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Barriers and Adaptations to Rural-urban Mobility

A Focus of the Milk Value Chain in Peri-urban Nairobi, Kenya

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Abstract

Kenya has a per capita milk consumption of 110 liters per year, making the inhabitants the largest milk consumers in sub-Saharan Africa. The dairy sector requires functional infrastructure adapted to weather conditions, as well as affordable and easily accessible means of transport. However, only 18 percent (%) of Kenya's road network is considered to be in good condition.¹ As a result, farmers take alternative routes, reduce the number of trips, or limit their sales to the urban periphery. The daily transport of milk along the 47-kilometer urban-rural continuum in the peri-urban area north of Nairobi illustrates the reciprocal links between urban and rural areas and the dynamics of peri-urbanization. The challenges of the flow of milk along the value chain are intrinsically linked to those of mobility, which creates the connection between production, the exchange of goods and services, and consumption.

This *Ifri Study*, based on empirical data collected in Kiambu County, Kenya, between 2017 and 2021, explores how mobility — that goes beyond physical infrastructure — also faces social and political barriers. How does the use of *matatus* (mini-buses) by women milk vendors, instead of motorcycles deemed “unfeminine”, affect their mobility? How does the strict regulation of the dairy sector lead to more bribery and harassment, driving up transport costs? And how do issues of affordability lead to the exclusion of the poorest farmers? By circumventing these physical, social, and political obstacles, stakeholders in the milk value chain alter their trajectories and contribute to the transformation of peri-urban spaces. They also abandon certain routes and locations, which impacts the development of rural zones.

Thus, studying urban-rural linkages through a perishable commodity like milk provides insights into urbanization dynamics, enables the mapping of invested versus neglected spaces, and reveals adaptation strategies to overcome mobility challenges.

1. Kenya Roads Board (KRB), “Annual Public Roads Program for the Financial Year 2022-2023”, 2023.

Résumé

Un Kenyan consomme 120 litres de lait par an, ce qui fait des Kenyans les plus gros consommateurs de lait en Afrique subsaharienne. Cette consommation quotidienne nécessite des infrastructures praticables, adaptées aux conditions météorologiques, des moyens de transport peu coûteux et facilement accessibles. Or, seulement 18 % du réseau routier kenyan est considéré comme étant en bon état¹. Les agriculteurs empruntent alors d'autres itinéraires, réduisent le nombre de trajets ou restreignent la périphérie de leur vente. Le transport quotidien du lait le long du continuum urbain-rural de 47 kilomètres dans la zone périurbaine au nord de Nairobi illustre les liens réciproques entre zones urbaines et zones rurales, et les dynamiques de périurbanisation. Les enjeux du transport du lait sont intrinsèquement liés à ceux de la mobilité qui crée le lien entre la production, l'échange de biens et de services, et la consommation.

Cette *Étude de l'Ifri* qui est basée sur des données empiriques recueillies dans le comté de Kiambu, au Kenya, entre 2017 et 2021, exploite comment la mobilité, qui ne se réduit pas à des infrastructures physiques, est aussi confrontée à des obstacles sociaux et politiques. Comment l'utilisation du *matatu* (minibus) par les vendeuses de lait à la place de la moto qui « n'est pas féminine » diminue leurs ventes ? Comment la réglementation stricte du secteur laitier conduit-elle à une augmentation des pots-de-vin et du harcèlement, ce qui fait grimper les coûts de transport ? Et comment les questions d'accessibilité financière conduisent-elles à l'exclusion des agriculteurs les plus pauvres ?

En contournant ces obstacles physiques, sociaux et politiques, les acteurs de la chaîne de valeur du lait modifient leurs trajectoires et participent à la transformation de l'espace périurbain. Ils désertent aussi certaines zones, ce qui a des incidences sur le développement des zones rurales. Ainsi, l'étude de ces liens *via* une denrée périssable comme le lait facilite la compréhension des dynamiques de l'urbanisation, la cartographie des espaces investis et de ceux au contraire délaissés, ainsi que les stratégies d'adaptation aux obstacles de la mobilité.

1. Kenya Roads Board (KRB), Programme annuel des routes publiques pour l'exercice 2022-2023, 2023.

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Introduction

The Kenyan capital, Nairobi, is known for being an economic, diplomatic and international hub in East Africa. The city not only attracts international stakeholders but also dominates the national urban population: with a population of almost 4.4 million, Nairobi is home to 29.6 percent (%) of the total urban population.³ Although Kenya's urban population and commercial activities are concentrated in Nairobi city, the fast growth in demographic and socio-economic transformations in the city is closely tied to its peri-urban areas. Nairobi's influence is evident in the neighboring peri-urban counties of Kiambu, Kajiado and Machakos and sections of Makueni and Murang'a Counties, whose total urban population accounts for 17.7% of the total urban population in Kenya (see Map 1).⁴ In total, 47.3% of the urban population lives in Nairobi and its metropolitan area, and half of the fourteen major urban centers in Kenya are located within this region. Ruiru Municipality in Kiambu County, which is part of this study area, is the fourth largest urban center in terms of population (490,035 people).⁵

Nairobi's transformation and spatial expansion are linked to the daily socio-economic interactions with the peri-urban areas. In the agricultural sector, for instance, the city and its peri-urban zones influence each other mutually: on the one hand, the surrounding counties "feed" the city, and on the other hand, Nairobi progressively consumes rich agricultural land by expanding horizontally towards its outskirts.⁶ This paper looks into the relationship between urban and rural areas through the lens of the milk value chain, which creates close ties between Nairobi and its surrounding peri-urban and rural areas. The proximity to Nairobi contributes to a vibrant milk value chain by making it possible to sell raw milk⁷ collected in its adjacent counties before spoilage. The growing urban population within Nairobi and its peri-urban zone additionally create demand for the produce.

2. "2019 Kenya Population and Housing Census Analytical Report on Urbanisation", Kenya National Bureau of Statistics, Vol. IX, 2022.

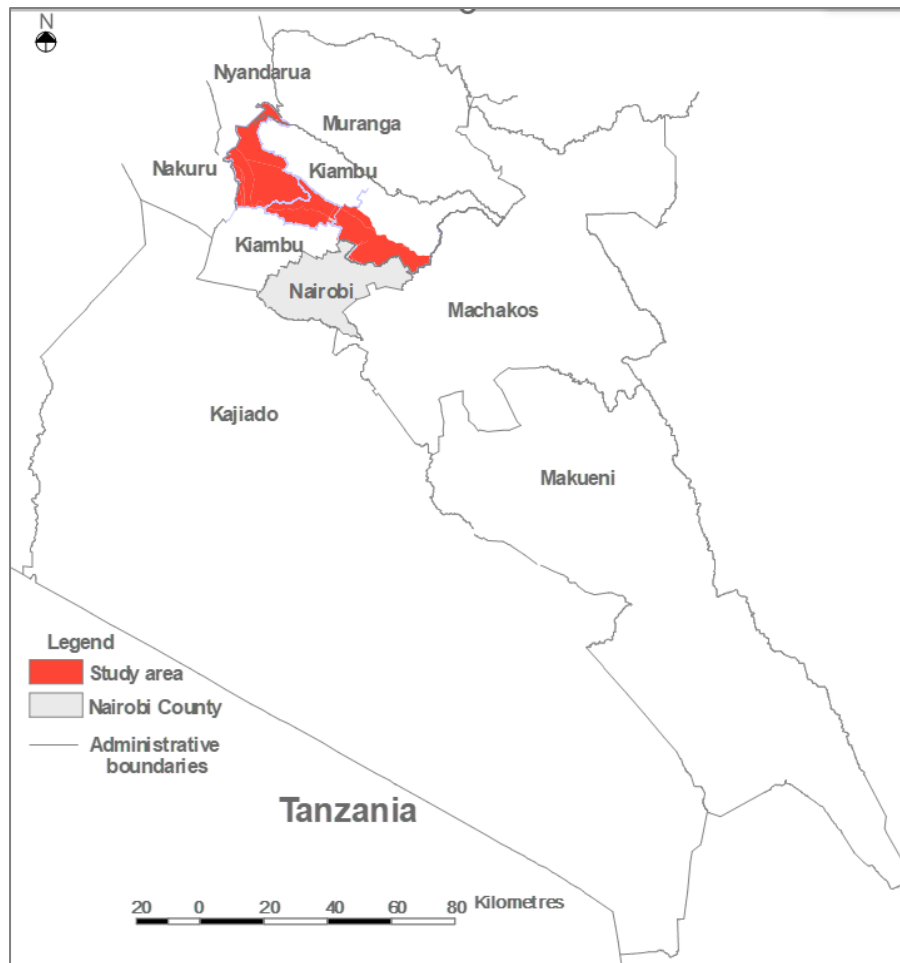
3. Ibid.

5. Ibid.

6. R. Sietchiping, J. Kago, X. Q. Zhang, C. Augustinus, and R. Tuts, "Role of Urban-rural Linkages in Promoting Sustainable Urbanization", *Environment and Urbanization ASIA*, Vol. 5, No. 2, 2014, pp. 219-234; J. Kago and R. Sietchiping "The Role of Urban-Rural Linkages in Feeding the City: A Case of Nairobi", *International Journal of Innovative Science and Research Technology*, Vol. 4, No. 10, pp. 80-97.

7. Eighty percent of the milk is sold through informal milk vendors, who sell mainly raw milk. See "Report of a Study on Assessing the Cost of Production Structures in Dairy Systems in Kenya", Tegemeo Institute, 2016.

Map 1: Map of counties in the Nairobi metropolitan area



© Jackson Kago, 2024.

Kenya, and its urban population in particular, has some of the highest milk consumption rates in sub-Saharan Africa, as highlighted in the third section of this paper. This is attributed to the high rates of urbanization and the growing middle class.⁸ Lastly, some industrial and market waste is a form of livestock feed. The resultant interactions taking place in Nairobi and its periphery lead to urban-rural linkages in the form of the flow of people, goods and services. Just like other economic sectors, the dynamism of the milk-value change relies on mobility and on the possibility for people, goods and services to circulate. Mobility plays a role in boosting the functioning of value chains by creating the link between production, the exchange of goods and services, and consumption.

Road infrastructure, in particular, is essential in enabling interaction and connectivity between rural and urban areas to boost local economic development.⁹ However, the state of road infrastructure is uneven between

8. "Sustainable Growth of the Kenyan Dairy Sector: A Quick Scan of Robustness, Reliability and Resilience", Wageningen University and Research, 2016.

9. "Connecting Systems of Secondary Cities", Cities Alliance, 2019.

urban and rural areas, with the rural areas lagging in road infrastructure. By 2018, 37% of the road network, mostly in rural areas, was considered to be in bad condition, 44% in fair condition, and only 18% of the road network was considered to be in good condition.¹⁰ It is notable that mobility between urban and rural areas goes beyond physical infrastructure and includes aspects of accessibility and socio-cultural considerations. Infrastructure that is not well integrated to ensure mobility and accessibility may not reliably improve livelihoods in rural areas. In particular, milk production, processing and distribution depend on efficient mobility because milk and fodder are perishable.

The research focuses on the peri-urban mobility between small and intermediate towns¹¹ and their surrounding rural areas. It focuses on the implications of mobility on urban-rural linkages, and especially on the motives, benefits, barriers, and challenges of mobility regarding the milk value chain: what is driving this mobility in peri-urban areas, and what does it consist of? Which mobility devices do different stakeholders of the milk value chain use, and which barriers do they encounter? To circumvent these obstacles, what are local adaptations to these mobility challenges? The research used primary and secondary data collected between 2017 -2021. The study used ethnographic techniques through direct observation and interviewing the actors while accompanying them in their daily schedules.¹² Secondary sources of data stem from international, national, and county government sources, reports, and newspapers.

The research was localized along a 47-kilometer urban-rural continuum transect in Kiambu County that includes the peri-urban area of Nairobi in Ruiru municipality and extends to Uplands village center (see Maps 2 and 3). A transect can be used to examine the geographical differences across the urban-rural continuum.¹³ The selected transect extends to the slopes of the 160-kilometer-long Aberdare Mountain Range, starting at the lowland savannah in Ruiru municipality to the edge of the forest in Uplands. It covers three sub-counties of Lari, Githunguri and Ruiru and has a diversity of geophysical and geo-climatic features from the highest point sloping towards

10. “Annual Public Roads Programme Financial Year 2022-2023”, Kenya Roads Board (KRB), 2023.

11. The Urban Areas and Cities (Amendment) Act, No. 3 of 2019, defines the minimum population sizes of various urban centers in Kenya. A city should have a minimum population of 250,000 people, a municipality of at least 50,000 people, a town of at least 10,000 people, and a market center of at least 2,000 people.

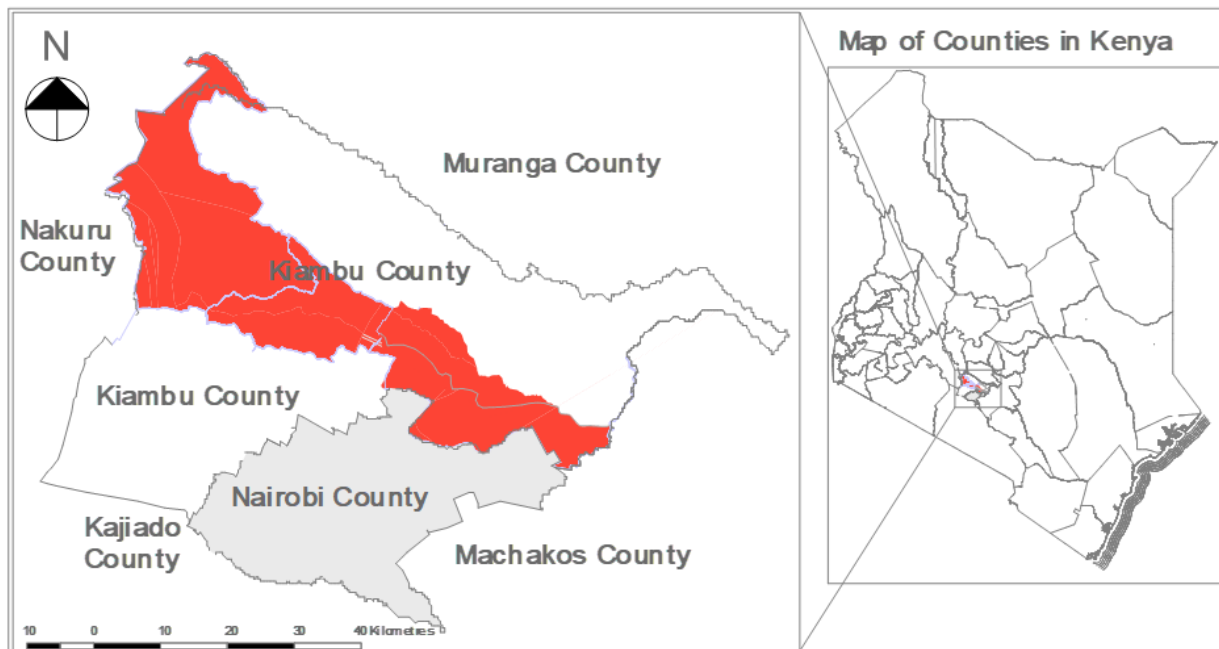
12. The respondents included farmers, laborers, agricultural veterinarians, hay suppliers, restaurant owners, *machicha* (brew waste) transporters, milk processing factory employees, *matatu* (public transport vans) operators, *boda boda* (motorbike) operators, collection points, milk bar/kiosk operators, milk vending machine operators, and civil servants.

13. S. Racaud and F. Bart indicate that through a transect, one can observe “level differences, slopes, altitudinal zonation, inclination gradients and altitudinal differences and complementarities.” S. Racaud and F. Bart, “On the Road from Mbeya to Uporoto Highlands and Lake Nyasa Lowlands (Tanzania): Mountain Transect, Rural-Urban Flows and Markets” in: F. Bart, R. B. Nakileza, S. Racaud and B. C. de La Masselière (eds.), *Rural-Urban Dynamics in the East African Mountains*, Dar es Salaam: Mkuki na Nyota, 2017.

the lower points (see Map 4). The area reflects a vibrant milk value chain stimulated by the proximity to Nairobi and its peri-urban zone and the presence of six large milk processing plants in the three sub-counties of the region. These include Brookside Dairy Ltd, the largest milk processing company in Kenya. Founded in 1993 and owned by former president Uhuru Kenyatta’s family, the company controls over 42% of the processed and marketed milk in Kenya. There is also Githunguri Dairy Farmers Cooperative Society (FCS) Ltd, which was established in 1961 and is the third-largest milk processing company. Uplands Premium Dairies & Foods Ltd and Canaan Factories Ltd were established in 2014 and 2019, respectively, while Palmhouse Dairies Ltd and Elite Dairies Ltd were founded in 1996 and 2019, respectively.

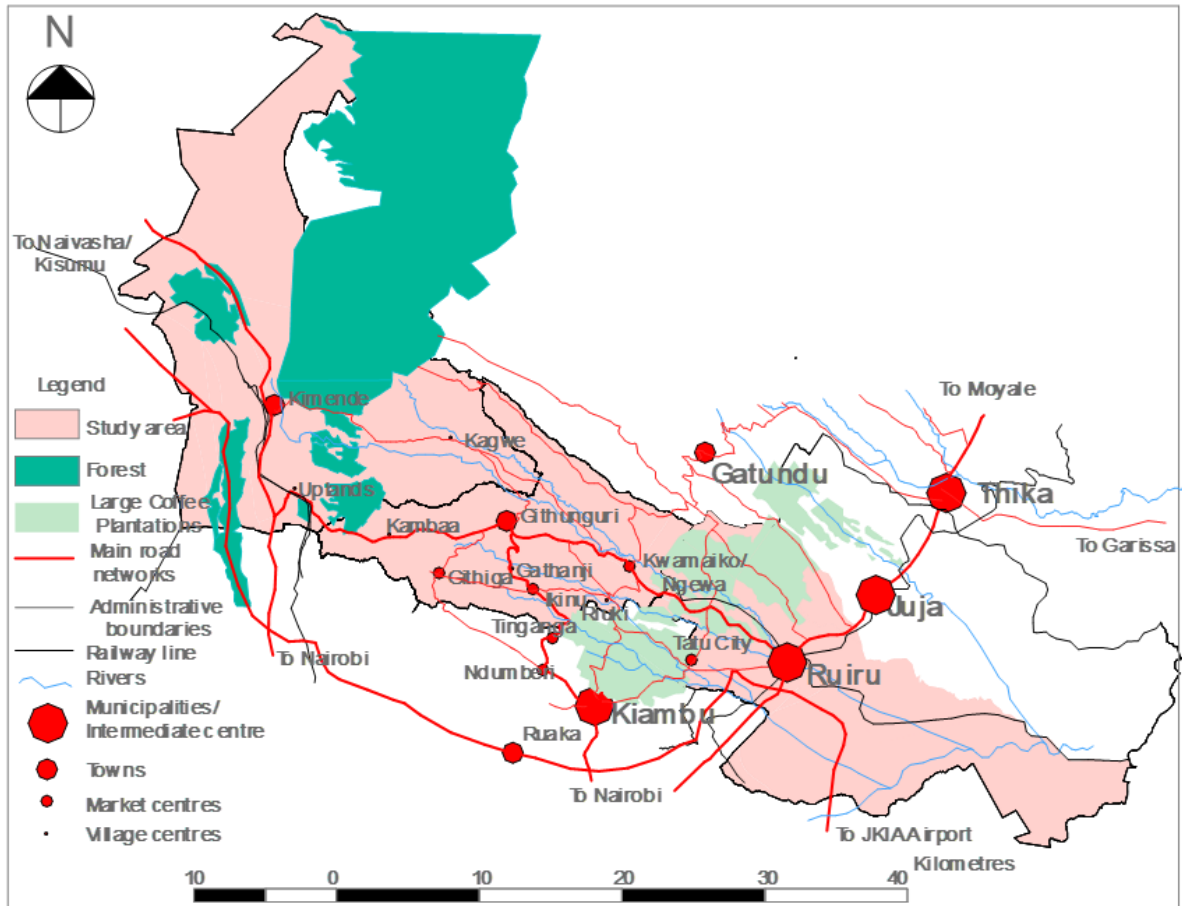
The first section of the paper discusses the concept of the rural-urban continuum and states why it is important to study these linkages to understand urbanization dynamics more generally. The second section describes peri-urbanization processes along the transect. Section three then offers an outline of the drivers of mobility in the milk value chain. The fourth section finally assesses the barriers to mobility along the transect as well as local adaptation strategies.

Map 2: Map of the counties surrounding the study area



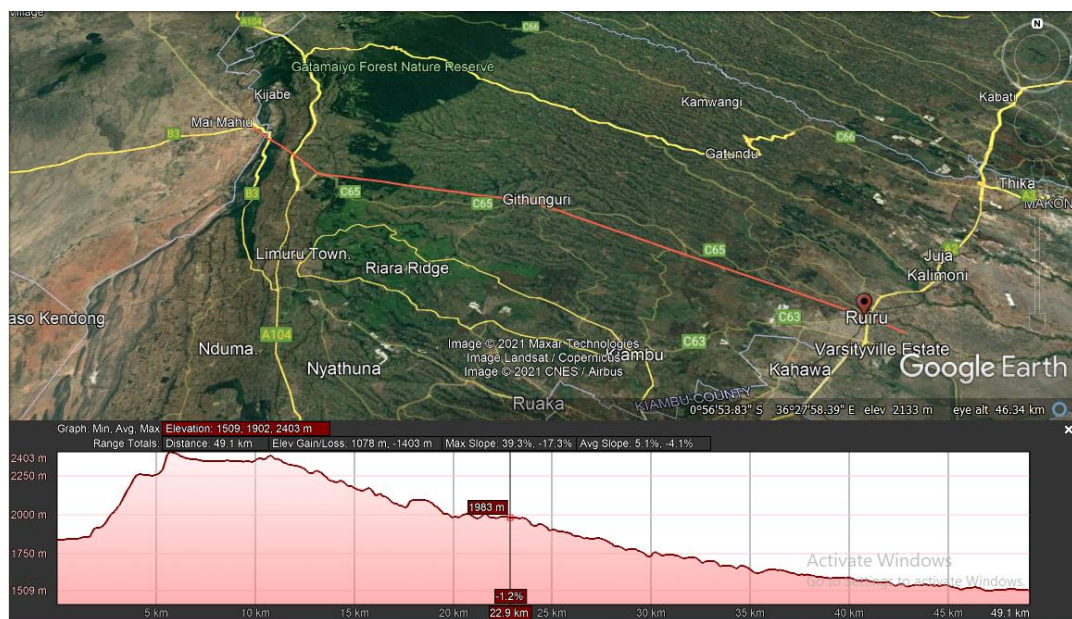
© Jackson Kago, 2022.

Map 3: Map of the study area



© Jackson Kago, 2022.

Map 4: Cross section of the urban-rural continuum transect



© Google Earth, 2021.

Understanding the urban-rural continuum

Urban and rural areas are interconnected by physical, economic, environmental, and social links, and their boundaries are blurred. They should be viewed as a continuum of settlements from rural villages to cities rather than a dichotomy. The approach of viewing urban and rural areas as two distinct spatial areas with either urban or rural features is misleading. The Food and Agriculture Organization (FAO)¹⁴ describes this dichotomy as “artificial and counter-productive”. Cresswell¹⁵ asserts that administrative borders can no longer be marked lines in plans separating territories – “borders, too, are on the move.” Similarly, the Organization for Economic Corporation and Development (OECD)¹⁶ points out that “the traditional distinction between urban and rural areas is increasingly blurred”. Urban and rural areas are, therefore, interconnected and interact with each other beyond administrative boundaries. Additionally, urban areas exhibit rural characteristics such as informal settlements whose structures are sometimes constructed using traditional materials like mud and thatch, while rural areas are experiencing rural urbanization, whereby rural areas are becoming urbanized. The social lives of people living in rural and urban areas are increasingly similar, especially owing to advancements in digital technology and communication.

The continuum of human settlements is important in the conceptualization of urban-rural linkages that are related to “spread” or “trickle-down” effects. Hirschman¹⁷ refers to these effects as the positive spillover of growth from major towns to smaller towns and rural areas. The urban-rural continuum is the spatial geographical space where the physical, economic, environmental, and social linkages and interactions take place.¹⁸ The “spread” effects stem from the interaction between economically advanced and advancing regions. They explain the interaction between

14. “Food, Agriculture and Cities Challenges of Food and Nutrition Security, Agriculture and Ecosystem Management in an Urbanizing World”, Food and Agriculture Organization, 2011, p. 16.

15. T. Cresswell, “Mobilities III: Moving on”, *Progress in Human Geography*, Vol. 38, No. 5, 2014, pp. 712-721.

16. “Rural-urban Partnerships : An Integrated Approach to Economic Development”, Organization for Economic Corporation and Development, 2013, p. 3.

17. O. A. Hirschman, *The Strategy of Economic Development*, New Haven: Yale University Press, 1958.

18. The United Nations Human Settlements Programme (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” in: “Implementing the New Urban Agenda by Strengthening Urban-rural Linkages – Leave No One And No Space Behind”, Nairobi: UN-Habitat, 2017.

unbalanced regions. François Perroux¹⁹ advanced the idea that as the core industries develop, they would, in turn, motivate the growth of the periphery industries through economic links. These are in the form of backward linkages created by the demand for inputs and services during production, forward linkages that result in the use of raw materials in other related industries and consumption linkages that result from disposable income derived from the extraction of those raw materials. These linkages drive mobility between urban and rural areas in the form of spatial flows across the urban-rural continuum, such as farm inputs, raw materials and processed goods.

19. F. Perroux, "Economic Space: Theory and Applications", *The Quarterly Journal of Economics*, Vol. 64, No. 1, 1950, pp. 89-104.

Peri-urbanization along the transect

The urban-rural continuum transect includes the peri-urban zone of Nairobi but with some differentiated transitions from Ruiru municipality that borders the city of Nairobi that is connected by C65 road to Uplands village adjacent to the forested Aberdare Mountain Range. The distinction between the peri-urban zone and the urban-rural continuum is that while both are transitional spaces, the peri-urban zone is restricted to the space between the edge of urban and rural areas where land uses overlap, while on the other hand, the urban-rural continuum encompasses areas that are completely urban or rural in the transition spectrum. Peri-urban zones are heterogeneous environments that are hard to define as they cover large areas ranging from relatively densely populated suburbs to the rural hinterland. These buffer zones are also areas where rural and urban lifestyles overlap.²⁰ They are zones of transition within the urban-rural continuum and influence urban-rural linkages because of their unique characteristics.²¹ The transition from rural to urban is that of a continuum from rural farms to rural villages, market centers, small towns, and intermediate towns to large towns. Village centers, like Uplands, exhibit certain urban characteristics, and while they cannot be categorized as market centers according to Kenyan law because their population is less than 2,000 people, they are in transition to becoming urban centers through a process of rural urbanization.

The character of the towns and market centers along the transect is shaped by their location in relation to the City of Nairobi and the underlying activities in those urban centers. Ruiru municipality has major residential, commercial and industrial activities, while Githunguri town, Ngewa, Ikinu and Githiga market centers are shaped by agricultural activities. The urban centers located further from Nairobi are more oriented towards the support of rural agricultural activities like a supply of farm inputs and veterinary services, while the towns adjacent to the city, like Ruiru, are oriented towards supporting urban activities such as retail and real estate development. Towns closer to Nairobi experience more influence from the city. Ruiru municipality is a satellite town²² that borders Nairobi, located 23 kilometers from the Nairobi central business district, and has the highest urban population in

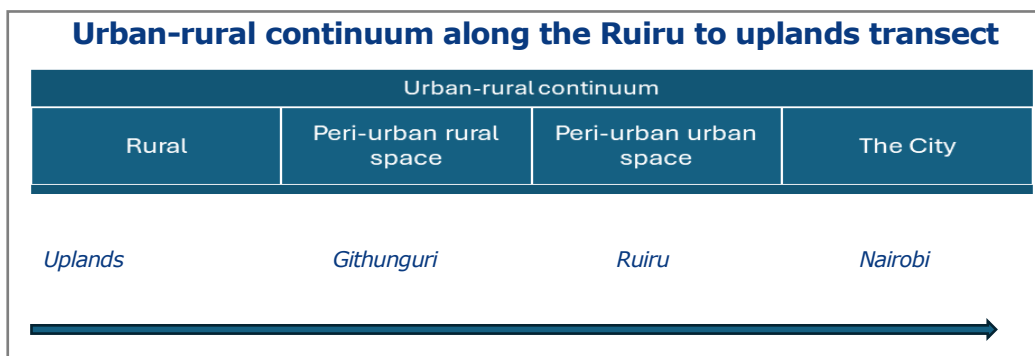
20. S. Schlimmer “Land Governance in the Outskirts of African Cities Socio-economic Challenges of Growing Peri-Urban Land Markets”, *Briefings de l’Ifri*, Ifri, July 2021.

21. R. Sietchiping, J. Kago, X. Q. Zhang, C. Augustinus, and R. Tuts, “Role of Urban-rural Linkages in Promoting Sustainable Urbanization”, op. cit.; P. Van Asperen, *Evaluation of Innovative Land Tools in Sub-Saharan Africa: Three Cases from a Peri-urban Context*, Amsterdam: IOS Press, 2014.

22. A smaller city that is located within a larger metropolitan area.

Kiambu County – 490,120 people.²³ Its growth is boosted by its proximity to Nairobi and a good transportation network through Thika Superhighway and Northern and Eastern bypasses, making it an attractive dormitory town. The growth of the peri-urban zone of Nairobi features both contiguous suburban growth around the city and linear patterns of strip development along the major ring road bypasses and radial roads leading to the city center.²⁴

This differentiated character of livelihoods and human settlements along the urban-rural continuum transect reveals a peri-urban space with predominant urban activities and a peri-urban space with predominant rural activities.²⁵ Ruiru primarily has urban activities but has sections where urban agriculture takes place in the form of poultry and livestock keeping and horticultural production, mainly in greenhouses or vacant plots of land. While agriculture is predominantly a rural activity, it at times takes place in an urban area like Ruiru town. Conversely, rural communities are also adopting urban lifestyles, undertaking activities that predominantly take place in urban areas like retail and industrial processing. This creates a sense of continuum as opposed to the structural dichotomy between urban and rural areas. While both Ruiru municipality and Githunguri town are located at the periphery of Nairobi, Ruiru municipality is adjacent to Nairobi and exhibits a stronger urban character in the peri-urban-urban space, while the peri-urban zone adjoining Githunguri town has a rural character in the peri-urban – rural space.



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Githunguri town is located about 40 kilometers from Nairobi and has a population of 10,615 people.²⁶ It is shaped by its relative proximity to the city and hosts a section of the population that works in Nairobi because of its

23. “Kenya Population and Housing Census – Volume IV: Distribution of Population by Socio-Economic Characteristics”, Kenya National Bureau of Statistics, 2019.

24. M. B. Siro and A. Sichangi, “Analysis of the Impact of New Road Infrastructure Development on Urban Sprawl and Modelling Using Remote Sensing-Thika Road Superhighway and Eastern Bypass of the Nairobi Metropolitan, Kenya”, *IOSR Journal of Environmental Science, Toxicology and Food Technology*, Vol. 11, No. 3, 2017, pp. 41-49.

25. G. Brient, 2013 as cited in: F. Bart, “Moshi (Kilimanjaro, Tanzania): The Urban Dynamics of a Rural Region” in: F. Bart, R. B. Nakileza, S. Racaud and B. C. de La Masselière (eds.), *Rural-Urban Dynamics in the East African Mountains*, op. cit.

26. “2019 Kenya Population and Housing Census – Volume II: Distribution of Population by Administrative Units”, Kenya National Bureau of Statistics, 2019.

relatively cheaper living conditions. Two roads connect Githunguri town to Nairobi, one passing through Kiambu municipality, the headquarters of Kiambu County, which is in good condition and the other link is through Ruiru municipality along the transect, which was in poor condition before its rehabilitation between 2018 and 2021. Compared to Ruiru, the transformation of Githunguri town is less influenced by Nairobi due to the longer distance to the city and its predominant agricultural activities. The location of Githunguri Dairy Farmers Cooperative Society Ltd in Githunguri town drives a process of rural industrialization and urbanization that creates convergence and divergence of activities, making Githunguri emerge as a “milk town”. The industry creates a growth pole that is more independent from Nairobi as compared to Ruiru municipality. The small town has carved a niche as an agricultural town. It started as an administrative center that grew into a small town driven by increased agricultural activities. Its economic growth is currently driven particularly by the dairy sector. Commercial activities are geared towards milk production. Shops sell animal feeds, and the town hosts several agrovet outlets (see Map 5). There are several linkages between Githunguri and surrounding market centers like Ngewa, Githiga, and Ikinu, where milk is collected and then transferred to the milk processing industry in Githunguri. These market centers also support the milk value chain through the provision of veterinary services and the sale of animal feeds. Githiga has a population of 5,565 people, Ngewa 2,452 people and Ikinu 2,532 people.²⁷ These linkages show the influence of the milk processing industry in the neighboring rural region and its positioning as a growth pole.

The OECD and Veneri²⁸ show that the extent of spread effects depends on the proximity to urban areas, and the intensity of socio-economic interaction decreases when the distance between urban and rural areas increases. In the case of the Ruiru-Uplands transect, Ruiru, which is located closer to Nairobi, has higher interaction with the city as a dormitory town and its transformation and character is influenced more by the city as compared to towns located further like Githunguri. The next section reveals how the issue of proximity to Nairobi affects the milk value chain.

27. Ibid

28. “Rural-urban Partnerships : An Integrated Approach to Economic Development”, op. cit. ; P. Veneri, “Rural-Urban Partnerships for Economic Development: Rationale, Geographies, and Governance Approaches”, *Regional Development Dialogue*, Vol. 35, 2014, pp. 162-177.

**Map 5: Dairy farming-related business activities
along Market Street in Githunguri town**



© Adapted from Google Maps, 2018.

Drivers of mobility along the transect

The proximity to Nairobi and its peri-urban zone has an influence on the milk value chain. It makes it possible to transport raw milk to the city before it spoils, usually in the morning hours,²⁹ creating a stream of informal milk vendors in urban areas who sell 80% of the marketed milk.³⁰ The rest of the milk is distributed by the milk processing industries, which are usually located in urban centers. 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 liters, which is expected to increase by 5.8% annually to 220 liters per capita consumption in 2030 driven by a traditional inclusion of milk in the diet, high rate of urbanization, a growing middle class and a potential export market.³¹ The U.S. Agency for International Development–Kenya Agricultural Value Chain Enterprises (USAID–KAVES)³² predicted that Kenya would experience an annual milk deficit of 675 million liters in 2017, which would grow to an annual deficit of 1.2 billion liters by 2022. The demand for milk in Nairobi and its peri-urban zone is conducive for the vibrant dairy farming ventures along the transect.

Beyond the high demand for milk products, mobility along the Ruiru-Uplands-transect is also driven by diminishing land sizes in the area because of population growth. Thus, small farms are not able to provide enough fodder for their livestock.³³ Farmers need to keep at least six cows to make at least a 10% profit, and the small parcels cannot sustain such a flock.³⁴ Furthermore, commercial agriculture necessitates additional farm inputs, which cannot be supported by these small parcels of land. This drives mobility to urban areas where processed animal feeds, consumable markets and industrial waste³⁵ are available. The farmers have also adopted a zero-grazing type of animal

29. Milk vendors have to ferry the milk to the urban centers within approximately six hours after milking to avoid spoilage. They also have to ferry the milk during cooler times of the day, like early morning or in the evening, to keep the milk in a good state.

30. “Report of a Study on Assessing the Cost of Production Structures in Dairy Systems in Kenya”, op. cit.

31. T. Njeru, “Kenya’s Dairy Sector Is Failing to Meet Domestic Demand. How It Can Raise Its Game”, *The Conversation*, February 13, 2022, available at: <https://theconversation.com>.

32. “Dairy Value Chain Analysis”, U.S. Agency for International Development – Kenya Agricultural Value Chain Enterprises (USAID-KAVES), 2015.

33. The average land holding in Kiambu County is 0.045 Ha (an eighth of an acre) for small-scale farms and 69.5 Ha for large farms, according to the County Government of Kiambu (“County Integrated Development Plan 2018-2022”, 2018).

34. “The Dairy Value Chain in Kenya”, TechnoServe Kenya, 2008.

35. Brew waste, locally known as machicha, is a popular feed used by farmers to feed their cattle. Farmers also use chicken waste sourced from chicken farms located in other areas beyond the transect.

husbandry whereby the cows are immobile and enclosed in a shelter while the farmer has to be mobile in search of animal feeds.

As a result of this rural-urban mobility during the sourcing of animal feeds, provision of services, and the collection and sale of milk, village centers, market centers and towns become urban nodes. Farmers commute there to source farm inputs and services and sell their produce, including raw milk. Urban centers emerge as points of convergence of the milk produced in rural areas and divergence of veterinary services, animal feeds and other farm inputs. However, the functional area of influence of these urban centers within the peri-urban zone is determined by their proximity to the rural areas. There is a limit to the distance that farmers can cover when sourcing animal feeds. Crossing the “viable distance” when commuting would lead to economic losses. Animal feeds located beyond this distance are sold through traders or middlemen who source them from other locations in bulk and sell them to the farmers in the urban centers. This “viable” travel distance to and from urban centers creates a local functional area of a town and its rural catchment area. The proximity to Nairobi and its peri-urban zone enables farmers to commute profitably within this zone, although the urban influence diminishes with distance, and consequently, the rural-urban interactions weaken as the distance increases. The proximity to the city and to Nairobi, in particular, is but one factor that stimulates mobility along the milk value chain. The next section shows other dynamics of mobility along the urban-rural continuum transect and their influence on the milk value chain and peri-urban transformation.

Dynamics of mobility along the transect

The nature of mobility along the urban-rural continuum transect is dynamic and varies depending on several factors. The research categorizes the dynamics of mobility broadly in two themes: barriers to mobility and adaptations to the barriers. Mobility is influenced by the nature of the transportation networks that determine the commuting patterns in the form of choice of routes and towns visited, making commuters travel to certain locations and abandon others. This section highlights the factors that determine commuting choices among farmers and milk vendors' and how these choices affect the milk value chain and contribute to the transformation of the peri-urban zone.

Mobility choices are influenced not only by the quality of infrastructure but also by other factors and barriers, including affordability, gender, age, culture, security, reliability, topography, institutional and governance aspects. Thus, while “hard” infrastructure in the form of roads is key to connectivity, it does not assure mobility efficiency and should be combined with aspects of ‘soft’ infrastructure.³⁶

36. “Connecting Systems of Secondary Cities”, op. cit.; B. Tjandradewi and H. B. Roberts, “Institutions and Governance in Post-Covid Recovery” in: H. B. Roberts, J. Drake, T. K. Mudadi, and P. R. Hohmann (eds.), *Secondary Cities Post Covid-19: Achieving Urban Sustainable and Regenerative Development in Emerging Economies*, New York: Routledge, 2013.

Barriers to mobility

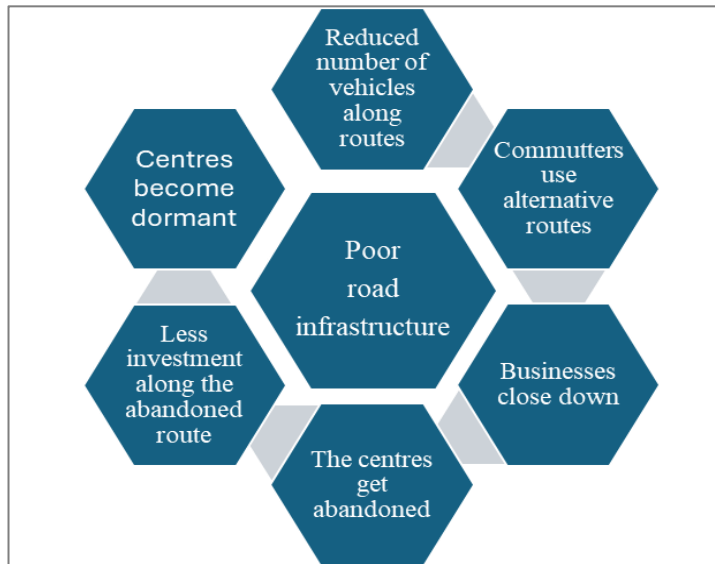
This research identified a set of barriers to mobility along the Ruiru–Uplands urban-rural continuum transect that affect the milk value chain and peri-urban transformation. These are organized into three categories, namely spatial, socio-economic and political barriers.

Spatial barriers

The poor state of roads reduces the accessibility of farm inputs, farm produce, and services and the efficiency of their flow between rural and urban areas. The poor condition of the Ruiru–Uplands road before its rehabilitation³⁷ led to a decrease in commuters along the route, as they opted for more reliable routes. “There are several routes I can use to get *machicha* (brew waste) – I prefer the road that is tarmacked”, indicated a 76-year-old farmer from Ha Donga, Githunguri. The decreasing use of the Ruiru–Uplands road affected local transport companies operating along this route: the Nagiru Savings and Credit Co-operative (Sacco) is a local transport service operating *matatu* vans³⁸ between Ruiru and Githunguri noticed the reduction of customers that led to decreased returns in the *matatu* businesses. Local transport companies had to adapt by deserting the Ruiru–Uplands road to more profitable routes such as the Githunguri–Kiambu road, which was in better condition. These changes in mobility routes affected local urban economies in that they led to a desertion of now less connected and frequented areas, such as the Kwamaiko/Ngewa market center, where the declining number of customers led local businesses to close down. The centers could no longer attract investment. Thus, road conditions affect mobility strategies, which in turn impact the rural economy, including the growth of the market and town centers (see Figure 1). This vicious cycle of “broken” infrastructure can be reversed by improving the quality of the road infrastructure.

37. The construction of the road began in June 2018 after the launch and by December 2019 the section between Ruiru municipality 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 town from where the construction stalled at the time of publishing this paper.

38. A private owned van used as a shared taxi by between 14-34 people operating along specific permitted routes.

Figure 1: The vicious cycle of “broken” infrastructure

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Similarly, dilapidated infrastructure leads to the “breakage” in linkages. “Punctured” road arteries can lead to a disconnection between locations, which was the case between the Ruiru–Uplands road between Githunguri town and Uplands village center. A section at Githiga was cut off during the rainy season, and *matatus* had to drop passengers at that section to avoid being stuck. The passengers would then walk along the muddy section to pick *matatus* at the other section of the road. This break in circulation caused a disconnection between Githunguri and Uplands village center. Consequently, people and businesses in Uplands village center had to look for goods and services that they used to get from Githunguri town in more distant cities, such as Nairobi. “The road is so muddy. We cannot use it. We resort to using other roads, making our journey to various places longer. Those roads are also not very good.” Pointed out the chairman of a motorbike/*boda boda* operators group from Uplands village.³⁹ These adaptations weakened the rural-urban links with Githunguri town. A manager at Canaan milk processing factory located in Uplands village center indicated that the company outsourced the services of mechanics and stainless steel welders from Nairobi despite these services being available in Githunguri town, which was closer. He additionally indicated that he commuted daily to the factory from Githunguri town, where he resided through Githiga, Ngorongo, and Limuru town, whose connecting road was tarmacked. This increased his travel distance by about 30 kilometers for a return trip. Thus, poor road networks directly affect the linkages along the urban-rural continuum. Cities Alliance⁴⁰ notes that the presence of hard

39. “Police Thwart Protests over Dilapidated Road in Lari”, *The Star*, February 9, 2022, available at: <https://the-star.co.ke>.

40. “Connecting Systems of Secondary Cities”, op. cit.

and soft infrastructure is essential in facilitating the flow of information, people, goods and services that eventually contribute to local economic development. As shown in the research, the nature of the transportation networks influences the growth and form of human settlements and economic development. In particular, the perishability of milk and fodder requires reliable infrastructure to facilitate its flow between rural and urban areas and vice versa. The female milk vendors, in particular, rely on the *matatus* to transport milk to urban areas.

The Ruiru–Uplands transect runs along the Aberdare Mountain Range, which is characterized by topographical features in the form of steep ridges and valleys that make the construction of roads a challenge (see Figure 2). The roads at the Northern part of the transect near Uplands are poorly maintained and difficult to navigate. The chairman of the Uplands Premium Dairy and Food Company indicated that the access road to the factory was through “a difficult terrain and a neglected road whose tarmac has worn off almost completely”. The steep topography of the area affects mobility, e.g., by causing landslides in the upper part of the transect. As a result of heavy rains in May 2020, fifty families in Matathia, Bathi, Magina, and sections of Gitithia villages in the Lari sub-county were displaced by landslides. The road connecting Kimende and Escarpment Village was also disconnected due to a mudslide, “making it impossible for pedestrians, motorists and motorcyclists to pass”.⁴¹

Figure 2: Construction of a bridge in Lari Sub-County



© Jackson Kago, 2021.

41. G. Mugo, “50 Families Displaced by Floods, Landslides in Lari”, *The Star*, May 3, 2020, available at: www.the-star.co.ke.

Dilapidated infrastructure, especially in hilly terrains, is vulnerable to the effects of weather, which directly affects the milk value chain: during the rainy season, when fodder is in plenty, muddy roads make accessibility to other farms and markets difficult, whereas, during the dry season, dusty roads affect the quality of fodder and milk.⁴² Infrastructure should be resilient to seasonal weather conditions that affect the farmers' ability to move. Earth roads are the most affected; thus, there is a 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. The cost of poor infrastructure translates to an increase in costs of production or of doing business in the form of maintenance of vehicles, delay in travel, longer distances of travel to avoid dilapidated sections (fuel costs), spillage and spoilage of milk.

Socio-economic barriers

Investment in good road infrastructure in itself does not solve the challenges of mobility. Socioeconomic barriers to mobility, including affordability, determine the extent to which communities put roads into use. While non-motorized transport is the cheapest means of transport, it entails the use of human energy. It limits the quantity of farm inputs that can be carried and the distance that can be covered in the search for animal feed's. "Without a car, dairy farming is difficult....without a car (pick up), I cannot keep cows." indicated a 56-year-old farmer from Riuki, Githunguri.

Figure 3: Hay being loaded onto a pickup truck



© Jackson Kago, 2019.

42. The direction of movement of the farmers is dynamic depending on the season and areas where fodder and processed animal feeds are available. Farmers travel more frequently and further during the dry season when fodder is in less quantity in their neighbourhood, and have to source it from other locations especially urban areas.

The distance that a farmer can travel depends on the affordability of a means of transport: farmers owning a wheelbarrow would travel a shorter distance compared to a farmer owning a motorbike or pickup. This affects the urban-rural linkages because farmers and milk vendors who cannot afford a means of transport are limited in their geographical area of operation within the peri-urban zone. In various instances, these farmers are required to hire out means of transport that they do not own, which is expensive, especially over long distances, compared to fueling their vehicles. The resultant effect of not owning a means of transportation with a bigger capacity is that the farmers have to buy goods in smaller quantities, thus making more trips and spending more on fuel. Thus, farmers who cannot afford motorized means of transport are excluded from effectively engaging in profitable dairy farming.

Men, women, and different age groups experience mobility in varying ways.⁴³ According to the study, the physical activities involved in milk production, including sourcing fodder using wheelbarrows, bicycles, motorbikes, and pick-up vans, were mainly carried out by men. In the milk value chain, women were more involved in taking milk to collection centers, running milk parlors and vending milk. Male and female vendors transport milk in strikingly different ways. During the study, no women were observed transporting milk with a motorbike or bicycle, which could be related to the difficulty of using a motorbike with a heavy load. Additionally, women riding bicycles and motorbikes are often considered ‘*Wanja Kihii*’ or Tom Boy.”⁴⁴ World Bank⁴⁵ 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.” Female milk vendors interviewed as part of this study preferred to transport milk using *matatus*. The research further reveals that women travel a shorter distance than men within this peri-urban zone, which is similar to Katothya’s findings.⁴⁶ He points 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. He noted that whereas dairy farming offered opportunities to both men and women to improve their livelihoods, their participation in the value chain has indications of gender barriers that do not favor women equally. He recommended that to improve inclusivity along the milk value chain, women be assisted in obtaining agricultural inputs, finance facilities, veterinary services, equipment, training, and access to collection centers and urban centers.

43. T. Cresswell, “Embodiment, Power and the Politics of Mobility: The Case of Female Tramps and Hobos”, *Transactions of the Institute of British Geographers*, Vol. 24, No. 2, pp. 175-192.

44. The term means a woman who picks the behavior of boys.

45. “Mainstreaming Gender in Road Transport: Operational Guidance for World Bank Staff”, World Bank, 2010, p. 23.

46. G. Katothya, “Gender Assessment of Dairy Value Chains: Evidence from Kenya”, FAO, 2017.

Political barriers

There are strict rules that govern the handling and transportation of milk, rendering most of the milk vendors to operate illegally. The Kenya Dairy Board (KDB) is mandated by section 17 of the Dairy Industry Act CAP (Chapter) 366 “to organize, regulate and develop the efficient production, marketing, distribution and supply of dairy produce.” The rules indicate that milk should be transported using aluminum containers, which the milk vendors felt were not conducive to use because they are bulky and could not fit into the matatus that they normally use (especially women’s vendors). Further, vendors’ sale of raw milk is prohibited. The milk vendors interviewed indicated that when the KDB, with support from the Kenya Police Service, conducts crackdowns⁴⁷ on the unlicensed milk vendors, the milk vendors use alternative routes to avoid arrest.⁴⁸ In 2018, the KDB developed draft regulations for the dairy industry. These regulations faced widespread criticism and resistance from social and mainstream media. Farmers and other stakeholders opposed the prohibition of the sale and consumption of raw milk at the farm level and the outlawing of the milk vendors. In the section dealing with the “conditions for the sale of raw milk,” the draft regulations indicated that farmers were only allowed to sell raw milk through milk cooperatives or other organized groups only to milk processors except those producing over 500 liters of milk. The processors were also supposed to buy raw milk only from licensed milk cooperatives or other groups with whom they were in contract. The regulations seemed to benefit milk processors by boosting the volume of milk delivered to them while decreasing competition from milk vendors in getting the raw material. The policy changes were viewed to be a form of state capture and creation of dominance by the milk processors and, in particular, Brookside Dairy Ltd, which is owned by former president Uhuru Kenyatta’s family.⁴⁹ Muyesu⁵⁰ was of the view that the extensive powers given to KDB in licensing, inspecting, and regulating the dairy sector create room for bribery and

47. A crackdown is a police operation in the form of a roadblock where offenders and non-compliant commuters are issued with Court Summons/Notification to Attend Court (NTAC) or arrested. To avoid this, commuters and transport operators resort to bribing the police, which is an added expense.

48. The fear of government officials was evident in the operations of the milk vendors, and they were reluctant to be interviewed during the research. During the fieldwork, the vendors operating motorbikes/*boda bodas* could not agree to stop when they were waved at. When I first met a milk vendor in Ruiru on December 14, 2018, and approached him for an interview showing him my staff identity and 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.

49. K. Karecha, “Milk Monopoly: Kenyatta’s Brookside Dairy Chokehold On Kenya Milk Market”, March 22, 2019, available at: <https://cnyakundi.com>; S. Muyesu, “Proposed Dairy Industry Regulations Are a euphemism for Hostile Takeover”, *The Nairobi Law Monthly*, April 2019, available at: <https://nairobiawmonthly.com>; D. Ndi, “Crony Capitalism and State Capture: The Kenyatta Family Story”, *The Elephant*, July 7, 2018, available at: <https://theelephant.info>.

50. Ibid.

harassment. Blackmore et al.⁵¹ recommends an inclusive approach to supporting the informal milk vendors in transitioning to the formalization of their businesses through training and progressive certification schemes as opposed to radical structural reforms.

Additionally, transport operators, especially those operating transport service businesses, complained of police harassment and extortion. The National Police Service Act Revised Edition 2012 gives the police powers to “stop, search and detain” vehicles in the course of their duty. In addition, the Traffic Act Cap 403 allows the police officers to enter the vehicle, drive it or ask the driver to drive the vehicle to the police station. The police demand bribes that are transmitted secretly through handshakes, slipping of money into the licenses or dropping the money on the ground.⁵² A 76-year-old farmer from Githurai, Ruiru, indicated: “There is normal police harassment along the road”, a description that shows acceptance of the practice of police harassment during commuting. The farmers own old pick-up trucks whose level of compliance is low, making them vulnerable to police harassment. “You have to be stopped by police; when they see a pickup, they know there is money.” Indicated 56-year-old farmer from Riuki, Githunguri. Bribery, in turn, increases their cost of production and limits their mobility.

The research also outlines the effects of COVID-19 on mobility and milk flow along the value chain. To effect the measures on social distancing, the seating capacity of *matatus* was reduced by 40%, and some of the *matatus* increased their fares by even 100%, raising the operational costs, especially that of milk vendors who use the *matatus* daily to deliver milk to urban areas. The closure of bars, on the other hand, disrupted the beer value chain, and EABL (East African Breweries Limited) reduced operations because the supply of beer was relegated to takeaway services in “wines and spirits” shops and supermarkets. This, in turn, reduced the supply of *machicha*, affecting the farmers who depend on it to feed their livestock. Thirty-eight-years-old distributor of *machicha* indicated that the effects of COVID-19 had significantly reduced its availability. Lastly, the Ruiru to Uplands transect was within the areas affected by the cessation of movement into the Nairobi Metropolitan Area (within the peri-urban zone of Nairobi) that was characterized by roadblocks preventing access into and out of this area. Although the farmers were allowed to pass through the roadblocks to get farm inputs, it meant that their old vehicles faced more scrutiny and harassment. The milk vendors,⁵³ on the other hand, could not use *matatus* that were not allowed to pass through, and motorbike/ *boda boda* operators had to use informal crossings referred to as “*panya*” routes (the underground tunnels that rats use.) The research also outlines the effects of police actions

51. E. Blackmore, S. Alonso, and D. Grace, “Legitimising Informal Markets: A Case Study of the Dairy Sector in Kenya”, *IIED Briefing Papers*, 2015.

52. A. Chagema, “How Police, Touts, Cartels Milk *Matatus* Dry”, *The Standard*, October 4, 2021, available at: <https://standardmedia>.

53. This has an effect especially on the women milk vendors.

and COVID-19 restrictions on disrupting mobility and flows along the milk value chain, especially as they affect farmers and informal milk vendors.

Spatial, social and political barriers to mobility can deter urban-rural linkages by limiting the flow of people and goods within the urban-rural continuum and they affect the transformation of the peri-urban zone. Stakeholders in the milk-value chain have developed responses to these barriers, still allowing for goods, people and services to flow and to maintain the rural-urban linkages.

Adaptations to barriers of mobility

Urban and rural populations develop livelihood strategies to deal with various challenges and limitations such as climate change, drought or flooding.⁵⁴ Previous studies have been conducted on the adaptation of camel milk production to the effects of climate change in Northern Kenya.⁵⁵ However, there is a research gap on the adaptation of the milk value chain to barriers of mobility. The research findings show that commuters have devised strategies to overcome barriers encountered in the course of mobility to make their commutes more efficient, reduce wastage and save on costs. These adaptations further enable mobility. The study groups them into three categories, namely: technological, optimization and political strategies.

Technological strategies

Existing literature shows that technological advancements have allowed commuters to overcome the geographical constraints of physical distance.⁵⁶ In addition, “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. The use of mobile phones for messaging, calls and payments exemplifies the use of space-shrinking technologies. M-Pesa, a mobile money transfer application developed in Kenya, is particularly useful to smallholder operators who send and receive small amounts of money.⁵⁷ Its application in financial transactions along the milk value chain shows evidence of how it has facilitated connectivity

54. K. Owusu and B. P. Obour, “Urban Flooding, Adaptation Strategies, and Resilience: Case Study of Accra, Ghana” in: W. Leal Filho (ed.), *African Handbook of Climate Change Adaptation*, Cham: Springer Nature.

55. N. S. Machan, F. J. Agwata and O. N. Ogue, “Environmental Factors Influencing the Sustenance of the Camel Milk Value Chain in Isiolo County, Northern Kenya”, *Resources*, Vol. 11, No. 3, 2022, pp. 27-41; S. A. George, “Camel Milk Production as an Adaptation to Climate Change Induced Drought in East Africa”, *Partners Universal Multidisciplinary Research Journal*, Vol. 1, No. 1, 2024, pp. 109-126.

56. M. Cahill, *Transport, Environment and Society*, Berkshire: McGraw-Hill Education, 2010; M. N. Coe, F. P. Kelly and C. W. H. Yeung, *Economic Geography: A Contemporary Introduction*, Oxford: Blackwell Publishing; D. MacKinnon and A. Cumbers, *An Introduction to Economic Geography: Globalisation, Uneven Development and Place* (2nd ed.), London: Routledge, 2011.

57. Mobile money technology has revolutionized business transactions through 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. 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. Additionally, the mobile phone acts as a mini-bank account that holds money for the users, so even those without bank accounts, users can have a way of safely keeping their money.

between rural and urban areas. Retailers receive money from their customers and send it to the bank using their mobile phones, thereby reducing the need to travel to the bank. The farmers can call a supplier of certain farm inputs, 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 necessity of commuting and saves on the cost that the farmer could have incurred to travel to the town or village center by themselves. Kiambu County, where the transect study was conducted, has a mobile phone ownership of 66% compared to the national ownership of 43.5%,⁵⁸ providing a good foundation for the application of this technology in the area.

Technology has played a role in overcoming the barriers to the perishability of milk using milk coolers, jacketed milk tankers, and pasteurization of milk. These technologies are facilitated by industries that provide value addition that enables raw materials from rural areas and processed products to be transported over longer distances strengthening the spatial flows and breaking the barriers of perishability.

“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.”⁵⁹

Modification of means of transport is another technological strategy that is used to ease mobility. The farmers have modified their wheelbarrows and handcarts to facilitate milk transportation to the collection centers (see Figure 4). Milk vendors have upgraded their motorbikes to accommodate about 50 jerry cans of milk carrying about 200 liters of milk. They have also devised a strategy to ensure that the jerry cans are labeled to enable tracing of the farmers who supply them with the milk so that in case of spoilage, they can locate the specific farmer who supplied that milk. The KDB also sensitizes the farmers to carry milk through a modified motorbike that can carry four 50-liter aluminum cans of milk, totaling about 200 liters of milk.

58. “Kenya Population and Housing Census – Volume IV: Distribution of Population by Socio-Economic Characteristics”, Kenya National Bureau of Statistics, 2019.

59. D. MacKinnon and A. Cumbers, *An Introduction to Economic Geography: Globalisation, Uneven Development and Place*, op. cit., p.3.

Figure 4: Modified wheelbarrow and motorbike



Jackson Kago, 2019.

Prolonging the life of fodder through silage processing also allows farmers to source it in bulk when it is cheaper or available in large quantities during the rainy season, convert it to silage and store it for use over longer durations. Enough storage space ensures that farmers are not adversely affected by seasonal changes in weather during the dry season when fodder availability reduces. Storage space is not only essential for farmers but also for retailers and milk processors. The higher the storage space, the less traveling is needed.

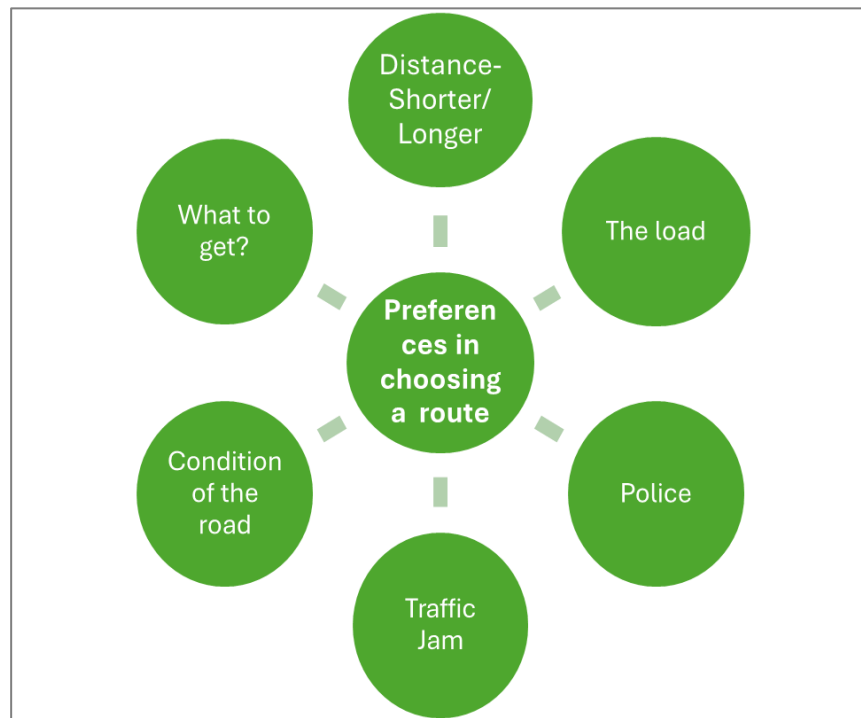
Thus, geographical mobility barriers, as well as the challenge of perishability, can be overcome through investment in technologies allowing for raw materials and processed goods from rural areas to be transported over longer distances, thereby strengthening the spatial flows and enhancing urban-rural linkages. Rural industrialization plays a critical role in overcoming the barriers due to the perishability of milk.

Optimization strategies

Commuters use strategies to make their trips efficient, reduce wastage, and save on costs to overcome social barriers to mobility. They take routes that save time and are in good condition to reduce wear and tear of the vehicles, choose the appropriate means of transportation, limit the number of trips they make, use codes to communicate, and, lastly, conceal their commutes. The choice of route is a rational decision informed by various factors. The commuters change routes to avoid certain barriers to mobility, like muddy or dusty road sections, hilly terrains, insecurity, reliability of *matatus*, and police presence, among others (see Figure 5). “I have no specific route. When the dairy board has a roadblock, I change the route”, stated a milk vendor from Kiganjo, Gatundu South. His choice of route is flexible and depends on the circumstances of that day. As discussed in the previous section, the choice of the route that

commuters collectively use has implications for the growth of towns and market centers. Fewer commuters along a certain route eventually lead to stagnation of market and urban centers along the route. These dynamics, in turn, impact the transformation of the peri-urban areas. Well-connected areas with sufficient road infrastructure experience higher rates of growth and urban sprawl. This is the case of Ruiru municipality, whose growth is not only influenced by its proximity to Nairobi but also by the connecting roads, including Thika Super Highway, Eastern Bypass and Northern Bypass, that connect it to other parts of the Nairobi metropolitan area.⁶⁰

Figure 5: Preferences in choosing a route

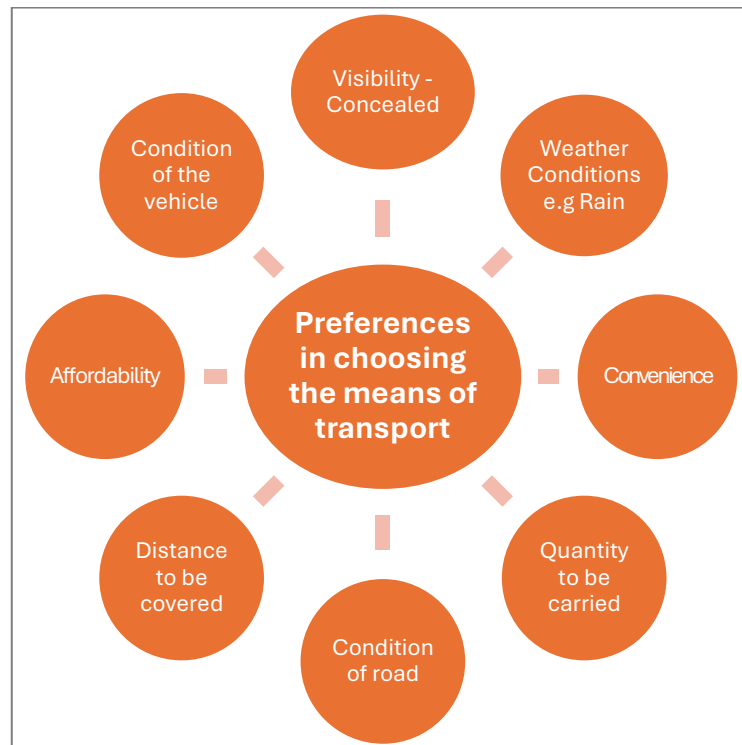


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Additionally, the choice of means of transport is motivated by different standards and expectations regarding a trip, including distance, items being transported, efficiency, comfort, image, safety, and convenience. It is also determined by the personal attributes of the individual who intends to make the trip, including income, behavior, attitude, gender, and culture (see Figure 6).

60. M. B. Siro and A. Sichangi, “Analysis of the Impact of New Road Infrastructure Development on Urban Sprawl and Modelling Using Remote Sensing-Thika Road superhighway and Eastern Bypass of the Nairobi Metropolitan, Kenya”, op. cit.

Figure 6: Preferences in choosing the means of transport



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To reduce the cost of transportation, commuters limit the number of trips they make by planning effectively for the trips. Farmers identify the amount of feeds that they require in a week or month and plan accordingly when to source them or to make combined trips to undertake certain activities together. To increase the efficiency of trips, they may cumulate different activities during a single trip along a certain route, even if not related to dairy farming.

Additionally, commuters use hidden visual messages or signs to communicate directions or messages to other commuters, allowing them to prevent them from spatial and political barriers. For instance, they can flash the headlights and wave their hand to indicate the presence of a police crackdown or roadblock ahead. 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. Through this communication, commuters can avoid routes where police are mounting a crackdown, saving the cost of bribing them and avoiding court summons.

Coded communication on roads is another strategy to facilitate mobility related to the milk economy along the urban-rural continuum. During fieldwork, I came across twigs dropped strategically on the main road connecting to the feeder road leading to a farmer’s home (see Figure 7). The twigs are used by farmers on that road to direct veterinary doctors from the

Githunguri Dairy Farmers Cooperative Society (FCS), who make a circuit around the entire Githunguri constituency every day to provide farmers with artificial insemination services. The twigs help the veterinary doctor locate farmers in need of these services and increase the efficiency in service delivery. Using twigs is a form of non-verbal or coded communication between the veterinary doctor and the farmer, which facilitates urban-rural linkages. Githunguri Dairy FCS Ltd has six veterinary technicians who are equipped with vehicles and motorbikes to travel across the sub-county to provide artificial insemination (AI) services to about 14-15 farmers per day.

Figure 7: Twigs placed on the access road to direct veterinary doctors



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Political strategies

The commuters have also devised strategies to deal with the police - they bribe or befriend them to avoid arrest and fines. As indicated in the previous section, farmers use old vans and trucks which police could identify as faulty and classify as un-roadworthy. A 76-year-old farmer indicated, “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 friendship with them. I crack jokes with them so that they let me go.” The research showed that farmers with old pickup vans considered bribing to be a normal occurrence, without which mobility would be difficult.

Additionally, due to the challenges faced during commuting and during the course of the dairy business, farmers and milk vendors work in solidarity. Groups with similar interests get together to articulate common issues that affect them. These groups range from informal gatherings between a few individuals to formal groups that are registered by the government, like self-help groups or cooperatives. At the lowest level, farmers and milk vendors associate informally among themselves. At a larger scale, the formal dairy

farmers' cooperatives rally the farmers together and get leverage on economies of scale in buying inputs, processing, and marketing of their produce. Githunguri Dairy FCS Ltd, established in 1961 with 31 members, had 26,422 members as of October 2021. It offers support in the collection, processing and distribution of milk. In addition, it supplies the farmers with processed feeds, hay, and household goods in contrast to their milk supply. It also gives loans to farmers based on the milk they produce and provides Artificial Insemination (AI) and farm extension services to its members.

The community also acts in solidarity to resist, protest, and express their anger regarding the poor condition of the roads and other issues affecting them, e.g., through physical protests and complaints raised through social media to exert pressure on government officials and elected leaders to take action. On several occasions in 2014 and 2016, residents protested about the poor condition of the Ruiru to Uplands road. Protestors symbolically 'planted' banana stalks in the potholes to signify the depth of those potholes. Residents of Kiambu County who had voted for President Uhuru Kenyatta during the 2013 and 2017 elections felt entitled to benefit from infrastructure projects in their area during his first and second term in government. This expectation of benefitting from development was strengthened by the fact that Uhuru Kenyatta is originally from Kiambu County. This position is reflected in an extract of a conversation with a market trader:

“Like here in Kiambu, what can we point and say this is what they have done for us, despite having the first and fourth president hailing from this area? We have worked hard to make sure we pay taxes and contribute to the country's GDP, but nothing has been brought our way.”⁶¹

The road project was a topic of Kenyatta's campaign agenda leading to the 2017 presidential elections. Both Uhuru Kenyatta and his then-deputy William Ruto promised to rehabilitate the road. The project was launched by William Ruto⁶² a year after the elections on June 22, 2018. Hereby, he was already seeking to gain support from the Kikuyu community for his presidential bid in 2022. The research has also revealed discontent of the local population concerning political interference and limited public participation in the selection and implementation of road projects, leading to feelings of disillusionment and exclusion. This frustration may again lead to protests by the community.

61. “Kiambu Residents Accuse Uhuru”, *DiploBrief*, May 21, 2019, available at: <https://thebrief.co.ke>.

62. William Ruto is the current President of Kenya since 2022.

Conclusion

Nairobi and its peri-urban zone are the theatres of a vibrant milk-value chain. The proximity to the capital city and the growing milk-consuming urban population are two main factors contributing to a dynamic urban-rural linkage in this economic sector, which this paper observes in the adjacent Kiambu County. Rural-urban links in the milk sector are numerous: raw milk is produced and collected in the rural areas of the peri-urban zone, transacted through milk vendors and processed by milk industries located in urban areas, where the produce is also consumed. Proximity also makes it possible for informal milk vendors to transport raw milk to the city before it spoils, usually in the morning hours. Additionally, farmers can directly source animal feeds in the urban areas in the form of market and industrial waste within an economically viable distance. The milk value chain exhibits itself in the peri-urban rural space and has contributed to shaping the territory in the village, as well as in market and urban centers. Through these urban-rural linkages, cities like Githunguri town – which is situated 38 kilometers from Nairobi – have become a “milk” town where businesses have specialized in milk production, collection, processing and distribution.

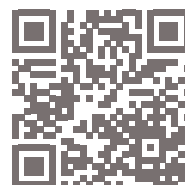
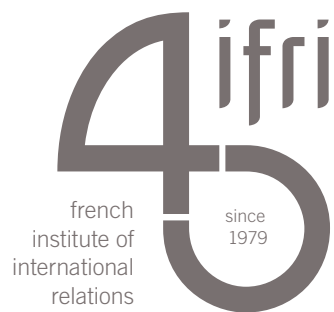
Mobility, defined as the movement of people, goods and services, is an enabler of the urban-rural linkages. This research has identified poor road conditions as one of the main barriers to mobility in the peri-urban areas of Nairobi. Other underlying factors also limit mobility throughout the milk value chain, including financial accessibility, culture, gender, topography, and governance. However, commuters develop adaptation strategies to overcome these barriers to mobility, including technological, optimization and political strategies. The application of technology has shown how geographical, perishability and mobility barriers can be overcome, enabling raw materials and processed goods from rural areas to be transported over longer distances, strengthening spatial flows and enhancing urban-rural linkages within and beyond regions.

The research shows that the barriers associated with certain routes lead commuters along the milk value chain to adapt by choosing different routes and urban destinations for their activities. These adaptation strategies can directly influence the spatial shape, the socio-economic development and ultimately the demographic evolution of urban areas. This is an indication that mobility along the urban-rural continuum is not linear but subject to a range of factors that influence the decision of a commuter to use a certain route. These choices collectively have an impact on the transformation of peri-urban areas as certain urban centers become popular destinations while some experience decline and stagnation. In this research, the Ngewa/

Kwamaiko market center along the Ruiru to Uplands transect experienced stagnation due to disjointed connectivity and severed links between urban and rural areas.

Lastly, the research shows urban-rural linkages that transcend administrative boundaries including peri-urban zones across the urban-rural continuum. This broad geographical context provides an opportunity to understand the functioning of agricultural value chains and flows of people, goods and services. This is useful in providing solutions to make the value chains robust and create functional and integrated territories.

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