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Pastoralism reorganised: Maasai resilience and governance in the shadow of mega-infrastructure in Tanzania

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ABSTRACT

Mega-infrastructure projects are widely promoted as engines of modernisation in Africa, yet their implications for pastoralist societies remain contested. This article examines how Tanzania's Standard Gauge Railway (SGR) has reshaped livelihoods, governance, and spatial practices among the Ilparakuyo Maasai in Kilosa District. Using interviews, focus group discussions, and field observations, the study draws on Lefebvre's notion of the production of space and resilience theory to analyze community responses. The findings show that the SGR has not displaced pastoralists but reorganised their practices through adaptation rather than transformation. Stations and adjacent settlements became economic hubs appropriated by women traders and youth entrepreneurs, with profits often reinvested in livestock, reinforcing pastoral continuity. Resilience emerged through livelihood diversification, though unevenly distributed across households. Governance appeared as a contested arena, where elders mediated disputes, women pressed for inclusion, and state regulations reshaped authority. The study argues that the SGR generates hybrid socio-spatial realities in which pastoralists assert agency, reorganise livelihoods, and renegotiate authority. By moving beyond binary narratives of disruption versus modernisation, it extends debates on infrastructure, resilience, and governance in African rangelands.

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1. Introduction

Mega infrastructure projects such as Standard Gauge Railway (SGR), dams and transport corridors are increasingly positioned as symbols of progress in Africa, promoted as engines of modernisation, economic growth and regional integration (Nori & Scoones, 2023; Owusu-Manu et al., 2019). These infrastructure ambitions are also embedded in continental development frameworks, particularly Agenda 2063, which frames transport corridors as catalysts for regional integration, mobility, and inclusive socio-economic transformation across Africa (African Union, 2015; United Nations, 2015). Yet, while often celebrated as transformative, these projects are also conceived as disruptive, reshaping livelihoods, fragmenting mobility and reconfiguring governance arrangements across rangeland societies (Bergius et al., 2020; Ojijja et al., 2024). Understanding their impacts requires moving beyond dichotomies of 'benefit' versus 'disruption' to ask how communities themselves experience, negotiate and reshape infrastructural change. Recent scholarship on development corridors further emphasises that such projects are shaped not only by physical investments, but also by powerful imaginaries of progress and future-making that often diverge from lived local realities (Gannon et al., 2020).

This article examines Tanzania's Standard Gauge Railway (SGR), a flagship of the national Vision 2025 agenda, which cuts across pastoralist territories in Kilosa District. For the Ilparakuyo Maasai, a pastoralist subgroup of the Maasai predominantly engaged in livestock-based livelihoods in central Tanzania, the SGR has not resulted in outright displacement. Instead, it has transformed spatial practices, governance arrangements and livelihood strategies. New market hubs, wage opportunities and service economies

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have emerged, even as mobility and grazing flexibility have been constrained. The central argument advanced here is that the SGR reconfigures Ilparakuyo Maasai livelihoods not through displacement but through livelihood reorganisation. Far from being passive victims, households and leaders navigate shifting spaces of governance and opportunity, turning infrastructural change into pathways of resilience and reassertion.

In advancing this claim, the study contributes to three strands of debate. First, it adds empirical depth to discussions of resilience as reorganisation rather than collapse (Akall, 2021; Devereux, 2001; Folke et al., 2010), showing how wage work and small trade are reinvested into pastoral continuity. Second, it extends theorizations of infrastructure and space by illustrating how SGR stations are actively reframed as ‘lived spaces’ of aspiration and resilience (Schwarze, 2023), rather than passively endured. Third, it enriches governance debates by tracing how authority becomes hybrid and contested, negotiated among state agents, customary leaders, and everyday acts of resistance (Bergius et al., 2020; Enns & Bersaglio, 2020). These dynamics are echoed in studies of infrastructure impacts on pastoralists across East Africa, including Kenya’s LAPSET corridor (Owino, 2019) and highway expansions in Ethiopia (Bekele, 2022), where diversification and contested governance similarly characterise local responses.

The paper is structured as follows. Section 2 provides a theoretical reviews on infrastructure, pastoralism, and resilience, and outlines the conceptual framing that combines Lefebvre’s production of space with resilience theory. Section 3 presents the study area, methodology, and data sources. Section 4 analyses the findings on livelihood diversification, market transformation, and governance contestations. Section 5 discusses these results in relation to wider debates on resilience, infrastructure, and pastoralist adaptation. Section 6 concludes with implications for policy and future research.

2. Theoretical framework

Mega-infrastructure projects reshape spatial organisation, governance systems, and livelihood strategies in ways that demand a multi-theoretical approach. This article draws on two complementary lenses: Lefebvre’s concept of the production of space, as elaborated by Zieleniec (2018) and Schwarze (2023), and the resilience theory (Folke et al., 2010). Together, these perspectives illuminate how Tanzania’s Standard Gauge Railway (SGR) reconfigures land use, authority, and adaptation among the Ilparakuyo Maasai.

2.1. Space and governance: the production of space

Lefebvre, as discussed by Schwarze (2023), conceptualises space as socially produced, comprising three interconnected dimensions: Perceived space which refers to the physical material environment (e.g. grazing lands, water points, railway tracks); the conceived space which refers to the planned, designed, and regulated space (e.g. state blueprints of the SGR corridor, zoning policy and laws, fencing); and lived space which refers to the everyday, experienced space where meanings are made, practices unfold, and resistance or adaptation occurs (e.g. markets at SGR stations, re-routed cattle paths, women’s trading spaces). Building on this perspective, Zieleniec (2018) highlights that the production of space is inherently political, shaped by planning practices, power relations, and struggles over how space is governed and lived.

In the context of the SGR, these three spatial dimensions interact dynamically. The *perceived space* of pastoral rangelands is materially altered by railway fences and construction. The *conceived space* is imposed through state-led infrastructure planning and zoning laws that restrict mobility and reorder land use. However, it is in the *lived space* that pastoralist agency becomes most visible: here, the SGR corridor is actively reinterpreted, repurposed, and negotiated. This study applies Lefebvre’s triad not as a rigid framework but as a lens to trace how Maasai pastoralists produce new spatial meanings and practices in response to infrastructural imposition.

In Kilosa, the SGR was conceived by the state as a corridor of modernisation and control, but it was actively reinterpreted and appropriated by pastoralists as lived spaces of opportunity, negotiation, and continuity. For example, *perceived space* changed as grazing routes were fragmented by railway fences; *Conceived space* was imposed through state regulations restricting mobility; *Lived space* emerged as pastoralists created new market hubs near stations, used motorcycle transport to connect villages, and

reinvested cash earnings into livestock, thus re-spatialising pastoralism within the infrastructure's shadow. These dynamics resonate with studies showing how infrastructure corridors in East Africa become hybrid arenas of authority and exchange (Enns & Bersaglio, 2020; Gebeyehu & Abbink, 2022). Rather than functioning solely as instruments of state control, such spaces are continually contested and negotiated between state visions and local practices.

2.2. *Adaptation and change: resilience theory*

Resilience theory conceptualises resilience as the capacity of social ecological systems to absorb shocks, reorganise, and retain core identity and function (Folke et al., 2010). In Kilosa, pastoralists reorganised their livelihoods around new economic activities such as food vending, motorcycle transport and wage labour, while consistently reinvesting profits into livestock, thus reaffirming pastoralism's central role. This aligns with findings across African rangelands where diversification is a core resilience strategy under conditions of climate variability and infrastructural change (Herrero et al., 2010). However, resilience is unevenly distributed. Households closer to SGR stations or with access to capital and social networks adapted more successfully, while those farther away or with fewer resources faced marginalisation. This differentiated resilience reflects the stratified nature of adaptation (Kaiser & Barstow, 2022) and will be examined through the lenses of gender, age, and proximity in the findings.

2.2.1. *Resilience as reorganisation in pastoralist contexts*

Resilience theory, when applied to pastoralist systems, moves beyond mere persistence to encompass *adaptive reorganisation* the capacity to transform livelihoods while retaining core functions (Folke et al., 2010). In African rangelands, pastoralists have long employed diversification as a buffer against climatic and political shocks (Akall, 2021; Devereux, 2001). The SGR represents a new kind of shock infrastructural that disrupts mobility and access to grazing lands, yet also creates nodes of economic opportunity. This study examines how Ilparakuyo Maasai reorganise their livelihoods around these new nodes without abandoning pastoralism, thus embodying what scholars term '*resilience through diversification*' (Herrero et al., 2010). This study distinguishes between adaptation incremental adjustments that preserve pastoralism and transformation, a systemic shift away from it.

2.2.2. *Differentiated resilience and structural inequality*

Not all households adapt equally. Resilience is mediated by *proximity* to infrastructure, *gender*, *age*, *wealth*, and *social networks* (Kaiser & Barstow, 2022). Households near SGR stations may leverage wage labour and trade, while remote herders face intensified vulnerability due to fragmented grazing routes. Similarly, women may gain economic autonomy through station-based trade yet remain excluded from formal governance. This *differentiated resilience* aligns with critical scholarship that cautions against romanticising local adaptability without acknowledging embedded structural inequalities (Scoones, 2023). By applying this lens, the study traces how the SGR redistributes vulnerability and opportunity across the Ilparakuyo Maasai community.

2.3. *Bridging space, resilience and governance*

By combining these frameworks, the analysis underscores that mega-infrastructure projects are not merely technical interventions but processes that reorganise space, authority, and livelihoods. The production of space lens foregrounds how state planning collides with and is reworked by pastoralist practices, while resilience theory highlights how communities adapt through diversification though unevenly. Comparable studies on transport corridors and dams across East Africa reveal similar patterns of opportunity and exclusion (Changwony et al., 2022; Kioko & Changwony, 2025), with pastoralists navigating territorial restructuring and anticipatory economies in the face of infrastructural expansion (Greiner, 2016). This study contributes by demonstrating that in Kilosa, the SGR did not simply displace pastoralists but compelled them to negotiate new governance arrangements and construct adaptive strategies, situating them as active agents in reshaping their futures.

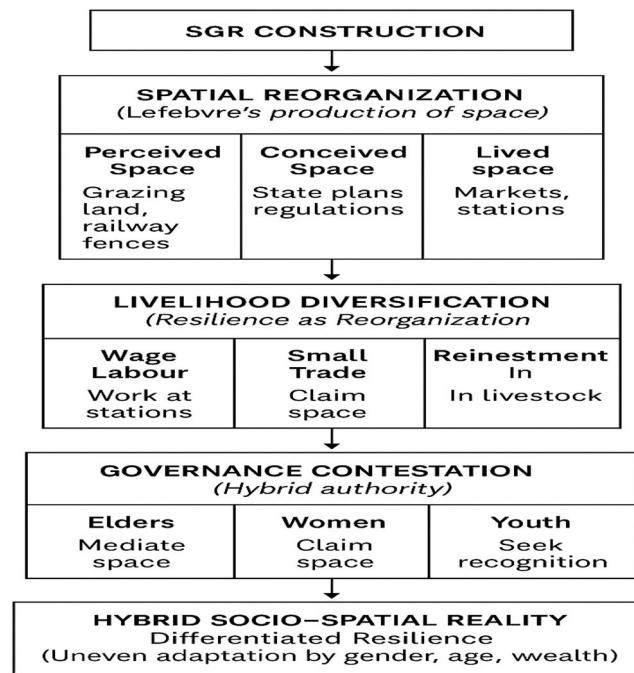


Figure 1. Conceptual mode of SGR-induced reorganization of pastoralist space, livelihoods, and governance. *Source:* Authors' own conceptualization, integrating Lefebvre's production of space (Schwarze, 2023) and resilience theory (Folke et al., 2010), informed by empirical data from Kilosa District (2023).

The model (Figure 1) illustrates how the Standard Gauge Railway (SGR) triggers spatial reorganization (perceived, conceived, and lived spaces), livelihood diversification (wage labour, trade, reinvestment), governance contestation (elders, women, youth), and ultimately produces a hybrid socio-spatial reality characterized by differentiated resilience

3. Context and methodology

This study was conducted in Kilosa District, Tanzania, where pastoralism remains central to Ilparakuyo Maasai livelihoods and cultural identity. Everyday life is anchored in herd mobility, communal grazing and livestock-based economies, yet these practices face growing pressures from land fragmentation, recurrent droughts and competing land uses (Benjaminsen et al., 2009; Bergius et al., 2020; Nori & Scoones, 2023). Similar to findings from Central Asia, where untested orthodoxies of degradation and privatisation have obscured pastoralists' adaptive capacity (Kerven et al., 2012), these pressures in Kilosa highlight the risks of oversimplifying pastoral resilience. The arrival of the Standard Gauge Railway (SGR) has further intensified these dynamics, reshaping grazing routes, altering land tenure and generating new economic spaces around stations and settlements (Gannon et al., 2020). These changes created both opportunities through trade and wage work and governance dilemmas around adaptation, participation and equity. The study area is shown in Figure 2, which maps the SGR corridor through Kilosa District and indicates key pastoralist settlements in Parakuyo and Twatwatwa.

This article is derived from the first author's Master of Public Administration thesis (Mzumbe University), on the effects of the Standard Gauge Railway on land use and livelihood sustainability among Ilparakuyo Maasai in Kilosa District, Tanzania conducted between October 2022 and December 2024 in Parakuyo and Twatwatwa.

3.1. Research design and setting

This study employed a qualitative case study design (Yin, 2018) to explore how the Standard Gauge railway (SGR) has reshaped livelihoods, governance, and spatial practices among the Ilparakuyo Maasai in Kilosa District, Tanzania. This approach aligns with contemporary qualitative research guidance that emphasises

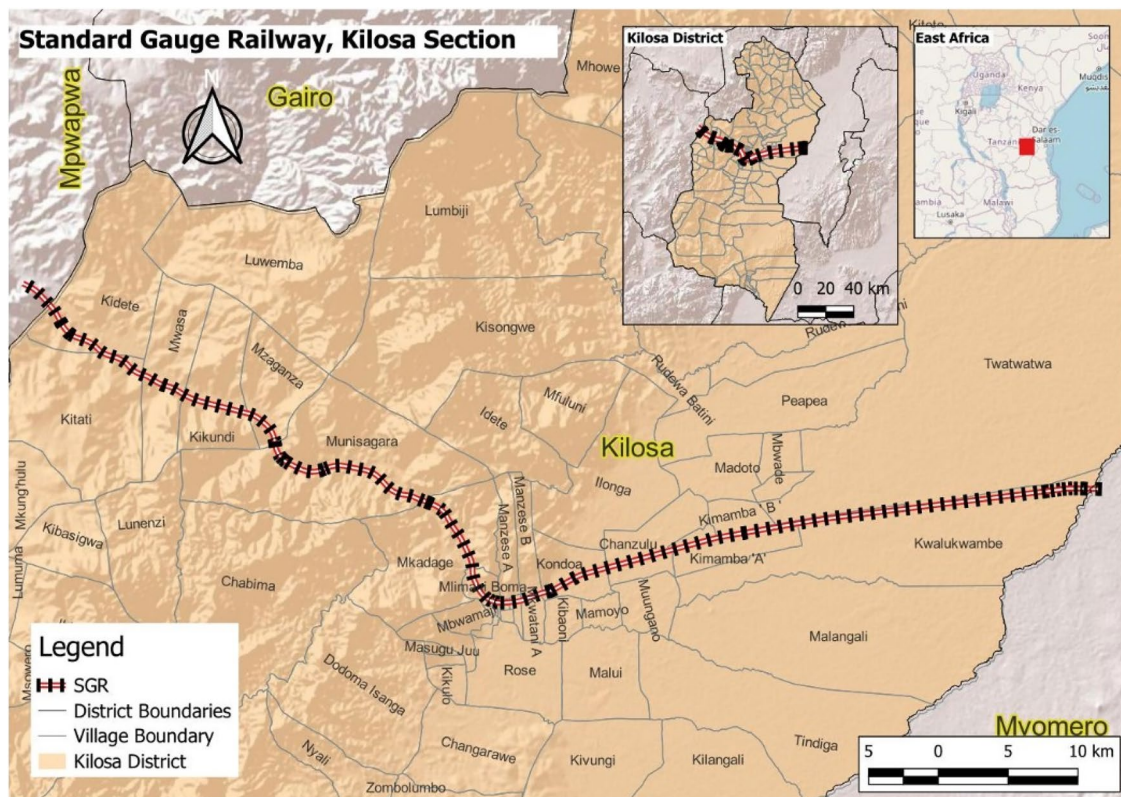


Figure 2. Map of the study area in Kilosa District, Tanzania showing the SGR corridor and key pastoralist settlements.

contextual depth, reflexivity, and interpretive richness when studying complex social processes in real-world settings (Savin-Baden & Major, 2023). The design was supplemented by descriptive quantitative elements (e.g. tallies of frequently mentioned themes) to provide breadth and contextual depth, following a mixed-methods logic articulated by Creswell and Clark (2023). The research was undertaken between October 2022 and December 2024 in Parakuyo and Twatwatwa villages and adjacent SGR station markets.

3.2. Participant recruitment and sampling

Participants were selected using a combination of purposive and snowball sampling (Palinkas et al., 2015). Initial contacts were made through local leaders and SGR station managers to identify key informants. Snowball sampling helped reach women traders, youth engaged in wage work, and elders involved in dispute resolution. Deliberate efforts were made to ensure diversity across gender, age, economic status, and proximity to the SGR corridor (see Table 1 for participant demographics). While this approach enabled rich, contextually grounded insights, we acknowledge potential biases, such as over-representation of households closer to stations and under-representation of more isolated herders. These limitations are considered in the interpretation of findings.

Of the 24 interviewees, 18 (75%) reported engaging in SGR-related wage labour or trade. Among FGD participants, all women ($n=5$) and youth ($n=5$) described livelihood diversification, while only 3 of 6 men in the men's FGD highlighted new economic opportunities suggesting gendered and generational differences in adaptation narratives. Proximity to stations strongly shaped engagement: 90% of participants living within 5 km of a station had diversified livelihoods, compared to 40% of those farther away.

3.3. Data collection methods

3.3.1. Interviews, focus group discussions and observation

Data were collected in 2023 through 24 semi-structured interviews (each taking approximately 30–60 minutes) with elders, women, traders, youth, and local leaders; three (3) focus group discussions (FGDs)

Table 1. Characteristics of study participants (N=40).

Category	Number	Gender (Male-M/Female -F)	Approximate age range	Primary role/occupation	Location (village/station)
Individual Interviews	24	M: 12, F: 12	20–65+	Elders, women traders, youth, leaders	Parakuyo, Twatwatwa, Mkata SGR station
Focus Group–Men	6	M: 6	25–60	Herders, wage workers, elders	Parakuyo
Focus Group–Women	5	F: 5	20–50	Traders, milk sellers, mothers	Twatwatwa, station market
Focus Group–Youth	5	M: 3, F: 2	18–30	Motorcycle riders, guards, small traders	Mkata SGR station, Parakuyo
Total	40	M: 21, F: 19	18–65+		

Source: Field data (2023).

Note. Recruitment via purposive and snowball sampling; all participants ≥ 18 years; roles are overlapping (e.g. elders also herders).

separately with men (n=6), women (n=5), and youth (n=5) to capture collective perspectives and gendered dynamics; participant observation at SGR stations, village markets, and grazing routes, recorded through reflexive fieldnotes. Interviews and FGDs were conducted in Kiswahili and Maa, transcribed verbatim, and translated into English. All participants provided informed consent (written or thumbprint with a witness).

3.3.2. Linking methods to findings

Each method contributed distinct insights: Interviews revealed individual adaptive strategies and intra-household decision-making; FGDs highlighted collective norms, gender dynamics, and intergenerational tensions; and participant observation contextualized spatial practices and unspoken governance negotiations (e.g. how elders mediated access to grazing near SGR fences).

3.4. Data analysis

Data were analysed using reflexive thematic analysis following Braun and Clarke (2006, 2021, 2022, 2023), involving familiarisation with the data, inductive coding, iterative theme development, and reflexive interpretation. This involved: Familiarization with transcripts and fieldnotes; Inductive coding to identify initial patterns; Theme development through iterative categorization and refinement; as well as integration of descriptive tallies to note the frequency of key concerns (e.g. land fragmentation vs. compensation grievances). Thematic findings were then interpreted through Lefebvre's production of space (Schwarze, 2023) and resilience theory (Folke et al., 2010), allowing us to link local narratives to broader theoretical debates on infrastructure, governance and adaptation.

3.5. Ethical considerations

This study was conducted in accordance with the ethical principles outlined in the Belmont Report and the International Committee of Medical Journal Editors (ICMJE) guidelines. All participants were adults (≥ 18 years). Prior to interviews and focus group discussions, participants provided informed consent (written; or thumbprint with an impartial witness for low-literacy participants), including consent to audio-record and to use anonymised quotations. Pseudonyms were used, and data were de-identified and stored securely to protect confidentiality. Similarly, administrative permissions were also obtained from local authorities. This study received ethical approval from the Directorate of Research, Publication and Postgraduate Studies (DRPS), Mzumbe University (approval number MUDRPS/R&P/4/VOL2/65). The research adhered to the ethical standards of the Belmont Report and ICMJE guidelines, ensuring respect for persons, beneficence, and justice. All participants provided informed consent, and data were anonymised and stored securely.

4. Findings

4.1. Livelihood diversification as resilience

The establishment of the Standard Gauge Railway (SGR) did not mark an end to pastoralism, but rather a reorganisation of livelihoods a theme that emerged consistently across interviews and FGDs. Households

turned to wage labour, market trade, and services around SGR stations, not as a departure from herding but as strategies to sustain and expand their herds. In resilience terms, these shifts represent adaptive reorganisation (Folke et al., 2010), where disruption is absorbed and reworked back into the pastoralist core, livestock. Similar patterns have been observed across pastoral communities adapting to development interventions (Akall, 2021; Devereux, 2001).

A young man in Parakuyo described this transition:

'When the SGR started, we thought we would lose everything. Cattle could not move as before, and we feared grazing land would finish. But then we saw another side. At the station people needed guards, riders, and other services. I first worked small jobs at the station and eventually saved enough to buy a motorbike. Now I ferry passengers between the station and the village. Each day I earn enough to buy food, to buy medicine for my cows, sometimes even to buy calves. So this work is not outside pastoralism, it is part of it. The SGR gave us a way to strengthen the kraal, not abandon it.' (FGD, Youth, 2023)

Women also extended their income strategies, blending traditional milk trade with new market opportunities:

'Before the train project, I used to sell milk in the village. When the SGR workers came, many passed hungry. I began with one pot of beans, then rice, now sometimes I cook for twenty people in a night. The profit is small, but steady. With this money I joined a women's savings group. Last month I borrowed and bought a goat; next year I hope for a cow. The train brought us customers, but also courage, we learned we can do more than before.' (Interview, Woman trader, 2023)

Elders, interviewed in key informant discussions, anchored these changes within the ethic of pastoral continuity, while also casting their gaze forward:

'A Maasai without cattle is not a Maasai. These small jobs, the selling of food, the riding of motorbikes, and guarding the SGR network, they are useful only because they bring back cows and goats. Our children work at the station, but their earnings return to the kraal. That is how we know we are still herders. Yet the future is uncertain. If the train construction expanded by taking more land, our herds may shrink. But if our children keep investing their income into cattle, then the kraal will remain strong.' (KII, Elder, 2023)

These voices show that livelihood diversification is not a departure from pastoralism but an extension of it. Wage work and petty trade around the SGR were consistently channelled back into livestock and household continuity, demonstrating resilience as reorganisation rather than collapse (Akall, 2021; Devereux, 2001).

4.2. Markets and stations as new social spaces

Beyond diversification, the SGR generated new arenas of interaction, aspiration, and exchange. Stations quickly became focal points where everyday practices of trade, savings, and mobility redefined what Lefebvre terms 'lived spaces' (Schwarze, 2023). Small-scale food vending and service activities clustered around the station, transforming what was conceived by the state as a transit node into a community marketplace. Similar dynamics have been observed across Africa, where infrastructure corridors catalyse hybrid socio-economic spaces that exceed their original purpose (Chuku et al., 2023; Kerven et al., 2011).

One woman described how this shift opened opportunities for both income and investment:

'When the train started, and this became an SGR station, we saw that travellers would always need food. I started with one pot of beans and tea, but within months I was serving many people each day. With the profit, I joined a women's savings group. Last month I borrowed from the group and bought a goat. Next year, I hope to buy cattle. The station did not only bring customers; it gave us courage to dream beyond daily survival.' (Interview, Woman trader, 2023)

For youth, stations also emerged as hubs of innovation. Motorcycle transport services linking villages with the railway became one of the most visible adaptations, enabling young men to generate cash and channel earnings back into herds. As one youth reflected: For us, the station is not only about passengers, it opened a path to imagine more for the future.' (FGD, Youth, 2023).

Elders, however, viewed the stations with a longer horizon in mind. While recognising the immediate benefits, they voiced concerns about what such spaces might mean for pastoral identity in the years ahead:

'The station today brings food, money, and even cattle through our children's work. But tomorrow, it may bring more towns than grass. We welcome the market, but we also fear the crowding of strangers, the fences, and the loss of paths for our herds. If our people keep turning the money back into cows, then the kraal will live. If not, the station may eat the kraal.' (KII, Elder, 2023).

These spatial negotiations occurred daily. For example, herders described rerouting cattle through unofficial gaps in railway fences after informal agreements with SGR guards a practice observed during field visits. Similarly, women traders negotiated stall placements with station managers, reshaping the *lived space* of the station through repeated, small-scale acts of appropriation. These everyday re-spatialisations illustrate how Lefebvre's triad is enacted through situated, material practice.

In this way, SGR stations and surrounding centres, where travellers, railway workers, and local people intersected, were not only arenas of entrepreneurial energy and aspiration but also sites where intergenerational debates about continuity and change unfolded. They emerged as hybrid social spaces, conceived by the state for infrastructure yet reappropriated by pastoralists as arenas of resilience, hope, and cautious negotiation about the future.

The transformation of SGR stations into markets and social hubs exemplifies Lefebvre's *lived space* in action. While the state *conceived* these stations as transit nodes, pastoralists *perceived* them as sites of economic opportunity and social exchange, and ultimately *lived* them as spaces of aspiration and continuity. This re-appropriation reflects a broader pattern observed in East African corridors, where infrastructure is continually remade through everyday practice (Enns & Bersaglio, 2020; Schwarze, 2023).

4.3. Governance as contested authority: hybridity, negotiation and re-stratification

Mega-infrastructure projects rarely produce clear or singular governance systems. Instead, they create contested spaces where multiple authorities customary, state, and emerging community actors overlap, collide, and are continuously renegotiated (Enns & Bersaglio, 2020; Müller-Mahn et al., 2021). The Standard Gauge Railway (SGR) in Kilosa exemplifies this dynamic: conceived by the state as a project of modernisation and control, it unfolded locally as a site where elders mediated disputes, women pushed for inclusion, and youth translated economic roles into claims for voice and legitimacy.

At the centre of these governance dynamics were elders, whose mediating role persisted but was reshaped under new infrastructural pressures. Elders continued to serve as mediators of everyday disputes over grazing routes, fenced lands, and market access, but their authority was reshaped within new infrastructural pressures. In 14 of 24 interviews, elders described negotiating with SGR security personnel to allow temporary cattle crossings or to resolve conflicts over damaged fences. As one elder explained:

'People still come to us when cattle lose the way or when there are quarrels about land. We try to settle it. Sometimes it works, sometimes not. The government has its rules, but our people still need us.' (KII, Elder, 2023).

This mediating role reported in 14 of 24 elder interviews reflects what Mkutu and Mdee (2020) described as 'hybrid authority' where customary leaders adapt their functions to interface with state-imposed infrastructures, often without formal recognition.

Alongside elders, women and youth also navigated shifting governance spaces, although in uneven and gendered ways. Growth of station-based trade strengthened women economic autonomy and collective voice, yet their inclusion in formal governance remained limited. All five women in the FGD reported joining savings groups and gaining greater control over household income, but only two had spoken in village meetings about land or compensation. As one noted:

'In the past, it was not common for us to speak in village meetings. But now, because our work at the station brings food and money, we go together and ask to be heard. Our words may not decide everything, but at least they are in the meeting.'

(FGD, Women leaders, 2023). Participant observation similarly confirmed that while women were more visible in market spaces, they remained underrepresented in village councils and SGR-related planning structures, patterns consistent with wider infrastructure governance dynamics in East Africa (Huang, 2016).

Youth engagement in motorcycle transport ‘bodaboda’, station guarding, and petty trade used their economic contributions to claim social recognition. In the youth FGD, all five participants described how wage earnings increased their standing in household and community discussions. *‘Working at the station helps us bring something home. For that, when meetings are called, people allow us to sit and talk. We are still young, but they see our effort.’* (FGD, Youth, 2023). However, this emerging agency generated intergenerational tension. Elders expressed concern that youth engagement in wage labour could erode pastoral knowledge and long-term herd management, particularly under continuing land pressure: *‘The young ones bring cash, but they no longer know the dry-season grazing routes. If the SGR takes more land, what will they herd?’* (Kil, Elder, 2023).

4.4. Governance around the SGR extended beyond formal meetings and committees into everyday negotiations at the infrastructure interface

Participant observation revealed three recurring practices: First, *bypassing fences*: Herders created informal passages through railway fences, sometimes with the tacit approval of unethical guards in exchange for milk or meat. Second, *market-space bargaining*: Women traders negotiated stall locations and fees with both village leaders and station managers, often using kinship or patron-client ties. Third, *mediated compensation*: Elders acted as brokers between households and district officials, translating state compensation procedures into locally legible terms and mediating disputes when processes became contested. These practices exemplify what Müller-Mahn et al. (2021) described as *infrastructural governance from below*, whereby local actors reinterpret and reshape top-down regulatory frameworks through everyday action.

Across the 40 study participants, 30 (75%) reported engaging in at least one form of governance negotiation related to the SGR. Participation was gendered and spatially uneven: Men (18 of 21) more often negotiate grazing access and compensation, while women (12 of 19) dominated market-space and trade-related negotiations. Participants living closer to stations (90%) described more frequent negotiations than those in remote areas (40%). This uneven engagement underscores that governance is not only contested, but also stratified by proximity, gender, and social capital.

Overall, the SGR was conceived as a space of state planning, yet in practice it became a lived and negotiated space where authority was reworked through everyday actions of elders, women, youth, and state actors (Schwarze, 2023). What emerged was not the disappearance of customary leadership, but its reconfiguration into hybrid forms, which were fragile, contested, and deeply entangled with the logics of the infrastructural state.

4.5. Differentiated resilience: uneven adaptation across households

While many Iparakuyo Maasai households adapted to the SGR through livelihood diversification and governance negotiation, resilience was not evenly experienced across the community. This *differentiated resilience* was shaped by the interaction of proximity to the SGR station, gendered access to emerging opportunities, and pre-existing household resources. Interview and FGD data revealed that, while some households were able to take advantage of wage labour, trade, and transport services around the railway, others mainly experienced restricted mobility, reduced access to grazing routes, and limited pathways for diversification.

Proximity to SGR stations strongly shaped who benefited from emerging opportunities. Participants living near Mkata stations described daily exposure to new opportunities, including transport services and casual work, while households in remote grazing areas reported fewer options and disrupted movements. As one young man from Parakuyo noted:

'We are near the station, we see opportunities every day. My brother guards the cargo, I ride the bike. But my uncle's family far in the grazing lands, they only see fences and lost pastures.' (Interview, Youth, Parakuyo, 2023).

Field observations in more distant areas similarly showed continued reliance on fragmented pastures and longer mobility routes with limited access to station-based markets.

Gender further mediated adaptive capacity in uneven ways. Women expanded their economic roles through food vending and savings groups, and many described greater control over household income. However, their participation in formal decision making remained constrained, particularly in discussions on land, compensation, and grazing access. One woman trader noted: 'I sell food at the station now. I have my own money. But when they discuss land or compensation in meetings, they still tell us: 'This is men's talk.' (Interview, Woman trader, Twatwatwa, 2023). Observations from village meeting observations confirmed that women were still underrepresented in governance spaces even when their economic contribution had grown.

Generational and wealth differences further shaped resilience outcomes. Youth often embraced station-related work such as motorcycle transport, guarding, and petty trade, and framed these activities as part of household survival and livestock investment. As one young man explained, 'We are among those riding, guarding, selling at the station. This money buys goats, pays for school. But our fathers say we are forgetting the herds' (FGD, Youth, 2023). Elders, however, raised concerns about the longer-term erosion of pastoral knowledge and mobility, warning that 'the young ones bring cash, but they no longer know the dry-season grazing routes. If the SGR takes more land, what will they herd?' (KII, Elder, 2023). Wealth also mattered: better-resourced households were more able to convert early livestock assets into new opportunities, with one participant noting, 'I had some goats before the SGR. When the station came, I used that to start a small shop. Now I have both shop and cattle' (Interview, Male household head, 2023). Poorer households, by contrast, struggled to transition and relied more heavily on shrinking common grazing areas. Together, these patterns show that resilience was not uniformly experienced, but mediated by structural inequalities and spatial disadvantage, reinforcing differentiated vulnerability (Kaiser & Barstow, 2022) and the uneven production of space (Lefebvre, 1991).

4.6. Adaptation pathways and uneven outcomes

The Ilparakuyo Maasai response to the SGR exemplifies *adaptive reorganisation*, whereby households adjusted livelihood strategies to absorb disruption while maintaining pastoral continuity. This adaptation unfolded through three linked pathways: *Spatio-economic diversification*, involving engagement in station-based trade and transport while reinvesting profits into livestock; *social-network leveraging*, through the use of kinship and community ties to access wage labour and market opportunities; and *governance negotiation*, characterised by ongoing engagement with both state and customary authorities to secure grazing access and livelihood space.

However, these pathways were not equally accessible. Of the 40 study participants, 32 (80%) reported some form of livelihood diversification linked to the SGR, yet only 12 (30%) mainly men and those living within approximately 3 km of a station described changes as 'successful' in terms of both income gains and herd growth. Women and remote herders more often described their experience as 'struggling' or 'partial,' shaped by mobility restrictions, market distance, and gendered barriers to decision-making. As one elder summarised: 'The SGR gave some of us a new path, but it closed older ones. Those who could walk the new path have grown stronger. Those who could not are now walking farther for grass.' (KII, Elder, 2023). Overall, resilience emerged as a stratified outcome shaped by pre-existing inequalities rather than a shared community condition.

5. Discussion

The findings show that the Standard Gauge Railway (SGR) has reconfigured, rather than displaced, Ilparakuyo Maasai pastoralism. It has produced hybrid socio-spatial realities shaped by everyday negotiations over livelihoods, space, and authority. This discussion situates these empirical insights within wider debates on resilience, spatial production, and hybrid governance, while also recognising the unevenness of adaptation across gender, generation, and geography.

5.1. Resilience as reorganization: diversification without displacement

A central insight is that livelihood diversification through wage labour, food vending, and transport services did not signal the abandonment of pastoralism, but its adaptive reorganization. Earnings from SGR-related activities were commonly reinvested into livestock, reinforcing pastoralism's central role while helping households to cope with new constraints. This aligns with what resilience scholars describe as 'reorganisation without collapse' (Folke et al., 2010), and aligns with studies showing pastoralists' tendency to diversify around, rather than exit, herding (Akall, 2021; Devereux, 2001). Contrary to narratives of pastoral decline, the Ilparakuyo Maasai illustrate how infrastructure can be incorporated into long-standing adaptive strategies, similar to patterns observed in pastoralist areas where transport corridors have stimulated off-farm income linked to livestock investments (Herrero et al., 2010; Müller-Mahn et al., 2021). These dynamics resonate with broader East African evidence showing that pastoralists integrate new economic opportunities without abandoning herding (Greiner, 2016; Nori & Scoones, 2023).

However, this reorganisation is not without cost. The SGR has intensified socio-economic stratification, favouring those with geographic proximity, social capital, and pre-existing assets. Such differentiated resilience reflects critiques of resilience theory, which warn that celebrating local adaptability can obscure deepening inequalities (Scoones, 2023). In Kilosa, resilience is therefore both a strategy of continuity and a lens through which structural vulnerability is reproduced.

5.2. Stations as lived spaces: appropriation and aspiration

SGR stations, conceived by the state as nodes of modernisation, were actively resignified as lived spaces (Lefebvre, 1991; Schwarze, 2023) where pastoralist aspirations and agency were renegotiated. Women traders, youth riders, and elders transformed stations into markets, savings hubs, and sites of intergenerational exchange-spaces where economic opportunity and cultural continuity intersected. This reflects broader trends across Africa where infrastructure corridors become hybrid socio-economic zones that exceed their planned functions (Chuku et al., 2023; Enns & Bersaglio, 2020). The Kilosa case extends this literature by showing that these spaces are not only sites of exchange, but also arenas where pastoralist identity is actively reproduced through reinvestment in livestock and reassertion of communal values.

5.3. Contested governance: hybridity, resistance and re-stratification

The SGR introduced new layers of state authority which are fences, guards, and regulations, that intersected with customary governance led by elders, women's growing economic voice, and youth claims for recognition. This produced hybrid governance arrangements characterised by negotiation, contestation, and everyday resistance, such as elders mediating grazing disputes or women demanding greater inclusion in village meetings. These dynamics resonate with studies highlighting the plural and contested nature of authority in East African infrastructure corridors (Bergius et al., 2020; Enns & Bersaglio, 2020), including cases where oil exploration in Turkana reconfigured customary authority amid new forms of dispossession and conflict (Mkutu & Mdee, 2020). Importantly, governance was shaped by gender and generation. While women gained economic visibility, their political inclusion remained limited, echoing critiques of infrastructure planning that marginalises women's agency (Huang, 2016). Youth, meanwhile, leveraged economic roles to claim social recognition, yet faced elders' concerns over the erosion of pastoral knowledge. This tension between economic integration and cultural continuity underscores that infrastructure does not simply disrupt governance, but can also re-stratify authority along existing social lines.

5.4. Adaptation vs. transformation

A key conceptual contribution of this paper is its distinction between adaptation and transformation. Adaptation refers to incremental adjustments that preserve the core of pastoralism (for example, diversifying income while reinvesting in livestock). Transformation would imply a systemic shift away from

pastoral identity and practice, which was not observed in Kilosa. This distinction challenges binary narratives that frame infrastructure as either fully assimilative or wholly disruptive. Instead, the SGR has triggered adaptive reorganisation within a largely continuous pastoral system, a pattern also noted in studies of infrastructure impacts in Turkana (Kenya) and the Somali region (Ethiopia) (Akall, 2021; Bekele, 2022).

5.5. Gendered and intergenerational agency

The SGR reshaped not only governance arrangements but also the gendered and generational dynamics of authority. Women used station-based trade to strengthen economic autonomy and collective voice, yet faced persistent barriers in formal governance spaces. Youth, through motorcycle transport and wage labour, gained social recognition and influence, challenging elder-centric decision-making. These shifts illustrate how infrastructure can become a site for renegotiating social hierarchies, even as it risks reproducing existing inequalities.

5.6 Differentiated resilience

While resilience was widespread, it was unevenly distributed. Proximity to stations, pre-existing wealth, gender, and age shaped households' adaptive capacity, a pattern reflecting structural inequalities rather than uniform adaptation. This differentiated resilience aligns with critical scholarship cautioning against romanticising local adaptability without acknowledging embedded vulnerabilities (Kaiser & Barstow, 2022). The SGR, while creating opportunities for some, risked reinforcing existing divides between those with access to capital and those reliant on diminishing commons, a pattern also observed in large-scale infrastructural projects like the LAPSET corridor in Kenya, where benefits were unevenly distributed (Bekele, 2022; Owino, 2019). These findings underscore that infrastructure-driven resilience is not a neutral process but one mediated by power, position, and privilege.

6. Conclusion

The Standard Gauge Railway (SGR) in Kilosa has not displaced the Ilparakuyo Maasai from pastoralism; rather, it has reshaped how pastoral livelihoods, space, and governance are organised. Households combined livestock keeping with income-earning activities linked to the railway, including small trade, wage labour, and transport services, and in many cases reinvested these earnings into livestock. In this way, pastoralism was not abandoned but reworked through new economic connections. SGR stations became important sites of everyday interaction and economic activity, shaped largely through local use and negotiation rather than formal planning. Governance around the railway also became more complex. Elders, women, youth, and state actors each influenced decisions in different ways, reflecting shifting authority and participation. Overall, the findings move beyond simple narratives of either 'benefit' or 'disruption' and instead point to processes of adaptation, uneven opportunity, and the growing importance of more inclusive forms of local engagement in infrastructure development.

While this qualitative case study prioritises contextual depth over broad generalisation and reflects experiences more strongly around SGR station sites, it demonstrates that mega-infrastructure can reorganise rather than erase pastoralist systems by producing hybrid socio-spatial realities shaped through everyday negotiation. The findings highlight the importance of supporting livelihood diversification that remains linked to livestock keeping, designing station environments as inclusive spaces for multiple users, and strengthening governance arrangements that recognise customary leaders alongside women's and youth roles. Attention to spatial and social inequalities is essential to ensure that remote households and resource-constrained pastoralists are not structurally excluded from emerging opportunities.

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Author contributions

CRedit: **Makulangwa Jeremiah Chambo**: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Validation, Writing – original draft; **Lucy Willy Massoi**: Project administration, Supervision, Writing – review & editing.

Ethical approval

Ethical approval for this study was granted by the Directorate of Research, Publication and Postgraduate Studies (DRPS), Mzumbe University, which oversees research ethics approval at the University under the approval number MUDRPS/R&P/4/VOL2/65. The approved protocol underpins the present article.

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Data availability statement

Due to confidentiality, interview and FGD transcripts are not publicly available. De-identified materials are available from the corresponding author upon reasonable request.

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