Technological innovation and competitive advantage in telecommunication companies

Peter Mugo(a), Jimmy Macharia(b)

(a) Chief Executive Officer at Jayden Ltd, Nairobi, Kenya
(b) Associate Professor of Information Systems, United States International University, Nairobi, Kenya

Abstract

Previous studies have established that the telecommunications industry in Kenya is characterized by decreasing voice revenues, many regulations, technological progress and varying consumer needs. This phenomenon has resulted in industry companies developing sound innovation strategies to make sure they form a competitive advantage over their rivals with the aim of ensuring their survival and growth in the evermore cut-throat marketplace. Nevertheless, in spite of the essential part played by these innovation strategies to safeguard competitive advantage, several companies have failed to translate the plans into reality. Therefore, the major objective of this study was to investigate the influence of technological innovation on the competitive advantage of telecommunication companies in Kenya. Technological innovation was measured by expansion of Global System for Mobile Communications (GSM) networks; new equipment and software; and partnerships and synergies. To satisfy the objective of this paper, a positivist philosophical stance was adopted and research design using cross-sectional survey data was used. Data was collected using proportionate sampling from 247 managers. The results indicate that technological innovation improves the competitive advantage of telecommunication companies in Kenya. However, with government regulation as a moderating variable, only the new equipment, and software constructs had a positive and significant influence on the dependent variable. Ultimately, the findings suggest that government regulation moderates the influence of technological innovation on the competitive advantage of telecommunication companies in Kenya.

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Introduction

The term “competitive advantage” was coined by Michael Porter in 1985, who made no reference to preceding publications (Kein, 2002). For the last three-and-a-half decades, there has been a myriad of publications in the field of strategic management, but the attempt to define competitive advantage has been problematic. According to Wen-Cheng et al. (2011), competitive advantage manifests when a company is able to provide the same benefits as competitors but at a lesser cost (cost advantage), or provides benefits that surpass those of competing products (differentiation advantage). Moreover, contemporary researchers posit that a firm’s winning proposition encapsulates measurable competitive advantage and defines how a firm will win the competition for value creation (Pietersen, 2011). For a firm to achieve this goal, it has to answer the following two questions: What distinctive benefits will we provide our customers that will offer a persuasive reason for them to select us over our competitors? How will we convert these innovation to safeguard competitive advantage, several companies have failed to translate the plans into reality. Therefore, the major objective of this study was to investigate the influence of technological innovation on the competitive advantage of telecommunication companies in Kenya. Technological innovation was measured by expansion of Global System for Mobile Communications (GSM) networks; new equipment and software; and partnerships and synergies. To satisfy the objective of this paper, a positivist philosophical stance was adopted and research design using cross-sectional survey data was used. Data was collected using proportionate sampling from 247 managers. The results indicate that technological innovation improves the competitive advantage of telecommunication companies in Kenya. However, with government regulation as a moderating variable, only the new equipment, and software constructs had a positive and significant influence on the dependent variable. Ultimately, the findings suggest that government regulation moderates the influence of technological innovation on the competitive advantage of telecommunication companies in Kenya.

The term “innovation” has a commercial characteristic different from its meaning in scientific research. Prior researchers have argued that innovation has a very significant role in the economic development of nations. This is because innovative companies, through commercializing their research and development results, create new value (Wen-Cheng et al., 2011). The innovation taking place in the telecommunications industry has triggered certain situations including massive data-intensive services, applications and services that have created new value. The research on this phenomenon has led to the development of several models to explain the relation between technological innovation and competitive advantage. However, the research on this phenomenon has led to the development of several models to explain the relation between technological innovation and competitive advantage. However, the research on this phenomenon has led to the development of several models to explain the relation between technological innovation and competitive advantage.
on the Internet, the call of high-definition multimedia, television services, and the presence of numerous telecommunications technologies. These developments called for an upgrade in the legacy telecommunications systems to the next-generation networks. The next-generation webs are mainly meant to offer clarifications for technology convergence together with quality of service (Arifiani et al., 2019). With respect to convergence of technologies, the natural evolution clearly seems to be the convergence of telecommunications technologies to All-IP technology—that is, the convergence of all types of telecommunications networks to the Internet Protocol (Taulukker & Garcia, 2013).

For the past decade, various innovative technologies have helped telecommunication companies to change lives under the Viable Development Objectives initiatives, which include education, health, and agribusiness apps. The applications have enhanced the efficiency and speed of delivering these services (Trubnikov, 2020).

Africa offers great opportunities in the telecom segment (Nawal & Cherif, 2019). Liberalization of the telecommunications sector, the extension of services by international conglomerates and the active competition currently experienced in the sector have all led to a telecoms revolution. Since privatization and liberalization processes have been deliberated on by various African countries, including Tanzania, Kenya, Uganda, Nigeria, South Africa and Sudan, their telecommunications structures have drastically improved (Adeolu, 2017). Many governments from Africa have industrialized their telecommunications setup through the privatization of enterprises that were formerly owned by the state (Tyagi, 2019).

In spite of the increasing importance of innovation and the role played by technological capabilities in a firm’s growth trajectory, little is known about how technological innovation in different organizations is driven by their technology strategy, or the plan that guides the accumulation and deployment of technological resources and capabilities (Dasgupta et al., 2009). Innovation and entrepreneurial activity are also the engines of long-run economic growth. Often, entrepreneurs first commercialize innovative new products and processes, and entrepreneurial activity provides much of the dynamism in an economy. For example, the economy of the United States has benefited greatly from a high level of entrepreneurial activity, which has resulted in rapid innovation in products and processes (Wen-Cheng et al., 2011).

Statistical information from the Communications Authority of Kenya report (CAK, 2019) indicates that the telecommunications market in Kenya has great growth potential due to its previous low diffusion in mobile and fixed markets. The report further states that the then leading telecommunications firm, Telkom Kenya, lost its dominance in the fixed line and international bandwidth sectors following the liberalization of the market by Kenya’s post-millennium governments. Licenses were delivered to a regional carrier involving a third mobile operator together with numerous new data carriers, which marked a very important change in the competitive scenery for telecommunication services across the country (CAK, 2019). Currently, the Communication Authority of Kenya (CAK) has accredited three mobile operators—Telkom, Airtel and Safaricom—that have, in turn, rolled out their respective networks. The continuous growth in the telecommunications sector is a vibrant indication of the increased focus by operators to provide innovative and competitive products and services that attract consumers (Gituma et al., 2016).

Thus, from the initial two players, the entrance of other network operators has brought intense competition in the industry. Subsequently, the increasing competitive situation has led to price conflicts, which have led to the lowest prices in Africa (Osano & Koine, 2015). The firms therefore have needed to employ various innovative and competitive strategies to survive in the industry (David, 2019). However, the issue of the sustainability of competitive advantage is still in early stages of research. While competitive advantages in the technological sector are subject to relatively rapid erosion—which is difficult to slow down—certainly, there are some methods that can be used, such as patent protection. However, in times of strong competition and dynamic development of science, such methods are not always effective. Sadly, the sustainability of competitive advantages decreases. Thus, to what extent will competitive advantage decrease and what meaning will it have for the practice of management become pertinent questions (Ceglinski, 2017). This study, therefore, examined the influence of technological innovation on the competitive advantage of telecommunication companies in Kenya.

According to Gachigo et al. (2019), the telecommunications industry in Kenya reveals that many companies have not fully integrated innovation and consequently have failed to perform optimally. For this reason, to overcome this challenge, a number of prior researchers have advocated for firms to adopt strategic innovations. Previous researchers posit that these innovations include: financial innovations (Mathenge, 2013); market, product, process, technology (Letangule & Letting, 2012); innovation capability and innovation type (Rajapatrihara & Hui, 2018); Porter’s Five Forces Model of firm performance (Bensecilas et al., 2016); and technological innovation capabilities and absorptive capacity on firm innovativeness (Ince et al., 2016). However, the primary focus of most prior research has been on innovations that have effects on performance. It is no wonder, then, that a recent study has asserted that, although telecommunication firms in Kenya have formulated sound innovation strategies to make sure they gain a competitive advantage, several companies have failed to translate their strategies into a competitive advantage (Gachigo et al., 2019). Consequently, they are unable to increase their chances of survival and growth in the ever-competitive telecommunications marketplace. To address this gap, the major objective of this paper was to investigate the influence of technological innovation on the competitive advantage of telecommunications companies in Kenya. Technological innovation was measured by the expansion of GSM networks, new equipment and software and partnerships and synergies (EYGM Limited, 2019).
Literature Review

Theoretical and Conceptual Background

Theories of innovations and technological advancement focus on key issues that help firms stay ahead of the competition. In many cases, for industrialists, those technological innovations that impact both production and performance require protection by industry leaders and government regulators for fair competition (Trubnikov, 2020). Several scholars, including Dachs et al. (2017), allude to the disruptive innovation theory as the mainstay for innovations on the basis of forced adaptations that firms must undergo, lest they face dethronement from their industry standing. The main protagonists on technological markets have always relied on the fact that, once an innovation comes on board, it has to remain well-marketed and carefully protected or managed to gain the expected profits while recouping most of the costs incurred during research and development prior to the innovation’s introduction (Tyagi, 2019).

Integrating emerging technological innovations and existing stable platforms is a strategic requirement that every CEO should factor into their initial company plans (Porter, 2008). The fact that achieving some form of equilibrium in the market is a must for most companies means that no disruption can be overlooked (Arifiani et al., 2019). Theories on survival therefore come into play as technological innovations emerge. On the other hand, the firms behind the innovations have to stake their claim on the market to justify the heavy investment into research and development. Similarly, existing stable and leading technological applications have to remain relevant and demonstrate that they can serve the market efficiently. These two forces thus create a highly competitive environment, making innovations a highly protected venture (Ceglinski, 2017).

To a large extent, the readiness of a market to receive changes also plays a key role in how technological innovations survive. This implies that the growth of an economy comes into the limelight when innovations appear on the market (Huang et al., 2015). The increasing competition in any economy drives companies into careful consideration of the types of innovations to adopt to achieve competitive advantage. In designing innovations, companies have to carefully market their products with two main strategies in mind: cost leadership and differentiation (Dachs et al., 2017). Exclusive markets are not easy to disrupt, and companies have to rely on the agility of their marketing teams to convince such markets to accept their innovations if any impact is to be made (Nawal & Cherif, 2019).

Figure 1 is a figurative representation of the variables explored in the present study, with the independent variables comprised of partnerships and synergies, expansion of GSM networks, and new equipment and software. The dependent variable was competitive advantage, while the moderating variable was government regulation.

Empirical Review and Hypothesis Development

Studies of the telecommunications industry have focused on partnerships and synergies while building up technological innovations for both existing and new markets. Innovation in any firm plays a strong role in the strategic planning and implementation process.
Jajja et al. (2017) studied the industrial market, focusing on the linkages between innovation strategy and other aspects of firm performance. The study was anchored on resource dependency theory to hypothesize about strategy and its inculcation of innovation through buyer–supplier linkages. The study used a descriptive design and had two sample frames, one in India targeting 450 firms, and the other in Pakistan targeting 850 firms. The analysis used structural equation modelling (SEM) with hierarchical linear regression to test the hypothesis. Key results of the study indicate that buyer–seller relationships do not moderate between innovation strategy and innovation performance. Jajja et al. (2017) specifically point out that, to achieve technological innovation, firms must align themselves with suppliers who are strategically in pursuit of innovations.

The importance of stakeholders in product innovation is emphasized through a similar analysis. In a study by Markovic and Bagherzadeh (2018), the focus was on how externalities influence the product performance of a firm. The key moderating variables included knowledge sharing and product innovation. Using a sample of 1,516 cross-industrial firms in Spain, the scholars aimed to establish, using questionnaires administered in person and online, whether product innovations play an important role in firms’ competitive performance. The study used ordinary least squares regression in analyzing the large amount of data. Markovic and Bagherzadeh’s (2018) results indicated that external stakeholders do not directly influence technological innovation. However, product innovation is heavily reliant on knowledge sharing. This implies that knowledge sharing results in stable technological innovation, hence, there is a need to have partnerships in strategic planning.

One of the key innovations in the market at any stage involves technological advancements that are very easy to note by both rivals and customers alike. This involves the adoption of totally new technology that could lead to increased competitive advantage for the innovating firm or among firms that strategically adopt it for the best market use. A study in Britain on telecommunications forecasting by Oughton et al. (2018) zeroed-in on fast-evolving technologies. The aim was to examine a scenario of the movement from 4G to 5G infrastructure while assessing the implications for mobile network operators. The methodology involved the use of an open-source modeling framework that could forecast technology diffusion in Britain between the years 2016 and 2030. Specifically, the study adopted the Cambridge Communications Assessment Model, which utilizes object-oriented programming techniques. The change in data demand of 4G compared to that of 5G technological advancements provided a forecast from 2020 to 2030. Oughton et al. (2018) found that demand, supply, and the market scenario in Britain were affected by the technological innovation. The authors ultimately foresee a rise in the cost of acquiring new technologies, and that the less wealthy regions that cannot install such technology will be left out of the market bracket.

Management of technological innovations is also important in maintaining a competitive edge on the telecommunications market. A study by Wasono and Furinto (2018) on the Indonesian market focused on digital innovation and its handling by leadership. The main aim of the study was to establish how digital leadership manages innovations that drive telecommunications firms in Indonesia. The study was anchored in disruptive technology theories, combining digital leadership, innovation management and disruptive technology. The authors conducted a survey using a sample 100 companies in the Indonesian telecommunications industry out of a population of 412. Wasono and Furinto (2018) applied partial least squares (PLS) to generate results that indicated that high digital leadership resulted in innovation management that can spur digital disruptions in the telecommunication firms. Technological innovations, therefore, need management through defined digital leadership. Wasono and Furinto (2018) recommend conducting further research into disruptive diffusion that affects the telecommunication industry globally.

The influence on competitiveness of new equipment and software is best demonstrated through successful companies that have innovated technology anchored on such a basis. Dzwigol (2019) demonstrates the mechanism of assessing competitiveness using technology advancements. The study focused on German enterprises that provide green energy in the technology economy. The results demonstrate the revolutionary nature of disruptive technology through software equipment restructuring. However, the cost of equipment and its maintenance plays a key role in the acquisition of such revolutionary disruptions. In conclusion, Dzwigol (2019) asserts that the key role played by equipment and software is demonstrated by the capability of the enterprise to sustain maintenance costs, including support staff and systems.

Similarly, Krammer (2017), in studies on science, technology and innovation for competitive advantage points toward smart specialization in developing countries in which equipment and software acquisition is paramount. In his observations, Krammer (2017) points out that smart specializations in developing countries in Eastern Europe, such as Bulgaria, and other parts of the world are sustainable if approached in a block. Such a smart specialization approach is best suited to economies that practice the exportation of goods, as this enables them to balance their exports with the expense of purchasing new equipment and software. The bottlenecks of regional difficulties in acquiring equipment and software will, therefore, be less burdensome, which could lead to increased competitive advantage by telecommunications companies in the region.

A common theme across the world of business is corporate responsibility, which has become nearly mandatory for all enterprises. Liu (2017), in linking international business to the fourth industrial revolution, focuses on a competitive advantage framework in Singaporean enterprises. Specifically, Liu (2017) points to the economic and regulatory frameworks of a country as key in determining what technological innovations are allowed on the market, both locally and internationally. In both cases, government policy on technology regulators aims to minimize the overall cost of acquisition and maintenance of such new and revolutionary technology. It also emerges that, without government regulation, some firms would take advantage of their revolutionary technology
to gain an unfair advantage. Liu (2017) concludes that most firms would easily copy the revolutionary technology if no structures exist to protect such innovations.

The government and regulatory authorities also play a key role in protecting the local economy from unwanted revolutionary technology. Cohen and Tubb (2018) have focused on the environmental regulations that impact the competitiveness of technology firms. The scholars establish that there is a strong relationship between environmental regulations and firm-level or country-level competitive advantage for technology-driven firms. This study is grounded in Porter’s (1985) competitive advantage hypothesis in which profitability can be affected through strict environmental rules set by government regulators. However, Cohen and Tubb (2018) recommend that regulations for any country require a collaborative approach in which technology-based production companies form associations to comply with robust environmental requirements. A good example at present is the debates over 5G, as highlighted by Frias and Martinez (2018) in their study of their frameworks and architecture. Essentially, the scholars argue that the many requirements for 5G networks will lead to a conflict with the regulators implying that objective neutrality might not exist. Specifically, Frias and Martinez (2018) point to the fact that the introduction of the 5G network through the anything-as-service paradigm might prove successful in the future of economic development.

The present world economy is largely driven by technological innovations, giving companies with an edge over their rivals, full competitive advantage in their market sector. Studies by various scholars point to the high competitiveness of the technological industries, meaning that companies have to stay well informed of their technological advancements. Ratten (2018) focused on the wine region of Borossia in Australia to establish the effect of green innovation on the competitiveness of vineyards. Using clustered semi-structured interviews, Ratten (2018) approaches the study in qualitative form. The findings indicate a clear advantage to the companies that practice eco-innovation, leading to strong international competitive advantage. The study implications are that enterprises utilizing their innovative capacities stand a high chance of competing favorably on the global market. Specifically, enterprises that demonstrate certified compliance with well-established international standards of quality have their goods accepted globally and, as a result, enjoy a strong competitive advantage.

The importance of technological innovations as a pillar of industrial development is emphasized by studies on competitiveness in Romania. Focusing on innovation and competitiveness, Andrei (2019) posits that every company is concerned with innovations, both internally and externally, in its environment. The intense research and development behind every innovation necessitates the establishment of a large financial reserve to cushion the innovative company and sustain its market position in case the innovation does not generate profit. In any case, the sole purpose of undertaking innovations in terms of technology is to reduce costs and increase the chances of profit maximization. In addition, Asheim (2019) established that smart specialization with a good innovation policy can help increase competitiveness, especially in less developed nations, both in Europe and the rest of the world.

This study tests the following hypotheses:

*H_1*: There was no relationship between technological innovation and competitive advantage in telecommunications companies in Kenya.

*H_2*: Government regulation had no significant effect on the relationship between technological innovation and competitive advantage in telecommunications companies in Kenya.

**Research and Methodology**

**Empirical research and goals of the study**

The reliability and validity of the “technological innovation” scales for developed expansion of GSM networks (Tiwari et al., 2015), new equipment and software (Griffith & Rubera 2014) and partnerships and synergies (Zawislak et al., 2012) were based and measured on a 5-point Likert scale, grounded in the innovation capability framework model. In this paper, we aim to identify the influence of technology innovations on competitive advantage.

**Sample and data collection**

The target population for the study comprised all 26 telecommunications companies listed by the Communication Authority of Kenya (2019). The total number of managers in these companies were 8,689, and using Cochran’s formula of two-step sampling, the total sample size obtained was 311. The top ten companies on the index enjoy a market share of more than 97.5%, hence, proportionate sampling was used to obtain the sample size for each company.

The field response sample was 247 managers in 26 telecommunication companies. The questionnaire was distributed to employees by hand, and they were asked to fill out the forms during the day. Further, empty envelopes were given to the participants to enclose the questionnaire as a way of building trust in their anonymity. After data cleaning, the data were analyzed using factor analysis to test the validity and suitability for Kenyan telecommunication firms of this scale.

**Analysis and interpretation of data**

The factor structure was established using the method of exploratory factor analysis, which is widely used in scale development studies. The method used by Mets and Torokoff (2007) was used for the verification of the factor structure of the scale (Sekaran &
The principal component matrix obtained after the explanatory factor analysis was subjected to varimax rotation (Saunders et al., 2016). SPSS version 26 was used for the explanatory factor analysis and other analyses in the study.

The study adopted the positivist research philosophy, whereby subjective and quantitative information was utilized to accomplish triangulation. Positivism is a decent rationality, as it does not confine one’s decision to positivism and interpretivism, seeing that strategies, rationale and epistemology are concerned (Creswell & Poth, 2018). The research design used was a descriptive design utilizing both quantitative and qualitative methodologies (Cooper & Schindler, 2014).

Results and Findings

Measure of validity and reliability

Following the data collection, all measurement scales were evaluated based on the following criteria: multi-collinearity, heteroscedasticity, normality, sample adequacy, convergent and divergent validity and reliability. Since the scales were used with a new sample, the measures were first subjected to exploratory factor analysis. The best fit of data was obtained by applying to the data a principal component analysis using a varimax rotation. Convergent validity, which shows the extent to which measures of a construct are indicative of the direction and size of that construct, was analyzed through factor analysis (Creswell & Poth, 2018). To obtain individual constructs, factors with eigenvalues greater than 1 were considered significant (Saunders et al., 2016). Furthermore, the Kaiser-Meyer-Olkin test, which informs researchers about the adequacy of the scales, was 0.88. Consequently, the presented items of the measurement scale were found to be appropriate to measure the variables used in the model.

Next, means and standard deviations for each factor were calculated and created a correlation matrix created, as shown in Table 1. The means and standard deviations are within the expected ranges. The correlation analysis shows that all of the constructs, each differing from each other as a factor, are significantly related to each other when one-to-one correlations are considered; moreover, the relatively low-to-moderate correlations provide further evidence of discriminant validity. To ensure the reliability of the measurement instruments, Cronbach’s alpha values were calculated. As shown in the diagonal of Table 1, the Cronbach’s alpha values for all constructs exceed the standard of 0.70, which is the lower threshold of acceptability (Sekaran & Bougie, 2016).

Reliability: The Cronbach’s alpha statistic was used for testing the reliability of the scale. In this context, the values were calculated separately for each factor. In addition, the contribution of the questions in the scale, both on their own factors and on the whole scale, was analyzed using the “Cronbach’s alpha if item deleted” statistic. After the analysis, the positive contribution of all items to the reliability of the scale and alpha values of 0.70 and above (Saunders et al., 2016) were determined as the minimum criteria to verify the reliability of the scale.

Validity: The data obtained through exploratory and confirmatory factor analysis (Saunders et al., 2016) and reliability values of factors in the scale were used in the assessment of the discriminant validity of the scale. The assessment of the structural validity of the scale was based on the conformity of the data to the normal distribution.

Table 1: Factor correlations, means, standard deviations and Cronbach’s alpha

<table>
<thead>
<tr>
<th>Factors</th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expansion of GSM networks</td>
<td>3.46</td>
<td>.09</td>
<td>α=.867</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New equipment and software</td>
<td>3.71</td>
<td>.27</td>
<td>.033</td>
<td>α=.670</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partnerships and synergies</td>
<td>3.52</td>
<td>.31</td>
<td>-.033</td>
<td>.050</td>
<td>α=.655</td>
<td></td>
</tr>
<tr>
<td>Competitive advantage</td>
<td>3.86</td>
<td>.42</td>
<td>.138*</td>
<td>.246**</td>
<td>.076</td>
<td>α=.741</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Results

Table 2 shows the results for two models, one that includes the moderating variable and one that does not. The equations are as follows:

Model 1: \( Y = \beta_0 + \beta_1 I + \varepsilon \)

Model 2: \( Y = \beta_0 + \beta_1 I + \beta_2 I^*Z + \varepsilon \)

where:

\( Y = \text{Competitive advantage}; I = \text{Technological innovation}; Z = \text{Government regulation} \)

\( I^*Z = \text{Technological innovation} * \text{Government regulation} \)

\( \beta, \beta_1, \beta_2 = \text{Beta coefficients} \)

\( \varepsilon = \text{Error term} \)
The output for Model 1 (without the moderating variable) indicates that the effect of technological innovation on the competitive advantage of telecommunications companies is statistically significant, $R^2$ (adj.) = 0.08, $F$ (4, 243) = 7.80, $p < .05$. This shows that approximately 8% of the competitive advantage of telecommunication companies is attributed to technological innovation in an environment where there are no government regulations. The remaining 92% can be attributed to other factors not included in the study and the error term.

The output for Model 2 indicates that the effect of technological innovations on the competitive advantage of telecommunication companies with the inclusion of the government regulation as the moderating variable is statistically significant, $R^2$ (adj.) = 0.14, $F$ (1, 242) = 20.17, $p < .05$. This shows that 14% of the competitive advantage of telecommunication companies in Kenya is attributed to technological innovation in an environment moderated by government regulations. The remaining 86% can be attributed to other factors not included in the study and the error term. A comparison of Model 1 and Model 2 shows that including the government regulation variable increases the rate at which technological innovation affects the competitive advantage of telecommunication companies.

### Table 2: Model summary of the moderating variable on competitive advantage

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R square</th>
<th>Adjusted R square</th>
<th>Std. error estimate of R square change</th>
<th>F change</th>
<th>df1</th>
<th>df2</th>
<th>Sig. F change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.30*</td>
<td>.09</td>
<td>.08</td>
<td>.41</td>
<td>.09</td>
<td>7.80</td>
<td>3</td>
<td>243</td>
</tr>
<tr>
<td>2</td>
<td>.40*</td>
<td>.16</td>
<td>.14</td>
<td>.40</td>
<td>.07</td>
<td>20.17</td>
<td>1</td>
<td>242</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Expansion of GSM networks, New equipment and software, Partnerships and synergies
b. Predictors: (Constant), Expansion of GSM networks, New equipment and software, Partnerships and synergies, Government regulations

The results of the test of Hypothesis 1 is shown in Model 1 of Table 3. The results of the regression show that all the constructs had a positive and significant influence on competitive advantage: a 1-unit increase in new equipment and software corresponds to an increase in the competitive advantage of telecommunication companies of 0.21 ($\beta = .21$, $t = 3.48$, $p < .05$). Similarly, a 1-unit increase in the expansion of GSM networks increases the competitive advantage of telecommunication companies by 0.14 ($\beta = .14$, $t = 2.33$, $p < .05$). Lastly, a 1-unit increase in partnerships and synergies increases the competitive advantage of telecommunication companies by 0.13 ($\beta = .13$, $t = 2.19$, $p < .05$). New equipment and software had the highest influence, followed by expansion of GSM networks, and partnerships and synergies. This led to the rejection of the null hypothesis, H1: There was no relationship between technological innovation and competitive advantage in telecommunications companies in Kenya.

The results of the test of Hypothesis 2 are indicated in Model 2 of Table 3. The results of the regression show that the inclusion of the government regulation variable influences the rate at which technological innovations affect competitive advantage. With the introduction of government regulation, only the new equipment and software construct had a positive and significant influence ($\beta = .18$, $t = 3.02$, $p < .05$). Expansion of GSM networks ($\beta = .11$, $t = 1.87$, $p > .05$) and partnerships and synergies ($\beta = .27$, $t = 4.49$, $p < .05$) had positive but not significant influences. This shows that government regulation as a moderating variable plays a key role on the effects of new equipment and software in the telecommunications industry. This led to the rejection of the null hypothesis, H2: Government regulation had no significant effect moderating on the relationship between technological innovation and competitive advantage in telecommunications companies in Kenya.

### Table 3: Coefficients of technological innovation on competitive advantage

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized coefficients</th>
<th>Standardized coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>2.34</td>
<td>.25</td>
<td>9.57</td>
</tr>
<tr>
<td></td>
<td>Expansion of GSM networks</td>
<td>.10</td>
<td>.04</td>
<td>.14</td>
</tr>
<tr>
<td></td>
<td>New equipment and software</td>
<td>.112</td>
<td>.03</td>
<td>.21</td>
</tr>
<tr>
<td></td>
<td>Partnerships and synergies</td>
<td>.09</td>
<td>.04</td>
<td>.13</td>
</tr>
<tr>
<td>2</td>
<td>(Constant)</td>
<td>1.76</td>
<td>.27</td>
<td>6.55</td>
</tr>
<tr>
<td></td>
<td>Expansion of GSM networks</td>
<td>.08</td>
<td>.04</td>
<td>.11</td>
</tr>
<tr>
<td></td>
<td>New equipment and software</td>
<td>.10</td>
<td>.03</td>
<td>.18</td>
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<tr>
<td></td>
<td>Partnerships and synergies</td>
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<td>.04</td>
<td>.11</td>
</tr>
<tr>
<td></td>
<td>Government regulations</td>
<td>.22</td>
<td>.05</td>
<td>.27</td>
</tr>
</tbody>
</table>

a. Dependent variable: competitiveness
Discussion

Partnerships and synergies

Many scholars have supported the findings indicating that partnerships and synergies play an important role in enhancing the competitive advantage of telecommunications firms. Jajja et al. (2017) have pointed toward good designs and innovations on the technological front that offer customers a variety of choices and hence increase market share for the firm. This occurs when there are strong partnerships and synergies between firms and customers. Other researchers have also produced findings similar to this study. Markovic and Bagherzadeh (2018) acknowledged that innovations surpass old technological standards and offer consumers the opportunity to enhance their capabilities to accomplish tasks and improve their social status resulting from the stakeholder synergies. This implies that innovations generate synergies and partnerships that influence organizational performance through technological advancement.

Expansion of GSM networks

Similar studies indicate that expansion of GSM networks has a high chance of increasing competitive advantage. Oughton et al. (2018) found that demand, supply, and the market scenario reduced the cost of acquiring the new technologies, and that the less endowed regions that cannot install such technology would be left out of the market bracket. However, the scholars noted that technological innovations enhance the ability of the firm to link up with stronger partners on the market, with the hope that a partnership on the technological front could improve the chances of reducing costs for the expansion of GSM networks, thus, working to the advantage of the firms carrying out the innovation (Wasono & Furinto, 2018).

New equipment and software

Oughton et al. (2018) acknowledged that innovations surpass old technological standards and offer consumers the opportunity to enhance their capabilities to accomplish tasks and improve their social status. Oughton et al. (2018) also found that a noteworthy effect on organization performance was from technological advancement. The organizations that endeavor to create procedures and items improve the execution of the firm, including quantitative and subjective execution. Wasono and Furinto (2018) also found positives in the technological innovations. By recommending further research in disruptive diffusion that affects the global telecommunications industry, the authors endorse the pursuit of acquiring new equipment and software through partnerships. On the contrary, some scholars also contend that, unless a firm is aggressive in marketing the new technological innovations, their rivals could even turn the new technology into a disadvantage for that firm. This means that technological innovation is not an assurance of competitive advantage, since some old equipment or software is known to be so robust that new entrants on the market fail to have any impact (Tyagi, 2019).

Moderating effect of government regulation

The findings for this study were in line with several scholars who also indicated the significance of government regulations in the telecommunications market. Monsreal-Barrera et al. (2019) pointed out in their conclusions that the government acts as a great control to telecom firms by ensuring that there is fairness in the competitiveness of the firms. The scholars contend that benefits advancement could be the key to having government regulators since customers face the risk of being exploited by the rival firms if not checked by the regulator. Similarly, Monsreal-Barrera et al. (2019) indicate that the government is always the arbitrator between the firms in either competition or when they have gone against customer wishes, noting that reduced costs of technological advancements will ease regulation by governments.

Conclusions

The results of this study showed that technological innovation has a significant effect on the competitive advantage of telecommunications companies in Kenya. From the studied companies in the field, there was evidence that technological innovations are highly preferred on the market by customers. Such innovations, if well protected by both the law and the innovating firm, will likely always stand out as a factor in maintaining competitive advantage. In general, Kenyans like to have new innovative technologies that are reliable and functional at whatever cost. Technological innovation, therefore, stands out as a key influence on competitive advantage in telecommunications companies in Kenya.

The study recommends that policymakers in Kenya use these findings as guidance on supporting technological innovation. This could be an indication that there is a need to support local technical institutions as well as advocate for the inculcation of technical subjects in the curriculum, which in turn support the technical innovation thought process. The study, however, recommends that there is a need for firms to consider which technological innovations are worth adopting to avoid cases of expensive innovative technologies that later prove cumbersome or too costly to sustain. Specifically, the study recommends that firms should only choose innovative technologies that provide economies of scale, regardless of whether they appear cheap or not. The study recommends more stringent government measures to curb any forms of cheating or contravention that give a firm an unwarranted competitive advantage. Telecommunications players could use the findings of this study to lobby for policies that improve market fairness in terms of innovativeness and market competitive advantage.
References


