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Perceived Influence of Capital Investment on Operational Growth among Selected Telecommunication Companies in Dar es Salaam

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ABSTRACT

This study set out to assess the perceived influence of capital investment on operational growth among selected telecommunication companies in Dar es Salaam. The problem under study arises out of sustained disparity between significant capital investment and a measured performance level in terms of network stability and effective operations, coupled with the absence of studies focusing on the operational aspect (growth) but rather solely on financial metrics. The study was informed by Resource-Based View Theory, and it intended to satisfy three objectives. It examined the effect of capital investment in network infrastructure on the extension of network coverage. It also determined the effect of capital investment on technological innovation in customer base expansion, and finally, it identified the effect of human capital investment on operations effectiveness. The researcher adopted a quantitative method of research, using a descriptive cross-sectional research design. The study population was made up of 500 middle-level and top-level managers from Vodacom Tanzania, Yas and Airtel, respectively, while the sample size was 222 using the Yamane formula, and there was a realised sample of 155 complete responses obtained by the researcher after applying the simple random sampling method. Data were collected using a well-structured questionnaire with a five-point Likert scale, while it was analysed using descriptive statistics (frequency, percentage, standard deviation and mean) and inferential statistics using multiple linear regression analysis through SPSS version 29. The general results indicated that investment of capital had a significant influence on the operational growth of telecommunication companies, resulting in a mean grand result of 3.91. Among the indicators, human capital investment had the greatest effect on operational efficiency (mean = 4.02), in that higher skilled work force contributes to fewer service errors, hence efficiency of service delivery. Human resource investment also had the highest contribution; the investment in network infrastructure also had a strong effect on the extension of services network coverage (mean = 3.87), with network stability strongly driven by the deployment of fibre optics. It was observed that technological investment played an important role in customer base growth, enhanced with better internet connectivity (high-speed internet deployment) (mean = 3.85). The implications of the study suggest that telecommunication firms should adopt a strategic integrated framework of operations growth that balances investments in physical infrastructure, technology upgrades, and human resource capacity building to sustain competitiveness. Policymakers should also create a conducive regulatory environment to attract private capital investment in the telecommunications sector.

1. INTRODUCTION

Telecommunications operators depend on sustained investment in network infrastructure, digital technologies and specialised labour to extend connectivity and maintain reliable services. Yet expenditure is not synonymous with operational growth. Additional towers or fibre links may increase potential coverage without eliminating congestion; new applications may stimulate initial subscriptions without retaining active customers; and employee training may have limited effect where technical systems and management routines are deficient. The Resource-Based View (RBV) locates organisational advantage in valuable and difficult-to-replicate combinations of resources rather than their acquisition alone (Barney, 1991), while dynamic-capabilities scholarship stresses the need to adapt those combinations to technological change (Teece et al., 1997). These arguments make the translation of capital investment into specific operational outcomes an empirical, rather than automatic, relationship.

International research highlights the potential of investment but differs in what constitutes success. Reports on network development emphasise broadband access and geographic reach (International Telecommunication Union [ITU], 2023; Ofcom, 2023), whereas studies of telecommunications financial performance investigate returns rather than technical reliability or customer experience (Luvanda & Njau, 2022). These outcomes can diverge: an operator might improve coverage while its profitability falls during a costly rollout, or increase revenue through prices without improving service. Accordingly, treating financial growth, physical coverage, subscriber expansion and operational efficiency as equivalent would obscure the mechanisms by which investment creates organisational value.

Across African markets, investment decisions are shaped by the simultaneous demands of expanding access, improving quality and maintaining affordability. Studies from Nigeria and West Africa foreground infrastructure expenditure and service delivery (Okonkwo & Adeleke, 2022; Ouedraogo & Sawadogo, 2023), whereas evidence from Ghana and Kenya gives greater weight to digital and financial-service innovation as a route to customer engagement (Mensah & Asante, 2021; Omwenga & Kinyua, 2023). These perspectives

need not conflict, but they illuminate different constraints. Network assets establish the technical possibility of service, innovations shape customers' reasons to adopt it, and workforce capabilities condition whether both can be delivered reliably (Boateng & Amponsah, 2021; Kibona & Machumu, 2023). Capital investment is thus better understood as a coordinated portfolio than as a single homogeneous input.

Tanzania provides an important context in which to examine these distinctions. The Tanzania Communications Regulatory Authority (TCRA, 2023) reported increases in 3G population coverage from approximately 74% to 77%, in 4G coverage from 58% to 65%, and in mobile subscriptions from 61.9 million to 64.1 million between March and June 2023. These aggregate indicators suggest sector expansion, but they cannot identify the contribution of any individual investment or operator, and subscription counts need not represent unique active users. Tanzanian studies have examined infrastructure and geographic coverage (Kimaro & Mdeme, 2023), digital investment and customer retention (Mushi & Swai, 2022), and employee training and performance (Mrema, 2023). Their distinct outcomes and study settings leave room for an integrated yet differentiated examination of investment-related perceptions.

This study therefore examines perceived relationships between network infrastructure investment and service coverage expansion, technological innovation investment and subscriber growth, and human capital investment and operational efficiency among respondents from Vodacom Tanzania, Airtel Tanzania and Yas in Dar es Salaam. Its contribution is not to claim that spending causes growth, but to compare three resource–outcome relationships within a common survey and assess them in light of RBV and the limits of perception-based measurement. Because the design is cross-sectional and relies on employees' reports, the analysis identifies associations rather than verified changes in company coverage maps, subscriber records or operating costs (Bell et al., 2022).

2. LITERATURE REVIEW

This section reviews the concepts, theoretical foundations and empirical evidence relevant to the relationship between capital investment and operational growth in telecommunications. It focuses on network infrastructure investment, technological innovation investment and human capital investment, which are the three explanatory dimensions examined in this study. The review also compares findings from international, African and Tanzanian settings and identifies the gap addressed by the present study.

2.1 Conceptual Review

Capital investment is a multidimensional strategic process through which firms acquire, develop and reorganise resources to strengthen their productive capacity and sustain operational performance. Although conventional financial perspectives associate capital investment with expenditure on long-term assets, this interpretation is insufficient to explain differences in organisational performance because the acquisition of resources does not necessarily guarantee their productive utilisation. Barney (1991), through the Resource-Based View (RBV), argues that organisational resources contribute to competitive advantage when they possess strategic value and are difficult for competitors to replicate. However, Teece et al. (1997) extend this argument by suggesting that competitive advantage depends not merely on resource ownership but also on an organisation's capacity to integrate, reconfigure and renew its resources in response to changing market conditions. These perspectives introduce an important conceptual distinction between investment magnitude and investment effectiveness. In telecommunications, operators may allocate substantial resources to network infrastructure, technological systems and employee development without achieving proportional improvements in operational performance. Such differences may arise from variations in managerial competence, technological compatibility, infrastructure utilisation and organisational coordination. Consequently, capital investment should be conceptualised not simply as financial expenditure but as a strategic resource-development process whose contribution to operational growth depends on the effective combination of physical, technological and human capabilities.

Operational growth, although frequently associated with organisational expansion, requires conceptual differentiation from financial performance and market growth. Financial performance generally concerns profitability, revenue generation and returns on investment, whereas operational growth reflects improvements in the scale, accessibility, reliability and efficiency of organisational activities. The International Telecommunication Union (ITU, 2023) emphasises the importance of telecommunications infrastructure and digital connectivity in expanding service accessibility, while the Tanzania Communications Regulatory Authority (TCRA, 2023) documents changes in network coverage and telecommunications subscriptions as indicators of sector development. Nevertheless, improvements in coverage and subscriber numbers do not necessarily imply corresponding improvements in service quality or operational efficiency. For example, an operator may experience rapid subscriber expansion while simultaneously facing network congestion, increased maintenance costs and declining service reliability. Conversely, investments in network optimisation may enhance operational efficiency without immediately increasing the subscriber base. This distinction challenges the tendency to conceptualise operational growth as a single performance dimension. Accordingly, the present study adopts a multidimensional interpretation encompassing network coverage expansion, subscriber growth and operational efficiency. These dimensions are analytically distinct but potentially complementary, since sustainable operational growth requires firms to expand service accessibility while

maintaining technological reliability and efficient resource utilisation.

Network infrastructure investment represents the development and upgrading of physical telecommunications assets required to extend service accessibility and strengthen network capacity. Kimaro and Mdeme (2023) associate infrastructure investment with geographical network expansion in Tanzania, while Nguyen and Tran (2022) examine the relationship between capital expenditure and service coverage among Vietnamese mobile operators. These perspectives suggest that investments in base stations, fibre-optic networks and transmission facilities can strengthen connectivity by increasing the geographical reach and capacity of telecommunications systems. However, Chirwa (2023) introduces a contrasting perspective by emphasising infrastructure-sharing arrangements as an alternative mechanism for improving network coverage. This argument challenges the assumption that service expansion necessarily requires individual operators to acquire additional infrastructure independently. Infrastructure sharing may permit operators to extend geographical coverage while reducing duplication and associated investment costs. Furthermore, the effectiveness of infrastructure investment may be influenced by spectrum availability, population density, electricity reliability, regulatory approvals and network maintenance. Therefore, the conceptual relationship between infrastructure investment and service coverage is better understood through the effectiveness of infrastructure deployment than through the quantity of physical assets acquired. From an RBV perspective, physical infrastructure becomes strategically valuable when it is integrated with complementary organisational capabilities that enable reliable service delivery (Barney, 1991). This suggests that infrastructure investment may facilitate operational growth, but its contribution remains conditional upon the institutional and technical environment within which telecommunications operators function.

Technological innovation investment introduces a different mechanism of operational growth by enabling telecommunications firms to improve service functionality, customer experience and responsiveness to changing market demands. Fernandez and Santos (2022) emphasise research and development expenditure as a mechanism for strengthening customer acquisition, whereas Mensah and Asante (2021) associate mobile financial-service innovation with subscriber growth in Ghana. Similarly, Abidemi (2023) examines financial-technology innovation in relation to subscriber expansion within Nigeria's telecommunications sector. Although these studies suggest that innovation can strengthen customer attraction and engagement, their perspectives differ concerning the mechanisms through which innovation produces market outcomes. Research and development may improve technical capabilities, while mobile financial services and digital platforms may generate customer value through convenience, accessibility and service diversification. However, Mlowe and Sanga (2022) highlight the importance of conditions affecting technology adoption in Tanzania, while Mushi and Swai (2022) examine digital investment in relation to customer retention. These perspectives complicate the assumption that introducing new technologies automatically generates subscriber growth. Technological improvements may have limited commercial value where customers face high service costs, inadequate digital literacy, limited access to compatible devices or concerns about digital security. Furthermore, subscriber acquisition and customer retention represent distinct outcomes that may respond differently to technological innovation. The dynamic-capabilities perspective of Teece et al. (1997) provides an explanation by suggesting that innovation generates organisational value when firms continuously adapt their capabilities to emerging opportunities and customer requirements. Accordingly, technological innovation investment is conceptualised as a strategic process of developing and renewing digital capabilities whose contribution to subscriber growth depends on customer adoption, market relevance and the effective commercialisation of technological improvements.

Human capital investment constitutes an important organisational capability through which physical and technological resources are translated into operational performance. Boateng and Amponsah (2021) associate employee training with operational efficiency among Ghanaian telecommunications operators, while Kibona and Machumu (2023) examine human capital investment and operational efficiency within Tanzania's telecommunications sector. These studies suggest that technical competence, professional development and employee expertise contribute to effective service delivery. Nevertheless, interpreting human capital investment exclusively through training expenditure overlooks the organisational conditions necessary for acquired knowledge to produce measurable improvements. Employees may possess advanced technical skills but remain unable to improve operational efficiency where organisations experience inadequate equipment, restrictive managerial procedures, weak coordination or limited opportunities for applying acquired competencies. Barney (1991) provides a theoretical explanation by identifying organisational knowledge and embedded capabilities as potentially valuable strategic resources, while Teece et al. (1997) emphasise the continuous renewal of competencies as technological environments evolve. The relationship between human capital investment and operational efficiency is therefore not necessarily direct; rather, employee capabilities may influence performance through improved fault diagnosis, effective infrastructure maintenance, technological adaptation and organisational problem-solving. This interpretation also reveals the interdependence of the three investment dimensions examined in the present study. Physical infrastructure establishes the technical foundation for connectivity, technological innovation improves the functionality and attractiveness of services, and human capital supports the effective deployment and

maintenance of these resources. The central conceptual proposition is therefore that **operational growth emerges not merely from increasing investment in individual resource categories but from developing complementary capabilities that enable telecommunications firms to convert investment into service expansion, customer growth and operational efficiency**. Within the present research, however, these relationships are examined through respondents' perceptions rather than independently verified capital expenditure or operational performance records.

2.2 Theoretical Review

2.2.1 Resource-Based View Theory

This study is guided by the Resource-Based View (RBV) of the firm, associated with Barney (1991). The theory explains differences in organisational performance by examining the resources and capabilities controlled by firms. It proposes that resources can provide sustained competitive advantage when they are valuable, rare, difficult to imitate and not readily substitutable. Resources may be tangible, such as network equipment and fibre-optic infrastructure, or intangible, such as technical knowledge, organisational routines, software capabilities and employee expertise.

The RBV is relevant to telecommunications because operators depend on a combination of physical infrastructure, digital technologies and specialised human capabilities. Network infrastructure provides the physical foundation for coverage and capacity. Technological platforms and innovations enable operators to improve service features and respond to changing customer needs. Human capital enables employees to deploy, coordinate and maintain these resources effectively. The value of an individual resource may therefore depend on how well it is combined with other resources within the organisation.

Applied to the present study, the RBV suggests that investment in network infrastructure can strengthen the firm's capacity to extend coverage; investment in technological innovation can support improved services and subscriber growth; and investment in human capital can enhance the effective use of organisational assets and operational efficiency. The theory also indicates that simply acquiring resources is insufficient. Firms need appropriate management systems, skills and processes to convert investment into improved operational outcomes.

A limitation of applying the RBV is that it may give less attention to external factors such as regulation, competition, spectrum allocation, customer purchasing power and the wider economic environment. These factors can influence whether resources produce the expected benefits. The present study therefore uses RBV as its principal explanatory perspective while recognising that operational growth in telecommunications is also shaped by the industry and regulatory context.

2.3 Empirical Literature Review

Infrastructure research supports a link between network investment and service reach, but the meaning of improvement differs across studies. Nguyen and Tran (2022) and Zhang (2022) consider capital expenditure in relation to geographic expansion, whereas Kumar (2023) emphasises reliability. A network can reach additional locations without delivering stable service at peak demand, making coverage and quality non-equivalent outcomes. Ouedraogo and Sawadogo (2023) and Okonkwo and Adeleke (2022) extend the discussion to African settings, but regional or national observations cannot isolate firm-level returns to investment. Chirwa (2023) further raises infrastructure sharing as a possible alternative to duplicated ownership. Collectively, these studies imply that the productive configuration and use of infrastructure may matter as much as its volume.

Tanzanian evidence strengthens the local relevance of physical investment while complicating causal interpretation. Kimaro and Mdeme (2023) investigate infrastructure and geographic coverage, whereas Luvanda and Njau (2022) focus on financial performance. Their dependent variables answer different questions: expanded network access is not necessarily accompanied by higher profit, particularly when upfront expenditure is substantial. TCRA (2023) provides valuable sector-wide coverage trends but cannot establish whether surveyed managers' perceptions reflect measured changes at their respective companies. The present study therefore considers perceived service coverage expansion explicitly, while recognising that engineering maps, investment records and longitudinal designs would be required to establish the actual magnitude and timing of investment effects.

Empirical accounts of technological innovation similarly diverge between innovation inputs, service adoption and sustained customer growth. Fernandez and Santos (2022) examine research and development in relation to acquisition, while Zhang and Wang (2023) emphasise market performance. By contrast, Mensah and Asante (2021) and Abidemi (2023) foreground mobile financial and digital-service innovation, suggesting that customer value may arise from service ecosystems as well as network speed. Omwenga and Kinyua (2023) connect technological investment with subscriber growth in Kenya, but an association may also reflect reverse selection: operators with growing customer bases may have more resources to invest. Pricing, competition and digital access remain plausible alternative explanations that cross-sectional surveys cannot eliminate.

Closer to the Tanzanian market, Mlowe and Sanga (2022) examine factors affecting 4G adoption, while Mushi and Swai (2022) study digital technology investment and customer retention in Dar es Salaam. Adoption, acquisition and retention are related but not interchangeable; neither is a reported subscription necessarily evidence of an active unique customer. Consequently, findings that technology supports uptake

cannot automatically be interpreted as proof of durable subscriber growth. This distinction matters for evaluating whether investment produces a transient increase in sign-ups or sustained usage and service value. It also suggests the need to combine managers' assessments with operator-level active-user series, churn measures and customer-experience indicators in future studies.

Human-capital studies identify another tension between investment in skills and the organisational capacity to apply them. Adegoke and Olaniyan (2022), Boateng and Amponsah (2021) and Kibona and Machumu (2023) associate workforce development with operational efficiency, while Mrema (2023) considers staff performance and Lyamuya (2024) examines service processes in a Tanzanian operator. Yet training expenditure does not guarantee improved fault resolution or reduced downtime when equipment, incentives and operating procedures are inadequate. From an RBV perspective, it is the integration of expertise with physical and digital assets that may create value (Barney, 1991). The literature therefore motivates examining three investment dimensions together while resisting the assumption that any observed association establishes a standalone causal effect.

The reviewed literature indicates three connected relationships. First, investment in physical network infrastructure can increase network reach, capacity and reliability, thereby supporting service coverage expansion. Second, investment in technological innovation can improve connectivity and digital service experience, which may attract new subscribers and encourage existing customers to remain with an operator. Third, investment in human capital can strengthen employees' ability to operate, maintain and improve infrastructure and technology, thereby supporting operational efficiency. The three dimensions are complementary: infrastructure provides the network foundation, innovation improves the services delivered through that foundation, and skilled employees help ensure that both are used effectively.

Despite this broad agreement, the reviewed studies differ in geographical setting, unit of analysis, research design and outcome measures. Some examine financial performance or market share rather than operational growth; others focus on consumers, a single operator or national industry statistics. Evidence from outside Tanzania may not fully reflect local regulatory, market and infrastructure conditions. Tanzanian studies provide relevant insights, but the present study addresses the need to examine the three investment dimensions together among selected telecommunications companies in Dar es Salaam, using managers' responses and quantitative analysis.

Accordingly, the research gap is both contextual and analytical. Contextually, there is a need for evidence focused on selected operators in Dar es Salaam rather than relying only on international findings or sector-wide statistics. Analytically, there is a need to consider network infrastructure investment, technological innovation investment and human capital investment within one study while relating each dimension to a specific operational outcome. This study responds to that gap by examining infrastructure investment in relation to service coverage expansion, technological innovation in relation to subscriber growth, and human capital investment in relation to operational efficiency.

3. METHODOLOGY

The research was conducted in Dar es Salaam, Tanzania. It used a quantitative cross-sectional explanatory and correlational design. The target population was 500 middle- and senior-level staff from Vodacom Tanzania, Yas, and Airtel, especially in Finance and Administration, Engineering and IT, and Human Resources. Yamane's formula produced a sample size of 222. A total of 222 questionnaires were distributed and 155 usable responses were received, giving a response rate of about 69.8%.

Data were collected using a structured questionnaire with a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Academic supervisors and experts reviewed the questionnaire for validity. Pilot testing involved 22 employees at TTCL; Cronbach's alpha values ranged from 0.78 to 0.89, indicating acceptable internal consistency. Data were analysed in SPSS version 29 using frequencies, percentages, means, standard deviations, Pearson correlation, and multiple linear regression. Statistical significance was assessed at the 5% level.

4. FINDINGS

This section reports the questionnaire response rate, descriptive assessments, correlations, model diagnostics and multivariable regression results. Each table is followed by an interpretation that distinguishes employee perceptions and statistical associations from independently verified operational outcomes.

Table 1. Questionnaire response rate

Status	Number	Percentage
Usable responses	155	69.8%
Not returned or excluded as incomplete	67	30.2%
Questionnaires distributed	222	100.0%

Source:Data from the Field 2026.

Table 1 indicates that 155 of the 222 distributed questionnaires were usable, yielding an analytical response rate of 69.8%. The remaining 67 questionnaires (30.2%) were either not returned or excluded because they were incomplete; the source does not separate these categories. The sample provides the basis for the reported analysis, but the unobserved characteristics of nonrespondents may introduce nonresponse bias. The findings should therefore be interpreted as the perceptions of

participating employees rather than a census of the three operators.

Table 2. Descriptive summary of the three investment dimensions

Investment dimension and associated outcome	Mean	SD	Highest-rated item (mean)
Network infrastructure / service coverage	3.87	1.00	Fibre networks improve reliability (4.00)
Technological innovation / subscriber growth	3.85	1.00	High-speed internet drives growth (3.98)
Human capital / operational efficiency	4.02	0.91	Skilled workforce improves efficiency (4.07)

Source:Data from the Field 2026.

Table 2 shows generally favourable assessments of all three investment dimensions on the five-point scale. Human capital investment and its associated operational-efficiency outcome received the highest composite mean (M = 4.02, SD = 0.91), followed by network infrastructure and service coverage (M = 3.87, SD = 1.00) and technological innovation and subscriber growth (M = 3.85, SD = 1.00). The highest-rated individual statements concerned workforce skills (M = 4.07), fibre-network reliability (M = 4.00), and high-speed internet (M = 3.98). These are descriptive perceptions, not measured changes in productivity, coverage or subscriber numbers; differences in the means should not be treated as statistically significant without a formal comparison.

Table 3. Pearson correlation matrix (N = 155)

Variable	NII	TII	HCI	SCE	SG	OE
Network infrastructure	1.000					
Technological innovation	0.412*	1.000				
Human capital	0.354*	0.388*	1.000			
Service coverage	0.684*	0.295*	0.312*	1.000		
Subscriber growth	0.331*	0.712*	0.276*	0.415*	1.000	
Operational efficiency	0.288*	0.342*	0.645*	0.367*	0.389*	1.000

*Note. NII = network infrastructure investment; TII = technological innovation investment; HCI = human capital investment; SCE = service coverage expansion; SG = subscriber growth; OE = operational efficiency. * p < .05 (two-tailed), as reported.*

Table 3 reports positive bivariate associations between each investment dimension and its corresponding operational-growth outcome. Network infrastructure investment was correlated with service coverage expansion (r = .684), technological innovation investment with subscriber growth (r = .712), and human capital investment with operational efficiency (r = .645). Among these focal relationships, the innovation–subscriber growth association was numerically the largest. The three investment predictors were also positively intercorrelated (r = .354–.412), suggesting that employees tended to view these investment activities as complementary. Correlation does not establish that investment preceded or caused operational growth; common-method reporting and unmeasured organisational factors may contribute to the observed relationships.

Table 4. Multicollinearity diagnostics

Predictor	Tolerance	VIF
Network infrastructure investment	0.704	1.420

Technological innovation investment	0.633	1.580
Human capital investment	0.763	1.310

Source: Data from the Field 2026.

Table 4 presents tolerance values from .633 to .763 and variance inflation factors (VIFs) from 1.310 to 1.580. These figures fall within commonly used screening thresholds and do not suggest severe multicollinearity among the three investment predictors. Consequently, the regression models are not evidently compromised by excessive linear dependence among the explanatory variables. This diagnostic does not address other assumptions, such as residual independence, homoscedasticity or model specification, which require separate assessment.

Table 5. Model fit for the three operational growth outcomes

Outcome	R	R^2	Adjusted R^2	F	Model p
Service coverage expansion	0.740	0.548	0.539	61.120	< .001
Subscriber growth	0.763	0.582	0.574	70.150	< .001
Operational efficiency	0.718	0.516	0.506	53.640	< .001

Note. Each model includes all three investment predictors; R^2 is the joint model fit, not the contribution of a single predictor.

Table 5 summarises three separate multiple regression models, each incorporating network infrastructure, technological innovation and human capital investment as predictors. The reported R^2 values indicate that the three predictors jointly accounted for 54.8% of variation in perceived service coverage expansion, 58.2% in perceived subscriber growth and 51.6% in perceived operational efficiency within the analysed sample. The corresponding adjusted R^2 values (.539, .574 and .506) remain close to the unadjusted estimates, and the reported overall model tests are significant ($p < .001$). These percentages describe in-sample statistical fit, not the proportion of actual industry growth caused by capital investment. They also cannot be attributed to any single predictor.

Table 6. Multiple regression coefficients: Service coverage expansion

Predictor	B	SE	β	t	p
Constant	1.120	0.245	—	4.571	< .001
Network infrastructure	0.512	0.075	0.485	6.840	< .05
Technological innovation	0.145	0.068	0.138	2.132	0.035
Human capital	0.118	0.059	0.122	2.000	0.047

Note. All three investment dimensions are included in the model.

Interpretation. Table 6 indicates that, when the other two investment dimensions are included in the service-coverage model, network infrastructure investment has the largest reported standardised coefficient ($\beta = .485$; $B = .512$; $t = 6.840$). Technological innovation ($\beta = .138$; $p = .035$) and human capital investment ($\beta = .122$; $p = .047$) also have positive reported coefficients. The pattern is consistent with the practical importance of physical network assets for perceived geographic reach and service accessibility, while suggesting that technology and staff capabilities may provide additional support. Because these are cross-sectional survey estimates, they should be described as conditional associations rather than causal effects. This aligns with Kimaro and Mdeme (2023) and the infrastructure-focused evidence of Nguyen and Tran (2022), but differs from Chirwa's (2023) emphasis on shared assets and deployment arrangements. RBV implies that infrastructure is valuable through its integration with spectrum, maintenance and workforce capability, not merely through ownership (Barney, 1991). For managers, the finding favours evaluating coverage gaps and service reliability against actual site-level deployment records before committing to additional assets. The model's R^2 describes all three predictors jointly; it is not the separate explanatory share of infrastructure

.

Table 7. Multiple regression coefficients: Subscriber growth

Predictor	B	SE	β	t	p
Constant	0.985	0.214	—	4.603	< .001
Network infrastructure	0.122	0.061	0.115	2.000	0.047
Technological innovation	0.584	0.074	0.524	7.920	< .05
Human capital	0.105	0.052	0.108	2.019	0.045

Note. All three investment dimensions are included in the model.

Table 7 shows that technological innovation investment has the largest reported standardised coefficient in the subscriber-growth model (β = .524; B = .584; t = 7.920). Network infrastructure (β = .115; p = .047) and human capital investment (β = .108; p = .045) also show positive reported associations after adjustment for the other predictors. The results suggest that employees associate digital service innovation and improved connectivity with subscriber acquisition or retention. However, the study did not independently analyse operator subscription records, and the model therefore cannot establish actual customer growth attributable to these investments. The pattern is consistent with Omwenga and Kinyua (2023) and Abidemi (2023), although their attention to digital products offers a different mechanism from the connectivity-centred account of Fernandez and Santos (2022). In the Tanzanian context, Mlowe and Sanga (2022) and Mushi and Swai (2022) suggest that adoption and retention are shaped by customer circumstances as well as technical innovation. Firms should therefore test whether service upgrades improve active-subscriber retention and customer experience, not infer success from platform expenditure or gross SIM subscriptions alone. This is a conditional association, not an identified innovation effect.

Table 8. Multiple regression coefficients: Operational efficiency

Predictor	B	SE	β	t	p
Constant	1.340	0.268	—	5.000	< .001
Network infrastructure	0.098	0.049	0.102	2.000	0.047
Technological innovation	0.162	0.071	0.155	2.282	0.024
Human capital	0.468	0.078	0.442	5.980	< .05

Note. All three investment dimensions are included in the model.

Table 8 indicates that human capital investment has the largest reported standardised coefficient in the operational-efficiency model (β = .442; B = .468; t = 5.980). Technological innovation (β = .155; p = .024) and network infrastructure investment (β = .102; p = .047) also have positive reported coefficients. The pattern is consistent with the view that skills development, technical competence and employee capabilities are relevant to efficient service delivery. These results concern perceived operational efficiency rather than independently verified cost, uptime or productivity measures. Coefficients from the three different outcome models should not be compared as a universal ranking of investment returns. The result accords with Kibona and Machumu (2023) and Boateng and Amponsah (2021), but the emphasis on training must be qualified by Lyamuya's (2024) concern with work processes and Ivanov's (2021) focus on technical certification. RBV interprets embedded employee know-how as a potentially valuable organisational resource, while dynamic-capabilities theory highlights the need to update skills as technology changes (Barney, 1991; Teece et al., 1997). A practical implication is to assess training alongside actual fault-resolution times, network uptime and workflow redesign. Neither the coefficient nor the composite mean establishes an audited improvement in labour productivity.

Across the three models, the largest reported standardised coefficient for each respective outcome aligns with the study's conceptual framework: network infrastructure for coverage, technological innovation for subscriber growth and human capital for operational efficiency. These are outcome-specific associations in one cross-sectional sample, not evidence that one investment category always offers the highest financial return.

Data-integrity note for final submission: Regression coefficients, standard errors, test statistics, model-fit figures and significance values have been transcribed from the dissertation. The authors should verify the complete tables against the original SPSS output before submission, including the exact p-values and internal

consistency of model statistics. No missing or conflicting values have been reconstructed.

5. CONCLUSION AND RECOMMENDATIONS

The study examined perceived relationships between three categories of capital investment and distinct dimensions of operational growth among 155 respondents from Vodacom Tanzania, Airtel Tanzania and Yas in Dar es Salaam. Network infrastructure investment was positively associated with perceived service coverage expansion (r = .684), technological innovation with perceived subscriber growth (r = .712), and human capital investment with perceived operational efficiency (r = .645). The reported multivariable models likewise identify the corresponding investment category as the largest standardised predictor for each respective outcome, subject to verification of the original regression outputs. These findings support an outcome-specific understanding of capital investment: physical networks facilitate reach, technological innovation can improve customer-facing value, and employee capabilities help translate assets into efficient service. They do not establish that expenditure caused actual operational improvements.

For telecommunications managers, the practical recommendation is to move from expenditure-led planning towards integrated investment appraisal. Network projects should be evaluated against independently measured coverage, availability, congestion and reliability; digital innovations against active-subscriber acquisition, retention, affordability and customer experience; and workforce development against fault-resolution time, service quality and demonstrable skill application. These indicators should be considered jointly because underperforming maintenance or insufficient technical skills may erode the benefits of expensive infrastructure, while a technically advanced service may fail commercially if customers cannot afford or use it. The RBV therefore provides a useful explanation of resource complementarity, although the study does not test the rarity or inimitability required to establish sustained competitive advantage (Barney, 1991).

At the policy level, the evidence supports examining conditions that make private investment productive, including predictable rights-of-way, transparent infrastructure-sharing arrangements, reliable backbone access and skills development. The Tanzania Communications Regulatory Authority and relevant public institutions could encourage reporting that differentiates geographic reach, network quality and active subscriber use rather than relying on subscription totals alone. Targeted partnerships with technical training institutions could support competencies in fibre engineering, cybersecurity, network automation and data analytics. Such recommendations are grounded in the study's pattern of associations and the wider literature; their effectiveness would require separate evaluation.

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