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# Technology Strategy and Competitiveness in Developing Nations: Exploratory Evidence from Nigerian Telecommunication Market

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ABSTRACT

*While direct link between technology strategy and competitiveness have been established there is dearth of quantitative research on the relative influence of key technology strategy constructs. Similarly although technology strategy is more daunting in developing countries most literatures predominantly focused on developed nations. Against this background scales were source from literature and focus group analysis. Principal component factoring and principal factor axis was run on 157 valid responses from Nigerian telecommunication industry to explore and confirmed the unidimensionality of the constructs. In addition, reliability analysis and constructs correlation provides evidence for constructs validity. Result indicates technology strategy significantly explained the variance on organizational competitiveness. Furthermore Beta coefficients indicate training, maintenance & exploitation policy (TMEP) is the most important driver of competitiveness reinforcing the need for skillful manpower and internal infrastructure to accommodate new acquisitions in technology strategy. Finally theoretical and managerial implications of the research findings were highlighted.*

**Keywords:** *Competitiveness, Developing Countries, Nigeria, Technology Strategy, Telecommunication*

## Introduction

Few organizations are immune from the pervasive influence of technology in today's sophisticated business environment (Skinner, 1985). More so, fewer industries are exposed to the consequence of technology strategy like telecommunication. As new technologies are invented and old ones improved, firms try to integrate them for optimal organizational performance. To do this well, given the variety, invention/obsolescence rate, cost and complexities of technological resources, firms need to find answers to questions such as: what, when and how should organizations acquire, utilize, maintain, upgrade, and replace these resources as well as the right organizational disposition to maximize integration of technological resources. Hence, it is increasingly clear that organizations require a reasonable, comprehensive and explicit technology strategy (Ahmad, 2005; Burgelman, Christensen & Wheelwright, 2004; Christensen, 1997; Khalil, 2001; Narayanan, 2001) to excel today. Porter (1985) underscores this point by pointing out that technology not only affects firms' competitive position but also overall industry structure. The situation is further aggravated by rapid changes taking place in telecommunications industry making it difficult for operators to remain focus (Byrnes, 2004).

The role telecommunication plays in today's increasingly globalize world cannot be overstated, in Nigeria for example research has shown investment in telecommunication positively impacts the economy in the areas of teledensity; stimulation of associated industries; corporate social investments; technological development; manpower development; increase the productive capacity of the economy employment generation (Elegbeleye, 2005; Okoruwa, 2007). Beside, vibrant telecom sector is regarded as prerequisite for attracting Foreign Direct Investment (FDI), hence no country can achieve an appreciable level of development without reaching the telecommunication comfort zone (Ndukwe, 2004). Additionally, positive co-relationship between economic growth and telecommunications penetration was established decades ago through the economic theory of the Gipps Curve (Nxele & Arun, 2005).

On the surface, it seems an inconsequential study. Organizations with up-to-date technologies are going to excel and vice-visa, thus telecom firms should speedily patronize new and sophisticated technologies. However, the relationship between technology availability, acquisition timing and technique, maintenance, among others on corporate competitiveness is somewhat contradictory (Carr, 2004; Hamel & Skarzynski, 2001) and complex (Ahmad, 2007; Farrell, 2003; Kotler, 1999; Maidique & Hayes, 1984). Similarly, most of the studies on technology strategy and corporate performance focused in developed nations (See for example, Baines (2004), Carr (2004) & Farrell (2003)) and failed to establish quantitative relationship. Developing countries however, present a unique operating environment that lacks solid technology base; preponderance of customers with low disposable income; and high cost and scarcity of capital (Sull, Ruelas-Gossi & Escobari, 2004) as a result technology strategy is more daunting in developing nations (Hipkin, 2004). The few available studies conducted in developing countries such as Indian automobile industry (Narayanan, 1997), Nigerian Medical sector (Ahmad, 2005) and South Africa (Hipkin, 2004) neglects high-tech industries and tend to provide generic rather that specific drivers of firms service delivery capabilities and overall competitive positions. Hence, this paper attempts to identify the overall and relative influence of key technology strategy drivers of organizational competitiveness in Nigerian telecom industry.

## Literature Review

### Technology

Technology has been used in management literature to represent many things by different authors. However recently Ahmad & Ahmad (2006) decomposed technology into two overlapping areas. What organization offer to the market-*technology product* and what organization requires to operate-*technology resource*. Ahmad & Ahmad (2006) further expounded that technology resource comprise three overlapping elements: machines (tools, structures, equipment); men (skills, expertise, knowledge); and method (relationship within and between men and machines). Few authors captures these elements than Zayglidoupolous (1999), who view technology (resource) as the codifiable and non-codifiable information and knowledge that is embedded partly in manuals and standard practices, partly in the machinery and equipment, and partly in people and social organization of a particular organization. Burgelman, Maidique & Wheelwright (2001), add functional facet to technology, as the theoretical and practical knowledge, skills, and artefacts that can be used to develop products and services as well as their production and delivery systems.

### Technology Strategy

From the foregoing, technology strategy is concerned with the deployment of technology for competitive advantage (Burgelman et al., 2001). Technology resource strategy includes but not limited to the: methods and responsibility of technology acquisition; policy on obsolescence's, update and retirement; determining organizational technology need; technology partnership and alliance; technology competence and competitive advantage (Ahmad & Ahmad, 2006; Baines, 2004; Burgelman et al., 2001; Khalil, 2000). The scope of technology strategy for technology (producing) firms involves both the management of technology resource and product (Ahmad & Ahmad, 2006).

One key area of technology strategy that received attention of researchers is acquisition timing, method and responsibility. Writing on acquisition timing, Kotler (1999) note that, taking advantage of a new technology entails working on a thin line. Firms should not jump too early or too late before the market is ready or already conquered respectively. In the case of micro-wave oven, he observed, three decades passed before it became a popular household appliance, in the meantime firms that jumped to early suffered substantial financial loss. Carr (2004) assert a more direct position, observing that, companies that stay off the leading edge not only reduce their chance of being saddled with soon-to-be-obsolete technology but are also better position to learn from the successes and mistakes of early movers, enabling them not only to avoid unnecessary costs but, often, build better systems. Despite FedEx aggressive and UPS cautious technology acquisition and adoption strategy respectively Carr (2004) noted that UPS handles more shipments from Internet retailers. Hamel & Skarzynski (2001), on the other hand attribute the superlative performance of CNN and Schwab on early adoption of new technologies, notably minicam, satellite and Internet. As a result they argued Schwab controls 30 percent of all Web-based stock trading, and more than double its market capitalization under a decade to pull even with Merrill Lynch, which engage the internet relatively lately.

Research by Farrell (2003) suggests the positions of Carr (2004) and Hamel & Skarzynski (2001) may not be contradictory after all. She observed that the critical question is for organizations to know when and where to lead and when and where to follow. Farrell (2003) argued that a company should only pursue aggressive acquisition and deployment policy, when the technology hold direct potentials to advance its business goals, enable true innovation that strengthens existing competence, and will be difficult to imitate. She argued that three important practices distinguish companies that were most successful in their IT acquisition and utilization: Acquiring IT equipment that are most relevant to their organizational and industrial requirements; careful thought through the sequence and timing of their investments; and pursuance of IT (acquisition and deployment) in tandem not in isolation with managerial innovations. Her study attributed the conflicting fortunes of Wal-Mart and Kmart to adherence and non-adherence to these practices respectively.

## Firm Competitiveness

Similarly, Baines (2004) outline as many as nine vital steps in an attempt to develop a complete, rational and integrated decision process of technology acquisition to increases firm competitiveness in manufacturing discourse. These steps include: technology profiling; establish requirements of technology; find a technological solution; form outline business case; choose technology source; demonstrate technology; confirm business case; implement technology and post-investment audit. Although the above studies virtually focused on acquisition but they nevertheless provide important insight on key variables relating to timing, linking acquisition with organizational vision as well as industrial requirements. Maidique and Hayes (1984) on the other hand advocate success in high-tech environment as an overall function of organizational disposition. Towards this end they identified six areas where successful high-tech firms score high; business focus, adaptability, organizational cohesion, entrepreneurial culture, sense of integrity, and hands-on top management.

Likewise, a number of studies found service delivery capabilities to play a significant role on competitiveness especially in saturated on telecommunication/ GSM markets by engendering customer satisfaction and loyalty. For example Muthaly, Ho & Lo (2007) found variables such as customer service, pricing policy and transmission quality to significantly explain 68% of the variance on customer satisfaction. Other studies (see for example Ahmad, 2007; Athanassopoulos & Iliakopoulos, 2003; Aydin, & Özer, 2005; Busacca & Padula, 2005; Lim, Widdows & Park, 2006; Woo & Fock, 1999) also found service delivery capability (operationalized to include coverage services, calls quality, competence/ kindness of contact personnel; transparency of the offers and value added services) to positively influence satisfaction, loyalty and market share.

In a study on Nigerian medical establishments Ahmad (2005), observed that despite high reliance on machineries and equipment few clinical outfits conduct formal assessment of these essential resources. The study further revealed that while lack of fund is the main reason for technology unavailability and inadequacy, yet firms virtually relied on the most costly technology acquisition option-direct purchase. Apart from lack of awareness there seems to be many other daunting challenges facing technology management in developing nations, Putranto et al. (2003) for example observed that since developing countries do not possess the necessary technology resource inputs nor do they have the capacity for R&D, importation is a key element of technology strategy. Similarly, Hipkin (2004) buttress the interference of environmental influence in fashioning technology strategy in developing economies such as resources, competencies and financial constraints. In the same vein, survey revealed in addition to the normal initial start-up capital expenditure for telecom financing such as taxes; duties; site acquisition costs; and equipment importation. Telecom operators in developing nations incurs additional capital outlay on building/maintaining roads to base stations; generators to operate the network; backbone telecommunication transmission equipments; high interest rate and possible low value of local currency in international market (*Pyramid Research*, 2001). In addition there is generally lower quantity of qualitative labour in developing nations, little wonder Hipkin (2004) concludes that technology strategy is more daunting in developing nations. From the foregoing variables such as management awareness, responding to environmental social and economic pressure, quality of labour, cost considerations among others influence technology strategy in developing nations.

In synopsis while management literatures generally indicates technology strategy has direct link with organizational competitiveness there is dearth of quantitative research that clearly demarcates key factors and their (relative and overall) influence of firms competitiveness.

## Methodology and Sample Characteristics

The research was conducted among providers of telecommunications, specifically telephone services in Nigeria. In general there are 37 licensed telecommunications firms offering telephonic services in Nigeria. With 27 active licensed fixed line operators and 10 licensed mobile operators, despite their numerical disadvantage mobile providers control 94% of the market (NCC, 2006). With no strong theoretical basis for classifying dimensions items were largely adaptéd from Hipkin (2004), other literatures aforementioned and focus group analysis. Similarly, competitiveness scales were developed from literature and refine via focus group analysis. The instrument has 38 items measuring perceived technology strategy and 14 items measuring perceived competitiveness, divided into 7 each for perceived *Competitive Competence* (CC) and *Service Delivery Capability* (SDC). Questionnaire designed on five point scale anchored on 1 'strongly disagree', 3 'neutral' and 5 'strongly agree' were distributed to staff of telephone providers in northern part of the country, specifically Bauchi, Kaduna, Kano and Plateau states. Out of the 400 administered questionnaires only 170 were retrieved, however casual observation revealed a number of morbidity and substantially unfilled cases, 157 cases were retained after removing these cases.

Analysis of the valid response revealed 126 to be male (80.3%) and 30 were female (19.1%), while 1(0.6%) respondent failed to indicate his/her gender. Regarding respondent's age, only 1(0.6%) respondent was younger than or 17 years old; the vast majority 140(89.2%) were between the age of 18 and 36; and 16(10.2%) were between 37-55 years old. In terms of employment status, full time staff accounted for 134(85.4%) of the sample while students on industrial training and contract staff represented only 12(7.6%) and 4(2.5%) respectively, 7(4.5%) have 'other' categories of employment status. In relation to respondents ranks, 7(4.5%) were clerks; 99(63.1%) were officers; while 33(21%) and 15(9.6%) were at managerial and executive level respectively, 3(1.9%) failed to indicate their rank. Concerning respondent working department 14(8.9%) work in personnel department; 44(28%) were deployed to marketing/customer service; 21(13.4%) work in maintenance department; whereas majority of the respondents 62(39.5%) were attached to work in technical/engineering units, finally 16(10.2%) work on 'other' sections. The vast majority of the respondents 131(83.4%) work with GSM firms, followed by CDMA 14(8.9%), while respondents from fixed line operators only accounted for 12(7.6%).

## Analysis and Discussion

A number of descriptive statistical analyses were conducted to assess normality and identify outliers. No significant normality violation was observed after deleting two univariate outliers. To validate dimensions and discover groups of related items correlations among all the 38 independent variable items was conducted using Exploratory Factor Analysis (EFA), via a Principal Component Factoring (PCF) as recommended by Netemeyer, Bearden & Sharma (2003). Significant Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) and Bartlette's tests of sphericity (BTS) provides strong support for the validity of running Factor Analysis (FA) on the dataset. Initial runs showed, seven factors on the basis of initial eigenvalues, however *Kaiser Criterion* often exaggerates the true number of factors, in some cases severely (Lance, Butts & Michels, 2006). Hence, when items with significant cross loadings and loading of less than 0.45 were remove, a six factor solution explaining 74.7% of the variance emerge with 30 items left. A number of rotation methods were tried to facilitated interpretation, finally oblique offers a more meaningful factor pattern. Factors were loosely name *Acquisition Policy* (AP); *Integration Strategy* (IP); *Training, Maintenance & Exploitation Strategy* (TMEP); *Safety & Management Issues* (SMI); *Environmental* (EP) and *Objective, Cost and Retirement* (OCRP) in line with the collection items in each factor.

Thereafter construct validity for all the six IVs and two DVs (CC & SDC) were examined using Principal Axis Factoring (PAF), constructs correlations, factor loading, factor structure and reliability analysis. The following measures: eigenvalues; factor loading and eigenvalues ratio provides evidence of unidimensionality for the eight constructs. For example, with regard to eigenvalues none of the eight factors have a second eigenvalue reaching one, hence evidence of absolute unidimensionality, while on the basis of factor loading all constructs exceed the 0.45 loading given the sample size (see table 1 & 2). Finally on the basis of eigenvalues ratio (also presented in table 1 & 2), six factors exceeds the 4.0 stringent prerequisite indicating strict unidimensionality (Hattie, 1985) while the remaining two constructs EP (3.4) and OCRP (3.2) both have ratios exceeding 3.0 indicating essential unidimensionality.

Convergent validity was assessed via factor loading, constructs reliability and factor structure (Garson, 2006; Hair et al., 2006). On the basis of factor loading all the eight constructs exceeds the minimum cut-off load of 0.45 required for a sample of 150 hence, statistical significance. Beside, all but two constructs (ORCP & CC) meet the 0.50 stringent cut-off recommended for convergent validity (Hair et al., 2006). However, even ORC & CC all other items except ORCP4 (0.49) & CC6 (0.45) meet the 0.50 strict requirement, nevertheless these items and constructs were left in the analysis in line with (Hair et al., 2006 p.129), that 'lower loadings (less than 0.5) considered significant (can be) added to the interpretation based on other (favorable) considerations'. Likewise all the constructs under study exhibit a clean factor structure and good internal consistency.

Table 1: IVs Factor Loading, Eigenvalues Ratios, Cronbach's Alpha and Correlations

| Factors & Loading of Items Included | Factors Correlation | |
|---|---|---|
| *Acquisition Policy* | TMEP | 0.653 |
| AP1 Scans the market for new relevant machineries & equipment 0.860 | | |
| AP2 special policy for vital technologies 0.825 | **IP** | 0.803 |
| AP3 Cogent partnership with technology vendors 0.817 | | |
| AP4 Technology decisions are justified on cost/benefit basis 0.772 | SMI | 0.626 |
| AP5 Encourages champions of new technologies 0.764 | | |
| AP6 Pioneering the deployment of sophisticated technology 0.748 | | |
| AP7 Offsetting cost of developing workforce with technical capabilities 0.734 | EP | 0.584 |
| AP8 Considers adaptability of technology to local conditions 0.599 | | |
| AP9 Clear policy on disseminating intangible technical knowledge 0.592 | ORCP | 0.410 |
| ***Cronbach's alpha, 0.917: Eigenvalues Ratio, 6.5*** | | |
| *Integration Policy* | **AP** | **0.803** |
| IP1 Link between Technology policy and overall business goal 0.846 | | |
| IP2 Creativity in managing technology issues 0.816 | **TME** | **0.707** |
| IP3 Acquiring relevant technologies 0.758 | SMI | 0.541 |
| IP4 Integrating new technologies with existing ones 0.745 | EP | 0.611 |
| IP5 Codification/documentation technology related knowledge 0.668 | | |
| ***Cronbach's alpha, 0.874: Eigenvalues Ratio, 5.9*** | ORCP | 0.394 |
| *Training, Maintenance & Exploitation Policy* | AP | 0.653 |
| TMEP1 Continuous training of technology-related staff 0.812 | **IP** | **0.707** |
| TMEP2 Quality through new technology 0.760 | | |
| TMEP3 Quality of labor 0.728 | SMI | 0.420 |
| TMEP4 Maintenance & repairs policy 0.716 | EP | 0.596 |
| TMEP5 Internal infrastructure to accommodate new technology 0.676 | | |
| ***Cronbach's alpha, 0.856: Eigenvalues Ratio, 5.3*** | ORCP | 0.359 |
| *Safety & Management Issues* | AP | 0.626 |
| SMI1 Safety of its technical staff 0.840 | TMEP | 0.420 |
| SMI2 Clear guidelines on safety of physical machineries & equipment 0.835 | IP | 0.541 |
| SMI3 Top management understanding of telecom technologies 0.631 | EP | 0.417 |
| SMI4 Using technology to support knowledge based business aims 0.591 | | |
| ***Cronbach's alpha, 0.800: Eigenvalues Ratio, 4.2*** | ORCP | 0.358 |
| *Environmental Policy* | AP | 0.584 |
| EP1 Technology policy & overall economic/ infrastructural development 0.795 | TMEP | 0.596 |
| EP2 Technology policy and the national crime level 0.751 | IP | 0.611 |
| EP3 Greater output through new technologies 0.588 | SMI | 0.417 |
| ***Cronbach's alpha, 0.750: Eigenvalues Ratio, 3.4*** | ORCP | 0.279 |
| *Objective, Retirement & Cost Policy* | AP | 0.410 |
| ORCP1 Clear objective required from technology 0.770 | TMEP | 0.359 |
| ORCP2 Retiring, replacing and disposing technologies 0.650 | IP | 0.394 |
| ORCP3 Estimation of hidden costs of technology investments 0.515 | SMI | 0.358 |
| ORCP4 My firm spends a lot of money on obsolete technologies 0.493 | EP | 0.279 |
| ***Cronbach's alpha, 0.695: Eigenvalues Ratio, 3.1*** | | |

In addition to factor structure aforementioned, discriminant validity is evaluated via constructs correlations (see Table 1). Examination of the matrix indicated IP have very high correlations with AP (0.803) & TMEP (0.707) this led to the removal of the construct from further analysis. Thereafter correlations between IVs were all lower than benchmark of 0.70 (Sekaran, 2003), the highest correlation is being 0.653 between AP and TMEP, indicating acceptable discriminant validity.

Table 2: DVs Factor Loading, % of Variance, Eigenvalues Ratios, and Cronbach's Alpha

| |
|---|
| *Competitive Competence* |
| CC1 Our technology strategy gives us distinctive competency 0.924 |
| CC2 Our technology strategy enable us improved relationship with our stakeholders 0.919 |
| CC3 Our technology strategy enable us neutralizes advantages of competitors 0.918 |
| CC4 Our technology strategy enable us make strategic alliances & partnerships 0.916 |
| CC5 Our technology strategy enable us minimize the effects of harsh operating environment 0.562 |
| CC6 My firm spends so much resources on technology with very little results (R) 0.450 |
| ***Cronbach's alpha, 0.906: % of Variance Explained, 65.02: Eigenvalues Ratio, 5.0*** |
| *Service Delivery Capability* |
| SDC1 Our technology strategy enables us offers wide variety of qualitative services 0.938 |
| SDC2 Our technology strategy greatly enhance our ability to offer value-added services 0.891 |
| SDC3 Our technology strategy enables us charge lower prices & deploy a reliable billings system 0.824 |
| SDC4 Our technology strategy is key to our ability to advertise, market and promote our services 0.822 |
| SDC5 Our technology strategy enables us provide reliable and error-free services 0.738 |
| ***Cronbach's alpha, 0.925: % of Variance Explained, 71.48: Eigenvalues Ratio, 9.0*** |

R = Reverse Items

Assessment of constructs internal consistency indicate Cronbach's Alpha values ranges from 0.695 for ORCP to 0.917 A (see table 2) for the IV and 0.906 (CC) to 0.925 (SCD) (see Table 2) for the DV scales, these values exceeds the 0.60 (Bagozzi & Yi, 1988) and except ORCP even the stricter 0.70 (Nunnally, 1978) acceptable cut-off point. Consequently, constructs validity is evidenced form the results of PCA, PAF, constructs correlations and internal consistency test. This provides preliminary evidence to support the meaningfulness and appropriateness for using the technology strategy (decomposed into five dimensional technology policies (after dropping IP)) to measure the variance in firms' competitive competence and service delivery capability.

Having established constructs validity the dataset is tested for the assumption of multiple regression; In respect of sample size, with 5 independents variables (after dropping IP due multi-collinearity) and a sample size of 151 (after deleting two univariate outliers as explained earlier and four multivariate outliers) the sample satisfied the requirements of N >= 104 + 5 i.e. N >109 and N >= 20 x 5 i.e. N > 100 prescribed by Tabachnick & Fidell (2001) and (Coakes, 2005; Hair et al., 2006) respectively. In assessing the assumption of multivariate outliers, standardize residual values and Mahalanobis distance were examined. Initial check of casewise diagnostic output indicate that two cases have residual values, however when they were deleted, all cases falls within the range of more than 3.3 or less than -3.3 values considered free of outliers (Tabachnick & Fidell, 2001). Similarly after deleting two cases from Mah_1 and Mah_2 data files, examination of Mah_3 revealed the data is completely free from multivariate outliers, as all cases falls below the 20.52 benchmark for 5 IV dataset (Pallant, 2001).

Next, assumptions of multicollinearity and singularity were examined, a rule of thumb is that multicollinearity is evident if a correlation is > .90 or several are >.7 in the correlation matrix formed by all independents variables (Garson, 2007; Tabachnick & Fidell, 2001). As mentioned earlier the highest correlations among IVs after dropping IP from the model is 0.653 between AP & TMEP hence absent of multicollinearity. Examination of the tolerance values AP (0.390), TMEP (0.496), SMI (0.592), EP (0.575) and ORCP (0.801) indicate the values exceeds the 0.1 minimum acceptable tolerance value (Hair et al., 2006) or the stringent 0.2 (Garson, 2007). Inspection of Normal Probability Plot of the regression standardised residuals indicates no major deviations from normality as the point's lies reasonably on the straight diagonal line (Pallant, 2001). Additionally absent of clear relationship between the residuals and the predicted value in the scatterplot is consistent with assumption of linearity (Coakes, 2005).

The foregoing analysis indicate none of the assumptions/requirements for multiple regression was violated, hence the appropriateness of the dataset for regression model. From the first model in table 3, the five independent variables (AP, TMEP, SMI, EP & ORCP) together explain 79.5% of the dependent (competitive competence) variable. Thus technology strategy explains 79.5% of the variance in competitive competence which is highly significant (Sig. = .000 i.e. p < .0005) as indicated by the F-value of 117.218. The second model presented in same table, also revealed technology strategy explain 67.3% of the variance in service delivery capability which is highly significant (Sig. = .000 i.e. p < .0005) with 62.828 F-value.

Furthermore, standardized Beta coefficients indicate TMEP has the largest beta coefficient of 0.4, which means that TMEP makes the strongest contribution in explaining competitive competence, when the variance explained by all other variables in the model is controlled for. AP makes the second largest contribution at 0.37, followed by ORCP at 0.22. Although significant, SMI makes a low contribution of only 0.18, finally EP is making an insignificant contribution of only 0.07. The pattern follows similar direction with regard to perceived service delivery capability, TMEP makes the largest statistically unique contribution

Table 3: Results of the Multiple Regressions

| F | Sig. | R | $R^2$ | Adjusted $R^2$ | |
|---|---|---|---|---|---|
| Model 1 Dependent Variable-Competitive Competence | | | | | |
| ANOVA[b] & Model Summary | 117.218 | .000[a] | .895[a] | .802 | .795 |
| Predictors | AP | TMEP | SMI | EP | ORCP |
| Standardized Beta Coefficients | 0.369 | .0404 | 0.183 | 0.07 | 0.219 |
| Beta Sig. | .000 | .000 | .000 | .152 | .000 |
| Model 2 Dependent Variable-Service Delivery Capability | | | | | |
| ANOVA[b] & Model Summary | 62.828 | .000[a] | .827[a] | .684 | .673 |
| Predictors | AP | TMEP | SMI | EP | ORCP |
| Standardized Beta Coefficients | .344 | .361 | .092 | .000 | .234 |
| Beta Sig. | .000 | .000 | .131 | .996 | .000 |

(beta = 0.36), followed by AP (beta = 0.34) and ORCP (beta = 0.23). While SMI (beta = 0.09) and EP (Beta = .00) are not making a statistically significant unique contribution to the model.

This result supports the overriding influence of technology strategy on firms' competitiveness as acknowledge by previous works (Khalil, 2000; Narayanan, 2001; Porter, 1985, Skinner, 1985) more so for technology firms (Ahmad & Ahmad, 2006). The relative importance of AP i.e. explaining 37% & 34% of the variance on competitive competence and service delivery capabilities respectively, making it the second most important driver of firm's competitiveness, also correlate the conclusions of Baines (2004), Carr (2004), Farrell (2003) and Hamel & Skarzynski (2001) on the importance of technology acquisition. However, with 40% & 36% TMEP is the most strategic technology strategy driver of firms' competitiveness. This finding is in line with Maidique & Hayes (1984) that right organizational disposition is the critical for technology firms' success. TMEP items 2, 4 & 5 support this as they measure quality, maintenance and internal infrastructure to accommodate new technology. Other items in TMEP dwell on labor training and quality, buttressing Sull et al. (2004) that poor technology (men, method & machine) base is a major consideration in developing nations.

Technology retirements and cost related issues also play vital role explaining 22% & 23% on CC & SDC respectively. Theoretically cost related issues are significant given the nature of developing nations (Hipkins, 2004; Putranto et al., 2003), while retirements, replacement and disposal of technology reflects the rapid innovations of technology input in the industry.

## Conclusion

This research makes important theoretical and research contribution on technology strategy in developing nations by exploring scales, theoretical constructs and establishing quantitative relationships between technology strategy and competitiveness. The research therefore provides a premise for comparing technology strategy vis-à-vis competitiveness between developing and developed nations. Findings of this research have important practical implication to telecom operators in developing economies. First, the study reinforces the overriding role of technology strategy in achieving competitive advantage. Second the relative importance of key technology strategy policies on competitiveness has been defined. These findings offer important inputs in formulating and implementing technology strategy.

This research has a number of limitations that future research should redress; the sample is biased towards GSM operators, besides the sample size ought to have been larger. Continuous licensing of telephone providers also negates absolute scientific sampling. Finally, scales were largely only subjected to EFA.

## References

Ahmad, A. (2007). Technology adoption life cycle model and market share of global system for mobile communication (GSM) firms in Nigeria: An appraisal. *Journal of League of Researchers in Nigeria* 8(2), 89-95.

Ahmad, A. (2005). Empirical analysis of technology resource management in medical establishments in Bauchi Metropolis. *Management Network Journal*, 4(7), 1-8.

Ahmad, A. & Ahmad, H. (2006). *Technology Strategy in Perspective.* International Conference of Technology and Operations Management Conference Proceedings Bandung, Indonesia, 1-2 December: 222-231.

Athanassopoulos, A. D. & Iliakopoulos, A. (2003). Modeling customer satisfaction in telecommunications: Assessing the effects of multiple transaction points on the perceived overall performance of the pProvider. *Production and Operations Management*, 12(2), 224-245.

Aydin, S. & Özer, G. (2005). The analysis of antecedents of customer loyalty in the Turkish mobile telecommunication market. *European Journal of Marketing*, 39(7/8), 910-925.

Bagozzi, R.P. & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science,* 16(1), 74-94.

Baines, T. (2004). An integrated process for forming manufacturing technology acquisition decisions, *International Journal of Operations & Production Management* 24 (5), 447-467.

Burgelman, R. A., Christensen, C.M. & Wheelwright, S. C. (2004). *Strategic Management of Technology and Innovation.* 4th edition, Singapore, McGraw-Hill/Irwin.

Busacca, B. & Padula, G. (2005). Understanding the relationship between attribute performance and overall satisfaction: Theory, measurement and implications. *Marketing Intelligence & Planning*, 23(6/7), 543-562.

Byrnes, J. (2004). Airline deregulation: Lessons for Telecom. *Harvard Business School Working Knowledge News Letter.* (on-line) available http:// www.hbswk/hbs.edu

Carr, N. G. (2004). *Does I.T Matter? Information Technology and the Corrosion of Competitive Advantage.* Boston, Harvard Business School Publishing Corp.

Christensen, C.M. (1997). *The Innovator's Dilemma: When New Technologies Cause a Great Firm to Fail.* Boston: Harvard Business School Press.

Coakes, J. S. (2005). *SPSS Analysis without Anguish: Version 12.0 for Windows.* Singapore: John Wiley & Sons Australia.

Elegbeleye, O.S. (2005). Prevalent use of global system of mobile phone (GSM) for communication in Nigeria: A breakthrough in interactional enhancement or a drawback? *Nordic Journal of African Studies* 14(2), 193–207.

Farrell, D. (2003). The real new economy. *Harvard Business Review*, 81(10) 105-112.

Garson, G. D. (2007). Multiple regression. [Retrieved November 28, 2007], http:/ /www2.chass.ncsu.edu/garson/PA765/ Multiple Regression

Garson, G. D. (2006). Validity. [Retrieved November 28, 2007], http:// www2.chass.ncsu.edu/garson/PA756/validity.

Hair, J. F. Jr., Black, W. C., Babin, B. J., Anderson, R. E. & Tatham, R. L. (2006). *Multivariate Data Analysis*. NJ: Prentice Hall.

Hamel, P. & Skarzynski, P. (2001) Innovation: The new route to new wealth. *Leader to Leader*, (19 winter) 16-21.

Hattie, J. (1985). An empirical study of the various indices for determining unidimensionality. *Multivariate Behavioral Research*, 19, 49-78

Hipkin, I. (2004). Determining technology strategy in developing countries. *International Journal of Management Science*, 32, 245-260.

Khalil, T. (2000). *Management of Technology: The Key to Competitiveness and Wealth creation*. Singapore: McGraw-Hill.

Kotler, P. (1999). *Marketing Management: Analysis, Planning, Implementation and Control*. NJ: Prentice-Hall, Englewood Cliffs.

Lance, C. E., Butts, M. M. & Michels, L. C. (2006). The sources of four commonly reported cutoff criteria: What did they really say? *Organizational Research Methods* 9(2), 202-220.

Lim, H., Widdows, R. & Park, J. (2006). M-loyalty: Winning Strategies for Mobile Carriers. *Journal of Consumer Marketing*, 23(4), 208-218.

Maidique, M.A. & Hayes, R.H. (1984). The art of high-technology management. *Sloan Management Review* 25 (winter), 18-31.

Narayanan, V.K. (2001). *Management of Technology and Innovation for Competitive Advantage*. NJ: Prentice-Hall Longman Englewood-Cliffs.

Narayanan, V.K. (1997). Technology acquisition, de-regulation and competitiveness: a study of Indian automobile industry. [Retrieved August 23, 2005] http://www.intech.unu.edu

Ndukwe, E.C.A. (2004). *Connecting the Next Ten Million People in Nigeria*. Paper presented at the 3rd Nigeria Telecom Summit, Le Meridien Hotel, Abuja, November 1.

Netemeyer, R. G., Bearden, W. O. & Sharma, S. (2003). *Scaling Procedures: Issues and Applications*. CA: Sage Publications.

Nunnally, J.L. (1978). *Psychometric Theory.* NY: McGraw-Hill.

Nxele, M. & Arun, T. (2005). Regulatory impact on the development of the telecommunications sector in East Africa: A case study of Kenya. Centre on Regulation and Competition, *University of Manchester Working Paper Series*, 09, 1-35.

Okoruwa, C. (2007), "The Nigerian telecom revolution and economic growth", *Zenith Economic Quarterly*, (2)9, 40-46.

Pallant, J. (2001). *SPSS Survival Manual: A Step by Step Guide to Data Analysis using for Windows (Version 10).* Victoria: Allen & Unwin

Porter, M.E. (1985), *Competitive Advantage – Creating and Sustaining Superior Performance.* The Free Press, NY.

Putranto, K., Stewart, D., Moore, G. & Diatmoko, R. (2003). Implementing a technology strategy in developing countries: The experience of the Indonesian rolling stock industry. *Technological Forecasting & Social Change,* 70, 163-176.

Pyramid Research. (2001). Nigeria: Justifying $285m for a GSM Licence. *Perspective: AFRICA/MIDDLE EAST,* The Economist Intelligence Unit, February 16,

Sekaran, U. (2003). *Research Methods for Business. A Skill-Building.* Singapore: John Wiley & Sons.

Skinner, W. (1985). *Manufacturing – The Formidable Competitive Weapon.* Wiley, NY.

Sull, D. N., Ruelas-Gossi, A. & Escobari, M. (2004). What developing-world companies teach us about innovation. *Harvard Business School Working Knowledge News Letter,* [Retrieved August 13, 2005] from http://www.hbswk/hbs.edu

Tabachnick, B. G & Fidell, L.S. (2001). *Using Multivariate Statistics.* Boston: Allyn and Bacon.

Woo, K. & Fock, H. (1999). Customer satisfaction in the Hong Kong mobile phone industry. *The Service Industry Journal*, 19(3), 162-174.

Zyglidopoulos, S. (1999). Initial environmental conditions and technological change. *Journal of Management Studies,* 36(2), 241-262.

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