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Transit-oriented development, development corridors and economic access: The Louis Botha development corridor's impact

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Review article

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Abstract

Apartheid's impact on South Africa's urban spatial patterns persists, resulting in spatial fragmentation and inequality. Unsustainable urban sprawl exacerbates challenges related to economic access. To address said challenges, the City of Johannesburg (CoJ) implemented the Corridors of Freedom (CoF) initiative, emphasising economic inclusion. Amid substantial public sector investment, the initiative prioritised the Louis Botha Development Corridor (LBDC) to create a dense, mixed-use, walkable urban environment. However, limited research investigated the LBDC's impact from an economic access perspective. This study investigates how the LBDC has improved economic access and provides policy insights for urban areas in South Africa, within the conceptual framework of transit-oriented development (TOD) and development corridors. A quantitative research approach using Network Analyst reveals that the Rea Vaya Bus Rapid Transit (BRT) system increased economic access by 16% compared to other LBDC transport services. This study demonstrates the potential of the dual implementation of TOD and development corridors to foster economic access in the study area and concludes with policy recommendations centred on cross-departmental collaboration, feasibility studies and risk allocation, location-based criteria and transit accessibility targets, transit-oriented design guidelines, and integrated transport systems.

Keywords: Development corridors, economic access, Louis Botha Development Corridor, spatial data analysis, transit-oriented development

VERVOER-GEORIËNTEERDE ONTWIKKELING, ONTWIKKELINGSKORRIDORS EN EKONOMIESE TOEGANG: DIE IMPAK VAN DIE LOUIS BOTHA-ONTWIKKELINGSKORRIDOR

Apartheid se impak op Suid-Afrika se stedelike ruimtelike patrone duur voort, wat lei tot ruimtelike fragmentasie en ongelykheid. Onvolhoubare stedelike uitbreiding vererger uitdagings verbonde aan ekonomiese toegang. Om genoemde uitdagings

aan te spreek, het die Stad Johannesburg (CoJ) die 'Corridors of Freedom' (CoF) inisiatief geïmplementeer, met klem op ekonomiese insluiting. Te midde van aansienlike investering deur die publieke sektor, het die inisiatief die Louis Botha Ontwikkelingskorridor (LBDC) beklemtoon om 'n digte, gemengde gebruik, loopbare stedelike omgewing te skep. Nietemin, beperkte navorsing het tans die LBDC se impak vanuit 'n ekonomiese toegangsperspektief ondersoek. Hierdie studie ondersoek hoe die LBDC ekonomiese toegang verbeter het en verskaf beleidsinsigte vir stedelike gebiede in Suid-Afrika, binne die raamwerk van vervoer-georiënteerde ontwikkeling (TOD) en ontwikkelingskorridors. 'n Kwantitatiewe navorsingsbenadering met gebruik van 'Network Analyst' toon dat die Rea Vaya Bus Rapid Transit (BRT) stelsel ekonomiese toegang met 16% verbeter het in vergelyking met ander LBDC vervoerdienste. Hierdie studie demonstreer die potensiaal van die gesamentlike implementering van TOD en ontwikkelingskorridors om ekonomiese toegang in die studie area te bevorder en sluit af met beleidsaanbevelings wat sentreer op geïntegreerde vervoerstelsels, onder andere.

TSOELOPELE E SHEBANENG LE LIPALANGOANG, LITSELA TSA NTS'ETSOPELE LE PHIHLELLO EA MORUO: TŠUSUMETSO EA LOUIS BOTHA DEVELOPMENT CORRIDOR

Tšusumetso ea puso ea khethollo tsamaisong ea libaka tsa litoropo tsa Afrika Boroa e ntse e tsoela pele, 'me e khina teka-tekanano ea libaka. Khaho e sa tsitsang ea litoropo e mpefatsa mathata a amanang le phihlello ea moruo. Ho rarolla liqholotso tse boletsoeng, Toropo ea Johannesburg (CoJ) e kentse tšebetsong morero oa Corridors of Freedom (CoF), o tobokelitseng kenyeletso ea moruo. Har'a matsete a mangata a lekala la sechaba, boikittaetso bona bo beile pele Louis Botha Development Corridor (LBDC) ho theha tikoloho ea litoropo e teteaneng, e tsoakiloeng, e ka tsamauoang. Leha ho le joalo, lipatlisiso tse fokolang li ile tsa batlisisa phello

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ea LBDC ho latela pono ea phihlelo ea moruo. Patlisiso ena e lekola ka moo LBDC e ntlafalitseng phihlelo ea moruo le ho fana ka leseli la maano bakeng sa libaka tsa litoropo tsa Afrika Boroa. E boetse e seka-seka LBDC e ikamahantse le moralo oa nts'etsopele e shebaneng le lipalangoang (TOD) le liphaseje tsa nts'etsopele. Mokhoa oa ho etsa lipatlisiso o sebelisang Network Analyst o senola hore tsamaiso ea Rea Vaya Bus Rapid Transit (BRT) e ekelitse phihlelo ea moruo ka 16% ha e bapisoa le litšebeliso tse ling tsa lipalangoang tsa LBDC. Boithuto bona bo bonts'a bokhoni ba ho kenya ts'ebetsong habeli ha TOD le litsela tsa nts'etsopele ho khothaletsa phihlelo ea moruo sebakeng sa boithuto. E boetse e phethela ka likhothaletso tsa maano tse shebaneng le tšebeliso-mmoho ea mafapha a fapaneng, boithuto, litekanyetso tse thehiloeng le liphelelo tsa phihlelo ea lipalangoang, tataiso ea moralo e tsepamisitsoeng, le litsamaiso tse kopanetsoeng tsa lipalangoang.

1. INTRODUCTION

South Africa's extensive landscapes were heavily moulded by the apartheid system's racial segregation ideology (Du & Gelman, 2018; Geyer & Du Plessis, 2013: 37). As such, Coloured, Black, and Indian inhabitants were restricted to residing in overpopulated and under-serviced townships on the far outskirts of cities (Geyer & Du Plessis, 2013: 39). While effort has been exerted since 1994 to mend South Africa as a whole, the country is still the face of fragmentation (Hofer *et al.*, 2021: 1855). The essence of apartheid planning lingers in South Africa's urban spatial patterns, manifesting in spatial inequality, fragmentation, and urban sprawl (Dewar, 2017: 28). The relatively unplanned growth of cities, driven by rural-urban migration (Yiran *et al.*, 2020: 14) and policy-led housing development beyond the periphery (De Swardt *et al.*, 2005: 101), has led to a spatial pattern featuring low-density residential areas and high-density townships (Yusuf & Allopi, 2010). This unsustainable expansion deprives disadvantaged populations without private modes of transport of economic access (Musakwa & Van Niekerk, 2014: 4), as sprawl in its various forms obstructs accessibility

by reducing the quality of residential and destination accessibility (Torrens & Alberti, 2000: 24), altering travel patterns (Musakwa & Niekerk, 2014: 2), increasing travel times and distances between land uses, and diminishing walkability (Wang, Shi & Zhou, 2020). The enduring sprawl intensifies economic accessibility challenges (Tomlinson, 2019). Disadvantaged communities in South Africa depend heavily on economic access (Tomlinson, 2019), a fundamental element for household well-being, regional competitiveness, community health, social connections, and upward mobility (Mahendra & Seto 2019: 4). Employment, in particular, fosters personal meaning, social networks, and overall quality of life by providing economic benefits and vital resources (Giloith, 2019: 1; Cartwright & Marrengane, 2016). Given the significance of economic access, the associated spatial challenges need to be overcome.

In an attempt to correct the spatial mismatch between areas of economic opportunity and human settlements, the City of Johannesburg (CoJ) incorporated transport-related investments in their service-provision programmes (Cartwright & Marragane, 2016: 23). To provide strategic direction for these investments, the CoJ turned to transit-oriented development (TOD) through its Corridors of Freedom (CoF) initiative, with particular focus on economic inclusion (Wood, 2021: 2460). The foundations of the CoF initiative, including the Louis Botha Development Corridor (LBDC), were laid in 2006 to promote TOD and mixed-use development along the Bus Rapid Transit (BRT) network (Harrison *et al.*, 2019: 3). Political support was secured in 2013, accompanied by detailed strategic frameworks for the LBDC and other corridors, with a decade-long capital budget of R1.5 billion (Harrison *et al.*, 2019: 4). Infrastructure upgrades and social facility enhancements commenced in 2014, with the LBDC reaching 50% completion by June 2015 (Planact, 2018: 17). Despite a leadership change in

August 2016, the project continued as the 'Transit Oriented Corridors', achieving substantial infrastructure improvements as of 2016, including road resurfacing, BRT stations, housing developments, clinics, urban precincts, parks, and pedestrian bridges (Planact, 2018: 17).

The CoF initiative, composed of development corridors, seeks to alter ingrained spatial patterns and guide future city growth towards areas with a complete selection of social services and amenities and quality transit infrastructure services (CoJ, 2012: 13). It strives to create more inclusive and accessible opportunities for the residents of Johannesburg and economies of scale that are attractive to investors by optimising compact, connected, and resilient development in and around high-intensity movement corridors (CoJ, 2012: 12). This initiative represents the convergence of the concepts of TOD and development corridors through their shared aim of creating integrated, efficient, and sustainable urban environments through hubs of mixed-use, compact, and high-density development located around transit nodes (CoJ, 2012: 17). The central objective of their dual implementation is the manifestation of well-connected, accessible, economically diverse, and socially inclusive neighbourhoods and precincts where residents can live, work, and access urban amenities and opportunities within close proximity to reliable public transportation. Ultimately, the objective is to reduce travel times, distances, and economic exclusion, enhancing overall urban inclusion and liveability.

Numerous studies have been conducted on TOD and development corridors and their implementation within the South African context. Masingi (2019) studied the CoF flagship programme and its associated projects and their potential in stimulating employment in the townships of Soweto and Kagiso. Lionjanga and Venter (2017) focused on well-being improvements associated with the CoF and the

Rea Vaya BRT system. Simoes (2014), on the other hand, studied the Turffontein Development Corridor (TDC), with specific focus on non-motorised transportation. Existing studies, respectively, identify potential economic and social benefits associated with the CoF, including through the effects of the Rea Vaya BRT system and the accelerated provision of affordable housing. However, limited research has been undertaken on the broad potential of CoF in mitigating urban challenges in South Africa and the required policy interventions to extract said potential. In the context of the CoF, further research is required to identify policies that are transferable to different contexts, in order to enhance potential accessibility benefits. This reflects the aim of the research, which is to determine the potential of the strategic implementation of TOD and development corridors in mitigating central spatial challenges in the South African urban milieu, with specific reference to economic access. The associated objectives in this regard are to analyse the impact of the LBDC on increasing economic access in the CoJ, and to investigate the features of the policy environment central to the successful implementation of LBDC and the broader CoF initiative in the CoJ. A related contribution of this research is thus to inform policy interventions in other cities in South Africa and other developing countries toward the synergistic implementation of TOD and development corridors.

The motive in selecting the LBDC is centred on the availability of ample industrial land, its diverse population, decaying precincts, and medium-density developments. This underlines the economic potential of the study area and its central role in providing access to opportunities to local and regional communities (CoJ, 2012: 28). Selecting the LBDC enables the investigation of the CoF initiative as a holistic intervention toward improved infrastructure, services, and stimulating economic accessibility for communities from different backgrounds and income

levels (Planact, 2018: 18). While featuring a mix of residential, commercial, and retail spaces, the LBDC is predominantly residential in nature, catering for a wide range of income groups and spatial preferences. Functioning as a residential area, the corridor is characterised by a fairly equitable distribution of social services and infrastructure. As a potential transport hub in the future, the corridor forms part of Phase 1C of the Rea Vaya BRT system and is serviced by supporting public transport systems such as Gautrain buses, Minibus Taxis, and Metrobus (CoJ, 2013: 29).

As this study follows a quantitative research methodology, GIS was used to conduct a spatial analysis (through the Network Analyst tool) to investigate the extent to which the LBDC has improved economic access. In addition, the related policy environment is discussed to provide insights on TOD and development corridor implementation in the CoJ and other South African and developing country contexts.

2. LITERATURE REVIEW

The objective of the literature review is to provide an overview of challenges related to economic access in different contexts, as well as an overview of the TOD and development corridor concepts as potential planning instruments for urban spatial challenges in South Africa.

2.1 Challenges of economic access

The overall spatial patterns of cities in the Global North and South embody, to different degrees, urban sprawl (Van Niekerk, 2018: 70). In the Global North, urban areas rank relatively high in multiple dimensions of sprawl, bringing about significant environmental, economic, and social consequences (OECD, 2018: 6, 11). Spatial patterns consist of suburban developments that are mainly mono-functional and dispersed in nature (Dieleman & Wegener, 2004). In most instances, the consequence

of these sprawled development patterns is poor destination accessibility (Torrens & Alberti, 2000: 24), due to greater travelling distances between residences and economic opportunities. In the Global South, urban areas are generally characterised by urban sprawl manifesting in informal, high-density settlements (Oyalowo, 2022: 694; Van Niekerk, 2018: 70). Access to areas of economic opportunity is limited, due to, *inter alia*, isolated, peripheral residential developments, the lack of access roads, as well as the fragmented nature of urban growth (OECD, 2018: 6; Reyes & Peon, 2022). As such, the spatial pattern and location of formal and informal housing developments in urban areas in the Global South hinder inclusion, mobility, and access to economic opportunities and other essential destinations.

These characteristics are also reflected in South Africa's urban structure, due to colonial and apartheid spatial planning (Adebayo, 2012: 6). The cost of urban sprawl is the quality of the disadvantaged population's living environment (Tomlinson, 2019) and deprivation of economic access – for those without private vehicles (Musakwa & Van Niekerk, 2014: 2) – to factories, shopping centres and other forms of business facilities (Parliamentary Liaison Office, 2017: 2). Urban sprawl is the source of an undesirable externality – unsustainable development – and, by extension, a condition of poor accessibility (Ewing, 2008; Frenkel & Ashkenazi, 2008: 3). The latter is due to communities being located far from opportunities and said opportunities themselves being spatially segregated and dispersed (Torrens & Alberti, 2000: 24), decreasing walkability and increasing travelling time (Bowyer, 2015: 69; Wang *et al.*, 2020).

Access relates to the ease or difficulty of reaching opportunities or destinations (Mahendra & Seto, 2019: 4), and may be improved by aligning residential locations with urban opportunities (Yuliastuti, Sukmawati & Purwoningsih, 2018),

or improving transport networks and connectivity. Opportunity, in this context, refers to the economic sphere, *i.e.* employment opportunities, and is measured using units of time or distance (Venter & Cross, 2014: 44). In this study, economic access refers to reaching employment opportunities, which is identified as properties zoned as either business, commercial, and industrial, as these provide goods and services which require labour as a factor of production (CoJ, 2018).

2.2 The development corridor concept

A development corridor links two economic nodes at each end via nodal lines, with the nodes functioning as key points in towns, cities, or industrial areas (Brand, 2018: 63). These nodes are interdependent, facilitating the flow of economic activities, including both physical transport and information sharing (Brand, Geyer & Geyer, 2017: 12). The interaction between nodes drives the development corridor's vitality, fostering further growth and development potential (Geyer, 1988). Development corridors involve dense economic activity along their routes, which stimulate various markets and offer advantages to adjacent areas (Harrison & Todes, 1996: 70). Serving as spatial instruments to connect different land uses and nodes in cities (Brunner, 2013: 2), corridors may foster urban growth and promote economic interaction (Yeates, 1984), and may be implemented to mitigate unique challenges in specific contexts, including addressing spatial disparities and foster sustainable development. These corridors are strategically identified for investment and are a focus of economic and spatial policies (Juffe-Bignoli *et al.*, 2021: 2). Development corridors are formed through the integration of axes (Brand & Drewes, 2021: 2696), representing nodal lines that agglomerate infrastructure and communication, fostering socio-economic interactions (Geyer, 1988). They serve as conduits

between market supply and demand, playing a pivotal role in a city's economic landscape, enabling the movement of goods and people while shaping their economic footprint (Brunner, 2013: 1; Brand & Drewes, 2020: 122). Central to development corridors are integrated transportation networks, including rail, air, road, and sea, which facilitate the seamless connection of processes such as consumption, production, and distribution (Yeates, 1984) within and between key economic hubs (Hope & Cox, 2015: 45). High economic cohesiveness in said networks leads to corridors with dispersed impacts, while low cohesiveness results in clustered, isolated effects (Brand, 2018: 67). Network effects are as important to development corridors as economic viability and the integration and attraction between urban centres. Four critical factors in network development, as emphasised by Felipe *et al.* (2012), include vertical network integration, which depends on land use and population densities, impacting accessibility, economic activity, and movement; information network integration, which fosters knowledge exchange, spurring regional investments, integration, and knowledge sharing for economic growth; complete transport networks, including links and nodes, which cut transaction costs, enhance reliability, and play a pivotal role in economic activity, as well as interconnectivity in technologies, which expands trade and interaction.

2.3 The TOD concept

TOD has emerged as a planning instrument capable of mitigating the proliferating outcomes of urban sprawl and reduced mobility (Ibraeva *et al.*, 2020; Li *et al.*, 2019). Central to TOD is its propagation of moderate- to high-density developments that foster mixed-use communities within 0.8km-1km – or walking distance – from the nearest local transit stations (De Vos, Van Acker & Witlox, 2014: 2; Lang *et al.*, 2020: 2). TOD fosters a complementary integration between land and movement

(FasTracks, 2008), catalysing synergies to bring about economic, social, and environmental benefits.

Furlan *et al.* (2019: 127) state that TOD strives to design and plan communities to provide spaces that enhance liveability, achieve low-impact and eco-mobility public transport systems, and create a future model for eco-cities. From an access perspective, TOD strives to increase opportunities for communities to satisfy their daily travel needs through the use of non-motorised (Evans & Pratt, 2007: 2) and public transportation (Li *et al.*, 2019; Nyunt & Wongchavalidkul, 2020: 57). Non-transportation objectives of TOD include, *inter alia*, supporting economic revitalisation or development; reducing infrastructure-related costs; providing affordable quality housing options; encouraging smart growth (Cervero *et al.*, 2004), and mitigating urban sprawl (Papa & Bertolini, 2015: 70).

The latter is achieved by promoting compact, dense development through the agglomeration of unique places, linking public services, workplaces, recreational activities, and transit stations (Lang *et al.*, 2020: 2). In effect, the clustering of jobs, industries, residences, and retail destinations close to public transit facilities means that areas of economic opportunity are more concentrated and accessible, increasing regional population and employment density (Noland *et al.*, 2014: 16). TOD thus creates nodes with improved access to ensure higher frequencies of service delivery and accessibility (Singh *et al.*, 2017). With regard to economic access, the TOD factor, destination accessibility (Ogra & Ndebele, 2014: 540), refers to the development of transport systems in a way that facilitates access to a range of destinations such as social, employment, and recreational facilities (Sivakumaran *et al.*, 2014). From a density perspective, access is a significant aspect of TOD (Singh *et al.*, 2017).

There are various required planning instruments to ensure successful TOD implementation, as illustrated in Table 1.

TOD seeks to promote urban developments characterised by walkability, high population density, mixed-use, access to public transport, and, ultimately, accessibility (Jackson & Kochitzky, 2009).

2.4 Synergies in TOD and development corridor implementation

There is significant potential synergy inherent to the dual implementation of TOD and development corridors. The first is with reference to integrated development, with TODs manifesting as high-density, compact, mixed-use nodes connected by corridors that facilitate the movement of trade, goods, and people between the stations and adjacent areas (Noichan & Dewancker, 2018). This enhances the potential diffusion of economic activity, both in the concentrated locations of the transit stations and in the precincts linear to the corridor infrastructure. Their dual implementation is also mutually beneficial to both components (Garcia & Crookston, 2019), with the corridor improving access to TOD nodes, increasing their viability, while increased usage of the corridors

enhances their attractiveness in terms of linear development and investment in adjacent areas. This mutual benefit translates in increased economic potential of the area in which they are located, stimulating vibrancy, activity, and production, while increasing connectivity for local and regional communities to access opportunities as a result of development synergies.

Case studies of dual implementation include Portland, Oregon, where a rail corridor connects the city centre to the northern parts of the city (Borkowitz *et al.*, 2013). This rail line has stimulated linear, mixed-use development along its route, in addition to providing access to a multitude of areas and opportunities to local residents and communities. The rail stations are developed as TODs, where planning incentives have been put in place to attract high-density, compact developments, including affordable housing and commercial spaces. Similarly, Curitiba, in Brazil, has implemented a BRT system with various axes that connect different parts of the city (DeWeerd, 2016: 53; Harrison *et al.*, 2019: 8). Diverse residential and commercial land uses have located along the road infrastructure of the corridors which act as catalysts of growth,

while specific zoning regulations have been put in place adjacent to BRT stations, acting as TODs, to encourage high-density and mixed-use development. This has attracted additional economic activities toward the corridors and stations, stimulating output and opportunity creation, and facilitating access.

2.5 TOD, development corridors, and the CoF

The CoF concept in Johannesburg has effectively applied TOD principles to transform the city’s urban landscape (CoJ, 2012: 9). This concept aligns with TOD principles by emphasising high-density, mixed-use development in close proximity to transit nodes, progressively decreasing density further from the city core (Lang *et al.*, 2020). By promoting these high-density living and working environments, the CoF aim to create vibrant, people-centric urban areas consistent with TOD ideals. A core element of the CoF concept is its focus on transit infrastructure (CoJ, 2012: 9). These development corridors are designed to be the backbone of the city’s transportation system, and the plan actively encourages the use of public transport over private vehicles (CoJ, 2012: 14). This approach not only reduces travel times and costs but also makes

Table 1: TOD implementation instruments

Land-use and zoning regulations	<ul style="list-style-type: none"> Land-use regulations play a big part in shaping urban growth and land-use patterns, and in facilitating changes in the built environment, which ultimately impacts travel behaviour, location decisions, and everyday travel needs (Zhu <i>et al.</i>, 2022: 2). Land-use and zoning regulations enable upzoning for higher density development, downzoning in non-transit accessible locations, and a transition to mixed land uses in areas encompassing transit hubs (Goodwill & Hendricks, 2002: 9).
Transportation policies	<ul style="list-style-type: none"> Transportation policies, whether through pricing (levies, subsidies), investment (infrastructure), or regulation (land-use) influence the demand for, and the supply of transport and, therefore, facilitate TOD and social inclusion by enhancing access to multimodal transport and, subsequently, to economic opportunities (Berg <i>et al.</i>, 2017: 466).
Infrastructure investment	<ul style="list-style-type: none"> Infrastructure investment is a primary requirement for successful TOD, as a change in the pattern of infrastructure investment changes the pattern of land use (Lindsey, 2004). Infrastructure investment directly influences the shape of cities and TODs as transit-oriented environments are the product of many phases of targeted infrastructure investment made by the public sector (Berg <i>et al.</i>, 2017: 472).
Development incentives	<ul style="list-style-type: none"> The success of planning concepts such as TOD is largely dependent upon the presence of effective development incentives, as this helps overcome constraints (Bajracharya, Khan & Longland, 2005: 35); attract investors who bring capacity, expertise, and funds to develop new infrastructure and industries, and stimulate development (SAPOA, 2016: 25).
Public participation	<ul style="list-style-type: none"> Public participation in TOD implementation is a significant success factor, as the process leads to the more efficient design and execution of a TOD project (Papagiannakis & Yiannakou, 2022). Public participation, as an inclusive process, enhances the quality of TOD initiatives and plans, creates a larger support base, and attains buy-in from all sectors by creating a public space that takes into consideration the needs and wishes of all stakeholders (Ballering, 2022).
Affordable housing policies	<ul style="list-style-type: none"> For a TOD to be successful in addressing urban sprawl (Lang <i>et al.</i>, 2020) and be effective in providing improved access to economic opportunities (SAPOA, 2016: 12), it should be equitable (Carlton & Fleissig, 2014) and include the correct mixture of housing options in a density and scale that promote walkability and that is inclusive of all incomes and ages (Coleman, 2018).
Integrated planning policies	<ul style="list-style-type: none"> For integration to be attained, which is essential for a successful TOD development, all relevant stakeholders need to be included in the phases of the TOD project (SAPOA, 2016: 7).
Public-private partnerships	<ul style="list-style-type: none"> Successful TOD outcomes are the result of shared decision-making among various relevant stakeholders and the continuing coordinated work among multidisciplinary teams (WSP, 2020: 13). Encouraging private developers to construct and deliver infrastructure at adequate densities in close proximity to transit facilities is key to the success of TODs because of the cost reliability, efficiency, and financial security gained (Ndebele, 2018: 8).

public transit more accessible, fostering a transit-oriented lifestyle.

The CoF, like TOD principles, place a strong emphasis on reducing private car usage (Calthorpe, 1997). This is achieved by prioritising pedestrian-oriented development, limiting managed parking, and providing convenient transit stops and stations along the development corridors (CoJ, 2012: 17). By discouraging private vehicle use, both concepts aim to create cleaner and more sustainable urban environments. Furthermore, the CoF envision the creation of compact and walkable communities around transit nodes and along the corridors (CoJ, 2012: 13). These neighbourhoods are designed to be supported by social amenities, local shops, parks, schools, and clinics, making it convenient for residents to access essential services and public transit facilities on foot (CoJ, 2012: 13). Economic opportunities are a key focus of CoF, aiming to stimulate economic growth and support small-scale informal economies (CoJ, 2012: 17). By bringing living and working spaces into close proximity, residents can access job opportunities without the need for lengthy commutes (Noland *et al.*, 2014).

3. STUDY AREA

Located in the north of Johannesburg, South Africa, the LBDC is situated between the Johannesburg central business district (CBD) and the northern parts of the city around the township of Alexandra (Risimati, Gumbo & Chakwizira, 2021). The location of the LBDC is indicated in Figure 1.

While residential areas such as Sydenham, Orange Grove, Houghton Estate, Observatory, and Belle-Vue dominate the southern parts of the corridor, industrial and commercial areas such as Wynberg, Bramley, and Kew make up most of the northern parts of the corridor (CoJ, 2012: 26). The corridor has significant links to major employment, economic, and growth nodes in the city such as Midrand, Sandton, and Greenstone/Modderfontein (Risimati, Gumbo & Chakwizira, 2021: 718). The CoF

were rolled out to connect the remote and marginalised settlements located in the northern and southernmost parts of the CoJ (Harrison *et al.*, 2019: 3). This was done in an attempt to link various adjacent municipalities, enabling access to employment opportunities while bringing people together. The LBDC constitutes Phase 1C of the Rea Vaya BRT, which includes designated lanes and bus stations (Wood, 2021: 2460).

4. RESEARCH METHODOLOGY

Toward achieving the research objectives, including to analyse the impact of the LBDC on increasing economic access in the CoJ, a quantitative research approach was applied by conducting a spatial analysis in which quantities – meters and the number of business, commercial, and industrial-zoned properties – were used to compare access to economic opportunities.

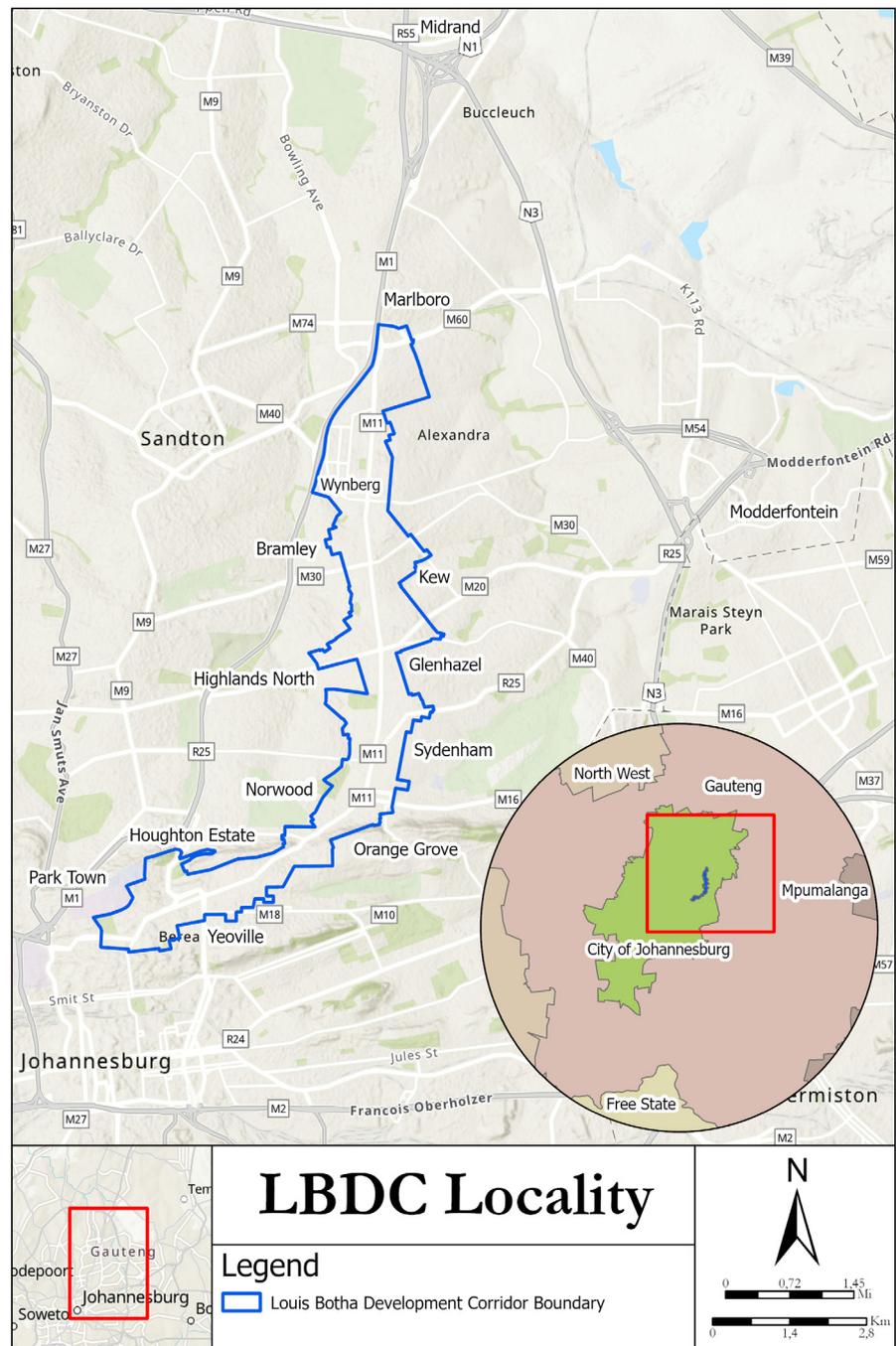


Figure 1: Location of LBDC, CoJ, Gauteng
Source: Author, 2022

As such, distance and the number of economic opportunities were the main variables quantified in the spatial analysis to measure accessibility and serve as premise for the study’s findings. The Rea Vaya BRT system is a significant and critical intervention in realising the accessibility benefits of TOD in the LBDC. Accordingly, the locations of Rea Vaya bus stations and other existing transportation services – minibus taxi ranks, Gautrain bus stops, and Metrobus bus stops – in the corridor were the starting points for measuring access in terms of distance to areas of economic opportunity. Access was measured according to the LBDC Strategic Area Framework’s (SAF) services access standards of a successful TOD, which deems facilities and opportunities accessible if they are within 800m (0.8km) of the nearest public transport interchange (CoJ, 2012). The Network Analyst tool was used to calculate the 800m service areas of each Rea Vaya bus station, minibus taxi rank, Gautrain bus stop, and Metrobus bus stop in the corridor. This is because all economic opportunities in the service areas of each transportation facility in the corridor were deemed accessible. The Network Analyst tool was used to determine the number of economic opportunities that could be accessed within 800m of all nine Rea Vaya bus stations and all 11 other transportation facilities in the corridor, via accessible roads. The average number of economic opportunities accessible using the Rea Vaya BRT system was compared to the average number of economic opportunities accessible, using the other existing transportation services. The spatial analysis helped determine the extent to which the LBDC (through the Rea Vaya BRT system) improved access to economic opportunities.

To avoid redundancy in accessible opportunities and ensure more accurate results, the overlapping service areas for Rea Vaya bus stations (1 and 2, 3 and 4, 7 and 8) were examined in pairs. Due to their close proximity, these areas had overlapping coverage, so their service areas were merged.

Similarly, the 800m service areas of Taxi rank 4, Gautrain bus stops 2, 3, and 4, and Metrobus stop 3 overlapped at the southwestern-most point of the LBDC. This overlap meant that all three transport services provided access to some of the same economic opportunities. Consequently, the service areas of the overlapping stations were merged, and the total accessible economic opportunities were divided among the relevant transportation services.

5. FINDINGS

5.1 Rea Vaya bus stations

Table 2 provides details on the economic access provided by the Rea Vaya BRT system in the LBDC, with reference to the service areas of each bus station (see Figure 2), the number of accessible business, commercial, and industrial-zoned properties located within 800m of each Rea Vaya bus station, and the total number of economic opportunities accessible from each individual bus station and the BRT system as a whole.

Table 2: The Rea Vaya BRT System in the LBDC and the total number of accessible economic opportunities

Rea Vaya bus station	Service areas (meters)	Business and commercial zones	Industrial zones	Total economic opportunities
1 and 2	0-200	0	0	0
	200-400	0	0	0
	400-600	11	16	27
	600-800	10	33	43
Totals		21	49	70
3 and 4	0-200	0	0	0
	200-400	28	3	31
	400-600	28	18	46
	600-800	20	46	66
Totals		76	67	143
5	0-200	2	0	2
	200-400	9	0	9
	400-600	13	0	13
	600-800	10	0	10
Totals		34	0	34
6	0-200	7	0	7
	200-400	17	0	17
	400-600	9	0	9
	600-800	23	0	23
Totals		56	0	56
7 and 8	0-200	1	0	1
	200-400	3	0	3
	400-600	19	0	19
	600-800	11	0	11
Totals		34	0	34
9	0-200	0	0	0
	200-400	1	0	1
	400-600	2	0	2
	600-800	2	0	2
Totals		5	0	5
Cumulative	Rea Vaya bus station	Business and commercial zones	Industrial zones	Total economic opportunities
	1 and 2	21	49	70
	3 and 4	76	67	143
	5	34	0	34
	6	56	0	56
	7 and 8	34	0	34
	9	5	0	5
	Total	226	116	342

Source: Author, 2022

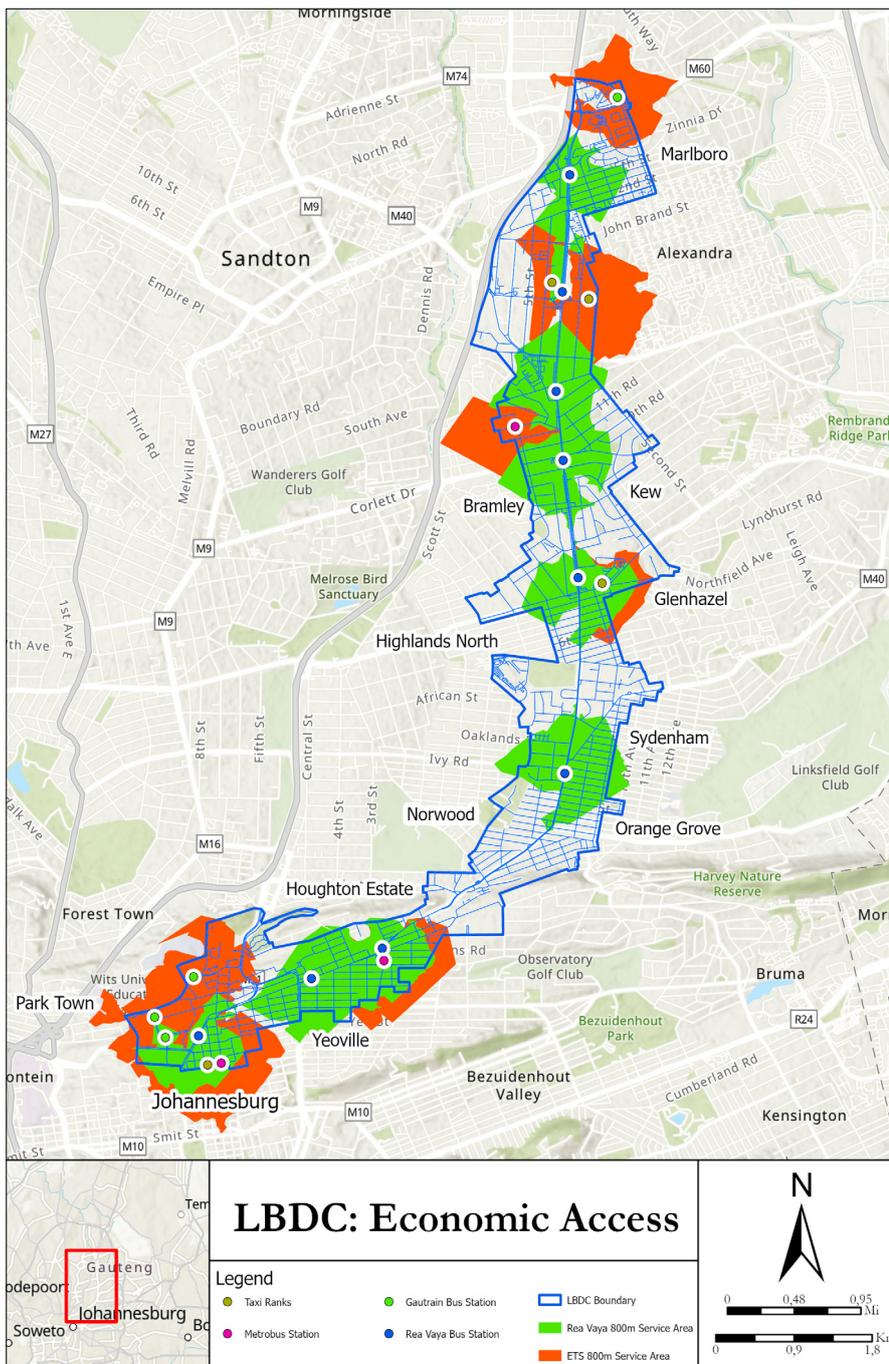


Figure 2: 800m service area and economic access provided by the Rea Vaya BRT system and Existing Transportation Services (ETS) in the LBDC.

Source: Author, 2022

Since 455 business and commercial-zoned properties, and 270 industrial-zoned properties were identified in the LBDC, it was found that Rea Vaya bus stations 1 and 2 provide access to 70 economic opportunities, providing access to 5% of business and commercial-zoned properties, 18% of industrial-zoned properties, and 10% of all economic opportunities in the corridor.

Rea Vaya bus stations 3 and 4 provide access to 143 economic opportunities, accounting for 17% of business and commercial-zoned properties, 24% of industrial-zoned properties, and 20% of all economic opportunities in the corridor. Rea Vaya bus station 5 provides access to only business and commercial-zoned properties. Given that

Highlands North is a non-industrial region catering mainly for residential properties, there are no industrial properties accessible within the 800m service area of bus station 5. As such, Rea Vaya bus station 5 provides access to 34 economic opportunities, accounting for 7% of business and commercial-zoned properties and 5% of all economic opportunities in the corridor.

Much like Rea Vaya bus station 5, there are no accessible industrial-zoned properties in the 800m service area of bus station 6. Located in Orange Grove, the region is mainly residential in nature. Therefore, Rea Vaya bus station 6 provides access to 56 economic opportunities, accounting for 12% of business and commercial-zoned properties and 8% of all economic opportunities in the corridor. Similarly, Rea Vaya bus stations 7 and 8 provide access to 34 economic opportunities, accounting for 7% of business and commercial-zoned properties and 5% of all economic opportunities in the LBDC. Lastly, Rea Vaya bus station 9 is located on the northern fringes of the CBD and thus provides access to zero industrial-zoned properties. The station does, however, provide access to five business and commercial-zoned properties, accounting for 1% of these properties and 0.7% of all economic opportunities in the LBDC. Ultimately, as noted in Table 2, the Rea Vaya BRT system provides access to 226 business and commercial-zoned properties, and 116 industrial-zoned properties. Therefore, the entire BRT system – through its 9 bus stations – provides access to 342 economic opportunities or 47% of economic opportunities in the LBDC.

5.2 Existing transportation services

Table 3 provides details on the economic access provided by the existing transportation services in the LBDC, with reference to the service areas of each transport facility (see Figure 2); the number of accessible business, commercial, and industrial-zoned properties located within 800m of each transport facility, and the total

number of economic opportunities made accessible by each individual transport service provider and by all existing transportation services as a collective.

As per Table 3, the Metrobus service, through bus stops 1 and 2, provides access to 47 economic opportunities in the corridor, which accounts for 7% of business and commercial-zoned properties, 1% of industrial-zoned properties, and 6% of all identified economic opportunities in the LBDC. In addition, Metrobus bus stop 3 provides access to 4 economic opportunities which accounts for 1% of business and commercial-zoned properties and 0.5% of all identified economic opportunities in the corridor.

Taxi ranks 1 and 2 were examined together because of their close proximity to one another and the subsequent overlapping of their service areas. They were found to

provide access to 100 economic opportunities, which accounts for 7% of business and commercial-zoned properties, 24% of industrial-zoned properties, and 14% of all identified economic opportunities in the LBDC. Taxi rank 3 provides access to 39 economic opportunities, which accounts for providing access to 9% of business and commercial-zoned properties, zero industrial-zoned properties, and 5% of all the identified economic opportunities in the LBDC. Taxi rank 4 provides access to 4 economic opportunities, which accounts for 1% of business and commercial-zoned properties, zero industrial-zoned properties, and 0.5% of the identified economic opportunities in the LBDC. Gautrain bus stop 1 provides access to 12 economic opportunities, which accounts for 2% of business and commercial-zoned properties, 1% of industrial-zoned properties, and 1.7% of all identified economic

opportunities in the LBDC. Gautrain bus stops 2, 3 and 4 were examined together because of their close proximity to one another and the subsequent overlapping of their service areas. As such, Gautrain bus stations 2, 3 and 4 provide access to 24 economic opportunities, which accounts for 5% of business and commercial-zoned properties, zero industrial-zoned properties, and 3% of all identified economic opportunities in the LBDC. The existing transportation services (taxi ranks, Gautrain Bus, and the Metrobus) in the LBDC provide access to 150 business and commercial-zoned properties, accounting for 33% of all identified business and commercial facilities in the corridor. The existing transport services also provide access to 73 industrial-zoned properties in the corridor, accounting for 27% of all identified industrial facilities in the LBDC. In total, as per Table 3, access is provided to 223 economic opportunities in the LBDC, accounting for 31%.

Table 3: Existing transportation services in the LBDC and the total number of accessible economic opportunities

Existing transport services	Service areas (meters)	Business and commercial zones	Industrial zones	Total economic opportunities
Metrobus stop 1	0-200	0	0	0
	200-400	4	0	4
	400-600	8	0	8
	600-800	19	3	22
Metrobus stop 2	0-200	0	0	0
	200-400	2	0	2
	400-600	2	0	2
	600-800	9	0	9
Totals		44	3	47
Taxi Ranks 1 and 2	0-200	10	5	15
	200-400	7	13	20
	400-600	8	20	28
	600-800	9	28	37
Taxi rank 3	0-200	3	0	3
	200-400	10	0	10
	400-600	15	0	15
	600-800	11	0	11
Totals		73	66	139
Gautrain bus stop 1	0-200	0	0	0
	200-400	3	1	4
	400-600	4	2	6
	600-800	1	1	2
Totals		8	4	12
Overlapping service area	0-200	0.33	0	0.33
	200-400	12.99	0	12.99
	400-600	9.16	0	9.16
	600-800	2.5	0	2.5
	Totals	24.98 ≈ 25	0	24.98 ≈ 25
Existing Transport Services	Totals	150	73	223

Source: Author, 2022

Based on the findings of the spatial analysis, the Rea Vaya BRT system and its 9 bus stations located along Louis Botha Avenue provide access to 226 business and commercial-zoned properties. Since 455 business and commercial-zoned properties were identified in the LBDC, the Rea Vaya BRT system provides access to 49% of those properties. The existing transportation services in the corridor provide access to 150 business and commercial-zoned properties. These existing transportation facilities provide access to 33% of all the identified business and commercial-zoned properties in the LBDC. The introduction of the Rea Vaya BRT system has improved access in the LBDC, which is evident in the 16% increase in access to business and commercial-zoned properties in the corridor. While some Rea Vaya bus stations provide more access than others, the transport system as a whole increases access to economic opportunities. With regard to industrial-zoned properties, the Rea Vaya BRT system provides access to 116 of these properties in the corridor. Since 270 industrial-zoned properties

were identified in the corridor, the Rea Vaya BRT system provides access to 43% of these properties. On the other hand, existing transportation services in the corridor provide access to 73 industrial properties, which accounts for 27% of all identified industrial-zoned properties in the corridor. These findings are illustrated in Figure 3.

Having considered the extent to which the Rea Vaya BRT system has improved access to business and commercial-zoned properties and industrial-zoned properties, respectively, it is also necessary to determine the extent to which it improved access to economic opportunities overall. Of the 725 economic opportunities identified in the corridor, the Rea Vaya BRT system provides access to 342 (see Figure 3), providing access to 47% of all identified economic opportunities. Existing transportation services provide access to 223 economic opportunities, thus providing access to 31% of all identified economic opportunities.

As per Figure 4, the introduction of the Rea Vaya BRT system increased access to economic opportunities by 16%. Much of this increase can be attributed to the fact that the Rea Vaya bus stations are located along Louis Botha Avenue, the spine of the development corridor around which economic facilities congregate and develop, while existing transport services and their associated bus stops and stations are located along through and local streets.

6. SYNTHESIS

6.1 The LBDC and access to economic opportunities

The spatial analysis found that the Rea Vaya BRT system provides access to 47% of all identified business, commercial-, and industrial-zoned properties in the corridor, while existing transportation services provide access to 31% of these properties. As such, the LBDC, through the Rea Vaya BRT system, increased access to economic opportunities by 16%. This illustrates the potential impact of the LBDC

and the strategic implementation of TOD and development corridors on increasing economic access in the CoJ. This finding is aligned with that of Mirzahosseini *et al.* (2020) regarding Copenhagen's economic access improvements as a result of its TOD Finger Plan; Masingi (2019) on the CoF initiative and its accessibility benefits for the urban poor in Soweto, and that of Lionjanga and Venter (2017) regarding the positive impact of the CoF on improved travel time. This is further linked to the potential broader benefits of TOD and development corridors, including improved destination accessibility (Ogra & Ndebele, 2014); the creation of mixed-use, high-density communities (Vale, 2015: 70); addressing spatial

inequality and fragmentation (Boraine *et al.*, 2006; Dewar, 2017), and fostering inclusivity, social cohesion, and mitigation of urban sprawl (Lang *et al.*, 2020).

6.2 COJ strategic policy environment

Another research objective is to investigate the features of the policy environment central to the successful implementation of LBDC and the broader CoF initiative in the CoJ. Toward achieving this objective, in line with Section 2.3, Table 4 elucidates the incorporation of the central implementation instruments – in the context of TOD and development corridors – in the CoJ strategic policy environment.

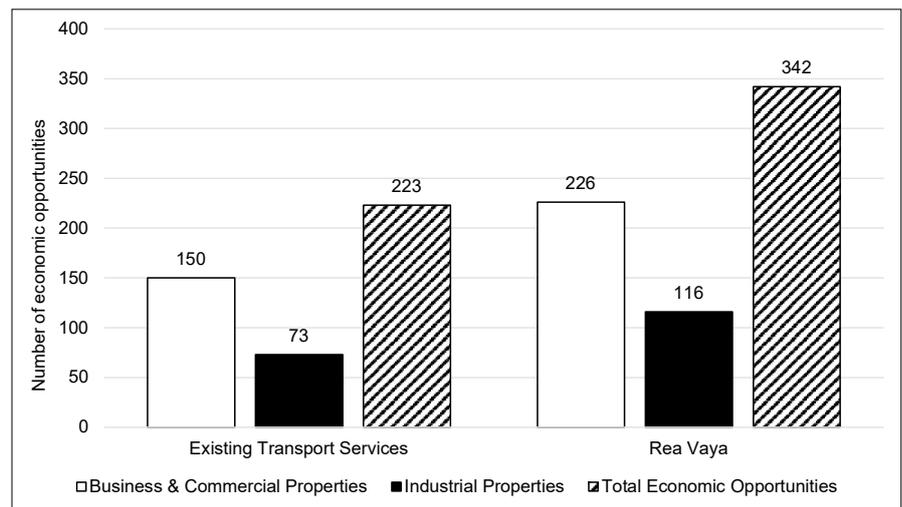


Figure 3: Comparison of access to economic opportunities in the LBDC
Source: Author, 2022

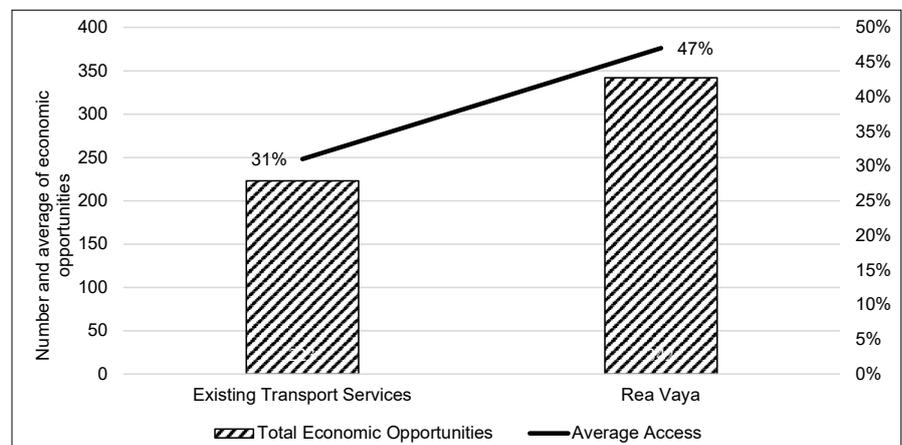


Figure 4: Increased economic access provided by the Rea Vaya in the LBDC
Source: Author, 2022

Table 4: Policy instruments for TOD implementation in COJ

CoJ strategic policy	Incorporation of TOD and development corridors
Instrument: Land-use and zoning regulations (enabling mixed-use, higher density areas around TOD)	
<ul style="list-style-type: none"> Spatial development framework (SDF) Land-use management scheme (LUMS) 	<ul style="list-style-type: none"> The SDF incorporates TOD as a crucial strategy for achieving a more compact and polycentric urban model (CoJ, 2021: 72), by emphasising the intensification of mixed-use and high-density residential development in and around TOD nodes (CoJ, 2021: 74), along the identified development corridors (CoJ, 2021: 104) and within the public transport backbone (CoJ, 2021: 106). The understanding that TOD improves economic access can align with, and influence the CoJ's SDF by encouraging mixed land uses, higher density development, a polycentric urban model, and investments in transit corridors that increase accessibility and economic prospects for residents. The LUMS identifies Priority TOD corridors and TOD Metropolitan and Regional nodes and sets specific parking requirements for these areas (CoJ, 2018). The findings of this study should drive the CoJ's LUMS to promote higher density development, mixed land uses, and reduced parking requirements in TOD areas, all of which are in line with TOD principles that aim to create vibrant, economically accessible, and sustainable urban environments.
Instrument: Transport policies (focus on TOD and multimodal transport approaches)	
<ul style="list-style-type: none"> Strategic integrated transport plan framework (SITPF) 	<ul style="list-style-type: none"> The SITPF prioritises TOD as a central strategy for sustainable and efficient transportation. It promotes TOD through incentives in TOD precincts (CoJ, 2013: 30), investing in mass public transportation systems (CoJ, 2013: 48), increasing ridership turnover, and reducing congestion (CoJ, 2013: 49, 106). The plan encourages mixed-use developments and high-frequency public transport corridors to create vibrant, walkable communities (CoJ, 2013: 5). The findings of this study underscore the significance of TOD principles in enhancing access to economic opportunities, promoting sustainable transportation, and creating economically vibrant, transit-accessible communities.
Instrument: Infrastructure investment (targeted public investment in TOD development)	
<ul style="list-style-type: none"> Integrated development plan (IDP) 	<ul style="list-style-type: none"> The IDP prioritises TOD to address infrastructure needs, promote strategic growth, and create an inclusive city. TOD nodes receive targeted investment to increase capacity in growth areas and address deprivation backlogs (CoJ, 2022: 228). TOD corridors are designated as spatially targeted investment areas (CoJ, 2022: 233), with focused funding in the Medium-Term Expenditure Framework (CoJ, 2022: 229). TOD is a key mayoral priority for an inclusive city (CoJ, 2022: 182), supported by various infrastructure projects and interventions (CoJ, 2022: 252, 260, 261). The findings of the study complement the IDP's goal of promoting strategic growth. TOD principles involve concentrating development around transit nodes and corridors, which can lead to the creation of more economically vibrant areas, by reducing the need for long commutes and increasing local access to jobs and services. TOD's role in increasing access to economic opportunities aligns with the IDP's aim to create an inclusive city. By making economic opportunities more accessible to a broader range of residents, TOD supports inclusivity and reduces disparities in economic access. In addition, the findings that TOD improves economic access underscores the significance of TOD as key mayoral priority in the IDP. This prioritisation highlights the recognition that improving access to economic opportunities is a critical aspect of TOD, and it serves as a guiding principle for planning and implementing infrastructure projects and interventions.
Instrument: Development incentives (support private sector to develop in TOD areas/precincts)	
<ul style="list-style-type: none"> IDP SDF 	<ul style="list-style-type: none"> To support and promote TOD corridors and other interventions, the CoJ is working on an investment incentives policy (CoJ, 2022: 27). This policy aims to encourage private sector participation and investment in TOD nodes and corridors, facilitating the creation of well-connected and sustainable urban environments premised on public transit accessibility. The findings of this study should provide further motivation for the city to create development incentives aimed at attracting private sector investments into TOD areas. The IDP's focus on well-connected and sustainable urban environments aligns with the understanding that TOD improves access to economic opportunities. The fact that TOD principles lead to such benefits reinforces the city's commitment to developing areas where residents have easy access to jobs and services through effective public transit systems. The SDF uses development incentives such as capital investment, increased density allowances, and land value sharing to promote TOD principles in the city's transformation zones. These incentives encourage private sector involvement and foster dense, diverse, and intense urban environments (CoJ, 2021: 104, 139). The SDF's utilization of development incentives such as capital investment, increased density allowances, and land value sharing reflects an acknowledgment of the potential economic benefits of TOD. The fact that TOD enhances economic access encourages the use of these incentives as tools to promote TOD principles. The SDF's goal of creating dense, diverse, and intense urban environments resonates with the finding that TOD enhances access to economic opportunities. Such environments make it easier for residents to access jobs, services, and economic centres, which can stimulate development and economic growth.
Instrument: Public participation (inclusive process with buy-in from all sectors)	
<ul style="list-style-type: none"> IDP 	<ul style="list-style-type: none"> Public participation is essential to the CoJ IDP for TOD. Inputs from community-based sessions directly influence infrastructure investments in TODs, ensuring alignment with local needs and earning broad support for TOD implementation (CoJ, 2022: 54). The findings of this study underscore the significance of public participation in the CoJ's IDP for TOD. It ensures that the development plans are not only economically beneficial, but also aligned with the needs and desires of the local population, resulting in more successful and sustainable TOD projects.
Instrument: Affordable housing policies (low-income households are not excluded and housing forms part of higher density, mixed-use developments around TOD to extract access advantages)	
<ul style="list-style-type: none"> IDP Inclusionary housing policy 	<p>The IDP prioritises affordable housing programmes in TOD nodes and corridors, providing low-rent and rent-to-buy units within mixed-income developments (CoJ, 2022: 34). This fosters inclusivity and access advantages for low-income households in the city. The findings of this study should drive the IDP to prioritise affordable housing programmes within TOD areas. This will demonstrate a greater commitment to addressing housing needs for low-income households in locations with improved access to jobs and services. In addition, the IDP's emphasis on inclusivity directly relates to the finding of this study. By making affordable housing available within TOD areas, the IDP fosters inclusivity, allowing a broader range of residents to live in areas with better access to jobs and services.</p> <p>The inclusionary housing policy does not mention TOD. Further review and adjustments are needed to align the policy with TOD goals for a more accessible and inclusive city. The findings of this study should encourage the city to incorporate TOD principles into the policy, in order to extract its access advantages. This can involve explicitly recognising the benefits of locating affordable housing within or near transit hubs to improve economic access for low-income households.</p>

CoJ strategic policy	Incorporation of TOD and development corridors
Instrument: Integrated planning policies (TOD encroaches on various planning fronts, including economic development, transport, land use, housing; all departments and stakeholders should work together)	
CoJ growth and development strategy (GDS)	The GDS mentions that TOD opportunities are provided for through the Rea Vaya BRT and Gautrain in certain nodes (CoJ, 2011: 71). However, integrated planning for TOD is not mentioned in a clear and detailed manner. To achieve desired spatial aims, the CoJ should coordinate efforts across departments and stakeholders to integrate economic development, transport, land use, and housing in its TOD approach. The GDS recognises that TOD opportunities are provided through the Rea Vaya BRT and Gautrain in certain nodes. The findings of this study should encourage the GDS to place greater emphasis on leveraging these opportunities to maximise economic accessibility for residents. This could involve more detailed plans for how these transit systems can be effectively integrated into broader economic development strategies.
Instrument: Public-private partnerships (PPPs) (public and private sectors work together in facilitating spatial development linked to TOD)	
IDP	The IDP encourages PPPs to implement TOD principles (mixed income developments, mixture of housing options) for the supply of housing (CoJ, 2022: 134), for ultimately creating inclusive accessible urban environments. The findings of this study reinforce the importance of such partnerships. These collaborations can help leverage private sector resources and expertise to create transit-oriented urban environments that improve economic accessibility for a wide range of residents. The findings of this study also reinforce the IDP's aim to create inclusive and accessible urban environments. By integrating TOD principles into the plan, the city can create neighbourhoods that allow residents, regardless of income, to have improved access to jobs, services, and economic centres.

The incorporation of TOD in the CoJ policy environment is evident across multiple key instruments. The City's IDP, LUMS, SDF, SITPF, and GDS all acknowledge the significance of TOD and development corridors in realising an inclusive and accessible urban form. The policies bring to light numerous strategies such as promoting mixed-use and high-density developments to encourage and support TOD, as these regulations shape urban growth (Huang & Tang, 2012); prioritising TOD corridors and nodes; investing in mass public transportation systems to influence transport supply and demand and enhance economic access (Mouter & van Wee, 2021) and encouraging public-private partnerships for cost reliability, efficiency, and financial security benefits (Ndebele, 2018: 8). The policies also pay special attention to community engagement for higher quality TOD initiatives (Ballering 2022); affordable housing initiatives to address urban sprawl and enhance economic access (SAPOA, 2016: 12; Lang *et al.*, 2020), and development incentives to attract investors (SAPOA, 2016: 25) and ensure accessibility and inclusivity in TODs.

6.3 Toward extracting TOD and development corridor potential

While there are notable efforts to incorporate TOD and development corridors in the CoJ, some strategic policies such as the GDS require further review and integration of TOD and development corridors goals and objectives, as successful

implementation requires all relevant stakeholders to be involved in all phases of the project (SAPOA, 2016: 7). The implementation of TOD and development corridors ought to be included as a strategic priority in the policy, outlining how these instruments fit into broader urban development plans and how they align with other policy priorities. In addition, cross-departmental collaboration for policy development should also be adopted to ensure that the various stakeholders involved in urban development are aligned in their approach to TOD and development corridor implementation.

From a PPP perspective, the IDP needs to explore opportunities for public-private partnerships to finance, accelerate implementation, and operate transport infrastructure linked to TOD and development corridors. The COJ ought to conduct comprehensive feasibility studies to identify suitable infrastructure PPP projects and assess potential related risks. The COJ's IDP ought to stipulate the roles, responsibilities, and risk allocation between the public and private sectors to build investor confidence and ensure successful completion of projects. In addition, to integrate affordable housing in TOD nodes and corridors and ultimately ensure inclusivity for all residents (Coleman, 2018), the inclusionary housing policy also requires additional focus. Location-based criteria and transit accessibility targets to align the policies with TOD and development corridor goals for a more accessible and inclusive city ought to be established

in affordable housing policies such as the inclusionary housing policy. These policies should prioritise the development of inclusionary housing units in areas with good access to public transportation, setting targets for a percentage of inclusionary housing units to be located within a certain distance from transit stations within development corridors.

The SITPF needs to include strategies to create a multimodal transportation network that will ensure increased social inclusion and economic access in TOD nodes and corridors (Mouter & Van Wee, 2021). Transport policies such as the SITPF should include and emphasise multimodal transport as core strategy. To optimise the accessibility potential of public transportation services for successful implementation, policies ought to clearly state the significance of integrating the various modes of transport to create an efficient transport network. Long-term strategies should be put in place to develop a comprehensive multimodal transport network in TOD corridors to ensure seamless transfers between the different modes of transport in the city, in order to ultimately enhance access. The LUMS also requires additional focus to enable mixed-use and high-density developments in TOD nodes and corridors. Therefore, it is recommended that the CoJ develop and include transit-oriented design guidelines within the land-use scheme that promotes the principles of TOD and development corridors.

From a spatial policy perspective and in relation to other levels of

planning, the LBDC SAF does not exist in isolation; it is rather regarded as an essential part within the broader package of plans and policies considered earlier. The SAF translates the intent of the CoJs GDS, IDP, SDF, Regional Development Framework, and informs the City's Precinct Plans. The framework's vision is premised on theories and best practices of TOD and development corridors, seeking to create urban spaces with a mix of high-density land uses within walkable precincts, anchored by transit facilities (CoJ, 2012: 13). However, the framework requires additional focus as no consideration is given to multimodal transport approaches to further enhance the accessibility impact of the Rea Vaya BRT and the supporting public transport systems in the corridor.

It is recommended that integrated transport system plans be considered with the development of transit corridors and incorporated into policy documents such as the LBDC SAF, to maximise access to economic opportunities. The Reya Vaya BRT system is the spine around which the LBDC has been developed with taxi ranks, the Metrobus, and the Gautrain Bus serving as supplementary transport services. Strategies should be put in place to develop integrated, user-oriented transport services. The TOD framework should make an integrated transport system a significant broad policy outcome and, therefore, provide guidance on linking the formal and informal transport services in the corridor to create an integrated multimodal transportation network. This will grant passengers access to at least two modes of transport to get to economic opportunities in the corridor perhaps beyond 800m. Providing a variety of transport modes will ensure that all users are accommodated and catered for based on their preferences and financial situation.

It must, however, be noted that, while the integration of transportation services is beneficial, duplication of such services (for instance, two transportation services running the same routes) must be avoided,

in order to optimise resources. Integration that enables good use of resources could entail, for example, engaging with the east-west taxi route operators to align their stops with stops on the north-south BRT routes, enabling them to work together harmoniously and complement one another. Transport interchanges serve as places that attract and distribute trips, and integrate transport, allowing commuters to transfer between different modes of public transport. It is recommended that the CoJ work with relevant public transport providers to develop strategies in the SAF for the provision of more feasible infrastructure and service enhancements required to facilitate integrated transport systems such as transport interchanges/hubs. The framework should promote, encourage, support, and provide guidance on investment, planning, and location decisions of more transport interchanges that can accommodate the Rea Vaya buses, Metrobuses, Gautrain buses, and taxis. The SAF should include the results of a comprehensive assessment that clearly indicates the most suitable locations for transport interchanges (if any), in addition to the Watt Street Interchange. This assessment can include consideration of existing travel patterns of taxis, Metrobuses, and Gautrain buses, and where strategic networks coincide or overlap in the corridor. In addition, the SAF should clearly and in detail stipulate the positive outcomes of good modal interchanges. The direction provided in the framework should indicate that transport interchanges in the corridor could act as catalysts for surrounding development, enhance transportation choices and the range of destinations and, subsequently, improve access to opportunities.

7. CONCLUSIONS

The research aimed to determine the potential of the strategic implementation of TOD and development corridors in mitigating central spatial challenges in the South African urban milieu, with specific reference to economic

access. The research sought to analyse the impact of the LBDC in this regard and investigate policy environment in the CoJ toward successful implementation. It was found that the LBDC has the potential to increase access to economic opportunities, while recommendations were delineated to amplify the potential inherent to the CoF. The latter focuses on increased cross-departmental collaboration, feasibility studies and risk allocation, location-based criteria and transit accessibility targets, transit-oriented design guidelines, and integrated transport systems as policy insights on TOD and development corridor implementation in the CoJ. This connects to existing research on these instruments as potential planning tools to guide urban growth and mitigate urban sprawl, and to create inclusive communities encompassing public transit systems with increased access to housing, economic opportunities, transportation, and other essential services for all residents. The findings and recommendations are applicable to the wider South African and developing country context, as they inform the benefits of dual TOD and development corridor implementation in potentially mitigating spatial challenges, and the policy interventions required to extract related benefits. This is a central contribution of the research. Limitations of this study include that, at the time of data collection, some properties in the corridor were undergoing rezoning. Therefore, while a property might be zoned as business, commercial, or industrial, secondary land-use rights permit other uses.

Secondly, this study examined the accessibility aspect of TOD. However, successful TOD is not limited to accessibility outcomes. The success of the LBDC can also be measured in terms of the extent of mixed-use development, high residential density, pedestrian orientation, connectivity, limited managed parking, and a topological road network.

Lastly, the Rea Vaya buses had also not been procured yet, thus the transport service was

not operational at the time the research was conducted. The extent to which the LBDC enhances economic access and stimulates developmental processes and growth may be impacted once the BRT line is operational.

This research considered the contribution the LBDC has made to accessibility. The SAF does, however, highlight a great deal more than merely accessibility outcomes, since a TOD development corridor is also concerned with supporting land uses. Therefore, in addition to supporting improvements in accessibility, SAF has also supported changes in land use that will support any kind of mass transit network. As such, the value of the SAF with regard to changing the character and development trends of the LBDC is a future avenue of research.

In addition, the primary focus of the study is a proximity comparison between TOD, in this case the Rea Vaya BRT and other transit services, to improve economic access. In essence, the study is a geographical footprint comparison. However, the study could be extended by first, looking at the potential feet in volume each transport service in comparison brings and how that translates to economic opportunity, and secondly, what the socio-economic profile for each transport service in comparison is and how that translates to economic opportunity.

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