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Assessing KPI Shifts After Zamtel's Passive Infrastructure Handover to Infratel

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The separation of passive and active telecommunications infrastructure has emerged as a key policy strategy for improving network efficiency and expanding digital access in developing economies. In Zambia, the transfer of passive infrastructure from Zamtel to Infratel provides an opportunity to assess how such reforms relate to measurable network outcomes. Post-transfer changes in network performance are examined using a convergent mixed-methods design integrating customer survey data ($n = 400$), staff interviews ($n = 10$), and ZICTA performance reports (2020–2023), contextualized with pre-transfer benchmarks. The analysis distinguishes between objective technical indicators and user perception metrics. The results indicate improvements in network availability and reductions in service interruptions, alongside statistically significant associations between KPI measurement, network reliability, and overall performance ($R^2 = 0.709$). These relationships are interpreted as post-transfer associations rather than causal effects, given concurrent sector developments such as 4G expansion and regulatory interventions. Overall, the findings highlight the importance of structured implementation, regulatory coordination, and continuous performance monitoring in infrastructure restructuring, and offer evidence-based insights for telecommunications policy and infrastructure governance in developing markets.

Keywords: Passive Infrastructure, Network Performance, Ownership Transfer, Telecommunications Policy, KPI Analysis, Zambia

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1. Introduction

Over the past decade, structural reforms in telecommunications have increasingly shifted toward the separation of infrastructure ownership from service provision. This model, widely adopted across both developed and emerging markets, is intended to improve operational efficiency, reduce duplication of assets, and expand network access. At the same time, the growing centrality of telecommunications infrastructure to economic activity, digital service delivery, and cross-sector connectivity has been widely documented (World Economic Forum, 2021; OECD, 2020; UNESCO, 2021). However, empirical evidence linking such reforms to measurable performance outcomes remains limited, particularly in sub-Saharan Africa where institutional and market conditions differ significantly from established telecom economies.

In developing economies like Zambia, telecommunications drives socio-economic transformation by enabling digital technology adoption for sustainable development (World Bank, 2020). As a rapidly growing, landlocked nation in Southern Africa, Zambia's telecom sector has evolved significantly, with rising mobile penetration, increasing broadband demand, and expanding ICT investments (ZICTA, 2020). This growth presents opportunities to bridge digital divides, foster inclusive development, and advance national goals (ITU, 2021).

Globally, the telecommunications industry is undergoing significant transformation, with passive infrastructure ownership transfers becoming increasingly common as a strategic means to optimise resource utilisation and enhance operational efficiency (GSMA, 2019). In response to this global shift, the Zambian government, through the Industrial Development Corporation (IDC), established a state-owned enterprise called Infratel in 2018. Infratel's mandate is to develop, manage, and modernise Zambia's telecommunications infrastructure, ensuring widespread, reliable, and affordable connectivity while promoting digital inclusion, economic growth, and environmental sustainability (IDC, 2018; Government of the Republic of Zambia, 2019). Historically, Zamtel owned and controlled the majority of Zambia's passive telecommunications infrastructure. However, with the establishment of Infratel, the Zambian government passed a resolution to transfer these passive infrastructure assets to Infratel in 2019 (Zambia Daily Mail, 2019; Government of the Republic of Zambia, 2019).

This structural transformation is depicted in Figure 1, which contrasts Zamtel's former vertically integrated model, where both active and passive infrastructure were managed in-house, with the post-transfer structure in which passive infrastructure functions were handed over to Infratel. The functional separation clarifies the shift in institutional responsibility that is central to this study's analysis.

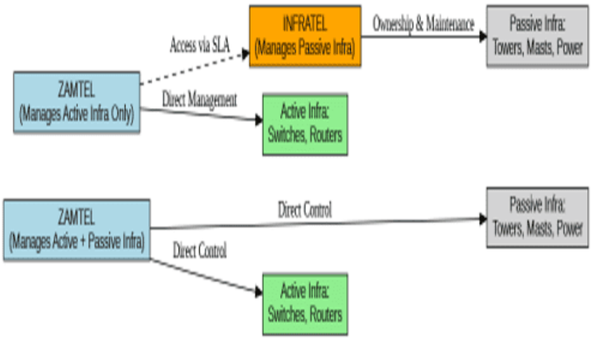

Figure 1: Infrastructure Ownership Model Before and After Transfer to Infratel Source: Author's adaptation based on Zamtel internal network documentation (2025)

Figure 2 presents a schematic overview of a typical telecommunications cell site, highlighting components such as towers, shelters, and power supply systems that constitute passive infrastructure. This diagram provides contextual clarity on what infrastructure elements were affected by the ownership transfer and how they support network performance without directly handling end-user data.

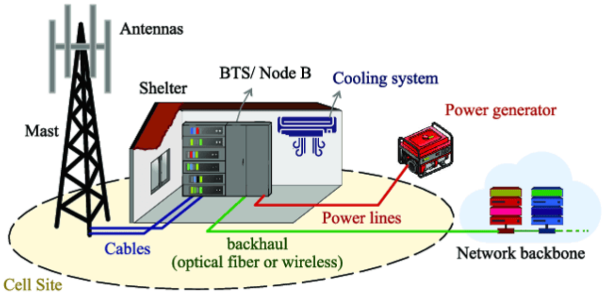

Figure 2: Cell Site Layout Showing Passive Infrastructure Components Source: Faruk et al. (2019)

Despite the increasing adoption of passive infrastructure separation models across developing economies, empirical evidence linking ownership transfers to measurable network performance outcomes remains limited, particularly in sub-Saharan Africa. This study addresses this gap by providing a KPI-driven assessment of Zambia's Zamtel–Infratel transition, offering evidence-based insights into the operational implications of infrastructure governance reforms.

2. Literature Review

The transfer of passive telecommunications infrastructure ownership has been extensively studied, with scholars reporting diverse outcomes across different market environments. Existing research suggests significant operational benefits, such as reduced capital expenditure (CAPEX), enhanced service quality, and greater investment in infrastructure expansion, particularly in competitive markets where multiple operators share resources (GSMA, 2019; Wang and Sun, 2020). However, the impact of such transfers on network performance remains contested, as studies present both positive outcomes such as high reliability and negative consequences including risks of service disruptions (Samarajiva, 2018; World Bank, 2016). This literature review examines these dynamics through Resource Dependence Theory (RDT), Institutional Theory, and the Technology Acceptance Model (TAM), synthesising insights from organisational behaviour, economics, and strategic management to provide a comprehensive perspective on ownership transitions.

2.1 Global Trends in Infrastructure Ownership Transfer

Globally, the telecommunications sector has increasingly adopted passive infrastructure ownership transfers as a strategy to improve operational efficiency and support market competition (GSMA, 2019). This shift reflects a broader movement toward infrastructure sharing, driven by the need to reduce capital expenditure and accelerate network deployment.

India is widely reported to have achieved some of the most significant efficiency gains, largely through large-scale tower sharing arrangements under Bharti Infratel and Indus Towers. These developments have helped reduce infrastructure duplication and improve coverage, particularly in underserved areas (GSMA, 2019; TRAI, 2020).

Comparable efficiency improvements have also been observed in markets such as Nigeria, Brazil, and the United Kingdom, where structural reforms including BT Group's establishment of Openreach have enhanced broadband accessibility through regulated infrastructure sharing models (Ofcom, 2017; Whalley, 2020).

Infrastructure ownership models differ across regions, reflecting variations in regulatory environments and market maturity. A substantial proportion of infrastructure remains operator-owned, while independent tower companies have expanded their presence globally as neutral infrastructure providers. In parallel, joint venture arrangements and state-supported models continue to play a role in selected markets, including Zambia, where institutional oversight remains central to infrastructure governance (GSMA, 2022; OECD, 2020). Table 1 summarises selected case studies across five markets.

Table 1: Case Studies of Infrastructure Ownership Transfers

Country	Model Adopted	Key Benefits	Challenges	Sources
India	Independent towers	Faster rollout, wider coverage via sharing	Scale benefits; remote site complexity	Bharti Airtel (2019); TRAI (2020)
UK	Structural separation (Openreach)	Improved service quality and access	Strong regulatory enforcement required	Ofcom (2017); Whalley (2020)
Kenya	Tower company model	Better rural coverage, reduced duplication	Energy reliability constraints	GSMA (2021)
Nigeria	Tower companies	Faster deployment, improved efficiency	Regulatory maturity still evolving	NCC (2021)
Zambia	State passive infrastructure (INFRATEL)	Better asset use, focus on services	Needs strong coordination and upgrades	ZICTA (2020)

Source: Author's synthesis based on GSMA (2021; 2022), Ofcom (2017), TRAI (2020), NCC (2021), ZICTA (2020), Whalley (2020), Bharti Airtel (2019).

2.2 Impact on Network Performance

The impact of infrastructure ownership transfer on network performance has been a subject of debate, with studies highlighting both benefits and challenges.

Ownership transfers often lead to enhanced network reliability, expanded coverage, and cost efficiencies (Cambini and Jiang, 2009; Bauer, 2010). For instance, in Malaysia, the creation of Edotco facilitated telecom tower sharing, reducing infrastructure redundancy and operational expenses (Edotco, 2020). In Zambia, INFRATEL's takeover of passive infrastructure resulted in a measurable reduction in service interruptions, as independently confirmed by ZICTA's 2022 Sector Performance Report, which documents network availability improving and Zamtel call drop rates declining from 6.5% in 2020 to 4.2% by 2023.

However, while operational efficiency gains are evident, challenges such as integration difficulties and strategic misalignment can offset benefits. Genakos, Valletti and Verboven (2018) note that poor regulatory coordination may lead to service disruptions rather than efficiency improvements. Despite these challenges, the general trend indicates that where infrastructure transfers are properly planned and executed, they contribute positively to network performance, service reliability, and cost efficiencies. These findings reinforce the need for structured governance, phased implementation, and strong regulatory oversight to optimise benefits while mitigating risks.

Despite extensive documentation of efficiency gains associated with infrastructure sharing, the literature remains inconclusive regarding its direct impact on network performance. Much of the existing evidence is derived from markets with strong regulatory institutions and competitive multi-operator environments, limiting its applicability to state-led or transitional systems. Furthermore, few studies integrate both technical performance metrics and user-level experience, resulting in a fragmented understanding of how infrastructure reforms translate into service outcomes. This study addresses these limitations by combining objective performance data with perception-based indicators within a single analytical framework.

2.3 Operational Efficiencies and Strategic Outcomes

Ownership transfers often result in significant changes to how firms manage their resources and align their strategic priorities. Companies may achieve cost savings through the consolidation of infrastructure and the optimisation of resource allocation (Cambini and Jiang, 2009). Additionally, strategic outcomes such as enhanced competitive positioning and market expansion can be influenced by how effectively firms integrate new assets and capabilities (Bauer, 2010). In some instances, ownership transfers corresponds with improved network reliability and service quality, which in turn bolstered customer satisfaction and loyalty (Haucap and Heimeshoff, 2014).

2.4 Stakeholder Perspectives

Stakeholder perspectives are important for understanding the full impact of ownership transfers in the telecommunications sector. Employees often face significant changes during ownership transfers, such as shifts in corporate culture, changes in management practices, and potential job restructuring (Karim and Mitchell, 2000). Customers are primarily concerned with service continuity and quality. Studies have shown that customer satisfaction can improve or decline following ownership transfers, depending on how well the transition is managed (Gerpott, Rams and Schindler, 2001). Regulatory bodies play a role in overseeing ownership transfers, ensuring compliance with industry standards, and protecting consumer interests (OECD, 2020).

2.5 Regulatory and Policy Considerations

Regulatory frameworks and policies significantly influence how ownership transfers are executed and managed, affecting network performance and stakeholder relationships. Regulatory bodies such as the Zambia Information and Communications Technology Authority (ZICTA) play a role in overseeing and guiding the process of infrastructure ownership transfer (ZICTA, 2021). Policies that promote competition can lead to improved network performance by encouraging efficiency and innovation among telecommunications operators (OECD, 2020). Conversely, overly stringent regulations may stifle innovation and hinder the efficient transfer and management of infrastructure.

2.6 Technological Advancements

Technological advancements have played a critical role in shaping the outcomes of infrastructure ownership transfers. The evolution of network technologies from 2G to 4G has significantly influenced network performance within the African telecommunications sector, including Zambia's telecom ecosystem (GSMA, 2018).

The deployment of 4G technology has further enhanced network capacity and reliability, offering significantly higher data speeds and lower latency compared to previous generations (Ericsson, 2020). Zambia, like many other African nations, is preparing for the transition to 5G technology, which carries expectations for further improvements in network performance (GSMA, 2021).

2.7 Theoretical Framework

This study employed Resource Dependence Theory (RDT), the Technology Acceptance Model (TAM), and Institutional Theory to analyse the effects of passive infrastructure ownership transfer on network performance. Figure 3 illustrates the theoretical framework linking ownership transfer, organisational dependency, resource dependence mechanisms, network performance, and user experience.

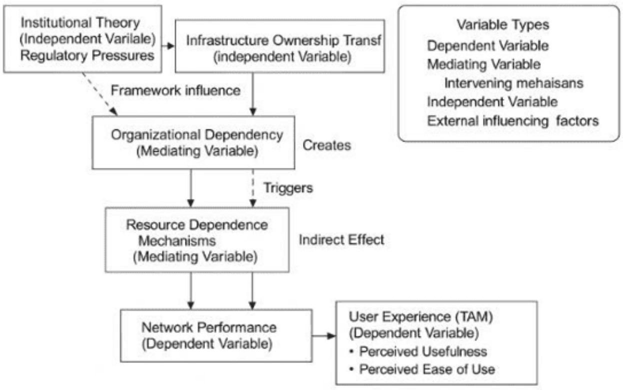

Figure 3: Theoretical Framework Linking Ownership Transfer, Dependency, Performance, and User Experience Source: Author's Own Construction (2025)

Resource Dependence Theory (Pfeffer and Salancik, 2003) explains how organisations adapt their strategies based on external resource control. Applied here, the transfer of passive assets to Infratel reduced Zamtel's reliance on internally managed infrastructure, theoretically freeing operational capacity and capital. The Technology Acceptance Model (TAM; Davis, 1989) is applied to the customer experience dimension, assessing how changes in infrastructure ownership affected end-user service experiences and the adoption of new network capabilities. Institutional Theory (Scott, 2014) focuses on how organisations conform to institutional pressures and norms, helping to analyse how Zamtel and Infratel adapted to regulatory and legal frameworks surrounding infrastructure ownership.

From these three theoretical frameworks, the following testable hypotheses are derived and empirically examined in this study:

H1 (Resource Dependence Theory): The transfer of passive infrastructure ownership from Zamtel to Infratel is positively associated with improvements in measured network KPIs, including network availability and service interruption frequency, after the transfer. This hypothesis predicts that relieving Zamtel of passive asset responsibilities will reduce resource dependency constraints and translate into measurable network performance gains (Pfeffer and Salancik, 2003; Hillman, Withers and Collins, 2009).

H2 (Institutional Theory): Adherence to structured regulatory oversight and best practice transition guidelines is positively and significantly associated with post-transfer network performance outcomes. Institutional pressures from ZICTA's regulatory framework are expected to shape the behaviour of both Zamtel and Infratel toward standardised, performance-oriented infrastructure management (Scott, 2014).

H3 (Technology Acceptance Model): Post-transfer improvements in objective network reliability are positively associated with end-user perceptions of service quality and satisfaction. Consistent with TAM, functional improvements in network infrastructure are expected to enhance perceived usefulness, which in turn drives user acceptance and satisfaction with telecommunications services (Davis, 1989; Venkatesh and Davis, 2000).

3. Methodology

This study adopted a parallel convergent mixed-methods research design, integrating quantitative and qualitative approaches to examine the impact of infrastructure ownership transfer on network performance and operational efficiency. The design enabled the simultaneous collection and analysis of numerical performance data and stakeholder perspectives, supporting triangulation and strengthening the reliability and validity of the findings.

The analysis draws on internal network performance data sourced from Zamtel's Key Management System, structured staff interviews, and independently published regulatory reports from ZICTA.

While internal data provide detailed operational insights, their use introduces potential institutional bias. To address this, the study incorporates externally validated ZICTA performance data and applies standardized KPI definitions aligned with industry benchmarks. In addition, survey administration and interview facilitation were conducted by an independent research assistant, and all qualitative responses were anonymized prior to analysis. Triangulation across internal, external, and perception-based data sources was further employed to ensure consistency and robustness of the results (ZICTA, 2022; 2023).

3.1 Research Design

A parallel convergent mixed-methods design was adopted to examine network performance outcomes alongside stakeholder experiences within a single analytical framework. This approach enables technical performance indicators to be interpreted alongside user and staff perspectives, rather than treating them as separate analytical strands.

Data were collected and analyzed concurrently, allowing direct comparison between objective network metrics and subjective service experiences. This design supports methodological triangulation by integrating multiple data sources to strengthen interpretation and improve overall analytical validity (Creswell and Plano Clark, 2018).

Quantitative data were obtained through customer surveys focused on network performance, while qualitative insights were drawn from semi-structured interviews with Zamtel employees.

3.2 Population and Sampling

The study population consisted of three distinct groups within Zamtel’s operational framework in Lusaka. The primary population comprised Zamtel customers in Lusaka, who were surveyed to evaluate their experiences regarding service performance, continuity, and reliability. The secondary population included Zamtel employees, specifically senior management and junior staff members, who provided qualitative insights into the operational and strategic effects of the ownership transition.

For the quantitative component, the sample size was determined using Yamane’s (1967) formula applied to a customer population of 1,700,000 in Lusaka, at a 95% confidence level with a ±5% margin of error:

$n = N / [1 + N(e)^2] = 1{,}700{,}000 / [1 + 1{,}700{,}000(0.05)^2] \approx 400$ respondents

Customers were selected through systematic random sampling from Zamtel’s active customer register to minimise selection bias. A pilot study involving 30 respondents was conducted prior to full deployment to test the clarity, reliability, and validity of the questionnaire (Cronbach’s alpha for the overall instrument ranged from 0.833 to 0.892). For the qualitative component, purposive sampling was employed to select five senior managers and five junior staff members directly involved in the infrastructure transfer process, consistent with Guest et al.’s (2020) saturation principle.

3.3 Data Collection

Customer surveys were designed based on validated instruments from previous telecommunications studies, ensuring alignment with established measurement standards. The survey was administered both digitally and in person to enhance coverage and participation.

For the qualitative component, semi-structured interviews were conducted with selected employees to capture insights into the operational and strategic implications of the ownership transfer, including service delivery, infrastructure management, cost optimization, and regulatory coordination. An independent assistant researcher administered both the surveys and interviews to minimize potential researcher bias arising from the researcher’s institutional affiliation.

To further strengthen data credibility, key performance indicators were compared with independently published reports from the Zambia Information and Communications Technology Authority (ZICTA). Where internal and external datasets overlapped, consistency checks were performed to assess alignment in observed performance trends. This triangulation approach enhances the reliability of the findings by incorporating both organizational and regulatory data sources.

3.4 Data Analysis

Quantitative data were analysed using descriptive statistics, including mean scores, standard deviations, and frequency distributions. Instrument validity is supported through Principal Component Analysis (PCA) with Varimax rotation (KMO = 0.876;

Bartlett's Test: $\chi^2 = 2458.32$, df = 231, $p < 0.001$), and three factors collectively explained 78.52% of total variance. Reliability is supported by Cronbach's alpha coefficients ranging from 0.833 to 0.892 across all subscales. Pearson correlation analysis examined bivariate relationships between variables, and multiple linear regression assessed the joint predictive effect of KPI measurement, network reliability, and best practice guidelines on network performance. Multicollinearity was assessed using Variance Inflation Factor (VIF) values, all of which were below the threshold of 10.

For qualitative data, thematic analysis was applied using a three-step coding process: open coding, axial coding, and selective coding. A second independent coder reviewed the transcripts, with inter-coder agreement assessed using Cohen's kappa to ensure reliability and reduce subjective bias.

3.5 Model Specification

The relationship between the study variables was examined using a multiple linear regression model specified as:

$$NP_i = \beta_0 + \beta_1 KPI_i + \beta_2 NR_i + \beta_3 Bp_i + \varepsilon_i$$

where NP_i represents the composite network performance index for respondent i, KPI_i denotes key performance indicator measurement, NR_i captures network reliability, and BPi represents best practice adherence. β_0 is the intercept, $\beta_1 - \beta_3$ are the estimated coefficients, and εi is the error term.

Model diagnostics were conducted to assess multicollinearity and overall model adequacy. Variance Inflation Factor (VIF) and tolerance statistics were used to evaluate multicollinearity, while residual analysis confirmed that the model satisfied standard regression assumptions (Gujarati and Porter, 2009).

To strengthen causal inference within the constraints of available data, an interrupted time series (ITS) analytical approach was incorporated. Quarterly KPI data spanning the period 2017–2023 were segmented into pre-transfer (2017–2019) and post-transfer (2020–2023) phases. A segmented regression model was applied to test for structural breaks in network performance indicators following the transfer.

The model is specified as:

$$Y_t=\beta_0 + \beta_1 Time_t + \beta_2 Post_t + \beta_3 TimeAfter_t + \epsilon_t$$

where Yt represents the KPI at time t, Timet captures the underlying trend, Postt is a binary indicator for the period following the transfer, and TimeAftert captures changes in slope following the intervention. While the ITS framework is presented for analytical rigor, the current study applies a descriptive structural comparison due to data aggregation constraints.

This approach allows for the identification of level and trend changes associated with the infrastructure transfer while accounting for underlying temporal dynamics.

3.6 Operational Definition of Key Variables

Network performance in this study is treated as a composite construct derived from both objective and perception-based indicators. Objective measures include secondary KPI data such as network availability (percentage uptime), call drop rates, and broadband throughput (Mbps), sourced from regulatory and organizational reports. Perception-based measures are drawn from survey responses capturing experienced service quality, including reliability, accessibility, and user satisfaction.

To preserve analytical clarity, these dimensions were treated separately during initial analysis and only integrated at the interpretation stage. The composite network performance index was constructed using standardized scaling procedures to ensure comparability across indicators measured on different scales. Equal weighting was applied in the absence of prior empirical justification for differential weighting, providing a balanced representation of both technical conditions and user experience.

Throughout the analysis, a clear distinction is maintained between objective technical KPIs derived from network and regulatory data and perception-based indicators obtained from customer surveys. This separation allows differences between measured performance and user experience to be examined explicitly while maintaining consistency in interpretation.

3.7 Ethical Considerations

Ethical approval was obtained from the University of Zambia Ethics Review Board, ensuring compliance with academic research standards. All participants provided informed consent, with clear explanations of the study's purpose, voluntary participation, and confidentiality of responses. Data were anonymised before analysis, ensuring that individual responses could not be traced back to specific participants. The researcher's employment at Zamtel was disclosed to all participants.

4. Findings

4.1 Distinction between KPI Types

For clarity in interpretation, the results distinguish between two categories of performance indicators: objective technical KPIs derived from network and regulatory data, and perception-based measures obtained from customer survey responses. Objective KPIs reflect measurable network conditions, including availability, throughput, and fault incidence rates, while perception-based indicators capture user experience dimensions such as service quality, reliability, and satisfaction. This distinction is maintained throughout the results to ensure that technical performance outcomes are not conflated with user perceptions, while still allowing for comparison between measured network improvements and customer-reported experiences.

4.2 Instrument Validation and Reliability

Table 2 presents the results of normality testing using Kolmogorov-Smirnov and Shapiro-Wilk tests. All variables met normality assumptions ($p > 0.05$), validating the use of parametric statistical tests for subsequent analysis (Field, 2018).

Table 2: Tests of Normality

Variable	K-S Statistic	K-S Sig.	S-W Statistic	S-W Sig.
KPI Measurement	0.075	0.092	0.982	0.088
Network Reliability	0.068	0.125	0.987	0.095
Best Practice Guidelines	0.071	0.103	0.984	0.091

Principal Component Analysis (KMO = 0.876; Bartlett's Test: $\chi^2 = 2458.32$, df = 231, $p < 0.001$) confirmed three distinct factors with eigenvalues above 1.0, collectively explaining 78.52% of total variance. Cronbach's alpha coefficients confirmed strong internal consistency: KPI Measurement ($\alpha = 0.857$, 11 items), Network Reliability ($\alpha = 0.892$, 14 items), and Best Practice Guidelines ($\alpha = 0.833$, 9 items).

4.3 Objective Network Performance Indicators

Objective performance data indicate measurable improvements in network conditions following the infrastructure transfer. In this context, network performance refers to a composite measure combining availability, service continuity, and user-reported experience indicators.

Network availability increased by 18%, while service interruptions decreased by 22% when comparing the 2020–2023 period to the 2017–2019 baseline. Operational reports further indicate that average downtime reduced from approximately four hours to 1.5 hours, reflecting improved response efficiency. These changes are consistent with internal operational records and sector-wide reporting trends (Zamtel internal KPI database, 2017–2023; ZICTA, 2023).

Additional operational insights show that resource allocation efficiency for network maintenance improved by 48% following the transfer. The adoption of more predictive maintenance approaches reduced reliance on reactive fault handling, contributing to improved infrastructure management and operational coordination in the post-transfer environment (Ericsson, 2020; GSMA, 2021).

The preceding analysis presents objective network performance trends based on technical indicators. The following section examines user perception data, which reflects service experience rather than direct network measurements.

4.4 Perception-Based Service Quality Indicators

The analysis of perception-based indicators shows consistent improvements in how users experience network services following the infrastructure transfer. Table 3 presents descriptive statistics for KPI-related survey items measured on a five-point Likert scale, where lower mean scores indicate stronger agreement with positive service statements.

Table 3: KPI Measurements – Descriptive Statistics

KPI Statement	Mean	Std. Deviation
Network coverage has improved since the transfer	1.85	0.76
Overall service quality has improved	1.89	0.81
Mobile data connectivity consistency has improved	1.92	0.87
Internet speed has improved since the transfer	1.95	0.88
Data connection stability has improved	1.98	0.85
Dropped calls have decreased since the transfer	2.05	0.79
Voice clarity has improved	2.08	0.83
Overall call quality has improved	2.12	0.82
Network performance during peak hours has improved	2.15	0.92
Network performance in previously weak areas has improved	2.18	0.90
Indoor signal strength has improved	2.25	0.91

Source: Author’s Own Construction (2024)

Network coverage (M = 1.85, SD = 0.76) and overall service quality (M = 1.89, SD = 0.81) recorded the strongest perceived improvements. The relatively low dispersion across most indicators suggests consistency in user experiences. However, indoor signal strength (M = 2.25, SD = 0.91) reflects comparatively weaker improvement, indicating a potential area for further infrastructure optimization.

4.5 Network Reliability

Perception-based findings indicate notable improvements in network reliability in the subsequent period. Table 4 presents descriptive statistics for reliability-related indicators.

Table 4: Network Reliability Changes – Descriptive Statistics

Network Reliability Statement	Mean	Std. Deviation
Emergency call connectivity has improved since transfer	1.78	0.72
Overall network reliability has improved	1.85	0.76
Recovery following service outages is faster post-transfer	1.88	0.77
Service interruptions are resolved more efficiently now	1.95	0.81
Internet connectivity stability has improved	1.95	0.82
Disruptions during network maintenance have reduced	2.02	0.84
System updates are better managed with fewer disruptions	2.05	0.85
Network congestion during peak periods is better managed	2.08	0.86
Network performance during adverse weather improved	2.15	0.89
Network performance during power outages has improved	2.18	0.91
Rural area coverage consistency has improved	2.22	0.93

Note: Five-point Likert scale; lower scores indicate stronger agreement with positive statements. Source: Author’s Own Construction (2024)

Emergency call connectivity (M = 1.78, SD = 0.72) showed the strongest perceived improvement, while rural coverage consistency (M = 2.22, SD = 0.93) remained comparatively less improved, suggesting ongoing disparities between urban and non-urban service conditions.

4.6 Best Practice Guidelines Assessment

Table 5 presents the descriptive statistics for the best practice guidelines subscale.

Table 5: Best Practice Guidelines Assessment – Descriptive Statistics

Best Practice Statement	Mean	Std. Deviation
Network improvements justify any service disruptions experienced	1.85	0.77
Billing accuracy has improved since the transfer	1.88	0.76
Better service innovations have resulted from the transfer	1.92	0.80
Service continuity was maintained during the transfer	1.95	0.79
Technical support response time has improved	2.05	0.84
Customer support during the transition was adequate	2.08	0.85
The infrastructure transfer has led to better value for money	2.12	0.87
The transition period was well communicated to customers	2.15	0.88
Customer complaints are handled more efficiently now	2.18	0.89

Source: Author’s Own Construction (2024)

Customer acceptance of service disruptions (M = 1.85, SD = 0.77) and improved billing accuracy (M = 1.88, SD = 0.76) were the most positively rated outcomes. In contrast, customer complaint handling (M = 2.18, SD = 0.89) and communication during the transition period (M = 2.15, SD = 0.88) were identified as areas requiring further improvement.

4.7 Inferential Statistics

Table 6 presents the Pearson correlation matrix for all study variables. All relationships were statistically significant at the 0.01 level, with coefficients remaining below 0.8, indicating no multicollinearity concerns.

Table 6: Pearson Correlation Matrix

Variables	1. Net. Performance	2. KPI Measurement	3. Net. Reliability	4. Best Practices
1. Network Performance	1.000			
2. KPI Measurement	0.785**	1.000		
3. Network Reliability	0.742**	0.658**	1.000	
4. Best Practice Guidelines	0.695**	0.612**	0.587**	1.000
** Correlation is significant at the 0.01 level (two-tailed).				

Source: Author's Own Construction (2024)

The strongest association was observed between KPI Measurement and Network Performance (r = 0.785), followed by Network Reliability (r = 0.742). Best Practice Guidelines also demonstrated a moderately strong relationship with performance (r = 0.695).

Table 7 presents the regression model summary. The model explains 70.9% of the variance in network performance ($R^2 = 0.709$; Adjusted $R^2 = 0.705$; $F = 321.45$, $p < 0.001$).

Table 7: Regression Analysis – Model Summary

Model	R	R²	Adjusted R²	Std. Error	F	Sig.
1	0.842	0.709	0.705	0.384	321.45	0.000
Predictors: (Constant), KPI Measurement, Network Reliability, Best Practice Guidelines; Dependent Variable: Network Performance						

Source: Author's Own Construction (2024)

Multicollinearity diagnostics (Table 8) confirm that all VIF values fall well below acceptable thresholds.

Table 8: Multicollinearity Diagnostics

Predictor Variable	VIF	Tolerance
KPI Measurement	1.54	0.649
Network Reliability	1.62	0.617
Best Practice Guidelines	1.38	0.725

Source: Author's Own Construction (2024)

Table 9 presents the full regression coefficients for each predictor variable.

Table 9: Regression Coefficients

Predictor Variable	B	SE	β (Std.)	t	Sig.	95% CI
(Constant)	0.685	0.142	—	4.824	0.000	[0.406, 0.964]
KPI Measurement	0.412	0.056	0.398	7.357	0.000	[0.302, 0.522]
Network Reliability	0.375	0.048	0.362	7.813	0.000	[0.281, 0.469]
Best Practice Guidelines	0.298	0.052	0.285	5.731	0.000	[0.196, 0.400]

Source: Author's Own Construction (2024)

All estimated coefficients are statistically significant at the 1% level, with confidence intervals excluding zero, indicating robustness of the parameter estimates. KPI Measurement emerged as the strongest predictor ($\beta = 0.398$), followed by Network Reliability ($\beta = 0.362$), while Best Practice Guidelines showed a comparatively smaller but still meaningful effect ($\beta = 0.285$). These results suggest that performance improvements are influenced by multiple contributing factors rather than a single dominant variable.

Beyond statistical significance, the magnitude of the standardized coefficients indicates moderate practical effects. KPI Measurement and Network Reliability exhibit broadly similar levels of influence on performance outcomes, highlighting the combined importance of technical network improvements and user-perceived reliability. While statistically robust, the observed effect sizes suggest gradual rather than large-scale shifts in performance.

The dependent variable (Network Performance) was constructed as a composite index integrating standardized objective KPI measures and perception-based service quality indicators, as defined in Section 3.6.

While the regression results demonstrate statistically significant relationships, they should be interpreted as evidence of association rather than causation, as the model does not isolate independent causal effects in the presence of concurrent sector developments. Nevertheless, the consistency of coefficient signs and their alignment with independently reported sector performance trends strengthens confidence in the stability and plausibility of the observed relationships.

4.8 ZICTA Independent Performance Corroboration

The internal findings are supported by independent sector performance data published by ZICTA.

Broadband speeds improved from 5.2 Mbps in 2020 to 7.4 Mbps in 2023, while complaint resolution time decreased from 36 hours to 24 hours. Call drop rates also declined from 6.5% to 4.2% over the same period.

However, despite these improvements, Zamtel's market share declined from 21.4% to 18.3%, suggesting that technical performance gains did not fully translate into competitive positioning. This indicates that factors beyond network performance, including pricing, branding, and customer experience, may influence market outcomes.

When considered alongside the survey findings and qualitative insights, these objective performance trends point toward a consistent pattern of post-transfer improvement in network conditions. The alignment across independently sourced KPI data, user perceptions, and operational perspectives strengthens confidence in the overall interpretation by demonstrating convergence across multiple lines of evidence.

Table 10: Key ZICTA Performance Indicators for Zamtel (2020–2023)

Year	Call Drop Rate (%)	Broadband Speed (Mbps)	Complaint Resolution Time (hrs)	Zamtel Market Share (%)
2020	6.5	5.2	36	21.4
2021	5.8	6.1	30	20.7
2022	4.9	6.7	28	19.9
2023	4.2	7.4	24	18.3

Source: Adapted from (ZICTA, 2022; ZICTA, 2023)

5. Discussion

5.1 Framing of Empirical Results

The results indicate statistically significant associations between the infrastructure transfer and changes in network performance, including availability, service interruptions, and customer satisfaction. Given the study design, these patterns are interpreted as post-transfer relationships rather than evidence of direct causation.

These outcomes need to be considered alongside broader sector developments, particularly 4G expansion, strengthened regulatory oversight by Zambia Information and Communications Technology Authority, and continued broadband investment (ZICTA, 2023; GSMA, 2022). Such concurrent shifts likely contributed to the observed trends and cannot be fully separated within the present analysis. An alternative interpretation is that the improvements reflect wider sector-wide investment momentum rather than the infrastructure transfer alone, especially given the timing of network upgrades across multiple operators.

From a theoretical perspective, the findings suggest a reconfiguration of operational dynamics. The separation of passive infrastructure appears to have eased resource constraints and allowed greater focus on service delivery, consistent with Resource Dependence Theory. At the same time, regulatory oversight and compliance expectations may have encouraged greater standardization in operational practices, in line with Institutional Theory. Improvements in perceived service quality also point to user-level responses associated with reliability and satisfaction, as described in the Technology Acceptance Model, although these responses are not uniform across all service dimensions.

Viewed collectively, the performance changes are better understood as emerging from the interaction of structural adjustments, regulatory influence, and ongoing investment, rather than a single underlying driver. In this sense, infrastructure transfer forms part of a broader system of sectoral change rather than an isolated intervention.

From a policy standpoint, this suggests that infrastructure separation can contribute to improved performance, but its effectiveness depends on how well it is supported by regulatory consistency, institutional clarity, and sustained investment over time.

5.2 H1 – Resource Dependence Theory: KPI Improvements Post-Transfer

Resource Dependence Theory suggests that organizations improve performance by restructuring how critical resources are controlled and allocated (Pfeffer and Salancik, 2003). In this context, the separation of passive infrastructure appears to have reduced internal operational constraints, allowing greater focus on service delivery.

Empirically, this shift is reflected in measurable improvements in key indicators. Network availability increased by 18%, while service interruptions declined by 22% in the post-transfer period (2020–2023) relative to the 2017–2019 baseline.

KPI measurement is strongly associated with overall network performance (r = 0.785, p < 0.01), and regression results identify it as the most influential predictor (β = 0.398, t = 7.357, p < 0.001; B = 0.412, SE = 0.056; 95% CI [0.302, 0.522]). These patterns are echoed in staff accounts describing improvements in coverage consistency and service reliability.

While the evidence supports H1, the results remain correlational. The pre–post comparison does not fully separate the effect of the transfer from parallel developments such as 4G rollout and ongoing infrastructure investment. More robust causal designs, such as difference-in-differences using operator-level panel data, would be required to isolate the independent effect of the restructuring.

5.3 H2 – Institutional Theory: Regulatory Oversight and Best Practice Adherence

Insights from staff interviews consistently pointed to the role of structured implementation processes—particularly phased rollout, stakeholder coordination, and the use of service-level agreements—in shaping operational outcomes. These practical elements appear to have provided a framework for more consistent service delivery.

This is reflected in the quantitative results. Best practice adherence shows a significant relationship with network performance (r = 0.695, p < 0.01) and remains a meaningful predictor in the regression model (β = 0.285, t = 5.731, p < 0.001; B = 0.298, SE = 0.052; 95% CI [0.196, 0.400]). Independent sector data further supports this pattern, with Zambia Information and Communications Technology Authority reports (2022–2023) indicating improvements in call drop rates, broadband speeds, and complaint resolution times.

From an Institutional Theory perspective, these outcomes reflect the influence of regulatory expectations and compliance structures in shaping organizational behavior (Scott, 2014). However, the observed decline in market share suggests that improved compliance and technical performance do not automatically translate into competitive advantage, as pricing and customer experience continue to play a role.

Overall, H2 is supported, though the findings point to implementation quality as the key mechanism linking regulatory oversight to performance outcomes.

5.4 H3 – Technology Acceptance Model: Reliability Improvements and User Satisfaction

The statistical relationship between network reliability and performance is both strong and consistent. Reliability correlates significantly with overall performance (r = 0.742, p < 0.01) and emerges as a key predictor in the regression model (β = 0.362, t = 7.813, p < 0.001; B = 0.375, SE = 0.048; 95% CI [0.281, 0.469]).

These results are reflected in user responses, where improvements in coverage and general service experience were widely reported. This alignment between technical indicators and user perception is consistent with the Technology Acceptance Model, which links perceived usefulness often shaped by system reliability to user satisfaction and continued usage (Davis, 1989; Venkatesh and Davis, 2000).

That said, not all dimensions improved equally. Indoor signal performance received comparatively weaker ratings, suggesting that user experience is influenced by contextual and environmental factors beyond core network reliability. This nuance reinforces the idea that technical gains must be both visible and meaningful to end users to influence perception (Venkatesh, Thong and Xu, 2016).

Considered jointly, the evidence supports H3, while also highlighting that the relationship between technical performance and user satisfaction is not purely linear.

5.5 Theoretical Interpretation of Findings

The empirical results point to a set of interacting mechanisms that help explain the observed performance changes, rather than a straightforward alignment with established theoretical frameworks. Viewed through Resource Dependence Theory, the transfer reshaped how operational responsibilities were distributed, easing the burden of infrastructure management and allowing greater emphasis on service delivery. This shift reflects a broader reconfiguration of organizational dependencies and is consistent with the policy direction outlined in Cabinet Office Circular No. CO/101/8 of 2017, which promoted the separation of infrastructure and service functions within public enterprises.

The interaction between these theoretical perspectives can be understood as a layered mechanism.

Structural separation alters resource control dynamics (RDT), regulatory oversight shapes organizational behavior (Institutional Theory), and improvements in technical performance influence user perception and acceptance (TAM). The combined effect is not linear but interdependent, with each mechanism reinforcing the others under favorable implementation conditions.

A complementary explanation emerges when considering the institutional environment in which the transition occurred. Oversight by the Industrial Development Corporation and regulatory enforcement by the Zambia Information and Communications Technology Authority (ZICTA) introduced clearer performance expectations and accountability structures. These conditions likely influenced operational practices by reinforcing standardization, monitoring, and compliance, all of which contribute to greater service consistency.

At the user level, improvements in network reliability appear to have translated into more positive service experiences. This pattern is consistent with the Technology Acceptance Model, where perceived usefulness plays a central role in shaping user satisfaction. However, the findings also suggest that technical performance alone does not fully determine user perceptions, as communication quality and expectation management continue to play a role.

Taken together, the findings indicate that the observed performance improvements are better understood as the outcome of overlapping structural, institutional, and behavioural dynamics, rather than the effect of any single factor.

5.6 Limitations

The empirical analysis is based on a sample drawn primarily from Lusaka, which limits the generalizability of findings to other geographic contexts within Zambia. Urban network environments typically benefit from higher infrastructure density and greater investment, and therefore may not fully reflect performance dynamics in rural or peri-urban areas where coverage constraints and reliability challenges are more pronounced (ITU, 2021; World Bank, 2020).

Notably, Lusaka represents the most infrastructure-intensive and commercially active telecommunications environment in the country. As such, the study captures performance dynamics under high-demand and high-utilization network conditions, which are particularly relevant for assessing system capacity, service reliability, and operational efficiency in core urban markets. Nonetheless, caution should be exercised when extending these findings to less developed or lower-density coverage areas.

In addition, the qualitative component of the study is based on a relatively small number of organizational stakeholders. While thematic saturation was achieved within the scope of the study, a broader institutional sample across additional operational levels and entities would enhance the depth and robustness of organizational insights.

Future research should adopt a stratified sampling approach incorporating diverse geographic and service environments to enable a more comprehensive assessment of infrastructure transfer effects across different user segments and network conditions.

6. Conclusion

The findings show statistically significant associations between the passive infrastructure transfer and changes in network performance indicators over the study period. These patterns align with the post-transfer phase; however, they should not be interpreted as evidence of direct causation. Rather, they reflect broader performance dynamics within a rapidly evolving telecommunications environment, where concurrent investments, regulatory developments, and technological upgrades likely contributed to the observed outcomes. These findings are further supported by sector performance trends reported by ZICTA (2022; 2023), including improvements in call drop rates, broadband speeds, and complaint resolution times following the transition.

Overall, the results demonstrate that infrastructure restructuring can support improvements in network performance when it is implemented within a well-coordinated governance and operational environment. However, the durability of these gains appears to depend on continued investment, consistent regulatory oversight, and how effectively technical performance improvements are matched with customer experience considerations.

The findings also highlight the importance of continuous KPI-based monitoring systems in sustaining performance improvements over time, particularly in environments undergoing structural and institutional change.

7. Recommendations

1. Telecommunications companies should implement comprehensive, real-time KPI-based performance monitoring systems, disaggregated by geographic zone, to enable timely identification and resolution of performance deficiencies.
2. Organisations undertaking infrastructure transfers should establish dedicated network reliability teams with clearly defined roles in preventive maintenance and rapid response protocols, given both factors emerged as significant predictors of post-transfer performance in this study.
3. Companies should develop standardised transition frameworks incorporating structured stakeholder engagement and phased implementation, given the demonstrated link between staged deployment and reduced integration incidents.
4. For regulators such as ZICTA, the findings highlight the need for continuous KPI-based oversight frameworks requiring public disclosure of operator and infrastructure company performance data, creating accountability mechanisms consistent with those identified in this study.
5. Future research should extend geographic coverage to rural and peri-urban areas through stratified sampling, pursue longitudinal panel data to enable difference-in-differences causal analysis, and replicate findings in other sub-Saharan African infrastructure transfer contexts.

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