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Measuring Transit-Oriented Development Readiness in a Declining Central Business District: A Methodological Framework for the Global South

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ABSTRACT

Motijheel, Dhaka's oldest Central Business District (CBD), suffers from spatial deterioration and institutional inertia despite the opening of Mass Rapid Transit (MRT) Line 6. While Transit-Oriented Development (TOD) research has proliferated in developed contexts, systematic assessment of TOD readiness in declining Global South CBDs remains limited. Using a mixed-methods design, this study evaluates Motijheel via the "5D" framework and a weighted TOD Readiness Index, interpreted through an integrated framework linking adaptive TOD, 18-hour city theory, and inclusive urbanism. Findings reveal a pronounced "over-dense yet under-diverse" condition: density scored 5/5 (32,729 persons/km², unrestricted FAR), while Design scored only 2.6/5, driven by weak safety (1.47/5) and security (1.39/5). Land-use diversity was moderate (3.4/5; entropy = 0.68), and MRT coverage reached just 20% of destination-accessibility needs. Income disparity in ridership was stark, with only 10% of low-income commuters using MRT versus 30% of middle-income users. A five-part strategic framework is proposed, emphasising mixed-use diversification, pedestrian-first mobility, informal-economy integration, adaptive reuse, and coordinated governance. This study offers the first systematic TOD Readiness Index for Dhaka's inaugural MRT corridor, providing a replicable methodology for Global South urban renewal.

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Highlights:

- Motijheel achieves maximum TOD density (5/5; 32,729 persons/km²) but scores just 2.6/5 on pedestrian design, exposing an "over-dense yet under-diverse" paradox.
- Land-use entropy analysis reveals critically low diversity (0.68/1) once institutional land is excluded, despite Dhaka's MRT Line 6 investment.
- Income-stratified survey data show stark transit equity gaps: only 10% of low-income commuters use MRT-6, versus 30% of middle-income users.
- A five-part adaptive-TOD framework is proposed, integrating informal-vendor formalisation, adaptive reuse, and coordinated governance for Global South CBD renewal.

Contribution to the field statement:

This study delivers the first primary-data TOD Readiness Index for a declining Global South CBD, revealing an "over-dense yet under-diverse" profile. It uniquely quantifies informal-economy activity, income-based transit equity, and after-hours vitality, advancing TOD assessment beyond conventional density-only metrics.

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1. Introduction

1.1. Background and Context

Early human settlement in Dhaka dates back to the 12th century. However, in the early 17th century, the Mughals developed Dhaka as a strategic town (Chowdhury, 2025). Since then, the city has undergone various phases under different rulers and has faced many challenges. From a military outpost, Dhaka gradually became a business centre, trading hub, regional and provincial capital, and now the primate city of Bangladesh (Chowdhury, 2025). Bangladesh has a population of 169.83 million (BBS, 2022). According to the United Nations Department of Economic and Social Affairs (2025), it is the second-most populous city in the world, with 26.88% of the country's population living there. Its internal migration rate of 25.62% (BBS, 2022) reflects rapid urban growth. Due to its strategic location and status as the capital, the city's structure has developed into a polycentric system with multiple business districts. Motijheel Commercial Area, developed in 1954, is the oldest CBD in Dhaka and has a long and significant history (Afrose et al., 2019). Once a peaceful lake area connected to the Nawab of Dhaka's Dilkusha Garden, it was transformed into a major commercial hub for business rehabilitation. Figure 1 illustrates how the area has evolved into Dhaka's busiest CBD and the country's main centre for business and finance (Hasan et al., 2022).

However, the CBD is gradually losing its significance and facing serious infrastructure problems. Peak-hour traffic congestion is a major issue in Motijheel (Badhan, 2020). The transport system mainly relies on road-based vehicles such as cars, buses, minibuses, rickshaws, and auto-rickshaws, leading to traffic jams, increased accident risk, and safety concerns. To address these challenges, Transit-Oriented Development (TOD) is important for sustainable urban growth and achieving the SDGs by 2030 (Raj & Naem, 2022). With support from the government and international organisations such as JICA, MRT-6 has been operational for three years, with 16 stations connecting Uttara North to Motijheel (Raj & Naem, 2022). It is expected to carry about 10% of the total traffic. By 2035, MRT and BRT systems are expected to be fully developed. Since TOD-based development is still in its early stages in this area, its performance requires monitoring to ensure long-term success (RAJUK, 2022).



Figure 1. Comparison of Motijheel Commercial Area in 1980 and 2024.

Note. Left: Motijheel in 1980, from Bangladesh Old Photo Archive (Facebook, n.d.). Right: Motijheel in 2024, from Getty Images.

1.2. Problem Statement

Motijheel, once the country's main financial and commercial hub, is gradually losing its importance. The area faces significant challenges, including unmanaged traffic congestion, parking shortages, ageing infrastructure, poor pedestrian conditions, limited mixed-use development, and economic decline. As a result, many businesses are gradually relocating to newer commercial areas in the north, causing Motijheel to lose its role as a vibrant CBD. It has a clear "9-to-5" paradox. The area is very busy during office hours, with many people working and moving around. But after the offices close,

the area becomes quiet and empty. It happens because of mono-functional land use. Public spaces become underutilised, retail activity declines, and the streets feel inactive or even unsafe at night. It not only reduces the area's economic potential and profitability but also deepens social disparities by limiting access to safe, vibrant public spaces after hours.

Despite many challenges, the site has strong redevelopment potential due to the introduction of MRT Line 6. Mass transit investment has long been theorised as a catalyst for urban regeneration, operating through several overlapping mechanisms: improved accessibility that reduces the "spatial friction" separating people from opportunity (Cervero & Kockelman, 1997; Kumar, 2019); land-value uplift near stations that creates redevelopment incentives (Higgins & Kanaroglou, 2018); direct catalysis of adjacent development and investment (Niger & Sinthia, 2025); and pedestrian-environment improvements that raise the overall quality of place (Renne & Listokin, 2019). MRT Line 6, developed with support from the Government of Bangladesh and JICA, now connects Uttara North to Motijheel across 16 stations and is projected to carry roughly 10% of total corridor traffic once the wider MRT/BRT network matures by 2035 (Raj & Naem, 2022; RAJUK, 2022).

However, even after three years of MRT operation, the area remains highly unregulated and largely mono-functional. As a result, it has not yet achieved the level of urban transformation and activity that was initially expected from the MRT investment.

1.3. Research Gap

Two gaps in the literature motivate this study. First, most published TOD studies focus on newly developing areas where transit is introduced before or alongside new development. Very few examine declining and already densely built CBDs in developing megacities, where the challenge is not to increase density but to make existing urban areas more socioeconomically diverse, active, and efficient (Pojani & Stead, 2015; Suzuki et al., 2015). Second, most studies using the 5D framework pay little attention to the socioeconomic realities of informal economic activities and the lack of activity after office hours. Motijheel's decline is not only a physical problem but a profound economic issue. Business relocation and mono-functional land use have reduced economic productivity and limited after-hours activity. As a result, the influence of informal street vendors, who are vital to the local socioeconomic ecosystem, and mono-functional land use on TOD performance remains poorly understood, particularly in the CBDs of Global South cities (Roever & Skinner, 2016).

This study addresses these gaps by applying the 5D framework together with field data on informal vending and after-hours activity in Motijheel. It also provides one of the first evaluations of MRT Line 6, three years after its operation, to understand its role in supporting urban revitalisation and future transit-oriented development.

1.4. Research Objectives

The research aims to assess the Transit-Oriented Development (TOD) readiness of Motijheel regarding MRT Line 6 and to suggest a strategic framework for its revitalisation as a mixed-use, pedestrian-friendly, and transit-integrated urban district.

The objectives of the study are as follows:

- To evaluate the current urban condition of Motijheel with respect to land use, infrastructure, mobility, and the pedestrian environment.
- To apply the 5D framework (Density, Diversity, Design, Destination, Distance) to assess the district's TOD readiness.
- To examine first-mile and Last-Mile Connectivity around MRT Line 6 stations and their effect on accessibility and transit use.
- To propose a strategic urban framework for transitioning Motijheel from an automobile-centric CBD to a TOD-based, pedestrian-friendly district.

To address the identified research objectives, the study is guided by the following research questions focusing on Motijheel:

- How can the TOD potential of Motijheel be assessed using the 5D framework in the context of MRT Line 6?
- What are the key challenges and opportunities for transforming Motijheel into a mixed-use, active urban district, including the roles of the informal economy, underused spaces, and off-hour inactivity?
- How effective is current first-mile and Last-Mile Connectivity around Motijheel, and how does it shape pedestrian movement and accessibility?

Table 1 shows how the research objectives, questions, and methods are aligned.

Table 1: Alignment of the research objectives, research questions, and research methods.

Research Objective	Research Question	Methods
Assess TOD readiness	RQ1: What is Motijheel's TOD Readiness Index across the 5D dimensions?	Field survey, GIS spatial analysis, and TOD Readiness Index construction
Evaluate informal-economy integration and underused space.	RQ2: How do informal vendor networks and off-hour inactivity shape Motijheel's potential as a mixed-use district?	Informal-activity mapping, temporal occupancy observation
Assess first/Last-Mile Connectivity.	RQ3: How effective is first-mile/Last-Mile Connectivity around MRT stations?	Pedestrian flow counts, walkability assessment, income/distance-stratified MRT usage survey

2. Literature Review and Theoretical Framework

2.1. The Evolution of TOD

Transit-Oriented Development (TOD) is an urban planning strategy that focuses on boosting public transport and reducing dependency on private vehicles. Its core intentions include achieving density and mixed-use development in an area that is centred on mass transportation facilities. It aims to encourage walking, cycling, and public transport. Peter Calthorpe formalised the term TOD. He defined TOD as a "mixed-use community within an average 2,000-foot walking distance of a transit stop and a core commercial area" (Calthorpe, 1993). In his book "The Next American Metropolis, Ecology, Community, and New American Dream," he emphasised the significance of walkability, public space, place-making, human-scale design, smart density, and mixed-use development, aiming to elucidate the crucial elements for creating sustainable and affordable communities with an enhanced quality of life (Jamme et al., 2019). The Development of TOD is an example of how a paradigm has shifted from the early 20th-century "Development-Oriented Transit" strategy to the current "Adaptive TOD" (Renne & Appleyard, 2019). Early TOD implementations often focused on greenfield development, in which transit infrastructure was built to spur growth along new corridors (Thomas et al., 2018). This model mirrors late 19th-century "Streetcar Suburbs," in which real estate entrepreneurs invested in new electric transit to access potential land on the city's periphery (Jamme et al., 2019).

As available land became scarce, planning attention shifted toward retrofitting existing urban fabric, giving rise to what the literature terms adaptive TOD. Unlike greenfield projects, these "brownfield" or "infill" TODs must address existing rail systems, established street patterns, and a history of industry (Renne & Appleyard, 2019). Where greenfield or "New Town" TOD, exemplified by projects such as Ørestad in Copenhagen, treats transit as the backbone around which an entirely new district is built (Thomas et al., 2018), adaptive or "brownfield"/"infill" TOD must instead negotiate existing rail alignments, land tenure, and institutional arrangements. It makes implementation more complex, both technically and politically, requiring coordination among many stakeholders and across financing mechanisms (Thomas et al., 2018). In the context of this study, the concept of Adaptive TOD is particularly relevant, especially in dense, built-up environments, as it helps revive existing urban areas

that are already in decline rather than focusing solely on developing new districts (Kimpton et al., 2020).

Unlike the initial greenfield TOD, which often assumes a blank slate, adaptive TOD works within the constraints of existing urban conditions, such as ageing infrastructure, fragmented land ownership, and established social patterns. Implementing such a plan in existing environments is complicated by both technical and institutional barriers, including the need to coordinate among multiple stakeholders and manage financing (Thomas et al., 2018). Adaptive TOD serves as a tool to bring life back to city neighbourhoods and to resist urban decline (Kimpton et al., 2020).

Mass Rapid Transit (MRT) is a fundamental component of TOD. It provides the main transport backbone supporting high-density, mixed-use urban areas. MRT includes various forms of high-capacity public transport (Kittelson & Associates et al., 2013), such as:

- Rail systems – including metro, subway, and light rail transit
- Bus Rapid Transit (BRT) – buses operating on dedicated lanes for faster movement
- Dedicated transport corridors – exclusive routes or tracks designed for mass transit use

The primary objective of MRT is to move a large number of people quickly and safely, provide a reliable alternative to private vehicles and support daily commuting and urban mobility needs. High-speed, low-cost, and efficient operation makes MRT a practical and attractive choice for urban transportation (Kittelson & Associates et al., 2013). A functional MRT system is crucial for creating sustainable, accessible, and well-connected cities, particularly in developing urban contexts.

2.2. The 5D Framework

TOD is a complex concept with many dimensions that affect planning, design, implementation, and evaluation in urban areas. One challenge is the lack of a single universal definition of TOD, which makes it difficult to set clear planning criteria. Earlier, researchers introduced the "3Ds" of TOD: density, diversity, and design, which were found to reduce car use and travel distance (Cervero & Kockelman, 1997). Later, two more essential factors—distance and destination—were added to form the "5Ds" (Iamtrakul et al., 2005). A successful TOD is considered a balanced combination of all five factors. The 5Ds serve as an indicator for analysing how the built environment influences travel behaviour (Sun et al., 2024). The components and impacts of the 5D framework, as outlined in the existing literature, are concisely summarised in Table 2.

Many scholars evaluated these five parameters in different ways. Density is evaluated by comparing the existing population of Dhaka wards with the allowed density standard (persons per acre). They used carrying capacity analysis ($\text{Area} \times \text{Allowable Density}$) to find which wards had exceeded sustainable population limits (Khan et al., 2017). Luan (2025) and Camporeale et al. (2019) evaluated diversity using Shannon's Entropy (Shannon's Entropy Index). It measured the mix of land uses, including residential, commercial, and institutional areas. A higher entropy score indicated a more balanced, mixed land-use pattern (Camporeale et al., 2019; Luan, 2025). Design is measured by transit frequency, affordability, and accessibility of transit stations. It shows the quality of transit service and how easily people can use it. Better design meant more frequent, affordable, and accessible transit options (Khan & Tabassum, 2024; Patnala et al., 2020). Destination accessibility is measured by counting POI (Points of Interest) visits within a 10-minute walking distance from transit stops. It reflects how easily people can reach jobs, services, and daily needs. More POI visits led to better accessibility (Camporeale et al., 2019; Luan, 2025).

Table 2: Dimensions and components of the 5D framework.

Dimension	Key Analytical Metrics	TOD Target	Primary Impact
Density	Floor Area Ratio (FAR), Population Density, Job Density	High	Supports transit frequency and efficient land use
Diversity	Land-use Entropy Score, Job-Housing Balance	High	Reduces travel distance and encourages walking
Design	Intersection Density, % of sidewalk coverage	High	Improves walkability, safety, and public life
Distance	Average walking distance to station (m)	Low (Physical)	Eliminates the psychological barrier of the "Last Mile."
Destination	Jobs reachable within 30 mins by transit	Low	Increases the utility of the transit network over driving.

A TOD area needs to perform well across all five dimensions simultaneously. For instance, high density is ineffective without design (walkability) because people may still choose to drive if the environment feels unsafe or hostile to pedestrians. Analytical models (like those by Ewing & Cervero) show that destination accessibility often has the strongest single impact on reducing Vehicle Miles Travelled (VMT), followed by Diversity and Design (Cervero & Kockelman, 1997). While a typical suburb might score well on "Design" for greenery, it usually falls short on Diversity and Distance to Transit, creating a structural dependence on private vehicles.

2.3. The 18-Hour City Concept

Many cities around the world are developing vibrant downtown areas with a mix of housing, shops, entertainment, and workplaces. These mixed-use environments are attracting investment and improving the competitiveness of these cities (Thomas & Bromley, 2000). This change is largely driven by "walk-to-work" housing, which encourages people to live close to their workplaces. As a result, companies, especially those in knowledge-based industries, are relocating their offices to city centres (Thomas & Bromley, 2000). It has led to the emergence of a new type of city, the "18-hour city."

The concept of an 18-hour city strikes a balance between the traditional 9-to-5 commuter city and the high-intensity 24-hour global metropolis (like New York or Tokyo). While 24-hour cities are often expensive and crowded, 18-hour cities have a balanced urban environment. It keeps economic and social activity going from early morning until late at night, with breaks in the early morning hours. These growing "18-hour cities" are inspired by places like Manhattan, where a good mix of activities increases demand, higher density raises property value, and vibrant environments attract investors (Heath, 1997; Kelly & Malizia, 2017).

Birch (2002) discussed a similar idea, explaining that cities could become "ghost towns" after work if they don't make downtown areas more active. Cities need to shift from traditional 9-to-5 places to more active 18- or even 24-hour urban centres to avoid this (Birch, 2002). Today, 18-hour cities are drawing in both millennials and young boomers who want to find work and live better in the city. New buildings in these cities often include restaurants, cafes, bars, and cultural spaces like art galleries and movie theatres, making these areas fun for people of all ages (Thomas & Bromley, 2000).

2.4. Inclusive Urbanism and Transport Equity

Inclusive urbanism extends beyond the "average citizen" to include women, children, elders, lower-income residents, and local communities. Urban planning is now beginning to incorporate diverse

perspectives, including those of women, children, older adults, and low-income groups. The concept is based on the "what–who–how" framework (Belausteguigoitia, 2019). The "what" refers to sustainable urban planning and design, the "who" to diverse stakeholders, and the "how" to participatory engagement processes, as illustrated in Figure 2. This approach addresses the limitations of traditional planning, which often overlooks diverse user needs (Bond & Thompson-Fawcett, 2007). Community engagement is identified as essential for achieving sustainability. Various methods, such as information sharing, consultations, workshops, and charrettes, enable stakeholders to contribute meaningfully. Among these, consensus-building tools are most widely used, while higher-level participation (e.g., decision-making or self-management) remains limited. Integrating diverse perspectives leads to better-targeted solutions, stronger public acceptance, and added benefits for communities, governments, and the private sector. However, challenges include the time and effort required, limited participation, and reluctance among institutions (Belausteguigoitia, 2019).



Figure 2. Framework for inclusive urbanism (Source: Author, 2026).

Since MRT accessibility in this study varies significantly across income groups, the analysis also considers transport equity. It includes both horizontal equity, which ensures equal transport services for similar groups, and vertical equity, which gives greater attention to disadvantaged and transit-dependent populations (Camporeale et al., 2019; Martens, 2016). Pereira et al. (2017) argue that transport accessibility should be evaluated not only by overall averages but also by the fairness with which its benefits are distributed. Therefore, the discussion interprets the income differences in MRT ridership as an issue of transport equity rather than simply a difference in usage.

2.5. Integrated Analytical Framework

The theories discussed above are not treated as independent literatures in this study but as three complementary components of a single analytical framework. The 18-hour city concept defines the study's goal by promoting activity beyond regular office hours. Inclusive urbanism provides the equity perspective by examining whether the benefits of redevelopment are shared by all groups, including women, low-income residents, and informal workers. Adaptive TOD offers a strategy to achieve this goal through mixed-use development, adaptive reuse, improved pedestrian environments, integration of the informal economy, and better governance in an already-developed urban area.

Based on this framework, the study argues that Motijheel's mono-functional land use has limited after-hours activity and business growth. These problems are further intensified by unequal accessibility and income-based differences in MRT use. The study proposes that adaptive TOD,

guided by the principles of inclusive urbanism, can use MRT Line 6 as a catalyst to transform existing urban density into long-term urban and economic revitalisation.

3. Materials and Methods

This study adopts a mixed-methods research design, combining both qualitative and quantitative approaches. It involves field observation, spatial analysis, and stakeholder insights to evaluate Motijheel's readiness for Transit-Oriented Development (TOD) using the 5D framework (Density, Diversity, Design, Destination, Distance). The method enables a thorough comprehension of both the physical urban environment and the functional dynamics of urban areas, as illustrated in Figure 3.

3.1. The Study Area

The study is conducted in Motijheel, Dhaka. It is historically acknowledged as Dhaka's oldest and most vital Central Business District (CBD). The area is selected due to its strategic location along MRT Line 6. As shown in Figure 3, it is a critical case for Transit-Oriented Development (TOD) analysis, as it represents one of the first major MRT-integrated CBDs in Dhaka.

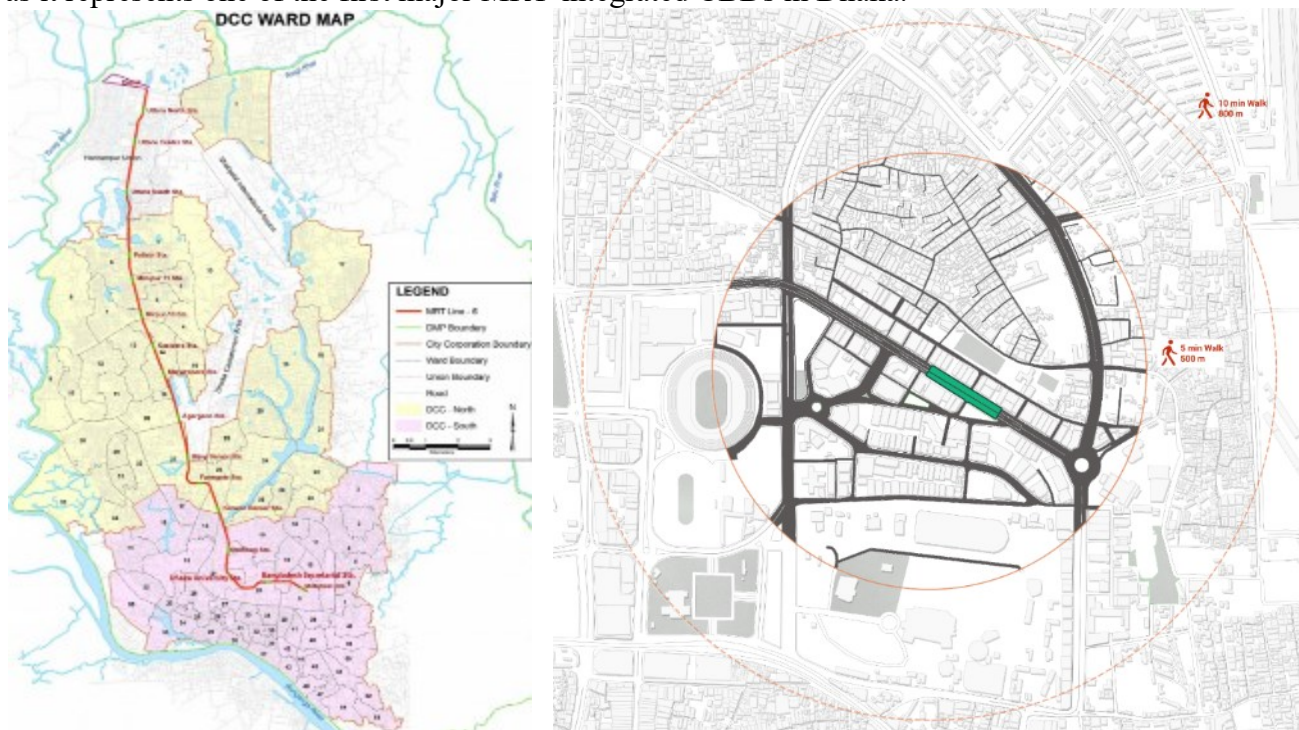


Figure 3. Left: MRT route in the map of Dhaka city (Source: DMTCL Website, 2026); Right: Map of Motijheel CBD Area within a 500 m and 800m radius from the MRT Station.

The key reasons why this study area was chosen:

- Its role as a primary financial and commercial hub of Dhaka
- Direct influence of MRT Line 6 as a major transit catalyst
- Existing issues of traffic congestion, poor pedestrian infrastructure, and informal encroachment
- Significant underutilisation of space during non-business hours, creating potential for an 18-hour economy
- Presence of ageing office buildings with potential for adaptive reuse

Thus, Motijheel is an appropriate setting for evaluating TOD readiness and for investigating strategies for urban revitalisation in a densely populated, developing-city CBD.

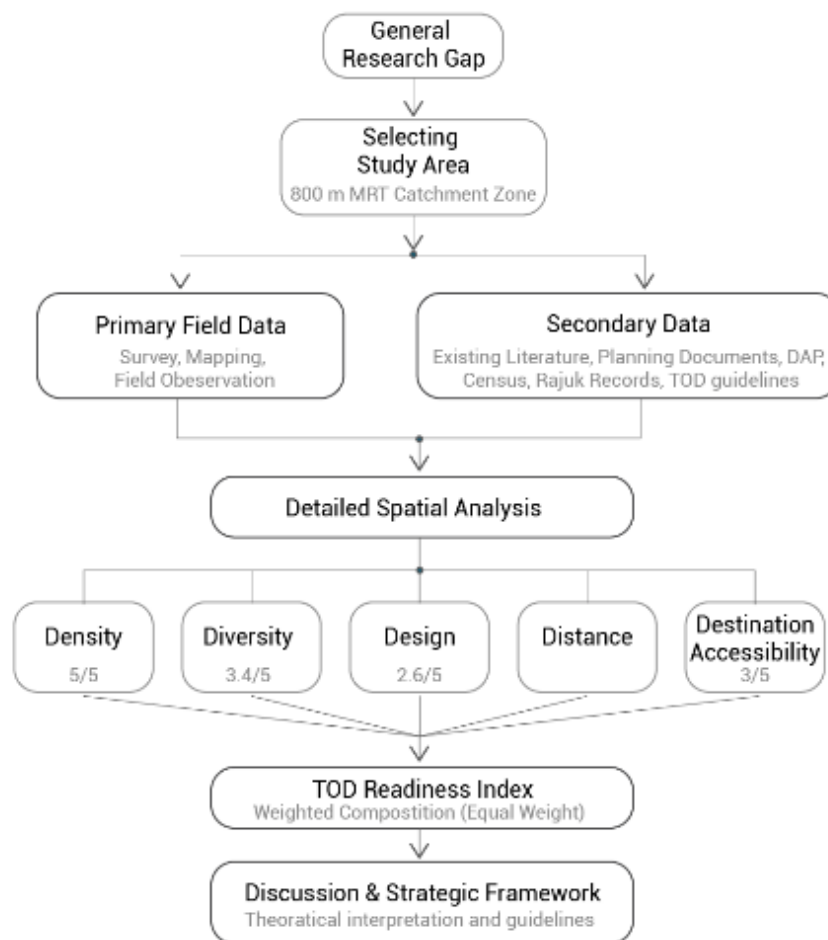


Figure 4. Methodological framework.

3.2. Sampling Strategy and Sample Size Justification

The target population for the stakeholder survey was office employees working within the Motijheel MRT catchment area, as this group is both the district's dominant daytime users and the primary determinant of the “9-to-5” pattern under investigation. The stakeholder survey targeted office employees in the Motijheel MRT catchment area, as they are the district's main daytime users and are directly tied to the area's “9-to-5” activity pattern. The survey was conducted in October 2025 in office buildings located within an 800 m radius of the Motijheel MRT station. A total of 115 employees completed the survey. Survey questionnaires were distributed in both Bangla and English, allowing participants to choose their preferred language. The survey collected information on participants' demographic characteristics, economic status, commuting patterns, personal preferences, and their experiences and perceptions of the Motijheel area.

As this is an exploratory study focused on a single site, the sample size was not determined through a statistical power analysis. Instead, it was selected to be consistent with similar field-based studies of single-station TOD catchments (Patnala et al., 2020).

3.3. Primary Data Collection

Primary field data were collected through direct observation and on-site surveys across four categories:

- Road Condition Survey: pedestrian walkability, road and footpath condition, congestion levels, and street usability within the MRT catchment.
- Land Use: existing land use documented from the Detailed Area Plan (DAP) and ArcGIS records, together with building occupancy variation between business and non-business hours.

- Informal Activity Mapping: locations, density, and temporal variation of informal vendors around transit nodes and high-footfall areas.
- Field Observation and Visual Documentation: photographic and behavioural recording of pedestrian movement and street-level conflicts.

3.4. TOD Readiness Index: Construction and Validation

Following the 5D framework described in Section 2.2, each dimension was evaluated using key indicators derived from spatial analysis and field survey data. Table 3 summarises the indicators, data sources, and scoring basis for the TOD Readiness Index.

Table 3: Indicators, data sources, and scoring criteria for the TOD Readiness Index.

Dimension	Indicator	Data Source	Scoring Basis
Density	Population density (persons/km ²) within the 500 m MRT catchment, cross-checked against maximum permissible Floor Area Ratio (FAR)	BBS (2022) ward-level census; RAJUK Imarat Nirman Bidhimala	Benchmarked against density classification thresholds in Khan et al. (2017)
Diversity	Land-use entropy (Shannon's Entropy Index)	DAP / ArcGIS land-use map (Figure 7, left)	Normalised entropy, 0–1 scale, converted to a 1–5 score
Design	Weighted walkability score across seven parameters (Table 6)	Field survey and street-network observation	Mean of parameter ratings, 1–5 scale
Distance	Share of the catchment area within an acceptable walking threshold of the MRT station	GIS network-distance measurement	Coverage ratio, converted to a 1–5 score
Destination Accessibility	Density and reachability of points of interest (POIs) within the catchment	Field survey / POI mapping (Figure 7, right)	Count-based, benchmarked against the catchment area

All five dimensions were converted to a common Likert 1–5 scale and combined to calculate the overall TOD Readiness Index using a weighted scoring method.

4. Existing Condition Analysis (The Reality)

4.1. The Physical Realm

4.1.1. Road condition

For this study, a specific area within the priority development zone has been selected. The study focused on peak hours (9:00–10:00 AM and 5:00–6:00 PM). A drastic change in traffic is evident during these hours, as shown in the graph in Figure 5 (left), which later decreases significantly. The physical condition of Motijheel shows clear signs of ageing and poor maintenance. Although the road network is well-connected, many roads suffer from poor surface conditions, frequent congestion, and inadequate traffic management. Key streets experience heavy vehicular pressure during peak hours, contributing to rapid wear and tear.

A large portion of the road network consists of underutilised and blind (dead-end) streets. Figure 5 (right), Figure 6 (right) illustrates that these spaces are mostly used for car parking and informal activities rather than for proper circulation. The ratio of secondary streets to underutilised and dead-end streets in the study area is approximately 1.5:1 (61% to 39%), indicating that a significant portion of the road infrastructure is underutilised or dead-end.

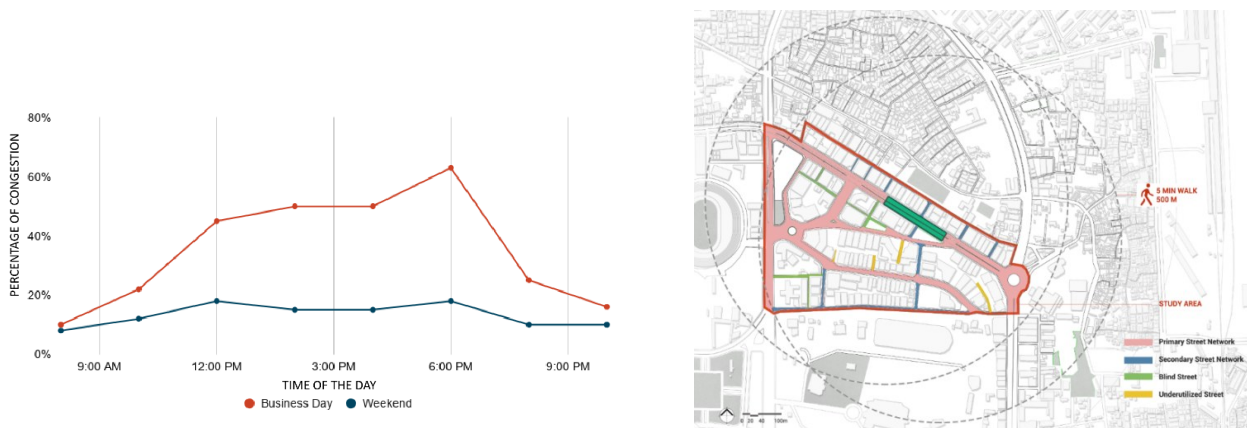


Figure 5. Traffic condition data (left), Road Condition Data (right) (Source: Author, 2025).

4.1.2. Pedestrian Flow and Sidewalks

During peak hour, a significant number of people disperse through the study area. The intensity of movement was recorded at 5-minute intervals during the evening peak (5:30 PM). As shown in Figure 6 (left), pedestrian flow is comparatively higher at major nodes, indicating concentrated movement patterns. However, the existing sidewalk infrastructure is inconsistent and often inadequate. In many locations, footpaths are either too narrow, encroached upon by informal vendors, or absent (Figure 6, right). As a result, pedestrians are frequently forced to use the carriageway, increasing safety risks and negatively affecting overall walkability.

Additionally, drainage systems, street lighting, and public amenities require repair. Waterlogging during the monsoon season further highlights the inefficiency of the existing infrastructure. The cumulative effect creates an environment that is functionally active but spatially uncomfortable and visually degraded. Moreover, most trees located along the road medians are small and do not provide

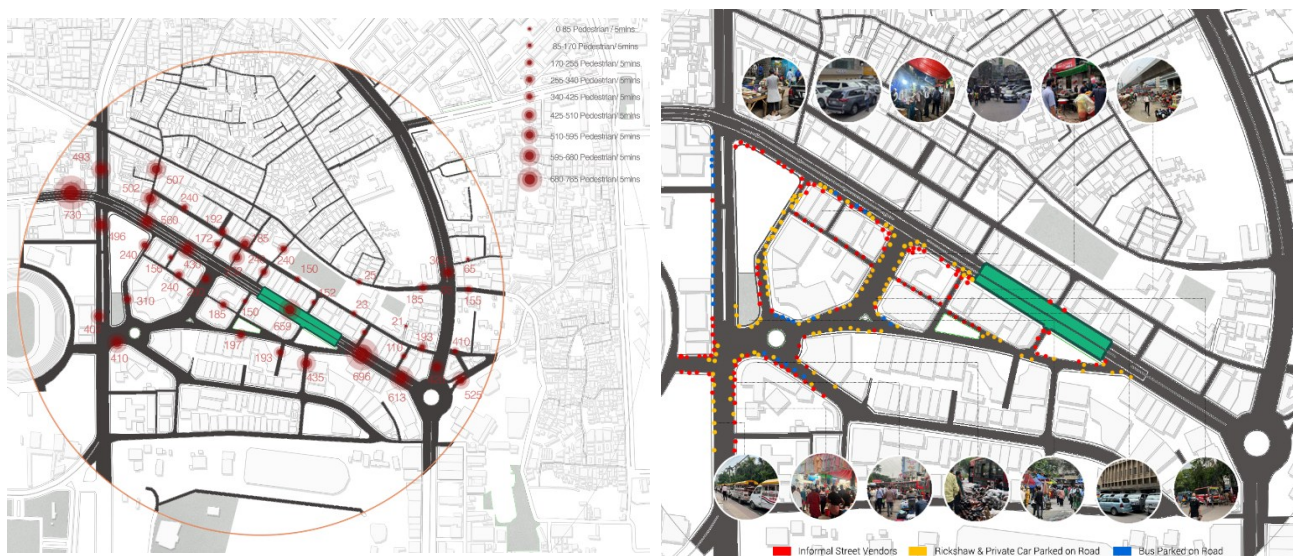


Figure 6. Pedestrian count per 5 minutes in peak hour (left), Informal activity mapping (right)

significant environmental benefits. Many of these trees may also be removed due to MRT line construction, although they should ideally be replanted elsewhere.

4.2. The Economic Realm

Motijheel's economy is highly mono-functional, primarily dominated by offices, banks, and financial institutions. As shown in Figure 7 (left), the core area is predominantly commercial. While this

specialisation once defined its strength, it now contributes to its decline. The absence of mixed-use development limits the diversity of activities throughout the day. Retail spaces, cultural venues, entertainment facilities, and recreational amenities are scarce. Figure 7 (right) further illustrates that the Points of Interest (POIs) within the core zone are largely concentrated as major banks and financial organisations. At the same time, other urban amenities remain scarce within a 500-metre radius of the MRT station. As a result, the area lacks vibrancy beyond standard office hours. Unlike emerging commercial zones in Dhaka, Motijheel fails to attract a broader demographic, particularly younger populations and residents seeking lifestyle-oriented environments.

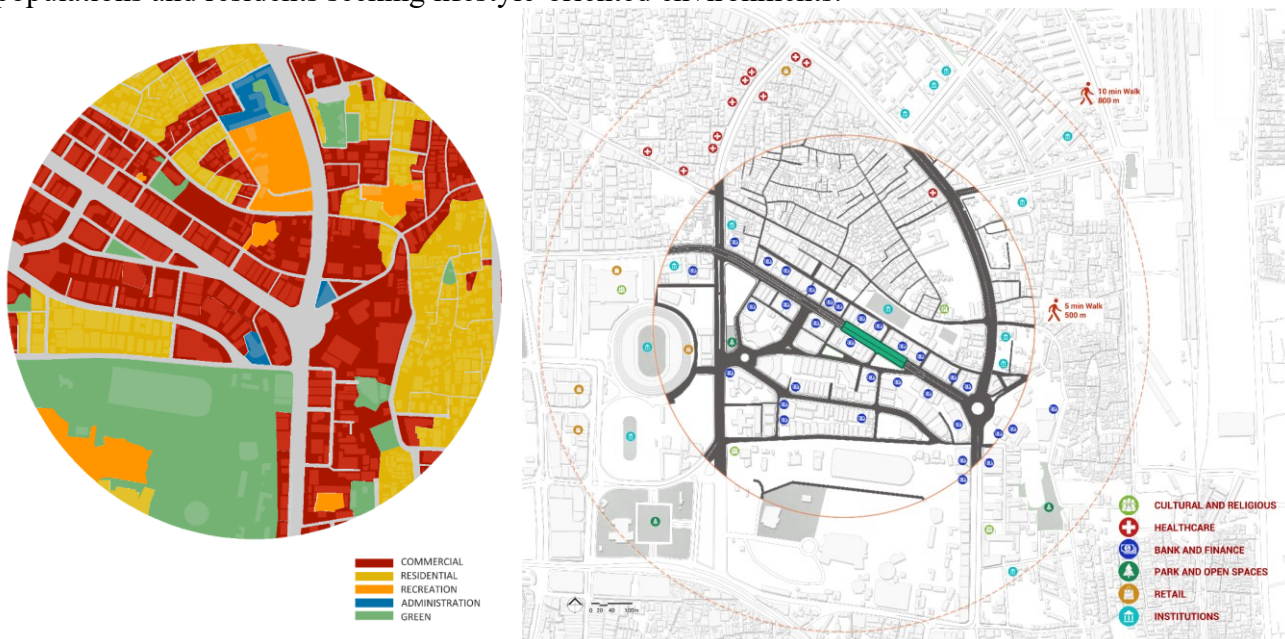


Figure 7. (left) Land Use Map (Source: GIS Map Data), (right) Point of Interest (POI) Mapping.

In this context, informal economic activities play a critical role in sustaining everyday urban life. The area has become relatively expensive, particularly for food and essential services, which compels many users to rely on informal businesses such as street food vendors and small-scale sellers of daily necessities. This informal layer fills the gap left by the absence of a diversified land-use structure. However, it also places additional pressure on already constrained public space and pedestrian infrastructure.

4.3. The Social Realm

A stark contrast between daytime intensity and night-time emptiness characterises the social landscape of Motijheel. During office hours, the area becomes densely populated with employees, street vendors, and service providers. The demographic profile shown in Figure 8 is notably dominated by males aged 36–45, many of whom have families. Due to limited housing options in the area, this group tends to live in more affordable neighbourhoods and commute from farther away to Motijheel. Thus, the area offers limited opportunities for vibrant social life and community activities beyond office hours.

Informal street vendors and small local shops have become important sources of retail and daily services (Figure 9). Informal hawkers occupy strategic locations along sidewalks and intersections, responding to the high demand for affordable food and goods. Figure 6 (right) clearly illustrates the overall scenario of hawkers' activity.

However, this activity is largely unregulated and often contributes to spatial congestion and pedestrian obstruction. The distribution of hawkers reflects economic necessity rather than planned integration into the urban fabric.

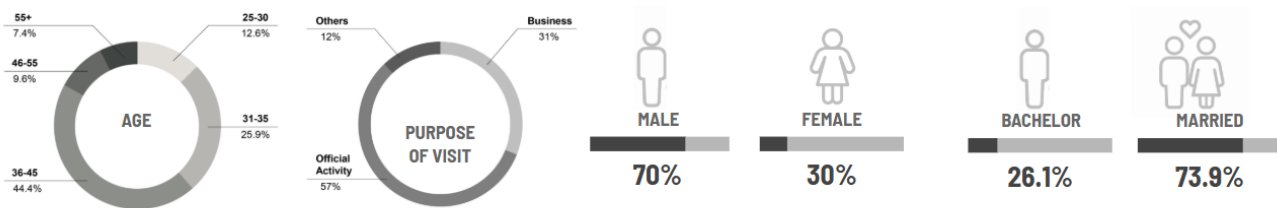


Figure 8. Demographic profile of office workers in Motijheel.

After office hours, Motijheel undergoes a rapid transformation. The workforce leaves the area, resulting in a significant drop in population density. This "after-hours exodus" results in inactive streets, reduced natural surveillance, and a perceived lack of safety. The absence of residents further intensifies this temporal imbalance, rendering the district largely non-functional at night.



Figure 9. Informal Activities in Motijheel (Source: Author, 2025).

4.4. The Connectivity Gap

The introduction of Mass Rapid Transit, particularly MRT Line 6, presents a transformative opportunity for Motijheel. It has created affordable, time-saving options for commuters to reach the office from farther away. Table 4 shows the frequency of MRT use by commuting distance. However, the effectiveness of this system is currently limited by significant last-mile connectivity challenges. Although many people travelling to this area have access to the MRT, it is not equally accessible to all user groups. Based on field survey data from 115 office employees, only 10% earning less than 20,000 BDT use the MRT. Although the percentage is low, the number is very high among middle- and upper-middle-income individuals. For income levels BDT 30,000-40,000, the highest 30% of MRT is used. This creates a vertical equity imbalance, with accessibility unevenly distributed across user groups based on their socioeconomic position and travel capacity. While MRT stations improve macro-level accessibility, the transition from station exits to final destinations remains problematic. Pedestrian pathways are often discontinuous, poorly shaded, and obstructed. There is a lack of clear wayfinding systems, safe crossings, and integrated mobility options such as rickshaws, buses, or non-motorised transport hubs. It discourages the use of public transport and pushes people toward private vehicles. Moreover, the absence of transit-oriented design elements, such as active ground floors, mixed-use Development, and pedestrian-friendly streets, reduces the potential impact of the MRT system. Without addressing these last-mile gaps, the full benefits of transit accessibility cannot be realised.

Table 4: Commuting Distance for Employment in Motijheel. (Source: Author, 2026)

Distance	Locations	Percentage
Very Close to Motijheel (Within 2–3 km)	Arambag, Siddique Bazar, Tikatuli, Shantinagar, Shantibag, Rajarbag, Paltan, Palton, Komlapur, South Kamlapur, Kalmapur	35%
Moderately Close (3–6 km)	Tejgaon, Kalabagan, Dhanmondi, Nilkhet, Polashi, Rayerbazar, Jigatola, Agargaon,	38%
Farther Away (6–12 km)	Mirpur, Pallabi, Shewrapara, Uttara, Cantonment, Rampura, Bashundhara R/A	19%
Outskirts or Beyond (12+ km)	Savar, Tongi, Gazipur, Keraniganj, Narayanganj, Gopalganj.	8%

5. Results

5.1. Density

Migration from rural areas of the country to the urban city of Dhaka is a major contributor to population growth. Dhaka continues to show steady growth, with estimates placing the 2030 population at 27.3 million (BBS, 2022). The fast-growing population has already put tremendous stress on the city, as evidenced by its high poverty rates, and future concerns include increasing congestion, higher unemployment, and inadequate infrastructure.

Density describes the number of people per unit area and is usually expressed as people per acre or dwelling units per acre (Khan et al., 2017). Population density within the 500 m catchment is calculated as an area-weighted average of the four wards intersected by that radius for this study. The share of each ward and its population is shown in Table 5. Each ward's population density is weighted by the proportion of its area within a 500 m radius. However, the study assumes the population is evenly distributed within each ward, which may over- or understate density in the blocks nearest the station.

So, the Population Density,

$$= (0.0526 \times 36527 + 0.7815 \times 30,732 + 0.0511 \times 43860 + 0.0863 \times 41,564) / (0.0526 + 0.7815 + 0.0511 + 0.0863)$$

$$= 32,729.3052 \text{ per sq. km}$$

Khan et al. (2017) explored various density concepts and their applications in urban planning across cities worldwide, and recommended density implications for Dhaka's city planning. High density is the classification for densities of 501 to 1000 individuals per acre (Khan et al., 2017). Population density in this case is very high compared to the standard. Therefore, the density would be 5.

Table 5: Density per Ward within the 500 m Radius of the MRT Station. Source: BBS, (2022)

Ward no	Area within radius (sq. km)	Density (per sq. Km)
DSCC 08	0.0526	36,527
DSCC 09	0.7815	30,732
DSCC 10	0.0511	43,860
DSCC 11	0.0863	41,564

In Motijheel, all plots along the primary roads are used for commercial (F1 type) purposes. The primary roads are more than 24 m wide in the 800 m catchment area. According to the Imarat Nirman Bidhimala, the FAR of these zones is NR (not restricted) (RAJUK, 2022). Since the area allows the maximum possible FAR, the density level based on FAR can be considered 5 out of 5.

5.2. Diversity

A diverse area reduces travel demand and encourages active streets throughout the day. It is usually measured through Land-use surveys, the entropy index, and the Percentage of mixed land use (Calthorpe, 1993). From the land-use map in Figure 7 (Left), it is evident that the area is mainly commercial, with limited other amenities. The commercial-to-residential ratio is 2.57:1, which indicates poor land-use diversity. As mentioned in the literature review, the Entropy Index is used to measure land-use diversity in an area. It shows whether different land uses are evenly mixed or dominated by one type. The Formula (1) measures the entropy index,

$$E = -\sum p_i \ln(p_i) \quad (1)$$

From the land use map in Figure 7, the percentages of land use are commercial 49.8%, Green 21.89%, residential 19.33%, and others 9%.

The calculation of the entropy index is $E = 1.22$

Max possible ($\ln 4$) ≈ 1.38

Normalised value $1.22/1.38 \approx 0.88$

Although the entropy value indicates "moderate diversity," this is mainly due to the large Area of Bangabhaban. While it is a residential zone with extensive green spaces, it is restricted for the general public. Therefore, to accurately reflect the actual land-use conditions, this area should be excluded from the calculation. If excluded, the entropy value is around 0.68.

The value of diversity is 0.68 on a scale of 1; thus, on a scale of 5, it is 3.4.

5.3. Design

Design refers to the quality of the pedestrian environment and urban form. Good design improves walkability and accessibility. The design is evaluated using seven parameters established in literature, including footpath quality, footpath continuity, safety, accessibility, security, comfort, and availability of amenities (Khan & Tabassum, 2024). The data were evaluated through field surveys, walkability assessments, and street network analysis.

The results from Table 6 show that footpath quality and continuity (3.40 each) are relatively stronger aspects of Motijheel's pedestrian environment, indicating better physical walking infrastructure in selected areas. Accessibility (3.04) is also moderately strong, suggesting reasonable connectivity within the CBD. However, safety (1.47) and security (1.39) are the weakest-performing indicators, highlighting major concerns about pedestrian protection, traffic risks, and perceived personal safety. Meanwhile, comfort (2.80) and amenities (2.90) fall within a moderate range, indicating the presence of supporting facilities, though there is still room for improvement. Overall, the distribution suggests that while Motijheel performs moderately in physical infrastructure, it significantly underperforms in safety and security-related aspects of walkability.

Table 6: Parameters for evaluating 'Design' in terms of walkability.

Measuring Parameters	Ward 8	Ward 9	Ward 10	Ward 11	Weighted average
	5.41%	80.43%	5.26%	8.88%	
Footpath Quality	1	4	1	1	3.4
Footpath Continuity	1	4	1	1	3.4
Safety	3	1	3	4	1.47
Accessibility	4	3	3	3	3.04
Security	3	1	3	3	1.39
Comfort	2	3	2	2	2.8
Amenities	2	3	2	3	2.9

5.4. Distance

Distance here refers to physical proximity to the MRT station. The core CBD is located close to the station (Figure 7, right), providing good access to office jobs for commuters travelling from different parts of the city. This is supported by the field survey, which found that most respondents travelled long distances to work (Table 7). However, MRT use varies across different groups. Only 6.7% of respondents travelling 2–3 km use the MRT, compared with 24.32% of those travelling 6–12 km and 19.35% of those travelling more than 12 km (Table 7). In addition, schools, hospitals, and housing remain relatively far from the CBD because of its mono-functional land use rather than the location of the MRT station. As a result, MRT accessibility works well for office commuters but is less effective for residents and non-work trips.

Table 7: Comparison of Commuting Distance and Frequency of MRT Line 6 Usage.

Distance levels	Distance	Number of Responses	Number of MRT-6 Users among the Responses	% of MRT-6 Users among the Responses
Very close	2-3 km	30	2	6.70
Moderate	3-6 km	17	3	17.60
Further	6- 12 km	37	9	24.32
Outskirts	Beyond 12 km	31	6	19.35

5.5. Destination Accessibility

Destination accessibility here refers to the reachability of jobs, services, and other points of interest from the MRT station, not physical proximity to the station itself. The nearest MRT station is approximately 2,200 m from the far edge of the assessed area, with roughly 1,100 m of that area requiring coverage. The coverage ratio can be expressed as:

$$\begin{aligned} \text{Coverage} &= \text{area within average walking distance} / \text{Total Area to be covered} \\ &= 0.8 \text{ km}^2 / 3.8 \text{ km}^2 = 0.2 \end{aligned}$$

The MRT effectively serves only about 20% of the catchment's destination accessibility needs. Combined with the lack of an integrated feeder transport system, this indicates poor accessibility to the destination. It supports the findings in Section 5.4, showing that although the station is well located within the CBD, connections to surrounding destinations remain inadequate.

5.6. Comparative Result Analysis

This study adopts equal weighting as its primary weighting scheme because TOD theory does not establish a priority hierarchy among the 5Ds. The analysis of Motijheel using the 5D framework shows mixed results. Table 8 summarises the results showing that the area has a very high density, a large population, and a maximum FAR, making it a highly developed urban core. However, diversity is limited because land use is mostly commercial, with few residential or mixed-use functions. The pedestrian design is moderate; footpaths are fairly good, but safety, security, comfort, and amenities need improvement.

In terms of distance, the MRT helps people reach offices easily, especially from far areas. But important services like housing, schools, and hospitals are far away, creating unequal access (vertical equity issues). Destination accessibility is also low, with only a small part of the area within walking distance of the MRT, and weak transport connections.

Table 8: Evaluation of the TOD Readiness Index based on 5D for Motijheel.

Index	Score	Considerations	Expected Outcome	Literature Reference
Density	5	Population density, the maximum Floor Area Ratio (FAR).	High	(Khan et al., 2017)
Diversity	3.4	Entropy Index, Percentage of Mixed Land Use, Inclusivity	High	(Camporeale et al., 2019; Luan, 2025)
Design	2.6	The weighted average of the walkability and infrastructure-based parameters	High	(Khan & Tabassum, 2024; Patnala et al., 2020)
Distance	3	Field data on MRT access and POI reachability	Low	(Camporeale et al., 2019; Luan, 2025)
Destination Accessibility	3	Coverage Area by MRT Stations	Low	(Camporeale et al., 2019; Luan, 2025)

Figure 10 compares Motijheel's performance with the ideal TOD target for each dimension. The area has sufficient density to support transit-oriented development, but it lacks the land-use diversity, urban design quality, and connectivity needed to function as a balanced TOD district. These gaps are addressed through the strategic framework proposed in the following section.



Figure 10. Comparison of the current performance and expected outcomes of TOD in Motijheel.
(Source: Author, 2026)

6. Discussion

6.1. The “Over-Dense yet Under-Diverse” Paradox, Read Through TOD Theory

The TOD Readiness Index presented in Section 5.6 reveals an important pattern. Although Motijheel has a very high density and high FAR (Section 5.1), it performs poorly in the other TOD dimensions, especially Design and Diversity, after excluding Bangabhaban from the entropy calculation (Section 5.2).

According to TOD theory, density alone is not enough to create a successful transit-oriented district. Diverse land uses, good urban design, and strong connectivity must support it. As shown by Cervero et al. (2013), density has only a limited effect unless combined with other factors. Motijheel demonstrates this clearly. While it already has the density needed for TOD, its long-standing mono-functional land use has prevented it from becoming a vibrant mixed-use district.

Similar findings have been reported in TOD studies from South and Southeast Asia (Iamtrakul et al., 2021; Patnala et al., 2020), where many dense CBDs perform well on density but score lower on diversity and design. It suggests that Motijheel's condition may be common among high-density, mono-functional CBDs in developing cities rather than being unique to this case.

6.2. Urban Regeneration Perspective: Justification of MRT–Renewal Link

Previous research supports the idea that MRT Line 6 can support the renewal of Motijheel. Studies show that transit investment improves access to jobs and services (Cervero & Kockelman, 1997), increases land values around stations, encouraging redevelopment (Higgins & Kanaroglou, 2016), and attracts new development and investment (Nurhidayati et al., 2026). These benefits are possible in Motijheel because of its high density and relatively good Distance scores.

However, this study is based on conditions observed about three years after the MRT began operating. Therefore, it cannot confirm whether urban renewal has already taken place or will occur in the future.

Instead, it provides a baseline assessment of TOD readiness that can be used in future studies to monitor changes in land value, building occupancy, and business activity over time.

6.3. Spatial Justice and Transport Equity

The differences in MRT use across income groups reported in Section 4.4 go beyond simple usage statistics. Only 10% of respondents earning less than BDT 20,000 use the MRT, compared with 30% of those earning BDT 30,000–40,000. From a transport equity perspective (Martens, 2016; Pereira et al., 2017), this suggests that the benefits of MRT Line 6 are being enjoyed more by higher-income commuters, while lower-income groups benefit less despite having fewer transport alternatives.

This finding is important for establishing the strategic framework. Improving pedestrian facilities and last-mile connectivity is not only a way to enhance walkability but also a way to make MRT access more equitable, particularly for lower-income users who rely most on public transport.

6.4. Inclusive Urbanism and Informal-Economy Integration

Consistent with the principles of inclusive urbanism, the informal vendors identified in Section 4.3 should be viewed as an important part of the urban economy rather than as a problem to be removed. They provide affordable food and daily necessities that the formal commercial sector does not adequately supply. International examples show that these activities can be successfully integrated into TOD through designated vending zones near MRT stations, licensing systems, vendor cooperatives, and planned vendor spaces within station areas and streetscapes (Putri et al., 2026; Roever & Skinner, 2016).

However, implementing these measures requires careful planning, institutional support, and vendor cooperation. Therefore, the study proposes designated vending areas and better-organised public spaces as practical first steps toward integrating the informal economy into Motijheel's TOD framework.

6.5. The 18-Hour City and Temporal Urbanism

The idea that MRT investment can help create an 18-hour economy in Motijheel should be considered a hypothesis rather than a confirmed outcome. Previous studies suggest that transit investment can support longer business hours, encourage mixed-use Development, and improve safety by increasing street activity (Heath, 1997; Thomas & Bromley, 2000).

However, Motijheel currently has low land-use diversity, poor urban design, and limited safety and security, with most activity concentrated during office hours. These conditions are consistent with those commonly associated with monofunctional CBDs. Since this study is based on a single point in time, it cannot confirm that MRT investment alone will create an 18-hour economy. Long-term monitoring of business hours, pedestrian activity, and land-use change is needed to evaluate this relationship.

7. Strategic Framework for Urban Renewal

The findings from the 5D analysis reveal that Motijheel possesses strong potential for Transit-Oriented Development (TOD) due to its high density and strategic integration with MRT Line 6. However, deficiencies in diversity, pedestrian design, destination accessibility, and last-mile connectivity prevent the area from functioning as a balanced and vibrant urban district. Therefore, a strategic framework is proposed to transform Motijheel from a mono-functional, automobile-centric Central Business District (CBD) into a mixed-use, pedestrian-oriented, transit-integrated, and inclusive urban centre.

7.1. The Proposed Strategic Framework

The 5D analysis and the discussion in Section 6 show that Motijheel has strong potential for transit-oriented development due to its high density and well-located MRT station. However, it is limited by

low land-use diversity, poor pedestrian design, weak destination accessibility, and inadequate last-mile connectivity. Therefore, the strategic framework focuses on addressing these challenges. Using an adaptive TOD approach, it emphasises retrofitting and improving the existing urban area rather than creating new development. The framework is developed based on five interconnected strategic goals:

7.2. Enhancing Diversity through Mixed-Use Development

According to the DAP 2022–2035, mixed-use and high-density development along MRT corridors is encouraged to reduce travel dependency and improve land-use efficiency. International TOD examples, such as Hong Kong's Rail + Property model and Singapore's integrated mixed-use districts, demonstrate how combining residential, commercial, and public functions can sustain urban activity throughout the day. These strategies help increase social interaction, economic vitality, and public safety. TOD guidelines recommend vertical mixed-use zoning, residential infill, active ground floors, FAR incentives, and cultural or night-time activities within MRT catchment areas (Ministry of Housing and Public Works, Government of Bangladesh, 2025).

7.3. Improving Pedestrian Mobility and Last-mile Connectivity

A pedestrian-first mobility strategy within the MRT influence zone should prioritise walkability, safety, and accessibility. DAP policies support walkable neighbourhoods, non-motorised transport, and reduced automobile dependency in TOD areas (RAJUK, 2022). Continuous and obstruction-free sidewalks, shaded walkways, and active street edges can improve pedestrian comfort and connectivity. Traffic calming measures, shared streets, and safe crossings enhance accessibility for all users. Integrating bicycle lanes and non-motorised transport systems further strengthens last-mile connectivity and sustainable urban mobility.

Although MRT Line 6 has improved accessibility, the lack of organised feeder transport and multimodal integration reduces its overall effectiveness. The proposed framework suggests creating integrated mobility hubs that connect MRT stations with buses, rickshaws, pedestrian paths, and non-motorised transport systems.

7.4. Integrating the Informal Economy into TOD Planning

Informal vendors play an important role in Motijheel's daily economy by providing affordable services to commuters and workers. However, unplanned vending activities often block pedestrian movement and increase congestion. Instead of removing vendors, the framework proposes integrating them into the TOD structure through designated vending zones and organised public spaces. The DAP also supports inclusive urban development and recognises the value of informal economic activities. Examples from Bangkok and Bogotá show that organised hawker zones can successfully coexist with pedestrian-friendly environments while maintaining urban vitality and supporting local livelihoods.

7.5. Adaptive Reuse and Regeneration of Ageing Buildings

Many buildings in Motijheel are old and functionally outdated, despite being located near key MRT infrastructure. The framework proposes adaptive reuse strategies to transform underused office buildings into mixed-use spaces, co-working areas, housing, and cultural facilities. International examples from Tokyo and Singapore show that older commercial districts can be revitalised through adaptive redevelopment rather than complete demolition. This approach helps preserve urban identity, reduce construction waste, improve land-use efficiency, and support sustainable TOD development.

7.6. TOD Governance and Institutional Coordination

Successful TOD implementation requires coordinated governance among planning authorities, transport agencies, and local stakeholders. Currently, fragmented institutional responsibilities limit integrated planning in Motijheel. The framework recommends establishing a coordinated TOD governance structure involving RAJUK, DMTCL, DSCC, and transport authorities.

8. Alignment with Sustainable Development Goals (SDGs)

The proposed framework is aligned with the SDGs, as detailed in Table 9.

Table 9: Alignment of the proposals with Sustainable Development Goals.

Strategy	Objectives	Alignment with SDG	Remarks
Enhancing Diversity through Mixed-Use Development	Promotes inclusive, safe, resilient, and sustainable urban Development through TOD and pedestrian-friendly planning	 	SDG 10: Reduced Inequalities SDG 11: Sustainable Cities and Communities
Improving pedestrian mobility and last-mile connectivity	Encourages walkability and safer public spaces. Reduces private vehicle dependency and encourages low-carbon public transportation	  	SDG 7: Affordable and three-year operation Clean Energy SDG 11: Sustainable Cities and Communities SDG 13: Climate Action
Integrating the Informal Economy into TOD Planning	Supports local businesses, informal economies, and mixed-use economic activities	 	SDG 8: Decent Work and Economic Growth SDG 11: Sustainable Cities and Communities
Adaptive Reuse and Regeneration of Ageing Buildings	Urban regeneration, redevelopment, and efficient land use	 	SDG 7: Affordable & Clean Energy SDG 11: Sustainable Cities and Communities
TOD Governance and Institutional Coordination	Coordinate land-use and transit planning institutions, and introduce incentive-based zoning regulations.	 	SDG 10: Reduced Inequalities SDG 11: Sustainable Cities and Communities

These five components directly address the key challenges identified in Sections 5 and 6. However, they represent a proposed framework rather than a validated solution. The feasibility of implementation, stakeholder acceptance, and the order of these interventions have not yet been evaluated. Therefore, they should be considered as recommendations for future research and implementation rather than confirmed solutions.

9. Conclusion

This study presents a primary data assessment of TOD readiness in Motijheel following the 3-year operation of MRT Line 6, explicitly evaluating the intersection between spatial infrastructure and socioeconomic outcomes. Using the 5D framework, Motijheel scored highest in density (5/5) because of its high population density and unrestricted FAR, while design (2.6/5) received the lowest score due

to poor safety and security. Diversity (3.4/5) remained moderate after excluding Bangabhaban from the land-use analysis. Distance and Destination Accessibility both scored 3/5, showing that although the MRT station is close to the CBD, destination accessibility and MRT use remain socio-economically limited, particularly marginalising lower-income groups. The results consistently show that Motijheel is over-dense but under-diverse.

This study contributes methodologically, empirically, and contextually to the discourse on contemporary urbanisation. It develops a clear and replicable 5D-based TOD Readiness Index for a data-limited developing-city context, uniquely incorporating vital socioeconomic indicators such as informal vending, after-hours activity, and transport equity. It also provides field evidence that high density alone is insufficient for successful economic revitalisation without diverse land use, inclusive urban design, and equitable connectivity.

The findings suggest promoting mixed land use, adaptive reuse, better pedestrian and last-mile connectivity, the socioeconomic integration of informal vendors, and longer business hours to support MRT-based urban renewal. These recommendations align with SDG 8 (Decent Work and Economic Growth), SDG 10 (Reduced Inequalities), and SDG 11 (Sustainable Cities), serving as a proposed framework for future policy that prioritises both spatial efficiency and economic justice.

The study has several limitations. The survey sample (115) was relatively small and may not represent all users of the area. Population density was calculated using an area-weighted method across the four intersecting wards. However, it still assumes an even population distribution within each ward and may therefore overestimate or underestimate density in areas closest to the station (Section 5.1). The walkability (Design) assessment includes some observer judgement, although a systematic parameter-based evaluation was used to reduce subjectivity (Section 5.3). Distance and Destination Accessibility were measured using area-based estimates rather than parcel-level network distance analysis due to data limitations (Sections 5.4 and 5.5). The TOD Readiness Index uses equal weights for all five dimensions as a reasonable and transparent approach.

Most importantly, this is a cross-sectional study conducted about three years after MRT Line 6 began operation, so it cannot confirm whether the expected urban renewal or 18-hour economy will occur over time. These relationships remain hypotheses that require long-term monitoring.

Future research should integrate longitudinal socioeconomic assessments of MRT Line 6, comparative 5D analyses of Global South CBDs, stakeholder evaluations, and temporal activity mapping to optimise the implementation of inclusive TOD.

In conclusion, Motijheel already has the density, transit access, and employment concentration that TOD planning aims to achieve. However, it lacks the land-use diversity, pedestrian safety, and Last-Mile Connectivity needed to become a vibrant, inclusive, and active 18-hour district. This study contributes a transparent and replicable TOD Readiness Index designed for a data-limited, adaptive TOD context. It also provides evidence of Motijheel's "over-dense yet under-diverse" condition, offering a useful starting point for MRT-led urban renewal in Motijheel and, with further comparative and long-term research, in other declining CBDs across the Global South. It is hoped that these findings will support future research, planning, and policy decisions for creating more sustainable and inclusive transit-oriented urban districts.

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Conflicts of Interest

The authors declare no conflict of interest.

Data availability statement

Data are available upon request due to privacy/ethical restrictions. Raw data were produced at North South University. Processed data can be obtained from the corresponding author, Nawshin Ahmed, upon request.

Institutional Review Board Statement

"This study was conducted in line with ethical research practices, ensuring voluntary participation, informed consent, and participant confidentiality."

NSU Institutional Review Board/ Ethics Review Committee (IRB/ERC):

<https://www.northsouth.edu/research-office/research-committee>

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