>Matatu</i> and <i>boda</i> <i>boda</i> to distribute	200 litres	2 casuals to drop the milk around Ruiru

32.	Mama Wambugu	Kigumo, Kiganjo, Githunguri/Gatundu south	40	10 kilometres	Husband collects with motorbike then she take <i>matatu</i>	120 litres	none
33.	Mr. Waruiru	Kwamaiko and Gathigi, Githunguri	45	Not revealed	motor bike	60 litres	Not indicated
34.	Mama Mukami	Kiambururu, Githunguri	55	N/A	<i>Matatu</i>	100 litres	1
Milk parlour and ATM operators							
S No.	Name	Area of collection	Age	Extent	Means	Milk capacity	Employees
35.	Mama Jimmy, Previous milk parlour operator, Kahawa Sukari	Kahawa Sukari, Ruiru	55	N/A	None during the time	150 litres	None
36.	Mr & Mrs Ndirangu	Githunguri and Kiambu	54 & 50	N/A	Pickup and Station wagon	150 – 170 Litres	2 female ATM Operators
37.	Mr. Kimata, Previous operator, Ruiru Prisons	Ruiru, prisons area	47	N/A	None during the time	20-25 Litres, First owner 75 litres	Own Occupation
38.	Mr. Kariamburi	Ruiru Town	65	N/A	owns a pickup; additional milk delivered by seller by pickup	own source 150 litres; 20 cows 5 milked; buys 100 litres hotel use 50 litres	2 people
Restaurant owners and tea sellers							
S No.	Name	Location	Age	Extent	Means	Milk Capacity	Employees
39.	Mr. Kimotho, operating Amani restaurant in Ruiru town.	Ruiru town	40	None at the moment	Matatu	70 litres from 5 milk vendors	9 People
40.	Mama Kamau	Ruiru – <i>matatu terminus</i>	45	N/A	Uses <i>matatu</i>	10 Litres from 2 vendors	1
41.	Mama Kimani	Ruiru – <i>matatu terminus</i>	47	N/A	Matatu	10 litres from 1 vendors	-

42.	Mr. Karanja , restaurant owner	Ruiru town	65	20 cows 5 milked	Pickup Bright by seller by pickup	Own Source 150 litres, buys 100 litres hotel uses– 50 litres	2 people
Labourers							
S No.	Name	Location	Age	Extent	Means	Milk Capacity	Employe es
43.	Jonny – grass cutter	BTL - Ruiru	33	N/A	hiking a lift/ walking	N/A	N/A
44.	Wa Teresia -grass cutter	Ruturu - Ruiru	51	N/A	Hiking a lift/ Walking	N/A	N/A
Feeds sellers							
S No.	Name	Location	Age	Extent	Means	Milk Capacity	Employe es
45.	Mama Winnie, hay supplier - Thika Rd	Thika Road - Ruiru	55	N/A	hires lorries	N/A	1
46.	Karimi wa hay - hay supplier - Thika Rd	Thika Road - Ruiru	27	N/A	hires lorries	N/A	1
47.	Mr. Mucheru , chicken waste seller	Githunguri town	65	N/A	Owens a pick up	N/A	1
48.	Mr. Kang'ethe Baraka Feeds	Githunguri town	45	N/A	Several trucks, lorries and pickup	N/A	Over 5
49.	Mr. Kibe, Amani feeds, that sells <i>machicha</i>	Dumberi, Winsor and over 15 outlets in Kiambu county	38	N/A	Several lorries and trailer trucks	N/A	Over 5
Service providers							
S No.	Name	Location	Age	Extent	Means	Milk Capacity	Employe es
50.	Mr. Kiama, Livestock Officer, Githunguri	Githunguri	46	N/A	N/A	N/A	N/A
51.	Caroline – Peak Agrovet	Githunguri	32	N/A	N/A	N/A	N/A
52.	Mr. Mwaura veterinary doctor, Githunguri	Githunguri	55	N/A	N/A	N/A	N/A

53.	Mr. Kagwe, Transporter	Miguta, Githunguri	47	1 acre, leases 2 acres	lorry and pick up	5 cows previousl y 10; 120 litres	1
54.	Mr. Nderitu, mechanic	Ruiru	48	1 acre	pick up	four cows being milked and four heifers	2 at garage; 1 at the farm
55.	Mr. Nduati, veterinary doctor	Githunguri	38	$\frac{3}{4}$ acre, bought another $\frac{3}{4}$ acre and rents a $\frac{3}{4}$ acre	father's pick up	3 cows and one heifer	1
Commuters and <i>matatu</i> operators							
S No.	Name	Location	Age	Extent	Means	Milk Capacity	Employe es
56.	Lilian administrator, GIKAKI Sacco	Githunguri town	45	N/A	N/A	N/A	N/A
57.	Mr. Kimata, Member, GIKAKI Sacco	Githunguri town	48	N/A	N/A	N/A	N/A
58.	Mr. Mwaria, NAGIRU Sacco	Ruiru town	48	N/A	N/A	N/A	N/A
59.	Mr. Njeru, NAGIRU Sacco	Ruiru town	45	N/A	N/A	N/A	N/A
60.	Nancy, NAGIRU Sacco	Kwamaiko/ Ngewa	40	N/A	N/A	N/A	N/A
61.	Wanjira, NAGIRU Sacco	Kwamaiko/ Ngewa	47	N/A	N/A	N/A	N/A
62.	Mrs. Kinuthia - teacher Kanjai secondary school	Kahawa West	48	N/A	uses a <i>matatu</i> or a taxi	N/A	N/A
63.	Mama Shiru, vegetable trader at Ruiru market	Ha Donga	52	N/A	uses a <i>matatu</i>	N/A	N/A
Total 63							