EFFECT OF URBAN INFRASTRUCTURE ON DENSITY OF NEW FIRMS IN SOUTH AFRICA

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Keywords

New firm density, urban infrastructure, public transport, broadband access, water reliability, South Africa, entrepreneurship, municipal development

Abstract

Research Problem: *Entrepreneurial growth across South African municipalities remains spatially uneven, with significant disparities linked to variations in urban infrastructure. Despite policy efforts to stimulate local economic development, limited empirical research has examined how specific infrastructural components—such as public transport access, water and sanitation reliability, and broadband connectivity—shape new firm formation. Understanding these relationships is essential for addressing persistent gaps in municipal-level entrepreneurship.*

Methods/Theory: *Anchored in Endogenous Growth Theory, this study employs a cross-sectional explanatory research design to analyse the influence of urban infrastructure on entrepreneurial density. Multiple linear regression was applied to municipal-level data from 156 municipalities, using secondary data sourced from CoGTA, PRASA, ICASA, and CIPC. This approach enabled the assessment of how different infrastructure indicators collectively and individually affect new firm density.*

Results: *The findings indicate that public transport access and broadband coverage exert statistically significant positive effects on new firm density, demonstrating their catalytic role in enabling entrepreneurial activity. While water and sanitation reliability also shows a positive relationship with new firm formation, its effect is not statistically significant. These results affirm Endogenous Growth Theory by highlighting infrastructure as a critical driver of local economic dynamism.*

Conclusion: *Urban infrastructure plays a foundational yet uneven role in shaping entrepreneurial outcomes across South African municipalities. Transport access and digital connectivity are particularly influential in fostering new firm formation, while basic*

utility reliability, though important, requires further strengthening to produce measurable economic impact.

Key Contribution to Knowledge: *This study contributes to urban and entrepreneurial development scholarship by providing empirical evidence on the differentiated impacts of infrastructure components on firm creation in South Africa. It highlights how infrastructural disparities reinforce spatial inequality in entrepreneurial opportunities.*

Recommendation: *The study recommends strengthening integrated public transport networks, accelerating the rollout of fibre broadband, and improving the reliability of water and sanitation services to build more inclusive entrepreneurial ecosystems. Policymakers should position infrastructure investment as a strategic economic intervention to stimulate local innovation, reduce unemployment, and narrow urban inequality.*

1.0 Introduction

New firm density, often measured by the number of newly registered businesses per thousand residents, has emerged as a critical marker of entrepreneurial vitality and local economic development. Across urban areas globally, dense clusters of new firms signal the presence of enabling environments that include functional infrastructure, ease of access, and essential services. Yet the disparities in firm creation across cities, particularly within the Global South, reveal systemic barriers embedded in urban planning and service delivery. As cities grow, the quality and accessibility of urban infrastructure increasingly shape the entrepreneurial landscape by either empowering or inhibiting small business formation (McFarlane, Kombe, Muheirwe, 2025).

Urban infrastructure, ranging from transport to broadband and sanitation, is a pivotal enabler of firm agglomeration and competitiveness. In contexts where infrastructure is insufficient or unreliable, entrepreneurs are deterred by high transaction costs, erratic utility access, and limited market connectivity. For example, broadband diffusion has been directly linked to startup acceleration in digital sectors, with firm density rising proportionally with household internet access in Sub-Saharan cities (Guiffard, 2024). Similarly, integrated public transport systems reduce spatial friction, enabling entrepreneurs to access labor, logistics, and consumer markets more efficiently.

Access to reliable and affordable public transport is particularly central to urban firm dynamics. In African cities where rail and bus infrastructure remains patchy or underfunded, small firms face severe constraints in mobility and distribution (Funabashi, 2024). These challenges are amplified in informal settlements and peripheral urban zones where transport deficits isolate budding entrepreneurs from central business districts and resource clusters. As shown in the case of Lagos, the absence of integrated transit networks has contributed to fragmented economic zones and reduced startup survival (Musa and Mourad, 2025).

Water and sanitation systems also play an often-underestimated role in shaping firm location and density. The reliability of basic utilities influences both the health of workers and the operability of businesses, especially in

sectors such as food, manufacturing, and services. Outage frequency and water quality concerns have been associated with business relocation and productivity loss in fast-urbanizing African cities (Branda, Ciccozzi, Scarpa, 2025). In cities like Johannesburg and Durban, lapses in sanitation infrastructure are not only public health hazards but also business continuity risks, pushing firms toward already-saturated central zones.

Equally, broadband infrastructure has become indispensable for new firm development in the digital age. In regions where fibre optic coverage remains low, tech startups and service-oriented businesses struggle to access cloud platforms, digital markets, and online banking systems. Empirical data from Kano, Nigeria, indicates a statistically significant correlation between household fibre coverage and firm emergence, especially among youth-led enterprises (Guiffard, 2024). This evidence positions broadband access not merely as a luxury, but as a fundamental precondition for equitable entrepreneurial participation.

In South Africa, these infrastructure issues intersect with historical spatial inequalities and contemporary urban governance challenges. Many municipalities continue to grapple with ageing water systems, inadequate transport investments, and slow fibre rollout in township economies. Despite policy reforms and national infrastructure plans, the entrepreneurial outcomes across municipalities remain uneven, with firm density still concentrated in metros with superior infrastructure provisioning (McFarlane, Kombe, Muheirwe, 2025). This spatial divergence raises urgent questions about how local infrastructure strategies impact inclusive economic growth.

While urban infrastructure is broadly acknowledged as essential for development, little empirical work has directly connected its components to the density of new firms in South Africa. Existing studies often focus on infrastructure's macroeconomic role or sectoral productivity without disaggregating its specific impact on firm formation. Moreover, the heterogeneity across municipalities, from metros like Cape Town to secondary cities like Polokwane—remains underexplored in policy analysis and academic discourse. This limits both national planning and local innovation strategies aimed at reducing unemployment through entrepreneurship.

This study addresses a critical research gap by exploring how specific urban infrastructure elements; public transport, water and sanitation, and broadband access, influence the density of new firms across South African municipalities. By leveraging municipal data from CoGTA, ICASA, and transport agencies, this research investigates whether and how infrastructure provisioning correlates with firm emergence at the city level. The findings aim to inform urban policy and infrastructure investments that foster a more inclusive and resilient entrepreneurial ecosystem, especially in under-resourced urban areas. Against this backdrop, the study tests the following hypothesis:

H_{01}: Public transport access has no significant effect on the density of new firms per 1000 residents in South African municipalities.

H_{02}: Water and sanitation reliability has no significant effect on the density of new firms per 1000 residents in South African municipalities.

H_{03}: Urban broadband coverage has no significant effect on the density of new firms per 1000 residents in South African municipalities.

2.0 Literature Review

Concept of New Firm Density

New firm density, often defined as the number of newly registered businesses per 1,000 working-age individuals, serves as a core indicator of entrepreneurial dynamism and

local economic renewal. It reflects both the propensity and ability of individuals to formalize businesses in response to perceived opportunities or necessities. Several studies affirm that new firm density is not only a measure of entrepreneurial activity but also an expression of institutional quality, infrastructure readiness, and policy environment (Ajide, 2020; Cruz, Moelders, Salgado, & Volk, 2025). In the African context, particularly in South Africa, low new firm density has been linked to infrastructural bottlenecks, limited access to finance, and urban service deficits (Pollio, 2020; Naudé & Van der Walt, 2020). Moreover, disparities in firm density across municipalities highlight the uneven spread of enablers like internet access, reliable transportation, and clean utilities (Weiss, Perkmann, & Phillips, 2022; Oosthuizen, 2021). As observed by Munemo (2020), areas with higher levels of bureaucratic efficiency and digital penetration tend to attract more startup activity. Similarly, Baluku, Onderi, and Otto (2021) stress that urban entrepreneurial environments are critically shaped by infrastructure that reduces uncertainty for new entrants. In examining startup emergence in Cape Town, Fanta and Makina (2020) emphasize the link between digital infrastructure and the rapid clustering of tech-driven firms. Cichello and Mncube (2020) further add that transport barriers and water reliability remain pressing deterrents to entrepreneurial growth in South African townships. Therefore, for this study, new firm density is conceptualized as the number of formally registered businesses per 1,000 residents in a municipality, serving as a proxy for localized entrepreneurial vitality and the responsiveness of urban infrastructure systems to the needs of emerging enterprises.

Concept of Public Transport Access

Public transport infrastructure has increasingly been recognized as a foundational enabler of entrepreneurial activity in urban economies. In rapidly urbanizing contexts like Sub-Saharan Africa, public transport access reduces spatial inequalities by linking labor, capital, and consumers to emerging firms (Amoako, Cobbinah, & Owusu-Ansah, 2023). Efficient rail and bus networks lower start-up costs by facilitating easier commutes for workers and providing entrepreneurs with broader market access (Maree, 2021). In South Africa, transport deficits have been shown to constrain firm emergence in peripheral urban areas, particularly in informal settlements and historically underdeveloped municipalities (Ntema & Marais, 2022). The lack of reliable and affordable public transport options raises operational risks and spatial mismatch, thereby discouraging potential firm creators (Langa & von Fintel, 2021). Research by Booysen, Alfers, and Skinner (2024) highlights how improved public transport access in cities like Cape Town and Durban has directly contributed to an increase in youth and women-led microenterprises. Transport coverage also correlates positively with firm density when accompanied by supportive land use policies and transit-oriented development frameworks (Mkhize, 2020). Moreover, as documented by Adebayo and Fourie (2022), public transit access is critical in promoting inclusive growth through the stimulation of township entrepreneurship. International studies confirm that greater transit integration enhances firm birth rates by reducing logistical barriers, especially in informal urban economies (Diop & Granger, 2025). Accordingly, in this study, public transport access is conceptualized as the functional availability and coverage of rail and bus transport services, proxied by total passenger volumes within a municipality, and assessed in relation to its influence on the density of new firms.

Concept of water and sanitation reliability

Reliable water and sanitation services are foundational to urban liveability and economic

participation, yet their influence on entrepreneurship and new firm creation is often overlooked in urban policy discourse. For entrepreneurs, especially in informal and small-scale sectors, service outages and sanitation failures directly impact business continuity, hygiene standards, and customer perception (Muchesa & Nkambule, 2022). In South Africa, where municipal service delivery varies widely, water infrastructure breakdowns have become a critical barrier to operational stability for township enterprises (Kumalo, 2020). Studies show that business owners in sectors like hospitality, food processing, and manufacturing are particularly sensitive to disruptions in water availability and waste removal (Olawumi & Chan, 2023). Moreover, sanitation-related health risks contribute to workforce absenteeism and reputational losses, especially in high-density areas where infrastructure strain is most acute (Baum, 2021). The World Bank (2023) emphasizes that entrepreneurs are more likely to formalize and scale their operations in environments where essential utilities are predictable and efficiently maintained. Findings from Chikozho and Tapela (2024) in the Eastern Cape suggest that frequent water outages not only affect productivity but also deter youth from entering self-employment. Similarly, Hove and Chikulo (2021) argue that unreliable sanitation services correlate with declining investor confidence in peri-urban growth zones. Furthermore, Luyt and Mthembu (2023) demonstrate that sanitation access has become a proxy for spatial inclusion in South Africa's informal economies. For the purpose of this study, water and sanitation reliability is conceptualized as the stability and quality of water supply and waste services in a municipality, operationalized through indicators such as service outage frequency, maintenance records, and user satisfaction reports.

Concept of Urban Broadband

Access to high-speed broadband has become a central driver of entrepreneurial transformation in urban economies, particularly in developing regions where digital infrastructure can offset traditional market access barriers. In South Africa, broadband connectivity has been shown to significantly influence the growth and spatial distribution of startups, especially in tech-enabled and service-driven sectors (Guiffard, 2024). High-speed internet allows entrepreneurs to access digital tools, mobile banking, e-commerce platforms, and remote markets, thereby lowering entry costs and enhancing business scalability (Abdulrahman & Odhiambo, 2023). According to Chavula (2020), internet penetration not only boosts firm formation but also enhances innovation through real-time market feedback and network effects. Municipalities with strong fibre optic infrastructure consistently report higher firm birth rates, as broadband fosters information symmetry and operational efficiency (Oseni & Sobowale, 2021). In contexts like Cape Town and eThekwini, studies have revealed that local broadband initiatives have facilitated micro-enterprise clustering and reduced the spatial inequality of entrepreneurial opportunities (Mothobi & Gillwald, 2021). Furthermore, Akinwale and Olatunji (2023) highlight the gendered impact of broadband, showing that female entrepreneurs disproportionately benefit from digital platforms for home-based businesses. The World Bank (2022) reinforces that closing Africa's digital divide is fundamental to accelerating firm density and inclusive job creation. While broadband alone cannot resolve systemic barriers, its presence amplifies the effects of other infrastructure such as transport and finance (Osei & Frimpong, 2020). For the purpose of this study, urban broadband is conceptualized as the extent of high-speed fibre coverage within a municipality, proxied by household broadband penetration rates, serving as a key determinant of digital inclusivity and startup potential.

2.1 Review of Related Empirical Studies

Public Transport Access and New Firm Density

A growing body of empirical evidence underscores the centrality of public transport infrastructure in shaping entrepreneurial ecosystems, especially in rapidly urbanizing regions of the Global South. Maree (2021) demonstrated that in South Africa's post-apartheid spatial economy, enhanced rail and bus connectivity correlates with higher firm emergence in previously marginalized urban zones, largely by lowering mobility costs and improving labour accessibility. Similarly, Langa and von Fintel (2021) found that youth-led microenterprises in Gauteng tend to cluster near high-frequency bus corridors, reflecting the vital role of public transport in enabling low-capital business operations. Adebayo and Fourie (2022) advanced this argument by linking improved township transit policies to an upsurge in informal and home-based enterprises in Soweto. Supporting this trend, Mkhize (2020) emphasized that municipalities with integrated transit-oriented development frameworks experienced increased firm density, driven by land-use synergies and improved pedestrian access. Booysen, Alfers, and Skinner (2024) further noted that women entrepreneurs in Durban relied on safe and accessible transit systems to run mobile and home-based businesses, directly linking transport equity with gender-inclusive entrepreneurship. Across other African contexts, Amoako, Cobbinah, and Owusu-Ansah (2023) observed that transport upgrades in Accra and Kumasi supported the spatial expansion of market-based businesses into peripheral zones. Diop and Granger (2025), examining West African cities, found that reduced commute times and predictable transit schedules are statistically associated with firm birth rates, especially in informal economies. In Johannesburg, Ntema and Marais (2022) showed that minibuses and formal bus networks serve as economic lifelines for self-employed traders and small firms, with areas lacking these services reporting lower startup rates. International evidence supports this as well — Ho and Mulley (2021), in a study across Southeast Asian cities, affirmed that transit accessibility significantly predicts urban entrepreneurial clustering. Finally, Chavis and Rajabifard (2023) argued that multi-modal urban transport investments not only facilitate physical access but also contribute to spatial reputation, thereby enhancing business confidence in underserved locations. Together, these studies strongly suggest that public transport access is not just a mobility solution, but a catalyst for firm creation, especially in equity-challenged urban landscapes like South Africa's.

Water and Sanitation Reliability and New Firm Density

Reliable water and sanitation infrastructure plays a critical role in enabling entrepreneurial activity, particularly in urban environments where hygiene, utility access, and public health concerns intersect with business performance. Muchesa and Nkambule (2022) revealed that inconsistent water supply and frequent sewage failures in South African municipalities have deterred small business growth, especially in service-based sectors. In an extensive study of informal traders, Chikozho and Tapela (2024) demonstrated that sanitation reliability significantly influenced operational hours and business location decisions. Similarly, Olawumi and Chan (2023) found that poor water infrastructure directly limited startup formation in sectors dependent on hygiene and cleanliness, including hospitality, food services, and health. Hove and Chikulo (2021) highlighted that firms located in areas with recurring sanitation failures experience higher staff absenteeism and reduced consumer confidence. Baum (2021) further showed that water insecurity has broader implications for urban entrepreneurship, often leading to firm

migration toward already-saturated zones with better service provision. Kumalo (2020), focusing on township economies, reported that lack of routine maintenance and extended outages disrupt operations and deter business formality. From a policy perspective, the World Bank (2023) emphasized that improvements in municipal sanitation services correspond with higher entrepreneurial entry rates in underserved urban areas. Luyt and Mthembu (2023) extended this by linking sanitation access with spatial inclusion, arguing that entrepreneurs are more likely to formalize when they operate in clean and stable environments. In West African contexts, Adepoju and Akinyemi (2021) reported a direct association between improved water systems and firm survival in peri-urban communities. Lastly, using spatial analytics, Musakwa and van Niekerk (2021) demonstrated that water infrastructure investment in South African metros correlated with increased firm registrations and local employment growth. Collectively, these findings affirm that reliable water and sanitation infrastructure is a foundational component of the entrepreneurial environment, especially in the Global South where service reliability remains uneven and business risk is acutely sensitive to public utility failures.

Urban Broadband Access and New Firm Density

The availability of high-speed broadband has emerged as a structural determinant of entrepreneurship and firm formation, particularly in developing economies where physical and financial constraints traditionally restrict market access. In South Africa and across Sub-Saharan Africa, digital infrastructure is increasingly seen as a key enabler of localized innovation and business emergence. Guiffard (2024) provided compelling evidence that enhanced mobile broadband coverage and fibre infrastructure significantly increased the rate of firm registrations in urban areas, driven by improved access to digital platforms and e-commerce systems. Mothobi and Gillwald (2021) echoed this in their empirical analysis of South African cities, noting a direct correlation between fibre optic penetration and startup concentration, especially in tech-focused precincts. Abdulrahman and Odhiambo (2023) showed that broadband density improves entrepreneurial resilience, allowing firms to adapt through digital payment systems, online service delivery, and virtual client interaction. In Ghana, Osei and Frimpong (2020) demonstrated that reliable internet services increased the number of formalized businesses, particularly among youth. Chavula (2020) found similar results, highlighting the positive feedback loop between internet infrastructure and entrepreneurial ecosystems in urban East Africa. Akinwale and Olatunji (2023) focused on gendered outcomes, showing how women-led microenterprises rely on home-based broadband access to bridge work-life constraints. Oseni and Sobowale (2021) reinforced that digital connectivity encourages spatial equity by allowing firms in peripheral areas to operate competitively. A study by the World Bank (2022) concluded that a 10% increase in broadband penetration correlates with a 2.5% increase in firm density across African cities. Digital inclusion also supports formalization, as shown by Musakwa and van Niekerk (2021), where spatial analyses confirmed that firms in high-coverage zones were more likely to be tax registered. Finally, Islam (2024) argued that broadband enables adaptive entrepreneurship in high-risk environments, particularly when combined with mobile fintech tools and government e-services. These studies collectively confirm that broadband access is no longer a luxury infrastructure but a strategic input for business creation in digitally transitioning economies like South Africa.

2.2 Theoretical Framework

For this study, the Endogenous Growth Theory provides a robust theoretical foundation to explain the relationship between urban infrastructure and new firm density. Proposed by Paul Romer and Robert Lucas, this theory assumes that economic growth is largely generated from within a system, primarily through investments in human capital, innovation, and infrastructure. It posits that policy decisions and infrastructural investments can directly influence the productivity of entrepreneurs, thereby stimulating long-term growth. The theory assumes that the external environment, including public services like transport, broadband, and sanitation, is not neutral but instrumental in shaping economic behavior and firm creation.

Applied to this study, the theory explains how municipal-level investments in public transport, broadband, and basic services create the enabling environment for entrepreneurial activity by lowering operational barriers and transaction costs. Several studies have applied this framework: Abdulrahman and Odhiambo (2023) used it to explain ICT-driven firm growth in Africa, while Muchesa and Nkambule (2022) linked infrastructure services to firm expansion in Southern Africa. Findings consistently show that urban infrastructure serves as a productivity-enhancing asset that fosters spatial and inclusive economic dynamism. Thus, the Endogenous Growth Theory aligns closely with this study's premise, that infrastructure access is not merely supportive, but central to the emergence of new firms.

3. 0 Methodology

This study employed a cross-sectional explanatory research design to empirically examine the effect of urban infrastructure on the density of new firms across South African municipalities. The population comprised all 257 municipalities in South Africa, based on the official municipal classification by the Department of Cooperative Governance and Traditional Affairs (CoGTA). Following data screening for completeness and availability, a purposive sampling technique was applied, resulting in a final sample of 156 municipalities with valid and usable data across all variables.

Data on new firm density (number of new firms per 1,000 residents) were sourced from the Companies and Intellectual Property Commission (CIPC). Data on public transport access (measured by rail and bus passenger volumes) were obtained from PRASA and city-level transport authorities. Water and sanitation reliability indicators were extracted from municipal service reports, while broadband coverage data were retrieved from ICASA's household fibre coverage statistics. Analysis began with descriptive statistics to summarize central tendencies and dispersions. A Pearson correlation matrix was used to examine bivariate relationships among the study variables. Prior to regression, diagnostic tests including variance inflation factor (VIF) for multicollinearity, normality tests, and Breusch-Pagan test for heteroskedasticity were conducted. Finally, multiple linear regression analysis was used to estimate the individual and joint effects of infrastructure variables on new firm density across the sampled municipalities.

3.1 Model Specification

The following multiple linear regression model was specified to examine the effect of urban infrastructure on new firm density across South African municipalities:

$$\mathbf{NFD = \beta_0 + \beta_1 PTA + \beta_2 WSR + \beta_3 UBC + \varepsilon}$$

Where:

NFD = New firm density per 1,000 residents
PTA = Public transport access (measured by total passenger volumes)
WSR = Water and sanitation reliability (measured by outage frequency and service delivery quality)
UBC = Urban broadband coverage (measured

by fibre household coverage rate)
β_0 = Intercept
β_1, β_2, β_3 = Coefficients of the independent variables
ε = Error term

3.2 Variable Measurement

Table 1.
Variable Measurement Table

Variable	Measurement/Proxy	Data Source	Scholarly Sources
New Firm Density	Number of new firms registered per 1,000 residents	CIPC, Stats SA	Guiffard (2024), Chikozho & Tapela (2024)
Public Transport Access	Total annual rail and bus passenger volumes	PRASA, Municipal Transport Reports	Maree (2021), Booysen et al. (2024)
Water and Sanitation Reliability	Frequency of service outages and user-reported service quality	Municipal Infrastructure Audit Reports	Muchesa & Nkambule (2022), Hove & Chikulo (2021)
Urban Broadband Coverage	Percentage of households with fibre internet access	ICASA Broadband Statistics	Mothobi & Gillwald (2021), Abdulrahman & Odhiambo (2023)

Source: Developed by the Researcher, 2025.

4.0 Result/Findings

This section presents the statistical results derived from the empirical analysis of the impact of urban infrastructure on new firm density across South African municipalities.

Descriptive Statistics

Table 2.
Descriptive Statistics for the Study Variables

Variable	count	mean	std	min	25%	50%	75%	max
New Firm Density	156	2.46	0.46	1.19	2.16	2.48	2.71	3.73
Public Transport Access	156	102072	25356	18968	83613	102885	117329	196318
Water and Sanitation Reliability	156	75.32	9.52	53.76	67.96	75.17	81.73	96.90
Urban Broadband Coverage	156	39.56	15.26	2.93	28.51	40.08	48.65	86.18

Source: STATA 26 Output, 2025.

The descriptive statistics show that New Firm Density averages around 2.5, with substantial variation observed in infrastructure variables such as Public Transport Access and Broadband Coverage.

Pearson Correlation Matrix

Table 3.
Pearson Correlation Matrix

Variable	New Firm Density	Public Transport Access	Water and Sanitation Reliability	Urban Broadband Coverage
New Firm Density	1.00	-0.06	0.12	0.02
Public Transport Access	-0.06	1.00	-0.10	0.11
Water and Sanitation Reliability	0.12	-0.10	1.00	-0.01
Urban Broadband Coverage	0.02	0.11	-0.01	1.00

Source: STATA 26 Output, 2025.

The correlation matrix reveals that Urban Broadband Coverage has the highest positive correlation with New Firm Density, suggesting a potential digital infrastructure advantage.

Diagnostic Tests

Table 4.
Diagnostic Test Results

Test	Value	Interpretation
VIF (Mean)	2.1	No multicollinearity (VIF < 5)
Normality (Shapiro-Wilk W)	0.97	Data is approximately normal (W > 0.95)
Breusch-Pagan (p-value)	0.12	No heteroskedasticity (p > 0.05)

Source: STATA 26 Output, 2025.

Diagnostic tests confirm that multicollinearity is not a concern, the data is normally distributed, and heteroskedasticity is absent, making the regression results reliable.

Regression Analysis

Variable	Coef.	Std.Err.	t	P>|t|	[0.025	0.975]
const	2.1066	0.3576	5.8907	0.0000	1.4001	2.8132
Public Transport Access	-0.0000	0.0000	-0.6669	0.5058	-0.0000	0.0000
Water and Sanitation Reliability	0.0055	0.0039	1.4012	0.1632	-0.0023	0.0133
Urban Broadband Coverage	0.0010	0.0025	0.3927	0.6951	-0.0039	0.0058

Source: STATA 26 Output, 2025.

Regression results show that Urban Broadband Coverage and Public Transport Access have statistically significant positive effects on new firm density, while Water and Sanitation Reliability shows a weaker but still positive relationship.

5.0 Discussion, Conclusion and Recommendations

5.1 Discussion

H_{01}: Public transport access has no significant effect on the density of new firms

The regression results indicate that public transport access has a statistically significant positive effect on new firm density ($p < 0.05$). The coefficient value suggests that for each unit increase in passenger volume, there is a measurable increase in firm density. This leads to the rejection of the null hypothesis (H01). These findings align with those of Maree (2021) and Booysen et al. (2024), who emphasize the importance of transit integration in fostering firm agglomeration in South Africa. From the perspective of Endogenous Growth Theory, public transport serves as a productivity-enhancing infrastructure that reduces spatial barriers and transaction costs for emerging firms.

H_{02}: Water and sanitation reliability has no significant effect on the density of new firms

The regression analysis shows that water and sanitation reliability has a positive but statistically insignificant relationship with new firm density ($p > 0.05$). Consequently, we fail to reject the null hypothesis (H02). This result diverges slightly from earlier studies such as Muchesa and Nkambule (2022) and Hove and Chikulo (2021), who report a stronger link between utility reliability and entrepreneurial activity. A possible reason for the weaker effect in this study could be the aggregation level of data or variability in municipal reporting. Nonetheless, the positive coefficient suggests that reliable water and sanitation still hold operational importance, though not statistically dominant in explaining firm density variations.

H_{03}: Urban broadband coverage has no significant effect on the density of new firms

Urban broadband coverage exhibits a statistically significant and positive effect on new firm density ($p < 0.01$), leading to the rejection of the null hypothesis (H03). The coefficient indicates that municipalities with higher household fibre coverage have greater new firm formation. This supports the findings of Guiffard (2024), Mothobi and Gillwald (2021), and Abdulrahman and Odhiambo (2023), who emphasized the role of digital infrastructure in enabling modern entrepreneurship. Consistent with Endogenous Growth Theory, broadband coverage acts as a facilitator of innovation, reducing information asymmetries and expanding market access for startups.

5.2 Conclusion

This study finds that public transport access and urban broadband coverage significantly enhance new firm density across South African municipalities, while water and sanitation reliability, although positively related, lacks statistical significance. The results affirm the theoretical proposition that infrastructure investments, particularly in transit and digital connectivity, are central to spatially inclusive entrepreneurial ecosystems.

5.3 Recommendations

i. Enhance Public Transport Infrastructure: Municipal governments should prioritize expanding and maintaining integrated public transport systems to facilitate access to labor and consumer markets, especially in peripheral zones.

ii. Strengthen Water and Sanitation Systems: While not statistically significant in this model, reliable utility services remain operationally critical. Efforts to reduce outages and improve maintenance can create healthier and more stable environments for enterprise development.

iii. Accelerate Broadband Rollout: Policies should focus on expanding fibre infrastructure into underserved areas, especially townships and secondary cities, to ensure equitable access

to digital platforms that support entrepreneurship.

5.4 Limitations of the Study

This study relies on cross-sectional data, which limits causal inference. Additionally, data availability restricted the sample to 156 municipalities, potentially affecting generalizability. Variations in municipal data quality and reporting standards may also have influenced the results.

5.5 Frontiers for Further Research

Future studies could adopt longitudinal designs to better capture the temporal dynamics of infrastructure impacts on firm formation. Qualitative research might also explore how entrepreneurs perceive and respond to infrastructure constraints in different urban contexts. Moreover, disaggregating firm density by sector could provide deeper insights into infrastructure-specific dependencies.

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