

# INFLUENCE OF 4G /5G BUSINESS PROCESS TECHNOLOGY ON THE COMPETITIVE ADVANTAGE OF TELECOMMUNICATION COMPANIES IN KENYA

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**Abstract:** The main objective of this study was to determine the influence of 4G/5G business process technology on competitive advantage of telecommunication companies in Kenya. The study was anchored on the Resource-Based View theory. A cross-sectional research design was adopted, targeting key players in the Kenyan telecommunications sector which comprised 39 telecommunication firms. A semi-structured questionnaire was used for primary data collection, incorporating both closed and open-ended questions to capture qualitative and quantitative insights. The collected data was analyzed using Statistical Package for the Social Sciences to obtain descriptive and inferential statistics, such as means, standard deviations, percentages, correlations and regression analysis to determine relationships between variables. A correlation of 82% indicated that the adoption of 4G/5G business process technologies had improved operational efficiency, network reliability, and speed of service delivery, thereby enhancing customer satisfaction and retention.

**Keywords:** 4G/5G Business Process, Technology, Competitive Advantage.

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## 1. INTRODUCTION

Globally, disruptive technologies have emerged as key drivers of innovation and competitive advantage across industries, with the telecommunications sector experiencing particularly profound transformation. Technologies such as fifth-generation (5G) mobile networks, artificial intelligence (AI), and the Internet of Things (IoT) have redefined service delivery models, improved network efficiency, and enabled new revenue streams. The global 5G market, for instance, was valued at approximately USD 22.4 billion in 2023 and is projected to reach over USD 120 billion by 2028, reflecting rapid adoption and increasing investment in advanced telecommunications infrastructure (Markets and Markets, 2023).

Within the African context, the adoption of disruptive technologies presents significant opportunities for economic growth and industrial competitiveness, particularly in the telecommunications sector. The African Development Bank (2022) estimates that digital transformation could contribute up to USD 180 billion to Africa's gross domestic product by 2025, highlighting the transformative potential of digital technologies. Despite this potential, the region continues to face substantial

barriers to technology adoption, including inadequate infrastructure, limited access to advanced technologies, skills gaps, and regulatory constraints.

For example, although global deployment of 5G networks has accelerated, Africa remains behind, with less than 2% of the population having access to 5G services as of 2023 (GSMA, 2023). This low penetration reflects broader structural challenges related to investment capacity, affordability, and policy frameworks. Nevertheless, regional initiatives aimed at accelerating digital transformation are gaining momentum. The African Union's Digital Transformation Strategy seeks to promote digital inclusion, innovation, and infrastructure development across member states (African Union, 2021). Similarly, the African Development Bank's High 5s Agenda emphasizes infrastructure development and technological advancement as key drivers of sustainable growth and competitiveness (African Development Bank, 2022). These initiatives are intended to strengthen Africa's position within the global digital economy and enhance the competitiveness of key sectors such as telecommunications.

In Kenya, disruptive technologies present substantial opportunities for enhancing competitiveness within the telecommunications sector. The rollout of 5G networks, for instance, is expected to contribute approximately KSh 43.5 billion to the national economy by 2025, through improved connectivity, innovation, and increased productivity across multiple sectors (Communications Authority of Kenya, 2022). Kenya has made notable progress in advancing digital transformation, supported by policy frameworks such as the National Broadband Strategy and the Digital Economy Blueprint. These initiatives aim to expand high-speed internet access, promote digital inclusion, and foster innovation-driven economic growth (Government of Kenya, 2019; 2021).

Despite these advancements, Kenyan telecommunications firms face significant challenges in leveraging the combined advantage of disruptive technologies for sustained competitive advantage. One major concern is the difficulty of accurately predicting which emerging technologies will deliver long-term strategic value. According to Deloitte (2023), over 60% of telecommunications executives globally cite the rapid pace of technological change as a major challenge to strategic planning and investment decisions. In Kenya, this challenge is compounded by relatively lower technology adoption rates compared to global benchmarks, as well as financial, infrastructural, and regulatory constraints (World Bank, 2022).

Consequently, telecommunication firms in Kenya must carefully balance the risks and opportunities associated with disruptive technologies. Strategic investment decisions must be informed by robust technological evaluation, alignment with organizational capabilities, and an understanding of the competitive environment to ensure that disruptive technologies translate into sustainable competitive advantage.

## **2. STATEMENT OF THE PROBLEM**

The telecommunications sector in Kenya is undergoing rapid technological transformation, driven by the emergence and integration of disruptive technologies such as 4G/5G business process technologies, artificial intelligence (AI)/ the Internet of Things (IoT), business intelligence services, and IT infrastructure platforms. These innovations have the potential to fundamentally reshape how firms operate and compete, particularly by enabling cost leadership, expanding market share, and enhancing operational efficiency (Davenport & Ronanki, 2018). However, despite increased investment in such technologies, there remains a limited understanding of their actual combined impact on the competitive positioning of firms within the Kenyan telecom industry. While previous studies have explored the individual contributions of 4G/5G to organizational performance, comprehensive empirical research addressing their combined influence on competitive advantage in the Kenyan context is lacking. For instance, Chirchir (2023) and Owino & Were (2021) highlight the need for targeted investigations into how these technologies can be strategically leveraged in the highly competitive Kenyan telecom market. Furthermore, there is insufficient understanding of the challenges faced by telecommunication companies in adopting these technologies.

A recent report from the Communications Authority of Kenya (2023) indicated that 57% of Kenyan telecom companies identified high operational costs as a significant barrier to the adoption of 5G technology. Kenyan telecom firms such as Safaricom, Airtel, and Telkom have made notable strides in adopting these technologies, yet empirical studies evaluating how specific innovations such as AI/IoT-driven business strategies, advanced IT infrastructure systems, and real-time business intelligence services translate into their combined effects on measurable competitive advantages are scarce (Munyua & Mutua,

2020). Moreover, the strategic alignment between these technologies and core performance indicators like cost efficiency, market penetration, and streamlined operations is often unclear or inconsistently documented (Ngugi & Kimani, 2021). This gap in understanding presents a significant problem: without a clear assessment of how these technologies contribute to competitive advantage in Kenya's telecom sector, firms risk misallocating resources or underutilizing high impact innovations. Therefore, this study sought to determine the influence of 4G/5G business process technology on competitive advantage of telecommunication companies in Kenya.

### 3. LITERATURE REVIEW

The advent of 4G / 5G technologies has transformed the telecommunications landscape globally, with significant implications for competitive advantage, particularly in emerging markets like Kenya. Research indicates that the transition from 4G to 5G enables telecommunications companies to offer faster data speeds, lower latency, and greater connectivity, which directly enhance customer experience and satisfaction (Zhang et al., 2020). For instance, a study conducted by Oke et al. (2021) found that telecommunications firms leveraging 5G technology can gain a competitive edge by providing advanced services such as augmented reality (AR) and virtual reality (VR) applications, which are increasingly in demand among consumers and businesses alike. This technological leap allows companies to differentiate themselves in a crowded market, attracting a wider customer base and enhancing brand loyalty.

Furthermore, the integration of 5G technology in business processes enables telecommunications companies to optimize their operations, reduce costs, and improve efficiency. According to a report by the International Telecommunication Union (ITU, 2022), companies adopting 5G networks experience improvements in operational capabilities, such as enhanced network management and automated processes, leading to significant cost savings and increased profit margins. In the Kenyan context, where the telecommunications market is characterized by rapid growth and intense competition, the ability to utilize these advanced technologies effectively can be a decisive factor for firms aiming to maintain or enhance their market position. Thus, the adoption of 4G/5G technologies plays a crucial role in establishing a sustainable competitive advantage for telecommunications sector in Kenya.

Moreover, the successful implementation of 4G/5G technologies also facilitates the emergence of innovative business models that further drive competitive advantage. Research by Abdullahi et al. (2023) highlights how telecommunications firms can create value-added services, such as smart city solutions and IoT-enabled applications, by leveraging the enhanced capabilities of these networks. These innovations not only attract new customers but also provide existing customers with new experiences, thereby improving retention rates. Consequently, the influence of 4G/5G business process technology on competitive advantage is multi-faceted, encompassing enhanced service delivery, operational efficiency, and the creation of new revenue streams that are pivotal for the growth and sustainability of telecommunications sector in Kenya.

The evolution 4G/5G business process technologies has been transformative for telecommunication companies worldwide, including those in Kenya. Each new generation of mobile technology not only increases network speed but also drastically improves connectivity and data transmission reliability. Recent empirical evidence confirms that telecom operators leveraging 5G for low latency, high definition video streaming deliver significantly enhanced user experience, leading to higher satisfaction and loyalty (Khan et al., 2024). In competitive markets, these improvements serve as key differentiators that drive customer acquisition and retention, essential components of competitive advantage.

Recent empirical studies such as those by Waleed et al. (2021) and Khan et al. (2021) focus on resource allocation and joint optimization in 5G networks, highlighting that efficient management of network resources leads to improved quality of service (QoS). This increased efficiency not only reduces operational costs but also provides telecommunication firms with the flexibility to customize service packages, meeting diverse consumer needs. In Kenya, this flexibility translates into the ability to serve both urban and rural customers effectively, bridging the digital divide and expanding market reach, which enhances competitive positioning.

The penetration of 4G and the gradual rollout of 5G technologies in Kenya has been associated with increased data consumption and new revenue streams, as demonstrated in sector reports and studies by local scholars like Shava (2021). These technologies enable telecommunication companies to launch innovative products such as mobile banking, e-commerce

platforms, and IoT applications, which not only increase average revenue per user (ARPU) but also create ecosystems that enhance customer stickiness. Thus, business process technologies like 4G/5G go beyond connectivity to becoming platforms for business model innovation that sustain competitive advantage.

However, challenges such as high infrastructure costs and regulatory hurdles persist. Studies by Waleed et al. (2021) indicate that the initial capital expenditure required for 5G rollout can be a barrier for many telecom operators, especially in emerging economies like Kenya. Nonetheless, companies that manage to overcome these barriers by forming strategic partnerships or leveraging government support tend to achieve first-mover advantages, solidifying their competitive edge. Overall, empirical evidence confirms that investment in 4G/5G business process technology is a critical factor in enhancing the competitive advantage of telecom sector in Kenya.

#### 4. RESEARCH METHODOLOGY

A cross-sectional research design was adopted, targeting key players in the Kenyan telecommunications sector which comprised 39 telecommunication firms. A semi-structured questionnaire was used for primary data collection, incorporating both closed and open-ended questions to capture qualitative and quantitative insights. The collected data was analyzed using Statistical Package for the Social Sciences to obtain descriptive and inferential statistics, such as means, standard deviations, percentages, correlations and regression analysis to determine relationships between variables.

#### 5. FINDINGS

The aim of this section was to summarize and interpret the responses related to the extent to which the adoption of 4G/5G technologies has enhanced operational efficiency, improved service delivery, and strengthened market positioning. Measures of central tendency and dispersion, such as means and standard deviations, were used to provide insights into respondents' perceptions.

**Table 1: Influence of 4G/5G business process technology on the competitive advantage of telecommunication companies in Kenya**

Statement	SD	D	N	A	SA	Mean	STD
The adoption of 4G/5G technology has improved our customer relationship management system.	25 (16.7%)	47 (31.3%)	3 (2.0%)	41 (27.3%)	34 (22.7%)	4.05	1.503
The implementation of workflow management software using 4G/5G has enhanced operational efficiency.	29 (19.3%)	34 (22.7%)	4 (2.7%)	54 (36.0%)	29 (19.3%)	3.99	1.442
4G/5G technology has contributed to cost leadership by reducing network operational expenses.	36 (24.0%)	39 (26.0%)	5 (3.3%)	45 (30.0%)	25 (16.7%)	3.89	1.466
4G/5G networks have significantly improved market share growth through better service delivery.	22 (14.7%)	41 (27.3%)	4 (2.7%)	43 (28.7%)	40 (26.7%)	4.19	1.482
The integration of 4G/5G in business processes has enhanced customer satisfaction and loyalty.	11 (7.3%)	11 (7.3%)	13 (8.7%)	78 (52.0%)	37 (24.7%)	4.72	1.142
4G/5G business technologies have led to better operational efficiency by automating routine tasks.	30 (20.0%)	28 (18.7%)	9 (6.0%)	45 (30.0%)	38 (25.3%)	4.14	1.515

The study investigated the impact of 4G/5G business process technology on various operational and strategic aspects within telecommunication companies. The findings reveal a generally positive perception of 4G/5G technology adoption among the 150 respondents.

Regarding customer relationship management systems, 52% of respondents agreed or strongly agreed that the adoption of 4G/5G technology had improved their CRM capabilities, although 48% were either neutral or disagreed, indicating some variability in experience or implementation maturity.

Operational efficiency benefits from workflow management software implemented via 4G/5G technology were acknowledged by 55.3% of respondents who agreed or strongly agreed. However, a notable 42% expressed disagreement or neutrality, suggesting potential challenges or uneven adoption across firms.

In terms of cost leadership, 46.7% of respondents believed that 4G/5G technology contributed to reducing network operational expenses, while just over half remained neutral or in disagreement. This indicates that while cost savings were recognized, they might not have been uniformly realized.

Market share growth attributed to improved service delivery through 4G/5G networks was positively perceived by 55.4% of respondents who agreed or strongly agreed, reflecting confidence in the role of these networks in enhancing competitive positioning.

The integration of 4G/5G in business processes was strongly linked to enhanced customer satisfaction and loyalty, with 76.7% of respondents agreeing or strongly agreeing with this statement, indicating a robust belief in the customer-centric benefits of the technology.

4G/5G business technologies were reported to improve operational efficiency through automation of routine tasks by 55.3% of respondents, though 38.7% remained neutral or disagreed, suggesting ongoing efforts may be required to fully leverage automation benefits.

The data reflects a positive but varied impact of 4G/5G business process technology on competitive factors such as customer management, operational efficiency, cost control, market share, and customer loyalty within the telecommunications sector.

The findings reveal a generally favorable perception of the impact of 4G and 5G technologies on various aspects of business operations in the telecommunications sector. Respondents agreed that the adoption of 4G and 5G has significantly enhanced customer relationship management (CRM) systems, as evidenced by a mean score of 4.05. This aligns with the study by Al-Shammari and AlShowaikh (2021), who found that advanced mobile technologies positively influence CRM effectiveness by enabling real-time engagement and improved responsiveness. Similarly, Almuqren and Cristea (2022) highlighted that the integration of social media analytics with 5G-powered platforms has enhanced the ability of telecom firms to predict and respond to customer needs, thereby strengthening CRM systems.

Furthermore, the implementation of workflow management software using 4G and 5G was reported to have improved operational efficiency, with a mean score of 3.99. These results echo the findings of Mazhar et al. (2023), who noted that 5G-enabled communication infrastructures improve network efficiency and automate operational workflows in complex environments. The integration of emerging technologies enhances organizational agility, minimizes operational delays, and improves the reliability of internal connectivity—factors that are increasingly critical for maintaining digital competitiveness in dynamic markets (Clohessy, Acton, & Morgan, 2019) also emphasized that telecom companies that embrace agile digital infrastructures such as 5G are better positioned to streamline processes and adapt quickly to market changes.

Regarding cost leadership, respondents moderately agreed (mean = 3.89) that 4G and 5G technologies help reduce operational expenses. Zhang et al. (2020) explain that 5G supports network slicing and virtualization, which enable telecom providers to optimize resource usage and cut down on physical infrastructure costs. This capacity for customization and efficiency supports a cost leadership strategy, allowing firms to offer competitive pricing without compromising service quality. These cost benefits can be critical in highly competitive telecom markets, especially in developing economies.

A strong agreement was noted on the role of 4G and 5G in improving market share through enhanced service delivery, with a mean score of 4.19. This is supported by Shahzad et al. (2021), who argue that technological improvements in mobile networks result in higher customer satisfaction and increased customer acquisition, thereby expanding market share. Hajar et al. (2022) also noted that value innovation enabled by technological advancement, including 5G deployment, significantly contributes to superior organizational performance and sustainable growth, reinforcing the competitive position of firms in the market.

The highest level of agreement was observed in the perception that 4G and 5G have enhanced customer satisfaction and loyalty, with a mean score of 4.72. This finding is consistent with the conclusions of Shava (2021), who reported that enhanced network performance significantly improves customer experiences in the mobile telecommunications industry. Mohammed and Andavar (2022) also demonstrated a direct relationship between improved service quality—facilitated by advanced mobile technologies—and customer satisfaction, which in turn drives brand loyalty and customer retention.

The findings show that 4G and 5G technologies have led to improved operational efficiency by automating routine tasks, with a mean score of 4.14. Chang et al. (2018) further emphasized the role of machine learning at the network edge, enabled by 5G, in automating decision-making processes and enhancing operational intelligence.

Inferential analysis was conducted to draw conclusions about the population of telecommunication companies in Kenya based on the sample data collected ( $n = 150$ ). This section focused on testing the research hypotheses and determining the relationships between the independent variables, 4G/5G Business Process Technology, IT infrastructure, AI/IoT Business Strategies, and Business Intelligence Services and the dependent variable, Competitive Advantage. Through the application of statistical techniques such as regression analysis and hypothesis testing, the study sought to establish whether the observed effects were statistically significant and could be generalized to the broader population. This analysis was essential in confirming the extent to which each of the specified variables influenced competitive advantage within the sector.

This section presents the inferential analysis of the influence of 4G/5G business process technology on the competitive advantage of telecommunication companies in Kenya. The objective was to determine whether the adoption and integration of these advanced network technologies had a statistically significant effect on enhancing competitiveness within the industry.

**Table 2: Influence of 4G/5G Business Process Technology on Competitive Advantage**

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.560 <sup>a</sup>	.314	.309	.49453		
ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.533	1	16.533	67.604	.000 <sup>b</sup>
	Residual	36.195	148	.245		
	Total	52.728	149			
Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.837	.198		9.267	.000
	4G/5G business process technology	.494	.060	.560	8.222	.000

The analysis examined the influence of 4G/5G business process technology on the competitive advantage of telecommunication companies in Kenya. The model summary indicated an R value of 0.560, suggesting a moderate positive correlation between business process technology and competitive advantage. The coefficient of determination,  $R^2$  was 0.314, meaning that approximately 31.4% of the variation in competitive advantage was explained by 4G/5G business process technology alone. The adjusted  $R^2$  of 0.309 confirmed the model's reliability after accounting for the number of predictors.

The ANOVA results demonstrated that the regression model was statistically significant, with an F-value of 67.604 and a p-value of 0.000, indicating that 4G/5G business process technology significantly predicted competitive advantage. The model showed a good fit given the relatively low standard error of the estimate (0.49453), reflecting that the model's predictions were reasonably accurate.

Further, the coefficients table revealed that the constant term was 1.837 with a t-value of 9.267 ( $p = 0.000$ ), confirming a significant intercept. The unstandardized coefficient for business process technology was 0.494, with a standardized beta coefficient of 0.560, and a t-value of 8.222 ( $p = 0.000$ ). This indicated a statistically significant and positive influence of business process technology on competitive advantage, where a unit increase in 4G/5G business process technology was associated with a 0.494 increase in competitive advantage, holding other factors constant.

The findings established that 4G/5G business process technology had a significant and positive impact on the competitive advantage of telecommunication firms, explaining nearly one-third of the variation in competitive advantage and demonstrating a strong predictive relationship.

These findings align with recent empirical studies emphasizing the role of technological infrastructure in shaping organizational competitiveness, especially in data-driven industries like telecommunications (Chege et al., 2021; Otieno & Kinyua, 2020). The integration of advanced technologies such as 4G/5G into business processes enables operational efficiency, real-time data processing, and improved service delivery, which are critical drivers of competitive advantage (Wanjiru & Mburu, 2023). The study thus affirms that investments in digital transformation through 4G/5G technologies are not just operational decisions but strategic imperatives that substantially enhance a firm's market position in dynamic and competitive environments.

The following hypothesis was tested to examine the influence of 4G/5G business process technology on the competitive advantage of telecommunication companies in Kenya.

$H_{01}$ : 4G/5G business process technology has no significant influence on the competitive advantage of telecommunication companies in Kenya.

$H_{a1}$ : 4G/5G business process technology has a significant influence on the competitive advantage of telecommunication companies in Kenya.

The findings indicated that 4G/5G business process technology had a positive and statistically significant effect on competitive advantage, with a standardized beta coefficient ( $\beta$ ) of 0.314 and a p-value of 0.000. Since the p-value is less than 0.05, the null hypothesis ( $H_{01}$ ) was rejected, confirming that the adoption and integration of advanced communication technologies such as 4G and 5G significantly enhance competitive positioning. The positive coefficient implies that an increase in the level of 4G/5G-enabled process technology is associated with a corresponding increase in the competitive advantage of the firms.

This outcome reinforces the importance of high-speed connectivity and digital infrastructure in improving service delivery, operational agility, and customer responsiveness. As noted by Muthoni and Wanjiru (2023), digital process technologies enable real-time data transmission, reduce latency, and facilitate automation of customer-facing and backend processes, leading to operational efficiency and improved market responsiveness. Similarly, Njoroge and Gathenya (2020) found that telcos investing in advanced wireless infrastructure reported superior network reliability, which directly contributed to customer satisfaction and retention—two critical drivers of competitive advantage.

In the Kenyan context, where the telecommunication sector is increasingly competitive and digitally driven, the ability to leverage 4G/5G for enhanced user experience and process innovation is vital. Furthermore, the results align with global evidence showing that next-generation technologies are not merely operational upgrades but are strategic enablers of firm-level performance (Kimani & Cheruiyot, 2021). Thus, the study confirms that business process technology—anchored in 4G/5G capability—is a core determinant of competitive success, enabling firms to differentiate themselves through quality, speed, and scalability.

## 6. CONCLUSION AND RECOMMENDATION

The study established that 4G/5G business process technology has a significant and positive influence on the competitive advantage of telecommunication companies in Kenya. The findings demonstrated that improvements in 4G/5G business process technology contribute meaningfully to enhancing operational efficiency, service quality, and overall competitiveness. As such, firms that invest in advanced 4G/5G infrastructure and integrate it effectively into their core processes are better equipped to respond to market demands, deliver superior customer experiences, and maintain a strong market position. Therefore, adopting and optimizing 4G/5G business technologies is essential for sustaining competitive advantage in the fast-evolving telecommunications landscape.

Based on the study findings, 4G/5G technology significantly enhances service delivery, operational efficiency, and customer satisfaction. However, challenges such as high infrastructure costs, regulatory hurdles, and cybersecurity risks limit its full potential. Therefore, telecommunication companies should: Accelerate 5G deployment strategically in both urban and underserved areas to expand market coverage, improve network reliability, and provide faster, low-latency services. Integrate 4G/5G technology with operational processes using automation, real-time analytics, and cloud computing to reduce operational costs and optimize service delivery. Strengthen cybersecurity frameworks to address emerging threats, ensuring data protection and maintaining consumer trust. Engage in collaborations with technology providers, research institutions, and regulatory bodies to innovate service offerings, improve infrastructure compatibility, and ensure adherence to industry standards.

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