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African Transport Studies 4 (2026) 100090

Contents lists available at ScienceDirect

African Transport Studies

journal homepage: www.elsevier.com/locate/aftran

Walking and freight delivery operations. Space-sharing conflicts in Nairobi

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ARTICLE INFO

Keywords:
Freight deliveries
Global south
Kerbside management
Pedestrians
Space-sharing conflicts
Right-of-way allocation

ABSTRACT

Urban planners seek to resolve tensions in public space by promoting street designs that prioritize active mobility. However, there is a tendency in overlooking freight operations in the allocation of street space, exacerbating conflicts in the access to space which threaten the safety, environmental, social and economic values of streets. While studies in European and US cities (Global North) have examined these issues, little attention has been given to the Global South. This research aims at examining conflicts in the access to street space, particularly between pedestrians and freight, to identify conditions that shape or restrict both walking as a mode of transport and efficient freight deliveries. Several methods supported data collection in five streets in Nairobi (Kenya), including secondary data analysis, focus groups, direct observation, surveys, and workshops. Findings reveal mismatches between policies, practices, power, and business models, driven not only by factors reported in Global North contexts but also by local dynamics, including politization of space occupation, informal last-mile structures, and illegal encroachment of public space. Additionally, the research provides insights to the design of practice-informed rules for access management, emphasizing the need to align access rules with everyday street practices and social dynamics. Outcomes from this research expand the understanding of how urban conditions influence freight–pedestrian interactions and the viability of walking as a mode of transport. Comprehending these dynamics becomes imperative for creating liveable cities.

1. Introduction

Urban street space is limited due to high and competing demands from different users, including pedestrians, cyclists, public transport, private vehicles, and freight (Castrellon, 2025). This scarcity is especially pronounced in dense cities where infrastructure growth cannot keep pace with population and economic activities. To manage these competing demands, local authorities define right-of-way (ROW) hierarchies that guide street design and access regulations, often with an increasing emphasis on active mobility. Frameworks such as Complete Streets, Healthy Streets, and Flexi Streets (Allen and Piecyk, 2022; Tierney, 2017) embody this shift by prioritizing walking and cycling. However, these approaches frequently neglect freight operations, particularly last-mile delivery activities at the kerbside, such as loading and unloading.

Promoting active mobility but ignoring or excluding freight from ROW allocation decisions contribute to what Williams and Carroll (2015) describe as the liveability–freight movement paradox: efforts to create liveable urban spaces that imply increased freight demand while restricting freight vehicles' access. For example, pedestrianisation and bike-lane expansions often stimulate commercial activity and attract more visitors, which in turn increase the need for deliveries and restocking. Yet, the same measures reduce kerb access for freight parking and delivery, making it more difficult for freight operators to serve these areas efficiently.

When access to kerbside space for loading and unloading (L/U) is unattainable for freight vehicles, freight operators opt for responses that may obstruct other users or compromise safety. These responses include cruising for parking, double parking, stopping in restricted areas, or using pavements (Castrellon et al., 2026). Such practices disrupt traffic flow, endanger cyclists, and add to congestion, as documented in cities from Europe and US (Lopez et al., 2016; Conway et al., 2013; Clarke

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https://doi.org/10.1016/j.aftran.2026.100090
Received 13 October 2025; Received in revised form 9 March 2026; Accepted 13 March 2026
Available online 21 March 2026

et al., 2018).

While studies in the Global North (e.g., Conway et al., 2018; Moshiri et al., 2022; Tierney, 2017) offer important insights for managing access among different street users, their relevance to Global South cities remains uncertain. Urban conditions in cities from the Global South differ significantly, shaped by informal practices, weaker regulatory frameworks, and different mobility demands (Watson, 2009). Moreover, although research has examined freight impacts on other users such as cyclists (Pokorny et al., 2018), little attention has been paid to conflicts between freight and pedestrians. Therefore, this study focuses on freight–pedestrian conflicts in the access to kerbside space, having a context from the Global South: Nairobi (Kenya).

In Kenya walking is the predominant mode of transport to work, with 72.7% of Kenyans walking to work, with rural areas recording the highest percentage (82.5%) compared to urban areas (53.4%) (KNBS, 2024). Nairobi provides a relevant case. Walking accounts for roughly 45% of daily trips, and residents rely on non-motorized transport (NMT) to access public transport (UNEP, 2020). Yet urban design remains car centric. As outlined in Nairobi's 2017 NMT Policy, less than 2% of the annual transport budget is allocated to NMT infrastructure. This underinvestment has led to spatial injustice for pedestrians, manifested in high crash rates, i.e., pedestrian fatalities rose by 20% in April 2020 compared to 2019 (NTSA, 2020), as well as congestion and air pollution. In addition, freight activities in Nairobi are not limited to motorized vehicles; they are frequently performed by pedestrians and NMT modes such as handcarts and bicycles. However, these practices occur without dedicated or safe space, forcing freight movers to share already constrained pedestrian infrastructure or mix with motorized traffic, further intensifying conflicts.

As public spaces are shaped by the social and contextual dynamics, this paper seeks to broaden the understanding of freight–pedestrian conflicts at urban streets by incorporating conditions and behaviours specific to a Global South context, i.e., Nairobi. This context provides the empirical setting where actions encouraging walking overlook the conducing conflicts with freight operations, increasing accidentality and threatening liveability. Accordingly, the aim of this research is to investigate how conflicts in the access to kerbside space emerge and intensify between pedestrians and freight deliveries. The paper addresses the research question: What local conditions shape or intensify conflicts between pedestrians and freight activities? In answering this, the study identifies conflict triggers and stakeholder perspectives to inform ROW allocation guidance tailored to Global South urban contexts such as Nairobi.

2. Conceptual framework

This section introduces concepts and frameworks that supported the research, drawing on access management literature, particularly related to kerbside management for freight deliveries. The emphasis is on conflicts over the street space and their implications for urban liveability.

In urban settings, the kerbside is a critical interface where movement and place-based functions of streets coexist. Decisions on its use increasingly involve competing priorities, e.g., walking, cycling, transit, businesses, and freight deliveries. Freight activities, particularly L/U, are more connected to place functions than to movement (Buldeo, 2024). Yet, these operations are often overlooked in design frameworks that prioritize active mobility, leading to the liveability–freight movement paradox.

Conflicts over space use are central to this issue. While transportation research has approached conflict from various angles, such as risk of collision in safety studies (Amundsen and Hyden, 1977), or competition for limited resources in planning (Paget-Seekins, 2013), this research adopts a spatial perspective. It builds on the definition by Fabricius et al. (2022), where a space-sharing conflict is an observable situation in which two or more users are likely to attempt occupying the same space at the same time. These conflicts occur when one actor's use of space, such as a parked freight vehicle, deters or prevents others, such as pedestrians, from using it safely or comfortably.

Empirical literature has documented such conflicts in specific contexts. For instance, Conway et al. (2013) studied how freight vehicles blocking bike lanes in New York forced cyclists to deviate, illustrating how space-sharing conflicts reduce safety and accessibility. Other studies focus on different user combinations, such as truck–cyclist or vehicle–pedestrian interactions (Pokorny et al., 2018). However, space-sharing conflicts go beyond movement, encompassing place-based uses such as street furniture, vending, and deliveries (Allen and Piecyk, 2022).

To address these interactions, this research draws on the concept of access management, with a focus on kerbside access management for freight deliveries. Access management involves coordinated decisions on how space is allocated along streets and at the kerbside. It has focused on optimizing traffic flow and safety by limiting and separating conflict points and ensuring property access. As defined by Williams et al. (2014), access management encompasses planning, regulation, and design methods that promote efficient and safe movement of people and goods across all modes. However, recent areas of development have emerged to extend access management beyond vehicle throughput to address liveability, sustainability, and spatial justice in street-level design (Dang et al., 2023; Gössling et al., 2016).

For the analysis of space-sharing conflicts, this research departs from the freight-related conflict framework proposed by Castrellon et al. (2026), shown in Fig. 1. The framework identifies specific spatial triggers that lead to operator reactions, resulting in four types of observable conflict outcomes: collision risks, traffic obstruction, space overuse, and pavement damage (Fig. 1). These conflict outcomes have broader impacts on urban conditions by undermining equitable access to infrastructure, creating unsafe spaces, contributing to informal or illegal practices, and degrading environmental quality.

The framework is used to diagnose existing conditions and to identify potential entry points for interventions in the design of access rules. While the design of access rules is often viewed as a technical process, it also reflects the social and institutional dynamics of street space. In Nairobi, the use of public space is shaped not only by formal regulations but also by informal norms, enforcement limitations, and power dynamics between actors. Conflicts over kerbside and pedestrian space are therefore not only operational or regulatory issues, but also manifestations of unequal claims to urban space and uneven enforcement of rules (Soja, 2013). Research on perceptions of urban space shows that different actors attach distinct meanings and legitimacy to street use, shaping how space is occupied, contested, or defended in everyday practice (Wang et al., 2022).

In contexts characterised by informality, such as Nairobi, these perceptions coexist with weak regulatory enforcement, leading to negotiated, politicised, or informal uses of public space. Framed within the concept of urban spatial justice, recent studies argue that conflicts in public space emerge where formal planning intentions intersect with lived practices, informal economies, and competing claims to legitimacy, rather than from design deficiencies alone (Soja, 2013; Watson, 2009). Thus, understanding how rules emerge, stabilise, or change is essential for managing kerbside access more effectively.

Therefore, this study adopts a practice-informed perspective. It examines how access rules are enacted and legitimised through everyday interactions between freight operators, pedestrians, vendors, and regulators. This approach helps to expose the gaps between formal policy and practice and highlights the need to align access regulations with local realities. By grounding access management in observed street-level practices, and user perceptions, the study aims to support more adaptive and inclusive approaches for balancing freight and pedestrian needs in contested urban spaces.

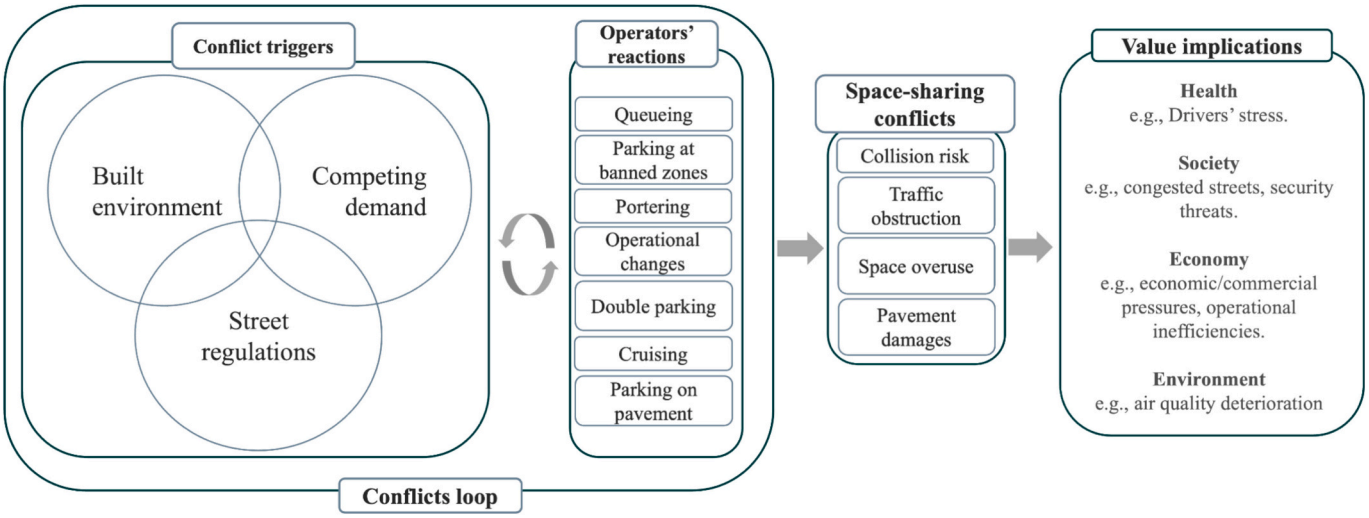

Fig. 1. Freight-related space-sharing conflicts framework. Source (Castrellon et al., 2026).

3. Methodology

This research applies the freight-related space-sharing conflicts framework introduced in Section 2 as both an analytical lens and a guide for data collection. The framework informs the identification of spatial triggers, user reactions, and observable conflict outcomes between pedestrians and freight operators. Accordingly, the methodological approach was organised in three phases: (i) selection of study streets, (ii) empirical data collection through mixed methods to capture conflict dynamics and contextual factors, and (iii) stakeholder workshops to validate findings.

3.1. Street selection

Street selection followed a reconnaissance survey across several urban corridors, where initial observations showed common space-sharing conflicts, including double parking, unauthorised L/U, pavement deterioration, and congestion. Based on these initial observations, streets were chosen where such conflicts were evident, while also ensuring variation in pedestrian density, economic activity, and functional roles connecting the Central Business District (CBD) to surrounding residential areas. This approach allowed the study to capture a range of spatial and operational conditions influencing freight–pedestrian interactions. Five streets were selected for in-depth assessment (Fig. 2): Mwihoko Road, Tom Mboya Street, Charles Rubia Road, Luthuli Avenue, and Haile Selassie Avenue.

Mwihoko Road – (Mixed Use Zone) Street at a low-income zone featured by residential, retail, food market next to a major highway and access to various middle income residential and government buildings. This street was selected due to its design aspect for traffic use with a designated non-motorized transport (NMT) lane and motorized transport (MT) lane. It provides access to the neighbourhood outside the CBD. It serves retailers/traders located along the road thus freight operations are observed.

Tom Mboya Street – (L/U Zone). This street offers access and connection links to most Nairobi metropolitan regions, walking dominates all modes, and pedestrian density is consistent throughout the day leading to reduced speed and sporadic congestion. Owing to its proximity to key motorized corridors, offices, hotels, and key business operations, it serves quick access to NMT traffic.

Charles Rubia Road – (Up Country Terminus Zone). It connects key passengers' traffic of upcountry and freight transport of dried farm products in the downtown area of the city. Many of the freight vehicles are forced to unload on banned zones due to the limited space available. Thus, portering is commonly performed after unloading. As the access lanes of the building are converted to bus terminals, many of the matatus (passenger vehicles) lack parking space and end up parking along the carriageways thus hindering smooth passage of the road.

Luthuli Avenue – (Non-Motorized Transport Zone). This street has been redesigned as an exclusive NMT corridor thus serving as a link and serves access to freight operations, NMT and MT. As the street was redesigned to accommodate NMT, MT was banned including the removal of L/U zones. The street is mainly occupied by electronics and instrument business operators.

Haile Selassie Avenue – (Fresh Produce and General Market Zone). This street traverses from the main highway (Uhuru highway) through the CBD to other trunk roads. It provides access to the two (2) main Nairobi largest markets (Wakulima, fresh produce market, and Muthurwa market) thus servicing freight operations, NMT and MT traffic. The street is connected to service lanes which serve as feeder roads which have zones designated as L/U zones but have since been taken over by public transport as bus stops.

By presenting these elements side by side, the Table 1 provides a synthesises of the key characteristics of the five study streets as a basis for linking street-specific conditions to the conflict triggers and outcomes discussed in Sections 4 and 5.

3.2. Data collection

The study adopts an exploratory, mixed-methods approach designed to capture the diversity of actors, practices, and spatial conditions shaping freight–pedestrian interactions. While the data do not aim for statistical representativeness, the combination of random intercept surveys, purposive sampling, direct observation, and group-based discussions provides a robust qualitative basis for identifying recurring conflict patterns and context-specific triggers across different street types.

Data collection was done using the following methods: direct observation (visual characteristics of study area that was recorded on observation forms and videos), a survey, interviews coupled with focus groups, and two workshops. Table 2 summarises the methods and their link to the elements of the conflict's framework, i.e., conflict triggers, space-sharing conflicts and value implications.

Direct observation consisted of four methods, namely, observation checklist, walkalong interviews, videos and photographs. An observational checklist (see Appendix A) was used to observe and document space-sharing conflicts at the various streets, types of NMT and motorized features, and types of road users present on site.

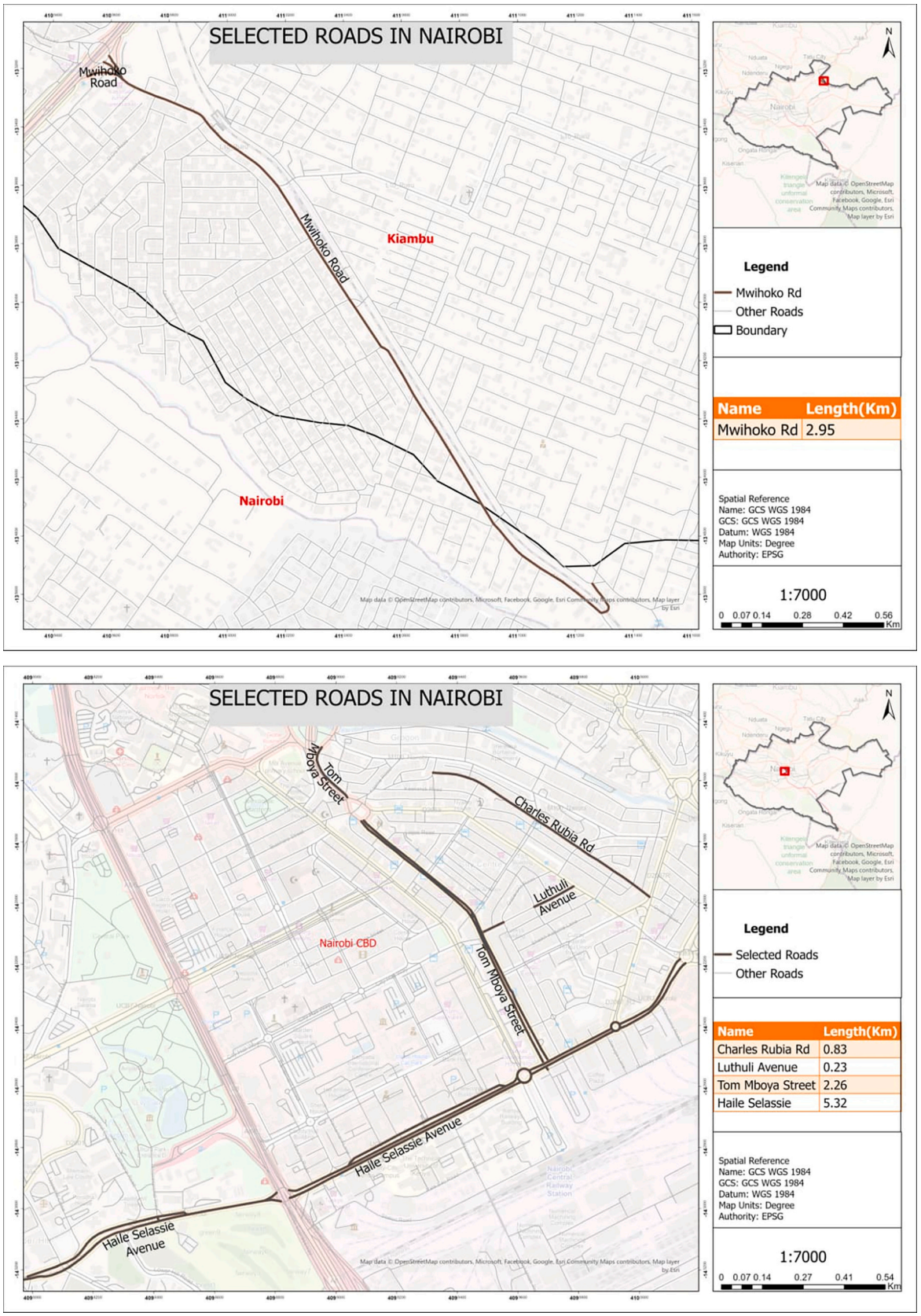

Fig. 2. Streets selected in Nairobi (Kenya).

Table 1
Cross-street comparison of spatial conditions and conflict characteristics.

Street	Dominant built environment characteristics	Supply - demand pressures	Street regulations	Operators Reactions
Mwihoko Rd.	High pedestrian activity; overlap with public transport operations; frequent freight activity	Limited parking space; presence of matatu terminals	Through-route designation; marked parking zones	Double parking; vehicle queuing; parking on pavements
Tom Mboya St.	Very high pedestrian density; overlap with public transport	Insufficient parking capacity	Vehicle size restrictions; designated service-vehicle parking; operational charges	Vehicle queuing; informal stopping; avoidance of formal charges
Charles Rubia Rd.	High freight vehicle presence; narrow carriageway	High delivery density in constrained space	Restricted stopping due to terminals and unloading activity	L/U on prohibited areas; portering
Luthuli Avenue	Pedestrianised/ NMT-focused design; street furniture encroachment; overlap with cycle lane	Lack of parking and L/U space	Time-restricted access; removal of L/ U zones	Queuing; operational charge avoidance; double parking
Haile Sellasie Avenue	High freight activity linked to wholesale markets; handcart staging	Limited and contested L/ U zones	Vehicle size restrictions	Portering; parking on pavements; informal handcart storage

Table 2
Summary of the methods and contribution to the paper's aim.

Method	Contribution to the paper's aim	Conflict triggers	Space-sharing conflicts	Value implications
Direct observation (check list, videos, photographs)	Streets selection Identification of freight-related users and infrastructure conditions	x	x	
Survey	Assessing perceived conflicts and theirs impacts on liveability		x	x
Interviews	Understanding of regulations and enforcement strategies in place and challenges	x	x	
Focus group	Understanding challenges of users when navigating through the selected streets		x	
Workshops	Identifying root causes of space-sharing conflicts and potential conflicts' effect	x		x

Direct observation was complemented by walk-along interviews with the freight-related users shown in Fig. 3. Handcart pushers were randomly approached as they went about their daily activities, based on their willingness to engage in conversation while navigating the street network. These operators typically travelled between 7 and 10 km, approximately, from wholesale markets in the Nairobi Central Business District to neighbourhood markets and informal settlements. Walk-along interviews allowed the research team to observe conflict situations in real time and document how operators adapted their routes and behaviour in response to constrained street space.

Other freight operators, including delivery workers using motorized vehicles, were purposively selected while undertaking delivery activities along the study streets. Three-wheeler operators were randomly selected from designated parking areas as they waited for customers.

Direct observation collected data about reactions of freight operators, street conditions, conflict triggers, and space sharing conflicts, following the framework presented in Section 2.

A questionnaire *survey* (see Appendix B) gathered 90 responses from different street users: pedestrians (14), vehicular drivers (9), the freight-related street users (27), shown in Fig. 3, and traders/shop owners (40). While the sample is not statistically representative of all street users in Nairobi, it captures a diverse range of actors and practices relevant to understanding space-sharing conflicts in high-intensity urban corridors.

Respondents selected through random intercept sampling, whereby individuals were approached as they moved along the kerbside and pedestrian areas of the study streets. Participation was voluntary, and questionnaires were administered only to respondents willing to take part.

Business and shop owners were purposively selected, with two respondents per street. Selection was based on the presence of observed conflicts directly outside their premises and their willingness to participate. This approach ensured that the survey captured experiences from locations where freight–pedestrian interactions were most pronounced.

Approval was obtained from the National Commission for Science, Technology and Innovation (NACOSTI), as the institution which is mandated to regulate and ensure the quality of the research. This was done before data collection. During the survey, the participants were guided through ethical statements and allowed to consent or withdraw from the exercise. Obtained data, whether digitally or physically, was restricted to access to authorized personnel only.

Researchers used a *semi-structured questionnaire* (see Appendix C) to capture a broad spectrum of experiences related to walking and interactions with freight vehicles. The interviews were conducted at strategically chosen times throughout the day to maximize participant availability and engagement. Each interview lasted approximately 10 to 20 min, allowing participants to provide feedback on space-sharing conflicts and general perceptions. Key informant interviews (KII) were purposively selected from policy makers and implementation officers in Nairobi City County government office consisting of traffic enforcement officer (1), transport engineer roads (2), urban planners (2), research officer (1) and academics in transport research (2). These interviews provided insights into existing policies, enforcement challenges, and institutional perspectives on managing street and kerbside space.

Two *focus group* discussions (10 people each) were held, having a mix of all the freight-related street users. One in a mixed-use zone and the other one at the CBD. The discussions aimed to elicit shared experiences, perceived causes of space-sharing conflicts, and the everyday practices participants use to navigate congested and contested street spaces. In line with the study's overall purpose, the focus groups sought to deepen understanding of how space-sharing conflicts emerge and affect both walking and freight delivery conditions.

3.3. Validation via workshops

Two *workshops* were held on March 4th and 5th, 2025. The workshop's objective was to bring together key stakeholders and those perceived affected by the conflicts into a discussion about the identified space-sharing conflicts between walking and freight, their causes and effects. The workshops participants included county government

Fig. 3. Freight-related Street users.

stakeholders (county engineers, Inspectorate, and Urban planners), NGOs, UN habitat, academia, and those perceived affected by the conflicts (road users, traders or shop owners, and freight operators).

The workshops started by members introducing themselves and the research team explaining the purpose of the workshop emphasizing the targeted objectives. The workshops were divided to three (3) sub-groups, each accommodating an equal number and representing all cadres present. The sub-groups were tasked to have a brainstorming session, mapping, discussing the root causes and effects of the conflicts on space shared areas and presenting their findings to the rest of the audience.

4. Results

This section presents the empirical findings from surveys, interviews, focus group discussions, direct observations, and validation workshops. Results are organised according to the space-sharing conflicts framework, distinguishing between conflict triggers, and observable space-sharing conflicts with their implications for street use in the Nairobi context.

4.1. Conflict triggers

Across the five study streets, conflict triggers align with the framework categories of competing demand, built environment conditions, and street regulations. These triggers often interact, reinforcing congestion, space overuse, and unsafe conditions for both pedestrians and freight-related users.

4.1.1. Competing demand

Kerbside space has been appropriated for informal economic activities, which forces pedestrians to navigate within the roadway contributing to space disputes along the streets. This is the tangible representation of the competition between economic activities and transportation land use resulting in a significantly degraded street environment, which affects both freight operators and pedestrians.

Typically, the streets studied experience heavy traffic congestion caused by numerous vehicles, 'boda bodas' (which pick up and drop off passengers at any point), pedestrians, tuk-tuks (auto rickshaws), bus stops terminals (in certain parts of the road), street vendors, carpentry operations, garages, bicycle repair shops, eateries, and more. The various activities disrupt the smooth flow of traffic on the road with severe jams occurring during the mornings and evenings rush hour.

Additionally, most transactions in the daily open-air market happen in the early morning as freight operators in the various streets interact with deliveries/suppliers of agricultural products from upcountry for distribution to various market outlets. In the evening, street vendors and hawkers set up along the road to sell their goods to pedestrians returning from their workplaces who are looking for household essentials and other commodities. The high volume of pedestrians along these streets attracts vendors who leave the open-air market stations to position themselves with their wheelbarrows or sacks laid on the ground along the street. This situation narrows the roadway, exacerbating traffic issues as explained by a participant.

(…) those who have constructed our roads have done it well. Right? But you'll find some hawkers selling where people should be walking. You have a right to pass there yet they have claimed it as their domain. Now, you'll see hawkers being chased back into the market since they have left their spots within the market and they're coming to sell on the streets. On the streets, they sell on the pavements and in front of other people's shops, where people should be walking. Now, you'll find them colliding with handcart and trolley pushers. The government should provide them with spaces within the market so they can go back. There's a very huge space there. You can see there are others hanging and selling their items on the walls in the market. (50-year-old male shop owner).

According to the data collected, enforcement of public space use has failed to prevent the illegal occupation of pavement and street space. The menace is further complicated by freight vehicles operating in the area due to lack of L/U zones which makes them end up operating on pavements thus generating more obstructions. Lack of proper legal framework has hampered smooth operations and management of the businesses in the area.

(…) there seems to be a lack of awareness of maybe some of the spaces available, the back streets, and so on. So, everybody thinks I can grab it, there's just vacant space, everybody thinks they can just use a space. People think that any space, if free, then it is available (48-year-old male county engineer).

Regarding concerns about navigating streets under the conditions presented above, some of the interview respondents mentioned: "*I no longer pass-through town because of the commotion and chaos. The pavements and walkways have been taken over by motorists, hawkers and traders*" (*56-year-old male public planner consultant*); "*The only place left to walk on is often the road, but this is dangerous too because one can be hit by a boda boda or a car.*" (*37-year-old female pedestrian*). Although other respondents have lauded the county government for its efforts to carpet pavements and walkways, the same have been taken over by hawkers leaving no place for pedestrians to walk.

The survey of street vendors revealed that 45% attribute their presence on the pavement to the high volume of pedestrians commuting to and from work as the workers typically do not traverse on the back lanes, compelling vendors to position themselves strategically in areas frequented by potential customers. Additionally, vendors perceive the street as a no man's land, where they believe no permission is required for occupation thus leading high likelihood of space overuse. This belief has led to a significant number of vendors establishing moveable structures in various sections of the street for their operations.

Businesses located on ground floors of buildings and markets have responded to the competition posed by street vendors and hawkers by displaying their products outside their shops to attract potential customers thus occupying portions of the pavement. Boda boda riders carry and drop passengers at locations anywhere they perceive advantageous to them leading space overuse/misuse, especially near bus stops as they serve as the last mile transportation mode. This scenario illustrates a competitive struggle for space between commercial activities, transportation, and land use.

4.1.2. Built environment

Some of the streets are characterised by several T-junctions that feed traffic from/to residential districts, and other land uses like educational, religious or recreational centres. These junctions have witnessed an influx of informal traders who have taken over much of the street space. As a result, these junctions have become very narrow thus impairing corner negotiation of vehicles joining or leaving streets at these points a situation made worse by the lack of traffic control mechanisms (traffic lights, speed bumps or traffic police officers) in the study area. This impediment affects the traffic flow along streets since the through traffic must wait for the vehicles joining or leaving the street.

These streets are originally intended to have a width of 25 m; however, over time, much of the designated space has been encroached upon, with 23% of the survey respondents indicating that inappropriate design of the road has led to conflicts over space use in the streets included in the study. This situation is further exacerbated by vehicles utilizing portions of the street for picking up and dropping off passengers, as there are no designated stops along the street and the drivers do not observe the designated ones, but pick and drop anywhere which is predominant along Mwihoko Road and Tom Mboya Street.

Haile Selassie Avenue serves two of the biggest markets (Wakulima and Muthurwa Markets) thus floating as the busiest road in terms of freight operations activities. Lack of L/U zones leads to freight operators manoeuvring most times and end up parking on undesignated zones, for example pavements and walkways creating obstructions. All these streets lack proper pedestrian infrastructures e.g., crossing points, foot bridges, and signages.

Some root causes of conflicts in Nairobi are poor planning, the size of the road, uses of the streets, and not well-defined drainage. Regarding poor planning, meaning the planning of the built environment and roads, usually, when we plan, we don't consider freight (…). The use of the streets is not well defined. We should have signs where a person can, for example, use loading zones or where freight people are supposed to be there. (54-year-old male transport engineer roads).

Luthuli Avenue was redesigned to cater for non-motorized traffic as well as cyclists and bikers, acting as a connector of uptown to downtown giving a clear picture of how decision management policies affect road users and the surroundings. The redesigned street has fewer L/U zones which are supposed to be regulated across the businesses in the area but lacks enforcement which leads to double parking and L/U on pavements. Bollards interfere with movement of bikers/cyclist and trolley pushers as spaces left in between at entry and exit points is not enough for manoeuvrability.

At the intersection of the streets and loading zones, matatus have converted the sections for un-designated bus terminus (Fig. 4). This site is not only used by vehicles serving people operating businesses in the region but also by vehicles plying the routes, and beyond who drop and pick passengers at this intersection. While this has eased traffic for the residents, it has also contributed to congestion at this intersection, leading to traffic snarl-ups along the streets.

Fig. 4. Walking and L/U space converted into bus terminus.

For instance, Charles Rubia Road was an arterial road which has been converted to a bus terminus serving up-country residents without redesigning, forcing conversion of buildings basements to bus terminus, where the space needed is not enough. Consequently, matatus park on carriageways narrowing carriageway width. Tom Mboya street has L/U zones which has been converted to bus stops, contributing to congestion of pedestrian traffic ferried to and from workplaces. Nearly 60% of the town's daily commuters travel down this street, making it the busiest for matatu operations.

Other spaces have been converted into parking zones by tuk tuks lining up to wait for their turn to pick passengers from an un-designated bus terminus. The tuk tuks in these spaces enter and exit to the street, causing massive jams along the streets. With the fact that sides of this adjoining street are occupied by street vendors, the space left is so narrow and therefore tuk tuks' activities at this site have become an impediment to the smooth movement of other street users and pedestrians included.

Also, pedestrian pathways have been converted to informal markets, no speed bumps, or zebra crossings to help slow down motorists. Therefore, pedestrians tend to cross from one side to the other in search of goods and services. This behaviour has resulted in congestion on the roadway and frequent fatal accidents in the areas.

4.1.3. Street regulations

Although Nairobi City County passed a Development Control Policy (2021), which provides parameters for land use and development, including controls on parking and business spaces, there are still many gaps regarding its implementation. For instance, the County does not have information on the number, location and the designated users/beneficiaries of all loading zones in the city. Even more importantly, the responsible County Government Officers fail to enforce measures aimed at collecting revenue from the loading zones due to compromise, corruption, negligence and a weak legal framework on loading zones.

Heavy fines and strict regulations should be put in place to govern the situation and regulate the entry of unnecessary operations and help decongest the city areas. (45-year-old female shop owner).

4.2. Space-sharing conflicts

Conditions in the context of the study led to the same conflicts defined in the framework, i.e., risk of collision, traffic obstruction, space overuse and pavement damage. However, the type of freight operators involved in the conflicts are context-specific including boda-bodas, handcarts, porters, hawkers and trolley pushers.

Table 3 shows the various freight operators and their likelihood of being involved in space-sharing conflicts based on field observations at the selected streets. The qualitative ratings of likelihood and severity presented in Table 3 are based on a triangulated assessment drawing on direct observations, walk-along interviews, questionnaire responses, focus group discussions, and validation workshops. Likelihood reflects the relative frequency with which specific operator–conflict combinations were observed or reported across the study streets, while severity reflects the typical consequences of these conflicts in terms of safety risks, obstruction intensity, and potential for harm. These assessments were derived through systematic synthesis by the research team, informed by repeated field observations and corroborated by participant accounts and stakeholder discussions, rather than from formal incident counts.

4.2.1. Risk of collision

Markets and transport corridors concentrate motorized and non-motorized users within limited space, increasing collision risk. L/U activities attract porters and handcart operators, intensifying congestion. Informal dispute resolution is common, with compensation negotiated on-site or avoided altogether.

Table 3
Freight space operators and their involvement in space-sharing conflicts.

		Boda bodas	Porters	Handcarts	Hawkers and Vendors	Trolley pushers
		likelihood/severity	likelihood/severity	likelihood/severity	likelihood/severity	likelihood/severity
Space- sharing conflict	Risk of collision	High/high	High/low	High/medium	High/low	Medium/high
	Traffic obstruction	High/high	High/low	High/high	High/high	Medium/low
	Space overuse	High/high	Low/low	High/high	High/high	Medium/medium
	Pavement damages	Medium/medium	Low/low	High/medium	Low/low	High/medium

If you have a handcart or motorbike or are a porter, you'll find there is someone who has encroached on the designated pathways. In that case, it's possible to bump into someone's belongings yet it's them who have put them up on the road. You'll be the one to suffer the loss as you compensate them (…) During a collision or the occurrence of an accident, the parties involved visually inspect the damage and they decide on how to compensate each other, but when damage is immense, they just vanish or run away. (*34-year-old male handcart puller*).

Boda bodas top the collision risk as well as fatality due to their high numbers, indiscipline and speed. Motorcycle users made up 35% of all Kenyan road deaths in 2023 (Kenya National Police Service, 2023). Traffic officers indicated that the primary contributors to conflicts and accidents on these streets is the negative behaviour exhibited by street users, along with the increasing presence of street vendors, boda bodas, tuk tuks, and taxi drivers. Officers remarked that the vast number of permits granted by the regulatory body for motorcycle licensing and registration has led to motorcycles and matatu being overcrowd in the studied areas with registered motorcycles having risen to 2.2 million: 22 million journeys, with fares totalling US$100 million (FIA, 2023).

Porter's likelihood of collision is also high because of carrying the load while walking and thus overlooking oncoming collision objects affecting their reaction rate. However, the collision fatality is low because they move at a slow speed and most other road users tend to avoid hitting them. When porters hit other road users, the collision severity is also low because of the speed and impact.

Hand carts' likelihood of collision is high because they operate on the motorized carriageway and thus have fatal accidents with motorized vehicles. Hand cart operators park in spaces not allocated for their parking and because of their size, they occupy the entire kerbside, thus blocking other road users, they also overload the handcart to optimize their profit. Although the handcarts do not have brakes to lessen the speed, the collision severity is medium because they move slowly and can easily be avoided by other users.

Hawkers and vendors have a high likelihood of collision because they display their wares on the ground where everyone is passing and crisscross various streets looking for customers or looking for goods. However, the collision severity is low because they are visible and thus all other road users tend to avoid the collision thus lessening the impact.

With trolley pushers, the risk of collision is medium due to the size of trolley, but the severity is high especially for pedestrians because the trolley is made of heavy metal and pulled in the overcrowded streets injuring pedestrians (direct injury by the trolley, a fall or a hit by another vehicle as they try to avoid the pusher).

4.2.2. Traffic obstruction

Boda bodas pose a high risk of obstruction as well as high conflict severity for various reasons including road indiscipline (park anywhere and use any space available to move as well as drop and pick passengers); lack of traffic policies enforcement and their motorized nature thus move at high speeds causing injuries to pedestrians and the riders.

Porters' risk of obstruction to pedestrians is high as they tend to move as pedestrians but with a heavy load on their shoulders, obstructing or slowing down pedestrian traffic movement. In narrow street pathways, it is almost impossible to pass them and sometimes they cause injuries to pedestrians. However, the conflict severity of the obstruction is low because other road users avoid blocking their way. The pedestrian moves off the path of the porter.

The likelihood of obstruction by handcart pullers is high especially on Mwihoko street as it is a single carriageway as the handcarts use the same space with motorists causing queuing due to their slow movement.

Hawkers/vendors pose high risk. They occupy any open space, especially walkways, displaying their items, resulting in high conflict severity on pedestrians' traffic, who are forced to occupy carriageway endangering their lives and causing vehicular traffic. The obstruction risk by trolley pushers is average and severity is low as they are not so many, and they carry medium sized luggage due to their small size and availability.

4.2.3. Space overuse

Informal traders operating from temporary structures have significantly occupied a large portion of the available space. The traders engage in the sale of a diverse range of commodities, including agricultural and non-agriculture products. Wholesale activities occur in the morning until 11:00 AM, drawing numerous wholesalers and retailers who gather to conduct transactions. Once the wholesale and L/U activities conclude, the space is repurposed for other uses, including small retailers, second-hand good vendors, chicken sellers, local food vendors, fruit sellers, and furniture dealers. Some vendors provide manicure and pedicure services along the streets, while others hawk their goods, moving from one location to another based on pedestrian traffic.

The land designated for Wakulima market is insufficient to accommodate the numerous traders requiring space for their operations. Traders who have secured spaces within the market have set up street wares to capitalize on sales and net a bigger market, which restricts new entrants from finding space and they all squeeze on the designated pedestrian or even motorized way. Encroachment on the access roads surrounding the market hinders accessibility of the premises.

Matatus in the CBD, hawkers outside the shops, and trolley pushers occupy any available space whether designated for them or not. The situation is exacerbated by lack of implementation framework as the Nairobi County Bylaws (RoK, 1998) was repealed by the new constitution creating a vacuum where there were bylaws governing the city but currently none.

The research indicates that 40% of the participants identified the limited size, mixed allocation, and poor management of the land use activities as well as political declarations as the primary reason for utilizing the street pavement to display their goods. Overall, the street spaces in all sampled streets are overcrowded, which serves as a motivating factor for some traders to move to the pavement on the streets and push away the pedestrians. A significant number of respondents noted that during the evening hours, the markets and surrounding lanes have become poorly lit and unsafe due to the absence of security lighting discouraging potential customers from visiting their off-street stalls, prompting migration to the streets.

This encroachment obstructs access to businesses, consequently limiting their potential customer base. Additionally, they hinder freight vehicles from reaching the business premises, often compelling business owners to employ security personnel to remove the vendors and porters to ferry the commodities as they are forced to L/U on the carriageway even though porters do not use a lot of space. In response, vendors argue that shop premises should not extend into the street reserve. This situation has created a conflict between formal traders situated in

commercial buildings along the street and informal vendors occupying the adjacent spaces.

Hawking is a big business, hawkers come from all over the country especially the metropolitan zone. They set up their stations everywhere blocking the pedestrians and the shop owners in their operations.

I need to be clear about Hawkers, especially in Nairobi CBD. If you remember five years ago, we didn't have hawkers in CBD and, in Nairobi City County, as much as we have the term hawkers, the definition of a hawker is somebody who moves with their wares from here to there, standing. If you look at the situation right now, the county has taken a step further. To accommodate these hawkers, they're usually back street but they are resistant to change. Then they feel that they own it because they were given a slight leeway. So, they are usually connected. And if you remember, there's somebody who used their slogan, Hustler. The hustler community. They're also connected. So, usually, they want to use the parts that are not designated to them. And if we arrest them, somebody, somehow, will make a call. So, hence, the political interference. (36-year-old female traffic enforcement officer).

The handcart pullers' likelihood of space overuse is high as they have no designated zones, and they operate and pack their handcarts on pavement as long as the space is open, leading to damages and obstruction of pedestrian traffic. Trolley pushers are few thus having minimal effects on space overuse and severity.

4.2.4. Damage to the pavement

The survey indicated that nearly 30% of pavement damage occurs due to informal traders operating from temporary structures erected on the pavements along the streets and around the markets. Freight and luggage are L/U at these zones damaging pavements as portering takes place for the destination.

Boda-bodas likelihood of damaging the pavements is medium as the tires are rubber and they park slowly at the kerbside but, the parking stands have medium impact on the pavement as well damage severity. Porters' likelihood of damaging the pavement as well as severity is low because they are pedestrians moving on foot and delivering to the destination which is either the shop, the street or the bus terminus.

Handcarts' likelihood of damage to the pavement is high especially around the market areas because they carry heavy loads, have uneven tires and have no brakes thus they are pushed off the road causing heavy friction on pavement materials causing damage.

Hawkers and vendors likelihood and severity of pavement damage is low because they usually spread a cover on the street and place their wares thus no material damage. But, in situations where they erect temporary structures, the damage is medium because of localized pavement materials. Trolley pushers' likelihood of pavement damage is high because the wheels are made of metal thus causing friction especially when overloaded and the trolley pusher who is a pedestrian weave on and off the pavement scraping the pavement with the wheels and the trolley hedges. Whereas the damage might seem minor, the impact on the concrete pavement is severe as it weakens the localized area.

Shop owners' respondents in adjacent business premises indicated the damage on pavements by boda bodas and handcart/trolley pushers during the last mile delivery as they lack proper designated area zones for operations as well as L/U zones for their cargos.

5. Discussion

While the framework by Castrellon et al. (2026) identified three main conflict triggers, i.e., built environment characteristics, street regulations, and competing demand, the Nairobi case revealed three additional triggers of conflicting conditions: (1) political interference, (2) informality in last-mile logistics, and (3) illegal occupation of public space. These findings support a context-sensitive reformulation of the original framework illustrated in Fig. 5. This section discusses these three new elements of the framework based on the data from Nairobi and how they reflect broader social, institutional, and spatial dynamics.

5.1. Political interference and the politization of street space

The actors involved in street-level conflicts in Nairobi are diverse and include national government agencies (such as the National Police Service), Nairobi City County departments, elected politicians (Members of the National Assembly and County Assembly), and a wide range of street users, including market leaders, informal traders, matatu operators, taxi drivers, boda-boda riders, and pedestrians. This multiplicity of actors contributes to a fragmented governance environment in which responsibility for street management is diffuse and enforcement is uneven.

The main responsible is the Nairobi City County government administration, which is often unable to exert control over governance and urban administration or is reluctant to do so. This is partly attributed both to limited capacity in urban planning enforcement, as well as the socio-economic and political environment. Other challenges include inadequate implementation of land use planning policies and regulations due to insufficient funding, lack of political will, political interference, and corruption (Brookings-KIPPRA, Report, 2023). Attendant to

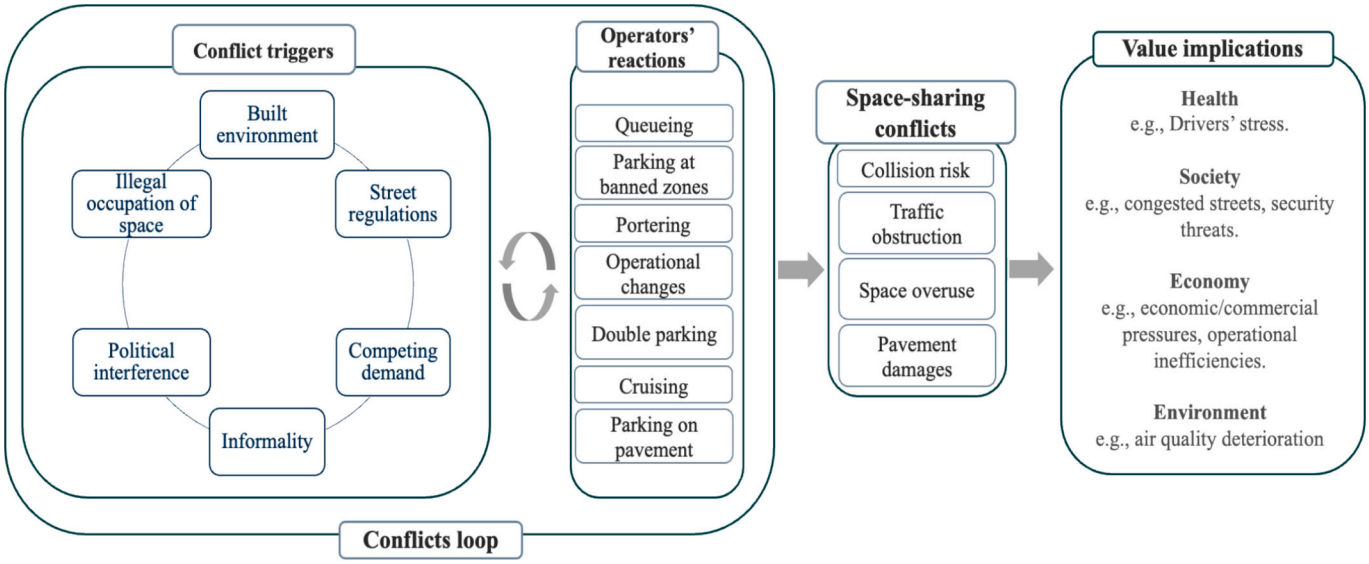

Fig. 5. Revised version of the space-sharing conflicts framework.

these challenges include encroachment of drainage infrastructure, lack of and poor work sites for cottage (jua kali) industries, as well as the proliferation of trading in undesignated spaces (Nairobi City County Integrated Development Plan 2023–2027).

Sverdlik et al. (2020) have similarly observed that local county government officials in Kenya have been accused of interfering in the acquisition of public land for private benefit, by taking advantage of their own position within the government. This is partly aided by the elite cohesion and political patronage character of public administration since colonialism. As a result, wealthy individuals are allocated premium public land for a small amount of money, in return for kickbacks (Dafe, 2009). This leaves thousands of informal operators with little space for operations. Corruption not only within land administration, but also within local government administration, is regularly mentioned but rarely addressed by authorities. Given that informal traders lack legal documentation allowing them to operate, they often must bribe the officers. Consequently, they operate with impunity as they are protected from punishment (Kinuthia, 2007).

Given that informal operators command a large population and votes, the local politicians, including the Member of National Assembly and the Members of County Assembly are often reluctant to support any measures to punish errant activities such as encroachment of the road by street vendors. This in turn encourages the street vendors, passenger taxi operators, boda-bodas and other informal actors to continue bending the law. This could explain why despite the passing of the Nairobi City County Supplementary Appropriation Bill (2023), which amended the Transport Act (2020) and introduced new charges to control the behaviour of motorists, there has been negligible impact on the street decongestion. Some of the fees introduced include L/U zone fees for (2.5 × 5) meters space. Notably, motorists do not obey these regulations, thereby obstructing other road users.

Another fee introduced by this amendment bill includes an annual registration fee for taxi and boda-boda operators in the City of USD11 and USD7 respectively, for taxi and boda-boda operators. Again, riding on political protection, most of the boda-boda riders consistently defy this regulation with impunity.

5.2. Informal structures in last-mile service provision

The concept of “informality” was introduced by Hart in 1970 while examining informal employment in Ghana (Hart, 1973). This definition was subsequently revised by the International Labour Organization (ILO) to encompass “all paid work (both self-employment and wage-employment) that is not acknowledged, regulated, or safeguarded by the current legal and regulatory system including unpaid work carried out in an income-generating venture” (International Labour Organization, 1972).

Urban streets are crucial in enhancing the vibrancy and enjoyment of city life and can become ineffective when poorly planned. The five streets that were analysed for this study have numerous informal activities that vie for space, encompassing: encroachments from commercial properties, street vendors, on-street parking, pedestrians, boda-bodas and vehicles all competing for space on the streets, resulting in clashes among the different users competing for access to the carriageway.

The informal sector comprises activities that are easy to enter, relying on local resources, being family-owned, operating on a small scale, employing labour-intensive and adaptable technologies, and utilizing skills learned outside traditional educational systems, all within unregulated and competitive markets (ILO, 1972).

Streets are generally appealing for informal sector activities as they are frequented by a diverse range of people in multiple ways, including driving, walking, and others passing by as customers of goods on display. All these individuals represent potential clientele for the informal sector. Consequently, those involved in the informal sector make efforts to secure prime locations along the street to maximize the visibility of their goods to attract a larger customer base (Racaud et al., 2018, Skinner, 2008) yet, the informal sector is often overlooked by urban planners, which leads to its exclusion from cities' development plans (Racaud et al., 2018).

Kim (2015) argues that in major cities worldwide, streets and pavement are among the most contested public spaces. Due to historical migration and immigration to urban areas, numerous spatial projects competing for this space have emerged. The rise of street vending prompts a re-evaluation of some foundational concepts used to understand urban environments. Vending may be viewed as private individuals occupying public spaces. It can enhance civic vibrancy but also hinders traffic flow. Vendors typically operate as micro-entrepreneurs who are unable to access the private real estate market for places of business. Issues surrounding the legitimate use of public space, the right to urban living, and the enforcement or neglect of local ordinances are often complicated by class conflicts, as well as the diverse ethnic backgrounds and migrant or immigrant statuses of street.

In the study area, the types of activities that compete for street space vary widely, including merchandise sales – from solitary kiosks to larger markets; small businesses such as cafes, ‘mama mbogas’ (vegetable sellers), apparel shops, fruit vendors, and vehicle repair services; uncontrolled stops made by buses, Matatus, taxis, and ‘boda-bodas’ (motorcycle taxis), push carts, tuk-tuks, trolleys; informal public transport; and other unregulated parking related to businesses on road reserves. Additionally, there is rampant development in built environments, where structures are constructed too close to roadways without adherence to building codes. The street's function as a venue for business has encroached significantly upon its other purposes as many perceive the street as a place to earn a living.

Brown et al. (2010) stated that contemporary street vending plays an essential role in the urban economy, serving as a source of employment, generating revenue, and adding value to the economy. In the study area, the informal activities are the dominant sector and should be planned for solving street conflicts and creating a way for the pedestrian towards liveable streets solutions. Incorporating spaces for informal vendors should be an essential part of street design, particularly in densely populated areas, to ensure that services reach their intended audience while also generating revenue for local authorities.

5.3. Illegal occupation of public space and the normalisation of encroachment

The illegal occupation of transportation corridors is quite rampant due to the vast land usually allocated for this purpose and the fact that the construction of this infrastructure is quite expensive resulting to the land remaining vacant for a long period of time. These are lands mostly set aside for airport expansion, pathways, railway reserves and land for road construction.

Illegal occupation and development show a lack of enforcement on the ground by agencies concerned which can be because of lack of capacity both financial and technical, lack of awareness or total disregard of the laws governing the management of the land. Lack of coordination between different government agencies often leads to severe land disputes and none of the departments is usually willing to settle them (Gateri and K'Akumu, 2023).

Nairobi's transport infrastructure is ill-equipped to handle the additional travel generated by the increasing population and urbanization. In all the streets studied, traffic congestion is a common problem exacerbated by lack of space leading to users' conflicts, weak enforcement of traffic regulations especially observation of parking restrictions, L/U zones, land-use control and failure to develop an adequate policy and planning framework.

The study area contains two large open-air markets which attract and generate a lot of traffic in terms of motorized (Lorries, motorcycles, private cars) and NMT (pedestrians, cyclists, wheelbarrows and handcarts pushers) as they ferry goods to and from the market. Much of the

open-air market land has been encroached upon through illegal acquisition. The areas that were illegally acquired are currently occupied by business cum residential buildings increasing traffic congestion. The remaining land left for the open-air market cannot serve the many traders who need space for their businesses, but the planning and enforcement authorities seem incapable of dealing with the situation thus "normalizing" the illegality. Furthermore, the traders who have spaces within the market or in the shops have built temporary structures or just displayed their goods in the street thereby encroaching on the use of the streets as open public spaces. The illegal occupation of the streets by all other users (boda-bodas, tuk-tuks, matatus, shop owners, street vendors, handcarts) has made it a dangerous task for the pedestrian who must contest for space with all these other users sometimes being pushed out to the carriageway.

Workshops participants agreed on the need of new policies and practices that enable zoning, improved safety, enforcement, freight management, accountability as well as operational flow reliability where pedestrians and freight operators can interact and coexist harmoniously together.

5.4. Implications for Practice-Informed Access Management

The findings indicate that illegal occupation of pedestrian space by freight and informal vendors should not be interpreted solely as non-compliance. Instead, these practices reflect negotiated claims to urban space shaped by economic necessity, uneven enforcement, and local power relations. From a spatial justice perspective, pedestrians (despite being prioritised in policy), experience limited effective access to safe infrastructure, while other actors secure space through informal or politicised means. This aligns with literature on public space conflicts that emphasises perception, legitimacy, and everyday practice as key drivers of spatial outcomes, particularly in Global South cities (Soja, 2013; Wang et al., 2022).

Taken together, these findings reinforce the need to move beyond purely technical approaches to access management. Freight–pedestrian conflicts in Nairobi are not simply the result of design deficiencies or regulatory gaps but emerge from the interaction between formal rules and lived practices in a context characterised by informality and contested claims to space.

A practice-informed access management approach requires engaging with the social realities shaping street use, including political dynamics, informal economies, and perceptions of legitimacy. Rather than focusing solely on enforcement or infrastructure provision, access management strategies should account for how rules are enacted, negotiated, and resisted in everyday practice. This perspective provides a basis for developing more adaptive and inclusive interventions that balance freight efficiency with pedestrian safety and urban liveability.

5.5. Implication for research in kerbside access management

Several findings from the Nairobi case align with previous research on kerbside conflicts in cities of the Global North. Similar to studies in European and North American contexts, this study finds that limited kerbside space, competing demands between freight deliveries and pedestrian movement, and inadequate provision of L/U zones are triggers of space-sharing conflicts (e.g., Conway et al., 2013; Lopez et al., 2016; Tierney, 2017). Observed operator responses such as double parking, cruising, and loading in restricted areas are also consistent with reactions documented in Global North cities, suggesting that certain conflict mechanisms are common across urban contexts.

However, the Nairobi case reveals important differences that extend existing literature. While Global North studies often emphasise regulatory design and infrastructure constraints, conflicts in Nairobi are strongly shaped by politicised use of space, informal last-mile delivery structures, and weak or selective enforcement. Freight–pedestrian conflicts frequently involve non-motorized and informal actors, such as handcart pushers, porters, hawkers, and boda-bodas, who are absent from most studies in logistics systems. These actors rely on negotiated and informal access to street space, leading to conflict patterns that are not fully captured by existing frameworks developed in other contexts.

In addition, whereas prior research typically treats illegal occupation of public space as a compliance issue, findings from Nairobi suggest that such practices represent negotiated claims to urban space driven by economic necessity, power relations, and uneven enforcement. This supports calls in the urban studies literature to interpret public space conflicts through the lens of spatial justice and everyday practice, rather than purely technical or regulatory failure.

This research extends existing freight and kerbside management literature by incorporating informality, politization, and practice-based access rules into the analysis, and highlights the need for context-sensitive access management approaches in Global South cities.

6. Conclusions

This study examined space-sharing conflicts between pedestrians and freight delivery operations in Nairobi through the lens of access management and freight-related conflict assessment. The research confirmed the relevance of the original conflict triggers from the conceptual framework –built environment, street regulations, and competing demand– but also identified three additional, context-specific conditions that intensify conflicts in the Global South: politization of space use, informal last-mile structures, and illegal occupation of public space.

These findings highlight the limitations of applying urban freight and pedestrian planning frameworks developed in the Global North without adaptation. In Nairobi, conflicts arise not only from infrastructure and regulation deficiencies but from governance dynamics, informality, and weak regulatory enforcement. The revised framework proposed in this study integrates these dimensions and offers a more comprehensive tool for diagnosing and addressing pedestrian–freight conflicts in similar urban environments.

The study also underlines the importance of context-specific ROW allocation policies that are responsive to local street dynamics. Time-based space allocation, formal inclusion of informal actors in planning, stronger institutional coordination, and enforcement mechanisms emerged as critical measures to mitigate conflicts.

The proposed framework is based on qualitative synthesis of observed practices and user perceptions, which makes it sensitive to context-specific dynamics and researcher interpretation. It captures street-level conflict patterns but does not account for longer-term temporal changes, such as seasonal variation or evolving enforcement and policy conditions. Future research could extend this work through longitudinal and comparative studies across Global South cities, and by integrating quantitative indicators of conflict frequency and severity to further test and refine the framework.

Additionally, three directions for future research are proposed: 1) Apply and test the revised framework in other cities across the Global South to validate its relevance and adaptability across diverse institutional and spatial contexts. 2) Conduct longitudinal studies to assess the effectiveness of space reallocation policies (for example, designated loading zones, vendor relocation programs, non-motorized transport (NMT)) corridor planning) in reducing conflict intensity. 3) Investigate the influence of political patronage, decentralization, and electoral incentives on urban street space regulation, particularly regarding enforcement and informal sector integration.

Funding

This project was funded by The Volvo Research and Educational Foundations [grant number EP-2023-WK-05].

CRediT authorship contribution statement

Catherine Gateri: Writing – original draft, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Juan Pablo Castrellon:** Writing – original draft, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Jesse Muriithi:** Writing – original draft, Formal analysis, Data curation. **Felix Kiruthu:** Writing – original draft, Formal analysis, Conceptualization. **Ivan Sanchez-Diaz:** Writing – original draft, Supervision, Funding acquisition, Conceptualization. **Michael Browne:** Writing – original draft, Supervision, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgements

The authors want to extend our gratitude to all the participants involved in the survey, workshops, and interviews. The insights provided were fundamental for this research. Our thanks go also to the anonymous reviewers for their helpful recommendations that improved the final version of this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.aftran.2026.100090.

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