THE RELATIONSHIP BETWEEN TECHNOLOGY STRATEGY AND COMPETITIVE PERFORMANCE IN THE TELEPHONY INDUSTRY IN KENYA

BY

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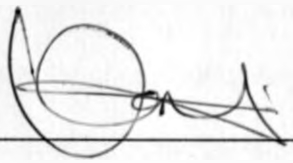
This management project report is my original work and has not been presented for a degree in any other University.

SIGNED:  DATE: 29/04/2004

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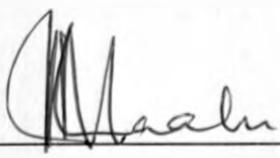
SIGNED:  DATE: 29/4/04.

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God bless you all

ABSTRACT

Technology has been used extensively by many organizations to acquire a competitive advantage over the competition. The gap in the study and particularly basing in the Kenyan market environment is whether there really exist a link between how the firms perform and the technology strategy in place. Therefore the objective of this study was to determine the relationship between technology strategy and competitive performance in the telephony firms in Kenya. This study was carried out on the three firms involved in the telephony industry in Kenya; Telkom, which operates the fixed line system, Safaricom and Kencell which both operate in the cellular system.

Pragmatic telephony professionals, accustomed to intense price competition and focused on the bottom line, have difficulty justifying investments in advanced technology. This study set out to find out the results of research to begin answering the question, "does technology matter?"

This study indicated that a higher value for a number of technology strategy dimensions is associated with superior competitive performance. The findings were that 23 of the 40 possible relationships between dimensions of technology strategy and competitive performance illustrate a significant positive relationship. This number of significant relationships determined in this analysis is far more frequent than could have occurred by chance.

According to the analyzed data there is a strong positive correlation between the number of subscribers and holding capacity of the switching equipment, software version, number of base stations launched, number of trans-coders: (p=0.00,0.963), (p=0.444), (p=0.00,0.939) and (p=0.895) respectively. The correlation coefficient between sales turnover and the technology variable are also strong and positive, except the software version whose coefficient is not significant and also negative. These strong and positive correlations imply that a change in the level of technology has a strong positive influence on the sales turnover of the companies.

The findings also indicate that the Average Revenue Per User as a measure of performance has no significant relationship with the technology variables i.e. Holding capacity of the switching equipment, software version, Number of base stations launched, number of trans-coders: (p=.929,0.33), (p=.937,-0.029), (p=.707, -137), (p=439,.276) respectively.

These results demonstrate clear technology strategy and competitive performance relationships. These findings indicate that technology does matter. This led to the conclusion that telephony industry managers should pay close attention to their technology strategies in order to remain competitive.

Further research examining the causality of successful competitive performance of telephony firms is warranted. The chicken-egg controversy described by Glueck and Jauch (1984) merits investigation in telephony industry in Kenya, i.e., if those firms that demonstrate a relatively higher technology strategy valuation are shown to be more successful, does that show that technology strategy leads to success, or are those that are more successful able to devote more attention to technology strategy?

CHAPTER 1: INTRODUCTION

1.1. Background

Firms are social entities that are goal-directed, deliberately structured activity systems with identifiable boundaries (Bedeian, 1980). Firms operating in a turbulent business environment face a lot of competition from other firms within the same industry.

The rapid pace of technological change is creating a wide array of new business opportunities. The development of the internet, for example with its global reach and tens of millions of users is opening up possibilities for electronic banking, education on demand, digital photography, virtual shopping, and virtual factories; ultimately it has the potential to change almost every aspect of business life (Robson, 1997). Telecommunication infrastructure is the backbone of this Internet related developments.

Strategy can be seen as the matching of the resources and activities of an organization to the environment in which it operates. This is sometimes known as the search for *strategic fit.* The notion of strategic fit is developing strategy by identifying opportunities in the business environment and adapting resources and competences so as to take advantage of these (Johnson and Scholes, 2001).

Over the recent years, corporate organizations have revolutionized their operations in line with the dynamic business environment in order to be more competitive. Technology has come in handy to enable firms achieve competitive advantage against their competitors. Competition determines the appropriateness of a firm's activities that can contribute to its performance, such as innovations, a cohesive culture, or good

implementation. Competitive strategy is the search for a favorable competitive position in an industry, the fundamental arena in which competition occurs. Competitive advantage grows fundamentally out of value a firm is able to create for its buyers that exceeds the firm's cost of creating it. Value is what buyers are willing to pay for, and superior value stems from offering lower prices than competitors for equivalent benefits or providing unique benefits that more than offset a higher price (Porter, 1998).

When firms compete in the same market, the firm that possesses a competitive advantage over its rival returns a consistently higher profits, or has the *potential* to earn a consistently higher profit (Johnson and Scholes, 2002). *Competitive advantage* is the ability of the firm to outperform rivals on profitability. It depends on how a firm is able to create for its customer's value that exceeds the firm's cost of creating a product. Value is what the customers are willing to pay, and superior value stems from offering lower prices than or from providing unique benefits (Narayanan, 200 I: 14).

Recently, a more direct role for technology strategy for the market driven firm in achieving and sustaining competitive performance has been presented (Day and Wensley, 1994). In a framework classifying the capabilities driving competitive advantage, it was concluded that superior-performing firms rely on two sets of capabilities. The first are those with *external* emphasis, related to a firm being market driven. These capabilities can be categorized as outside-in activities, spurred by market needs and dynamics (e.g., market sensing, developing linkages or relationships with customers, etc). Simultaneously, these external capabilities are linked with

internal capabilities that are deployed from inside-out but are guided or activated by market requirements (e.g., technology development, manufacturing processes used, etc.).

The conclusion here is that a firm's technology knowledge is a necessary condition that enables the market driven firm to respond to the market and create/sustain market driven competitive advantage. Firms with external (i.e., market driven) capabilities but lacking internal (i.e., technical) capabilities may know what is needed for market success but they are unable to create or deliver competitive customer solutions. Similarly, firms with internal capabilities (e.g., advanced technologies, excellent engineering skills, etc.) but lacking a market orientation may be able to develop technical advantages. But their deficiencies in knowledge of competitors' offerings, precise market requirements and the trade-offs customers make limit their market success.

Intense competitive pressures in telecommunication industry demand new ways to improve performance and better satisfy customers' needs. Advanced technology offers one possible way to differentiate a firm from its competitors, but it presents many uncertainties and risks. The technology strategy of a firm includes plans and actions to anticipate and acquire technology that can improve performance. To invest in advanced technology, managers need a way to measure the expected benefits, including competitive performance of the firm.

The business-operating environment in Kenya has been undergoing drastic changes in the last couple of years. Some of the changes include the accelerated implementation

of economic reforms, the liberalization of the economy, discontinuation of price controls, privatization and commercialization of public sector and increased competition (Kandie 2001). Pearce and Robinson (2003) contend that wider environmental conditions (political framework, Government policies, economic, social cultural conditions and customers whose preferences often shift inexplicably) affect business practices. Telecommunications industry did not escape these changes.

Globally, it is recognized that telecommunications is an economic infrastructure to serve other social economic sectors. Kotter (1996) notes that the increasing pace of technological changes that hinged on the information technology is one of the major economic and social forces of change. An effective and efficient communication network is the key to economic growth and development of any country.

For some time, Kenya Posts and Telecommunications Corporation (K.P.T.C.) dominated the telecommunications industry. This was primarily because the range of services was few and capital requirements were high so that only the Government could provide these services cost effectively. With rapid technological change the capital requirements for investments in telecommunications have come down tremendously and the range of service has increased. In addition, the current trend of breaking trade barriers and the adoption of a private sector-led development paradigm has resulted in the need to implement economic reforms consistent with these developments (Kandie 2001)

Its against this background that the Government issued a Postal and Telecommunications Sector Policy Statement, of January 1997, on

telecommunications sector which defined the policy backdrop within which the Telecommunications, radio communication and postal services would be operated and provided a framework for the introduction of certain structural changes in the sector. The policy statement was set out against a deliberate move by the Government to optimize the sectors contribution to the development of the economy as a whole by ensuring the availability of efficient, reliable and affordable communication services throughout the country.

The provision of framework for the regulation the communication sector and enactment of The Kenya Communications Act (No. 2 of 1998), consequently saw to the split of KPTC into three legal entities, namely Telecom Kenya Limited (TELKOM), Posta Corporation (POSTA) and the Communications Commission of Kenya (CCK). Telkom was issued with the mandate to operate in the Telecommunications industry. It has universal access service requirements in its license and is obliged to provide interconnection facilities to other duly licensed operators.

In line with global technological changes and innovation, CCK licensed and welcomed mobile telecommunication industry in Kenya. Currently two mobile cellular licenses have been granted. The first was granted is Safaricom limited, formed in 1997 as a fully owned subsidiary of Telecom Kenya. A second cellular license was granted to Kencell communication Limited, a joint venture between Sameer investment group, a local company and Vivendi international of France. The entry of a third player is imminent with the licensing of Econnet Wireless and the licensing of a second fixed line operator is also expected soon (CCK website).

1.2. Problem Statement

Noted, three firms are currently involved in the telephone industry in Kenya; Telkom, which operates the fixed line system, Safaricom and Kencell which both operate in the cellular system. What has come up in the wake of this apparent competitive situation is the adaptation to technological innovations to achieve and maintain competitive performance.

Technology has been used extensively by many organizations to acquire a competitive advantage over the competition. The organization needs to ensure it chooses the right kind of technology for its given business environment. This is especially more pronounced in manufacturing entities. Competitive advantage is the key to long-term value creation and is a major objective behind the management of technology and environment studies.

This elaboration of the role of technology resonates findings in the manufacturing and operations literatures that have historically given significant attention to the strategic importance of technology within the firm (e.g., Buffia, 1984; Gregerman, 1981; Hayes and Wheelwright, 1984; Schmenner, 1983). In these fields, effective utilization of technology has been linked to: Reduced costs, Better quality, faster adoption of new processes technologies and more successful competition, particularly against global competitors. Clearly, effective utilization of technology is a central part of competitive strategy in manufacturing and service organizations.

Hampson and Tatun (1997) carried out an empirical research on the relationship between technology strategy and competitive performance in bridge construction. The findings indicated that technology does matter. The research also provides ways to analyze options for approaching technology and ways to relate technology to competitive performance for use by other interested researchers and managers. It also provides a valuable set of research measures for technology strategy.

As earlier stated there are a number of developments on the telecommunication industry in Kenya. The entry of mobiles and the ensuing competition has been a fundamental change in the industry. Given the growth and development in the telecommunications industry in Kenya many players are keen to find out if indeed technology can be used as a way of creating competitive advantage. The gap in the study and particularly basing in the Kenyan market environment is whether there really exist a link between how the firms perform and the technology strategy in place.

It is expected therefore that the study will answer the questions: Does technology matter? Is there an association between technology strategy and competitive performance?

1.3. Research Objective

The objective of this study will be to determine the relationship between technology strategy and competitive performance in the telephony firms in Kenya.

1.4. Research Hypothesis

Drawn from the stated objective the research hypotheses will suggest that:

- There is a link between technology strategy and competitive performance in telephony firms.

1.5. Importance And Justification Of The Study

It is expected that the findings of this research will be beneficial to various interested parties. The telecommunication industry players who are directly affected by changes in the turbulent environment will be interested in the findings as to whether technology truly contributes to competitive performance. This will give them an impetus to continue investing in technology. The telephony industry stakeholders will be interested to know what is going on in the telephony industry as regards levels of technological advancement in the industry. Regulator in the Telecommunications industry, interested in the development and strategic growth, will have a formal backing to insist on certain minimal technological requirements by the industry players. Safaricom, Telkom and Kencell managers interested in an independent evaluation of their performance as regards technology adoption and subsequent competitive performance. This evaluation could assist the managers in making better decisions in the future.

1.6. Structure of the project

This project is structured as follows:

Chapter One: Introduction

This chapter contains background, statement of the problem, research objective, research hypothesis and importance of the study.

Chapter Two: Literature Review

This contains a literature review on technology strategy and competitive performance.

Chapter Three: Research Methodology

This chapter contains the scope of the study, population, data collection and data analysis.

Chapter Four: Data Analysis and Interpretation

This chapter contains research findings and the interpretation of the results.

Chapter Five: Summary, Limitations and Recommendations

This chapter contains the summary of results, limitations of the study and recommendations for future research

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Over the past 15 years, increasing attention has been paid to the strategic management of technological innovation. Accordingly, models have been developed that treat technology as an input to the strategy formulation process and provide a link between the technological strategy and corporate/business strategy (Chiesa and Mauzini 1998). Both academic research and consultancy companies have given contributions in this area. Hax and Maljuf for example, provided a useful framework for linking technology and business strategies.

The responses of these write-ups focus mainly on what Roger Denis (2000), summed up as the relentless pace of technology development. According to him, identifying disruptive technologies, can give a business a well-deserved competitive advantage. Literatures reviewed have clearly shown that a company's technology strategy represents an opportunity to create an integrated experience that solves genuine problems and ensure competitive performance.

2.2 Technology Strategy and Performance

2.2.1 Technology

Literature attributed to scientific papers in strategic management generally analyzes the concept of technology along the lines of providing the borders (i.e. definitions, classifications, approaches etc), management, investment and role. The works reviewed in this study, have tended to address technology as an option approach to technology strategy.

In an attempt at answering the question," Does Technology matter?" Hampson and Tatum (1997) maintained that both researchers and industrial professionals need to improve tools to analyze how technology affects the performance of a firm. Erickson et al (1990) wrote widely on managing technology as a Business strategy. In giving a management review, they argued that by managing technology effectively, executives could ensure that their firms R&D program focuses developing technologies that support its product and marketing strategy. The goal here is to contribute to the value of the enterprise by helping ensure that the cash flow is sustained and growing.

Roussel (1990) provided a straightforward definition of technology: the ability to create a reproducible way to generate improved products, processes and service. To him, the management of technology is analogous to the management of investment; the development and use of technology must be guided explicitly by the business strategy of the firm. At the same time technology development should help define the opportunities and threats to which strategy should then respond.

A cross-section of researchers and management consultants are in agreement with the classification of technologies by competitive impact into three broad classes. These are: *base technologies*, which a firm must master to be an effective competitor in its chosen product market mix, *Key technologies* which provide competitive advantage by permitting the producer to embed differentiating features or functions in the product or to attain greater efficiencies in the production process and what could

become tomorrow's key technologies, *pacing technologies*, which in essence not every participant in an industry can afford to invest in (Erickson et. al, 1990)

Roussel and Little (1990) said that the technological strength of a business reflects the degree to which it has competence in, or proprietary control of, key products and process technologies. It also reflects the level of investment to sustain key technologies and to invest in pacing technologies. They categorized competitive technological strength as being dominant, strong, favorable, tenable and weak in areas.

Day and Wensley (1994) presented a more direct role of technology management and technical knowledge, for the market driven firm in achieving and sustaining competitive advantage. They viewed advanced technologies and excellent engineering skills as making up a firm's internal capability.

2.2.2 Technology Strategy

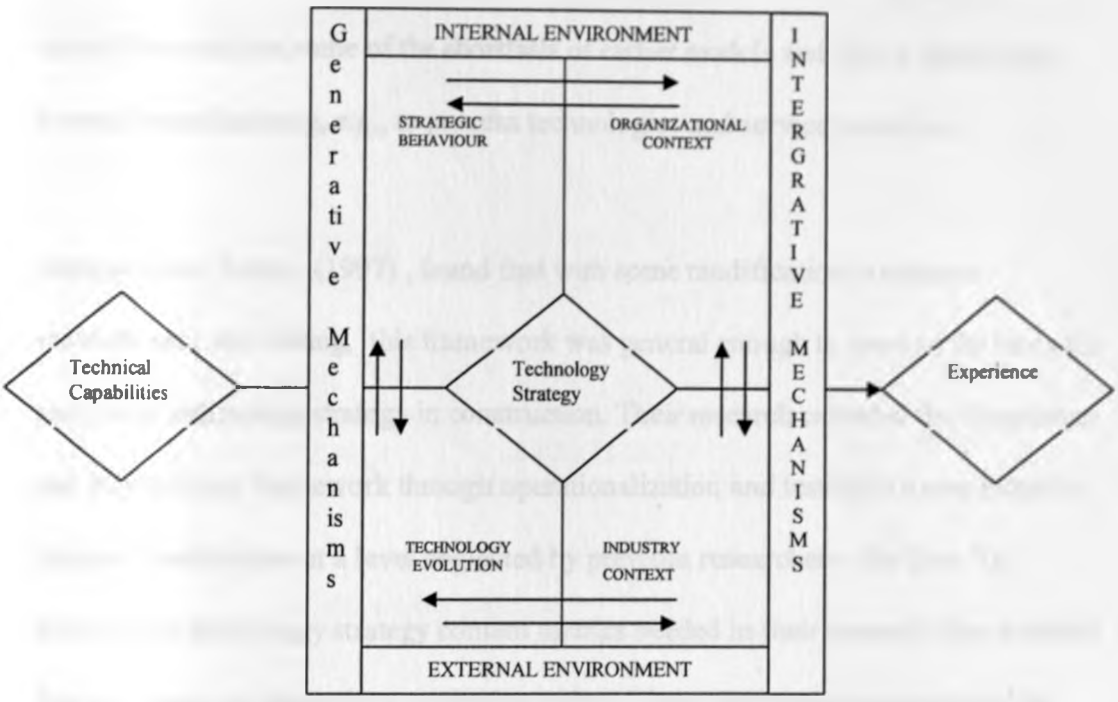
Simply put, technological strategy refers to a firm's approach to the development and use of technology. Writing for a practitioner's forum on a model of technology strategy, Rieck and Dickson (1993) pondered on the lack of a technology Strategy paradigm. To them, the concept is relatively new-having been given prominence over time by virtue of research, developed somewhat disjointedly through the identification of many issues for consideration is defined thus as the process by which firms utilize their technological resources.

A number of authors have attempted to elucidate the components of what they define as technology strategy, with as many results as there have been attempts. In considering the role of technology in enhancing competitive advantage, for example, Porter and Ansuff (1998) have developed technology in strategic ideas from a basis in corporate strategy theory as a distinct entity. Rieck and Dickson model in utilitarian, time-based process, linking six technologically related tasks with decreasing time frames reflecting short, medium and long term future periods relevant to management decision making and corporate development activities.

Research effort by Maidigue and Patch (1998), outline six areas for consideration in formulating technological policy: (1) selection, specialization and embodiment; (2) level of competence; (3) sources of technology; (4) research and development (R&D) investment level; (5) competitive timing and (6) R&D organizational policies. They proposed four broad strategies and provided a framework of analysis for technology policy in the manufacturing context. The four strategies (first-to-market, second-to-market, cost minimization, and market-segmentation) broadly parallel four strategies defined by Ansoff and Stewart (1967).

Burgelman and Rosenbloom (1989) proposed an evolutionary process framework for the formation of technology strategy, as shown in Fig. I below. In summary, the idea is that technology strategy emerges from organizational capabilities shaped by the generative forces of the firm's strategic behavior and evolution of the technological environment, and by the integrative mechanisms of the firm's organizational context

Fig 1. Evolutionary Process Framework for Technology Strategy



Source – Hampson, K and Tatum C.B "Technology Strategy and Competitive Performance in Bridge Construction", Journal of Construction Engineering and Management, June 1997.

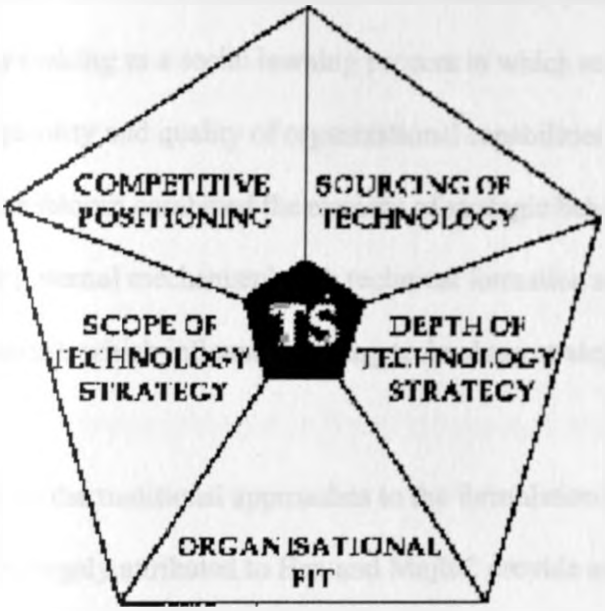
and the environment of the industry in which it operates. Experience with a particular strategy is expected to have feedback effects on the developing set of technical capabilities. This evolutionary perspective is representative of these researchers' view of strategy making as a social learning process in which strategy is inherently a function of the quantity and quality of organizational capabilities. Burgelman and Rosenbloom used this framework to analyze four cases- one each in manufacturing, retail, banking services, and business systems.

The Burgelman and Rosenbloom model proved useful for this research since it combined the elements of strategic behavior and organizational context (internal mechanisms) with technology formation and industry context (external mechanisms). These influences shaping technology strategy are significant dynamic forces in the firm's environment. Burgelman and Rosenbloom conceptually defined each of the

four driving mechanisms to allow application in multiple domains. This process model thus rectifies some of the shortfalls of earlier models and allows application beyond manufacturing, e.g., to process technologies and service industries.

Hampson and Tatum (1997), found that with some modification to enhance measurement and testing, this framework was general enough to serve as the basis for analyzing technology strategy in construction. Their research extended the Burgelman and Rosenbloom framework through operationalization and testing in a new industry domain-construction-at a level neglected by previous researchers - the firm. To develop the technology strategy content metrics needed in their research, they selected five groupings or dimensions as starting points. These parameters were selected to ensure conceptual completeness and avoid unnecessary duplication. These dimensions were competitive positioning, sourcing of new technology, scope of technology strategy, depth of technology strategy, and organizational fit. This original grouping of the attributes of technology strategy is illustrated in Fig. 2. below.

FIG. 2. Technology Strategy Content Framework [Adapted from Hampson (1993)]



Source - Hampson, K and Tatum C.B: "Technology Strategy and Competitive Performance in Bridge Construction", Journal of Construction Engineering and Management, June 1997.

Literature review has also unearthed scientific studies bent towards process framework for the formation of technology strategy, and a formation of dynamic technology strategy. The latter is readily identified with Chiesa and Manzini (1998), who wrote comprehensively for practitioners' forum. They argue from the premise of competitive environments, which they said are increasingly dynamic, and thus render traditional methodologies and approaches to the strategy obsolete or inadequate. The study is meant to help firms to conducive their technology strategy.

The other framework was proposed by Bugleman and Rosenbloom (1989), the process of which is evolutionary and complemented by a model. They averred that technology strategy emerges from organizational capabilities shaped by the generative forces of the firm's strategic behavior and evolution of the technological environment

and by the integrative mechanisms of the firm's organizational context and the environment, which it operates in. The evolutionary perspective in representative of strategy making as a social learning process in which strategy is inherently a function of the quantity and quality of organizational capabilities. In their model, Buryelman and Rosenbloom combined the element of strategic behaviour and organizational context (internal mechanism) with technical formation and industry context (external mechanism), which influence shaping technology strategy.

Studies on the traditional approaches to the formulation of a technology strategy, which is largely attributed to Hax and Majluf, provide a useful framework for linking technology and business strategies. This is also discussed by Chiesa and Manzini (1998), Friar and Horwitch (1986) and Hamel (1992), who see technology strategy as being integrated in the overall strategy formulation process as the functional strategies. The major decisions linked to technology are identified as technology intelligence, technology selection, timing of new technology introduction and modes of technological acquisition.

2.2.3 Competitive Performance And Competitive Advantage

The concept of competitive performance found prominence in researches concerned with portraying competitive advantage of firms. Hampson and Tatum (1997), developed a series of competitive performance indicators to be applied into research, based on data available. They defined four broad competitive performance indicators; trends in value of contract award, trends in market share, value of contract award per employee and weighted average performance index.

Metcalfe and Gibbons (1989) contends that competitive performance of the firm in the short run depends on the position of its technology within the relevant technology distribution of the industry. In the long run it depends on the firm's ability to maintain a momentum of technological improvement. Thus they argue that competitive performance depends not simply on success with a single innovation, but success with a sequence of innovations and post innovations improvements. The ability of firms to recognize the value of the new external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities and performance- absorptive capacity. They suggest that it is a function of a firm level of prior related experience. They contend absorptive capacity and innovative performance are path-dependent and argue that lack of investment early on may foreclose future development of a technical capacity in that area.

Firm's superiority in its skills and / or resources allows it to develop a position of advantage over its competitors. This position of competitive advantage is achieved by offering customers the lowest delivered cost or superior customer value, paralleling the strategic management literature's paths of cost leadership, differential advantage and nichemanship (Porter, 1985). The firms' optimal use of current technologies relevant to its industry and markets in creating sources or positions of advantage is *implied* in early competitive advantage frameworks (Day and Wensley, 1988; Porter, 1985). However, the specific role of technology management and technical knowledge in these models has not been examined.

Technology has been used extensively by many organizations to acquire a competitive advantage over the competition. The organization needs to ensure it chooses the right kind of technology for its given business environment. This is especially more pronounced in manufacturing entities. Competitive advantage is the key to long-term value creation and is a major objective behind the management of technology and environment studies.

The basic units of competitive advantage (Porter 1985) are the discreet activities, however than traditional functions such as marketing and R&D are what generate cost and create value for buyers. Given that an organization is affected by myriad of both internal and external forces multiple dimension, effective and timely commercialization of new technology is a strategy used in recent years by organization seeking competitive advantage (Zahra 2002).

2.2.4 The Link Between Technology Strategy And Competitive Performance

According to Johnson and Scholes (2002), what is key to technology strategy is innovation and technology should be seen as a means of underpinning innovations in organizations.

Comprehensive investigation in the link between technology strategy and competitive performance relied mainly on the information gathering instruments in field research. In insights (1993,P1) researchers synthesized and expended the relevant background

to develop specific measures in technology strategy and related then to those of competitive performance.

Several industry analysts have speculated about the nature of the link between technology strategy and competitive performance in the construction industry. Prudential securities Research Division described one firms approach in building shareholder value: "use of new technologies often provide only temporary advantage to companies.

Elsewhere, Porter (1998) stated that technology strategy affects competitive performance if it has a significant role in determining relative cost position or differentiation. Since technology is embodied in every value activity and is involved in achieving linkage among activities, it can have a powerful effect in both cost and differentiation. Further, Porter adds that despite its importance, the link between technology strategy and competitive performance is widely misunderstood. In many instances, the changes in technology are viewed as valuable for its own sake - as opposed to its importance in affecting competitive advantage and industry structure.

Brussel (1990) maintained that the technological strength of a business reflects the degree to which it has competence in or proprietary control of key product and process technology. Competitive performance also relies heavily on the relevance of stated technology strategy (Saad, 1990).

2.3 Mobile Telephony Technological development

The rapid technological developments in the mobile telecommunication industry, has resulted in the evolution of different standards in Europe and Americas (Olunga 2002). GSM operators recognized the need for international roaming and the compatible systems, therefore European operators formed the GSM MOU in 1987 to harmonize the standard of facilities being used in the network to achieve Internet work roaming services. GSM MOU has now been transformed to an international body, the GSM Association. This has resulted in the evolution from first-generation digital systems to second-generation 2G systems with the bridging +2.5G to 3G.

In recognizing dynamic developments in the mobile industry, ITU has undertaken initiative and successful development efforts, such as culminating in it the IMT-2000 standard, which is now the globally agreed standard for 3G mobile telephony to serve as the universal platform for 3G voice and mobile internet services.

Scientific researches on mobile telecommunication generally focuses on performance reporting and regulators are both for four reasons: to ensure that a network is performing accordingly to required service levels; to determine whether network performance has improved over time; to compare performance with competitors network; and to identify and verify faults. (Sorrell, 1995).

Olunga (2002) observed that the technology that underpins mobile telecommunication industry is standard and variation can only be on technology strategy of firms, which includes the management plans, action, diffusion of technology and other measures. Competitive performance on the other end draws responses- that although it is

standard to explain performance in the industry such measures as call congestion and dropouts' rates have been known to be firm specific.

The Convergent Communication Research group, recognize the measurement techniques of making use of equipment counters versus Drive Testing. The approach gives performance measurement and bears a number of advantages, which legitimizes its use.

Writing in the Engineering journal, Gicohi (2002) recognizes the challenges of providing sufficient GSM network capacity-which are many and multifaceted. The link between technology strategy and competitive performance in cellular industry can be appropriately studied in terms of core infrastructure and numbering, Base Station Sub-system and Business Support Peripherals.

Elsewhere, Kashorda (2001) reiterated that in the quest to the understanding of the performance of telephone networks, insight should be directed on the traffics generated by telephone users. He added that large networks need a structured method of routing traffic. In his later write-up on the same, qualitative description is provided to show the effect of dial-up Internet user and mobile telephone network traffic on the overall performance of telephone networks.

2.4 Methodologies in Technology Strategy and Competitive Performance

The majority of literature from studies on technology investment and competitive situation are contained in Business Source Premier database. What seems to be

overriding is the common tendency for all researches to measure both technology strategy and competitive performance.

According to Hampson and Tatum (1997), an examination of performance measures by previous researches shows that they relied on primary sources. Data was collected from the field and supplemented by interview schedules. Researchers also adopted models to show links between the two related concepts. Analysis is conveniently descriptive in many instances. The use of key indicators to establish levels rendered the design possible. Since the researchers sought to establish the correlation, the methodologies adopted and introduced duly analyzed the variances and co-variances of the selected variables.

The use of advanced statistical packages has been used in similar studies- analyzing the relationships between technology strategy and competitive performance in several firms. Given the number of case firms and the exploratory nature of the investigation, researchers have tended to adopt non-parametric analysis technique.

2.5 Summary

Admittedly, the field of technology strategy is new in the helm of strategic management studies. If any thing, it's an extension to other areas such as managing technology and technology analysis. A lot of research has concentrated on competitive advantage at the behest of competitive performance.

In this research, the question of whether technology matter will form the base of study, and then the attention given to the investigation on whether there is a link between the two, technology strategy and competitive performance indicators.

Hampson and Tatum (1997), in a similar study for Bridge Construction, developed measures of technology strategy and competitive performance. They synthesized and extended the relevant background to develop 29 specific measures of technology strategy grouped into the following five dimensions:

a) Competitive positioning: relative emphasis on technology in business strategy, and relative command of key technologies in the market.
b) Sourcing of new technology: how the firm structures its approach to acquisition of explicit (hardware) and implicit (knowledge) value-creating technologies
c) Scope of technology strategy: core and peripheral technologies used in the firm and sources of information concerning these technologies.
d) Depth of technology strategy: relative emphasis on research and development and depth of technical capabilities
e) Organizational fit: match reward systems in the firm with technological objectives and the structuring of information flows throughout the organization.

Based on the background, Hampson and Tatum (1997), selected the following measures of competitive performance (competitive performance indicators):

a) Trends in the value of contract awards, including absolute contract growth and proportional contract award growth (percentage)

b) Trends in market share over the past 10 years

c) Value of contract awards per technical management employee

d) Weighted average performance index, based on input from two most senior interviewees, including ranking of importance for six established financial criteria (total annual dollar value of contracts awards, annual growth of contract award values, return on investment, gross profit margin, net profit from operations and market share), and their assessed value on a satisfaction scale indicating the extent to which the manager was currently satisfied with the firm's performance against each of the above criteria.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research Design

This research study is descriptive in nature. The objective of a descriptive study is to learn the who, what, when, where, and how of a topic (Donald and Pamela 1998). The objective of this study was to determine the relationship between technology strategy and competitive performance in the telephony firms in Kenya. Descriptive study was found to be appropriate to determine how the two variables, technology strategy and competitive performance, were related.

3.2 Population Of Study

All the three players in the telecommunication industry in Kenya constituted the population. The telephone providers are Telkom Kenya, Kencell Communications and Safaricom Limited.

3.3 Data Collection

Data collection from the firms involved personal interviews using a questionnaire and review of secondary data. The interviews included both structured and unstructured questions to allow the interviewees to fully express their views regarding approach to technology in the firm and implications for performance.

Effort was be made to engage senior staff and particularly in technology wing in the interview schedule. The chosen respondents were those in key positions in the company as regard managing technology, heading company's strategic direction and research and development.

Primary data was collected using the questionnaire format with open ended and closed opened questions (Appendix ii). The questionnaire was administered via in-depth interviews.

3.4 Data Analysis

The primary data was analyzed by means of statistical techniques. The statistical package for social sciences (SPSS) was used extensively to aid in data analysis. The questionnaire was edited for completeness and consistency before processing. Data was then coded and then entered into defined variable labels.

The first step in analyzing the relationship between technology strategy and competitive performance of the three firms was to compare rankings of the two variables. The researcher then used the Spearman rank correlation coefficient to compare technology strategy dimensions and competitive performance. This was the most appropriate nonparametric analysis technique given the number of case firm's and the exploratory nature of the investigation.

CHAPTER 4: FINDINGS AND DISCUSSIONS

4.1 Introduction

The analysis of the data to produce the research findings involved assigning and verifying values for technology strategy, determining the competitive performance of each firm, and comparing the two. This section describes and gives the key results from each of these activities.

4.2 Respondent Firms Characteristics

As stated earlier, there are only three players in the telephone industry in Kenya, all locally incorporated. Out of the three companies, one, Telkom Kenya, is operating fixed line system and the remaining two, Safaricom Ltd and Kencell Communication Ltd, operates mobile telephony services.

Telkom Kenya was incorporated 1998 as a splitter from the defunct Kenya Post and Telecommunication Company (KPTC). The organization has a staff base has of 19,337. The majority of these employees were inherited from the defunct KPTC. Of the 19,337 employees, 4,746 are technical staff and 14,591 non-technical staff. This translates to 24.5% of technical staff and 75.5% of non-technical staff.

The two organizations that operate mobile systems were started within the last five years. Safaricom Ltd was incorporated in 2000. The organization staff base has grown from 189 employees at the inception to 540 in the year 2002 as shown in the Table 1 below.

Table 1: Safaricom Staff by Role

Year	2000	2001	2002
Management Staff	12 (6%)	34 (8.5%)	51 (9.4%)
Technical Staff	47 (25%)	106 (26.8%)	134 (24.8%)
Others	130 (69%)	256 (64.7)	355 (65.8 %)
Total	**140**	**240**	**540**

Source: Research Data

The organization has maintained an average of 25% staff as technical staff, management 9 % while other non-technical staff comprises of 65%. Considering that approximately half the workforce is in customer service the rest comprising of 25% technical staff depicts a highly technical orientation.

In terms of educational qualifications the situation was as follows in the year 2002 (see table 2 below).

Table 2: Safaricom Staff by Education Qualification

Qualification	Number of staff	Percentage
Doctorate	0	0%
Masters Degree	5	1%
Bachelors Degree	479	89%
Diploma	34	6%
Other / Labor Background	22	4%
Total	**540**	

Source: Research Data

Safaricom has maintained an average of 89 % staff holding various Bachelors degrees, 1% masters degree, 6% and 4% diploma and labor background respectively.

There are no doctorate holders in Safaricom. This depicts a high caliber workforce: easily trainable and adaptable to increasingly demanding working environment.

Kencell Communication was incorporated in 1999. The organization staff base has grown from 140 employees at the inception to 600 in the year 2002 as shown in the table 3 below.

Table 3: Kencell Staff by Role

Year	2000	2001	2002
Management Staff	50 (35.7%)	70 (29%)	150 (25%)
Technical Staff	60 (42.9%)	130 (54%)	350 (58%)
Others	30 (21.4%)	40 (67%)	100 (17 %)
Total	189	396	600

Source: Research Data

Kencell has maintained an average of 58% staff as technical staff, management 25% while other non-technical staff comprises of 17%. There appears to be more technical inclination, as far as workforce is concerned, in Kencell than in the other two companies.

In terms of educational qualifications the situation was as follows in the year 2002 (see table 4):

Table 4: Kencell Staff by Education Qualification

Qualification	Number of staff	Percentage
Doctorate	3	0.5%
Masters Degree	35	5.9%
Bachelors Degree	250	48.3%
Diploma	150	25%
Other / Labor Background	122	20.3%
Total	**600**	

Source: Research Data

The organization has maintained an average of 48 % staff holding various Bachelors degrees, 6% masters degree, 2.5% and 20% diploma and labor background respectively. There are a few doctorate holder staff. As in the case of Safaricom Limited, this depicts a high caliber workforce: easily trainable and adaptable to changing job demands.

Data collected showed that all the firms in the industry have a clearly articulated mission statement and highly formalized technology strategic planning process mainly developed by their top managers, consultants and adopted from the parent company. The technology strategy is normally reviewed twice a year for two of the firms and once a year for one firm. All the firms agree that the Kenyan telecommunication industry is still profitable and that the competition in the industry is intense.

4.3 Technology Strategy in the Firms

Over the years the Telkom Limited network has evolved from analog to digital technology in both switching and transmission. In 1984, the organization, then KP&TC, installed the first Digital Exchange to provide international services without intervention (ISD). In 1990, the organization unveiled its packet switched data service, KENPAC, for its corporate customers. In 1995, the organization introduced a leased line digital data service branded Kenstream, enabling the early introduction of Internet service by pioneering Internet service Providers (ISPs). In 1998, the organization launched Jambonet, an Internet backbone service. Telkom has a network that is 67% digital on the switching infrastructure and 86% digital on the transmission infrastructure, with the international network 100% digital in both switching and transmission. The digitalization process has enabled the organization to introduce intelligent network services such as account calling card services, free phone service and itemized billing. Telkom offers voice and data services on separate networks.

Telkom is employing the following technologies to offer services to its customers: Frame Relay, ISDN, Digital Subscriber Line, Asynchronous Transfer Mode, and Synchronous Digital Hierarchy. Telkom Kenya has deployed a blend of switching and transmission hardware. These are Erickson, Nec-Neax, Italtel, Linea-UT, GTE-Siemens, GTD-5c, Nec-Neax, X-bar and Fujistu. These hardwares have different holding capacity and have been deployed in different parts of the country based on the network requirements. Different software versions have been installed in these hardwares each providing a specific holding capacity. The Ericksson switching equipment running T.G 3 software has a holding capacity of 12,000. The Nec-Neax switching equipment running 61E software has a holding capacity of 3,000.

The respondents feel that the organization response to technological change has been minimal as technological change has been so rapid. In comparison with new operators, Safaricom and Kencell, the respondents feel that Telkom still lags behind in technology. The organization is faced with two main challenges related with technology, which are recouping of investment before the expiry of the equipment life and need for re-training of staff for new technologies.

Safaricom has deployed a purely 2.5 GSM digital network. The organization uses Siemens hardware with a variety of SR software over the years. The organization has upgraded its software over the last three years from SR6, to the current SR version 9. The call holding capacity has increased from 250,000 subscribers to 1,200,000 subscribers during the same period (see table v).

Table 5: Safaricom Switching Equipment

	2000	2001	2002
Switching Equipment	Siemens	Siemens	Siemens
Software Versions	SR6	SR8	SR9
Holding Capacity	250,000	300,000	1,200,000

Source: Research Data

The capacity of Subscriber Identity Module (SIMs) has improved over the years. The SIMs capacity in Kilobytes (kb) was 8kb, 16kb and 32 kb in years 2000, 2001 and 2002 respectively. The SIM capacity has a direct influence on the data storage in the SIM. The subscribers can store more data in a high capacity SIM.

Safaricom equipments allow for interconnectivity with other equipments and support per second billing. They allow for the following value added platforms: Voicemail services, Short Message service, SMS to email, WAP, mobile fax, mobile to internet access, Email to SMS, Prepaid Roaming and Mobile banking. Supplementary services

that are supported include Calling Line ID Presentation, Calling Line ID Restriction, Calling Line ID Restriction Override, Call Holding, Call Forwarding, Call Transfer and Call Completion to Busy subscriber.

Safaricom philosophy in terms of coverage is both mass and quality production while its emphasis on cell planning criteria is both for indoor and outdoor. The rapidly changing technology poses a number of challenges for the firm. This include cash flow problems and having to strike a balance between upgrading and / or replacing ageing equipment though this may have been in operation for a short duration typically one or two years. The company responds to changes in technology by upgrading the current network infrastructure to the highest possible level as next generation technology matures in an effort to maximize return from the current investment. The organization has utilized technology for competitiveness since inception. This has been demonstrated by the availability of per second billing, free access to voicemail and SMS as a standard since the inception of the organization. Lately the organization has adopted the use of Interactive Voice Response (IVR) to supplement the customer care service. The organization is working towards the introduction of a SIM toolkit cards that will allow for rapid introduction of more advanced services.

Each subsequent higher software version accorded the organization leverage for more product range and higher quality service for its subscribers. There were clear indications that Safaricom does lay a lot of emphasis on technology in the overall business strategy. The drive for technology innovativeness is both internally and externally induced.

Kencell has also deployed a purely 2.5 GSM digital network. The organization uses Alcatel hardware with a variety of RCP and SCP softwares over the years as shown in table 6 below.

Table 6: Kencell Switching Equipment

	2000	2001	2002
Switching Equipment	Alcatel	Alcatel	Alcatel
Software Versions	RCP 4.0 SCP 1.0	RCP 5.0 SCP 2.0	RCP 5.2 SCP 2.8
Holding Capacity	300,000	500,000	900,000

Source: Research Data

Kencell equipments allow for interconnectivity with other equipments and support both per second and per minute billing. They allow for the following value added platforms: Voice Mail Services, Short Message service, USSD, WAP, mobile fax and mobile to Internet access. Supplementary services that are supported include Calling Line ID Presentation, Calling Line ID Restriction, Calling Line ID Restriction Override, Call Holding, Call Forwarding, Call Transfer Call, Completion to Busy Subscriber and multiparty.

Kencell philosophy in terms of coverage is quality production while its emphasis on cell planning criteria is both for indoor and outdoor. The organization technology allows for auto migration to pre-paid class of service, which is unique and not available to other firms. Unique too is the ability to offer both per second and per minute billing to its customers.

There was general consensus among the respondents, across the firms, on a number of technology related issues. That for a firm to be competitively positioned in the sector

it was imperative for it to build a network that works based on stable, well tested and proven network technology, upgrade the network to the level required to offer services that will push revenue generation up, design and adopt network systems that will make introduction of new products and services quicker, ensure technology jumps do not lead to system instability, delay introduction of new technologies till they mature in other markets and use stepwise upgrade and migration to fully converged networks.

4.4 Competitive Performance in the Firms

To answer the principal research question, a series of competitive performance indicators were developed and applied consistently across all firms. Most respondents were reluctant to release hard financial data such as return on assets or other direct measures of profitability. Secondary data was used to fill some of the missing data.

The competitive performance indicators used and results are as follows:

Table7: Telkom Limited competitive performance indicators

Year	2000	2001	2002
Number of Subscribers	300,000	340,000	350,000
Sales Turnover (Kshs '000)	21,585	26,258	174,000
Average Revenue Per User (Kshs '000)	5.9	6.4	41
Market Growth Rate (%)	1.43	1	1.3
Number of products in the market	14	15	16

Source: Research Data

Performance in Telkom was fairly subdued in the years 2000, 2001 and 2002 (see table 7). The subscriber base grew by an average of 5%, while their market growth rate averaged at 1%. Average Revenue per user rose from 5.9 in 2000 to 41 in 2002, a 14% growth. The number of products over the same period did not show a marked change, increasing by one product in each year.

Table 8: Safaricom Limited competitive performance indicators

Year	2000	2001	2002
Number of Subscribers	20,000	193,000	729,000
Sales Turnover (Kshs '000)	2,000	6,000	12,000
Average Revenue Per User (Kshs '000)	10	31	16.4
Market Growth Rate (%)	0.42	2.1	3
Number of products in the market	4	7	12

Source: Research Data

Safaricom performance was fairly impressive in the years 2000, 2001 and 2002 (see table 8). The subscriber base grew by an average of 1200%, while their market growth rate averaged at 1.84 %. Average Revenue per user rose from 10 in 2000 to 16.4 in 2002, a 60% growth. The number of products over the same period did show a marked change, increasing from 4 in 2000 to 12 in 2002.

Table 9: Kencell Limited competitive performance indicators

Year	2000	2001	2002
Number of Subscribers	50,000	118,000	592,000
Sales Turnover (Kshs '000)	2000	4800	8500
Average Revenue Per User (Kshs '000)	2.5	3.58	2.012
Market Growth Rate (%)	1	1.7	2.3
Number of products in the market	1	3	6

Source: Research Data

Kencell performance, like that of Safaricom, was also fairly impressive in the years 2000, 2001 and 2002 (see table 9). The subscriber base grew by an average of 1184%, while their market growth rate averaged at 1.7 %. Average Revenue per user averaged at 2.6. The number of products over the same period did show a marked change, though much less compared to Safaricom, increasing from 1 in 2000 to 6 in 2002.

4.5 Technology Strategy and Competitive Performance

Change in technology levels within the three firms was measured using the following variables over a period of three years (2000 to 2002); Holding capacity of the switching equipment, Software version used, Number of base stations launched and the Number of trans-coders used. Performance of the three firms was also measured over the same periods. The following variables were used to measure performance; Number of subscribers, Sales turnover, Average revenue per user, Market growth rate, Return on equity, Operating cost, Operating profits and Number of products in the market.

To establish whether there is a relationship between technology strategy and competitive performance of the three firms Pearson correlation coefficient was used as shown the correlation matrix table 10 shown below.

According to the statistics in the table 10 there is a strong positive correlation between the number of subscribers and holding capacity of the switching equipment, software version, Number of base stations launched, number of trans-coders: (p=0.00,0.963),

(p=0.444), (p=0.00,0.939) and (p=0.895) respectively. The correlation coefficient between sales turnover and the technology variable are also strong and positive, except the software version whose coefficient is not significant and also negative. These strong and positive correlations imply that a change in the level of technology has a strong positive influence on the sales turnover of the companies.

The table 10 also indicates that the Average Revenue Per User as a measure of performance has no significant relationship with the technology variables i.e. Holding capacity of the switching equipment, software version, Number of base stations launched, number of trans-coders: (p=. 929,0.33), (p=. 937, -0.029), (p=. 707, -137), (p=439,.276) respectively.

There is a strong negative correlation between the operating cost and Holding capacity of the switching equipment and software version, of (p=. 000, -.920) and (p=. 14, -.501) respectively. This implies that the use of better more advanced technology leads to a decrease in the cost of operation of the firms.

This analysis indicated that a higher value for a number of technology strategy dimensions is associated with superior competitive performance. It was found that 23 of the 40 possible relationships between dimensions of technology strategy and competitive performance illustrate a significant positive relationship. This number of significant relationships determined in this analysis is far more frequent than could have occurred by chance (see Table 10). These results demonstrate a strong technology strategy and competitive performance relationships.

Table 10: Technology strategy and competitive performance relationships

Correlations

		Holding capacity of the switching equipment	Software version used	Number of base stations launched	Number o transcorde used
Number of subscribers	Pearson Correlation	.963**	.444	.939**	.8
	Sig. (2-tailed)	.000	.098	.000	.0
	N	10	10	10	
Sales turnover(Millions)	Pearson Correlation	.919**	-.510	.884**	.7
	Sig. (2-tailed)	.000	.132	.001	.0
	N	10	10	10	
Average Revenue per User	Pearson Correlation	.033	-.029	-.137	.2
	Sig. (2-tailed)	.929	.937	.707	.4
	N	10	10	10	
Market growth rate	Pearson Correlation	-.785**	.756*	.614	-.6
	Sig. (2-tailed)	.007	.011	.059	.0
	N	10	10	10	
Returns on equity	Pearson Correlation	.071	.763*	.036	.0
	Sig. (2-tailed)	.845	.010	.922	.7
	N	10	10	10	
Operating cost(Million)	Pearson Correlation	-.920**	-.501	.892**	.8
	Sig. (2-tailed)	.000	.140	.001	.0
	N	10	10	10	
Operating profits(Millions)	Pearson Correlation	.814**	.363	.771**	.7
	Sig. (2-tailed)	.004	.102	.009	.0
	N	10	10	10	
R&D costs(Millions)	Pearson Correlation	.923**	-.444	.884**	.9
	Sig. (2-tailed)	.000	.199	.001	.0
	N	10	10	10	
Total Assets(Millions)	Pearson Correlation	.903**	-.271	.835**	.9
	Sig. (2-tailed)	.000	.448	.003	.0
	N	10	10	10	
Number of products in the market	Pearson Correlation	.874**	.425	.826**	.8
	Sig. (2-tailed)	.001	.147	.003	.0
	N	10	10	10	

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

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

Source – Research Data

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section of the paper summarizes these conclusions and highlights practical applications of the results by telephony firms' managers and by future researchers.

5.2 Summary

This research is the first known attempt to explore the association between technology strategy and competitive performance in telephony firms in Kenya. The results provide early empirical evidence that a positive association of technology strategy with competitive performance exists. This gives a first response to the primary question "does technology strategy matter?"

Technology strategy does matter. The research results provide compelling motivation for researchers and managers to further investigate the powerful potential of an appropriate approach to technology strategy to improve competitive performance.

The future technology directions of fixed line operators will provide new challenges to the mobile telephony players. The new technologies will include laying the foundation for broadband technologies that offers various services including multimedia. It is expected that this will lead to significant price drop. The unbundling of the local loop will affect the tariff structures for mobile operators. Introduction of IP based Networks resulting in converged services and multimedia applications hence service prices will be affected. Expected Broadband Services will

include broadband video telephony / videoconference, video surveillance, multiple sound program signals, high-Speed data, and video information and distribution service. Staff development will become a priority.

On the Mobile telephony front, the new General Packet Radio Service (GPRS) and Third Generation (3G) technologies will present opportunities and challenges to all the telephony players. GPRS is a step between GSM and 3G cellular networks. GPRS offers faster data transmission via a GSM network within a range 9.6Kbps to 115Kbps and ability to make telephone calls and transmit data at the same time. The main benefits of GPRS are that it reserves radio resources only when there is data to send and it reduces reliance on traditional circuit-switched network elements. With GPRS, an IP data transmission protocol, which is characteristic of computer networks, is being introduced to GSM. IP is a data transmission protocol which is used in Internet, the largest computer network in the world today. Implementation of GPRS requires changes in the operator's network equipment, in the base stations and base station controllers. Complete overhaul of the network setup is not required hence its cost effective to migrate from 2GSM to GPRS. The modifications to the core network include: new routers need to be added so that traffic can be passed efficiently and radio network needs to be modified in a way that it works both in a packet oriented and circuit-oriented way. GPRS is designed to work within the existing GSM infrastructure resulting in faster introduction of GPRS coverage. GPRS permits more efficient use of the network than circuit radio data. Packet architecture offers higher speeds and better use of the radio resources. GPRS gives a chance for operators to try a new charging method that is charging by data volume instead of duration, which will lead to offering lower tariffs for users. Some of the applications particularly

suited to GPRS include: Chat, textual and visual information, still images, moving images, web browsing, document sharing/collaborative working, audio, job dispatch, corporate e-mail, vehicle positioning, remote LAN access, file transfer and home automation. Advanced consumer applications will include: information on demand regarding weather, traffic, entertainment, stock exchange and flight schedules; fast communication with the service provider to receive bank transactions and administrative information such as statements, bill reminders, or new services; tracking of taxis and credit card validation for customer payment;

control over the position of trucks for transportation companies; localization of stolen cars; support of security and monitoring systems; distribution of specific short messages to select groups of users in large corporations.

The Third Generation of mobile communications (3G) will bring with it mobile multimedia with high data bandwidths and sophisticated mobile terminals and new services and applications. 3G will provide support for: high data rates – up to at least 144 Kbit/s (384 Kbit/s), symmetrical and asymmetrical data transmission, packet-switched and circuit switched services, such as Internet (IP) traffic and real-time video, good voice quality (comparable to wireless), greater capacity and improved spectrum efficiency compared to present-day 2G wireless systems, several simultaneous services to end-users and terminals – that is, for multimedia services, the seamless incorporation of 2nd Generation cellular systems and for the coexistence of, and interconnection with, mobile satellite services, roaming, including international roaming between different IMT-2000 operators; and economies of scale and an open global standard that meets the needs of the mass market. The following services and applications embody the most highly valued capabilities of a third-generation wireless

system: Full range of services – from narrowband voice to wideband, real-time multimedia services. Voice traffic is expected to remain an important application and source of revenue; Support for high-speed packet data, including the browsing of information and the WWW, information delivery (news, weather, traffic, finance) via push techniques – the information might even be location-dependent; and remote and wireless access to the Internet/intranets; Unified messaging services, such as multimedia messaging; Real-time audio/video applications such as videophone, interactive video-conferencing, audio and music, and specialized multimedia business applications, including telemedicine and remote security surveillance ; Mobile e-commerce applications such as mobile banking and mobile shopping; Mobile office applications such as seamless multimedia for users who are on the move and at the office, specialized and private mobile-radio (SMR/PMR) services and Intranet access; Voice over Internet Protocol (VoIP) providing the ability to route telephone calls over the Internet to provide voice telephony service at local call rates to anywhere in the world.

5.3 Conclusions

The above clearly demonstrates that technology strategies adopted by telephony industry players are and will continue to determine the competitive performance of the same players. Taking advantage of what technology has to offer is key to sustained growth and market leadership in the industry.

The results of this study can assist in promoting attention to technology strategy in telephony industry by highlighting the positive relationships with competitive

performance. This should increase managers' motivation to pursue a more advanced approach to technology for competitive advantage. . 'What is the payback?" is a frequently asked question concerning potential investments in new technology. Results from this research should help convince pragmatic senior and operations managers that efforts to use advanced technology are merited.

The results of this study can assist in promoting a planned approach to technology strategy in telephony industry highlighting the positive relationships with competitive performance. More appropriate alignment of a firm's approach to technology with characteristics of its target sector or niche can provide competitive benefits. The measurement framework for technology strategy of the firm will help industry professionals better define priorities and evaluate alternative approaches to technology.

This study shows that more appropriate technology strategies are positively associated with improved competitive performance of telephony firms. Effective implementation of planned approaches to technology can accelerate the rate of technological advance throughout the industry. The study results demonstrate the powerful potential of establishing and maintaining an effective technology strategy to improve competitive performance.

5.4 Recommendations

Further research examining the causality of successful competitive performance of telephony firms is warranted. The chicken-egg controversy described by Glueck and Jauch (1984) merits investigation in telephony industry in Kenya, i.e., if those firms that demonstrate a relatively higher technology strategy valuation are shown to be more successful, does that show that technology strategy leads to success, or are those that are more successful able to devote more attention to technology strategy?

Detailed longitudinal case studies using more case firms (pooled time-series research) may further discern the issues of causality. Though this research was cross-sectional in nature, the richness of data collected provided some indicators of causality. The clear implication from the firms considered in the cases is that technology strategy does matter, and that the technology strategy-competitive performance relationship is worthy of future investigation.

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APPENDICES

Appendix i – Letter of introduction

Appendix ii – Questionnaire

UNIVERSITY OF NAIROBI

FACULTY OF COMMERCE

MBA PROGRAM – LOWER KABETE CAMPUS

Telephone: 732160 Ext 208
Telegrams: "Varsity", Nairobi
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P.O. Box 30197
Nairobi, Kenya

DATE 01/10/2003

TO WHOM IT MAY CONCERN

The bearer of this letter MAINA WANGAI

Registration No: D61/P/8393/01

is a Master of Business Administration (MBA) student of the University of Nairobi.

He/she is required to submit as part of his/her coursework assessment a research project report on some management problem. We would like the students to do their projects on real problems affecting firms in Kenya. We would, therefore, appreciate if you assist him/her by allowing him/her to collect data in your organization for the research.

The results of the report will be used solely for academic purposes and a copy of the same will be availed to the interviewed organizations on request.

Thank you.

M.B.A. OFFICE * P.O. Box 30197, NAIROBI * UNIVERSITY COMMERCE FACULTY

JACKSON MAALU
CO-ORDINATOR, MBA PROGRAM

APPENDIX II

QUESTIONNAIRE FOR DATA COLLECTION

THIS QUESTIONNAIRE HAS THE FOLLOWING SECTIONS

A. General Information
B. Technology Strategy Factors
C. Company Performance Information

(Please tick (√) where appropriate)

SECTION A: GENERAL INFORMATION

A1. Name of your organization.....

A2. Where your organization was originally incorporated?
( ) Kenya ( ) Abroad.

A3. Designation of respondent.....

A4. What services does your company offer?
( ) Fixed lines ( ) Mobile ( ) Both

A5. How long has your organization operated in Kenya?
( ) 0 to 5 years ( ) 6 to 10 years ( ) 11 to 20 years
( ) Over 20 years

A6. Please indicate the total number of staff per category for the specified years.

Year	1998	1999	2000	2001	2002
Management staff					
Technical staff					
Others					

A8. Please indicate the total number of staff per technical qualifications.

Qualification	Number of staff				
	1998	1999	2000	2001	2002
Doctorate					
Masters degree					
Bachelors Degree					
Diploma					
Labor background					
Otherrs					

A9. Please indicate the training costs incurred for the specified years.

Year	1998	1999	2000	2001	2002
Technical Training					
Management Training					
Other					

A10. Does your organization have a clearly articulated mission statement?

( ) Yes ( ) No

A11. Does your organization have a clearly articulated technology strategy?

( ) Yes ( ) No

A12 What kind of strategic planning process does your company follow?

( ) Highly formalized
( ) Somewhat formalized
( ) Vaguely structured
( ) No process may create one
( ) No process, no plans.

A13. Who developed your technology strategy?

( ) Top management
( ) Top management and other employees
( ) Consultants
( ) Adopted from parent company
( ) Others (please specify.....)

A14. How often is your technology strategy reviewed?

( ) once a year

( ) Twice a year

( ) Quarterly.

SECTION B: TECHNOLOGY STRATEGY FACTORS

B1. Do you have emphasis on technology in overall business strategy?

Yes ( ).

No ( ).

		1998	1999	2000	2001	2002
B2. What type of switching equipment do you use?						
B3. What is the holding capacity your switching equipment.						
B4. What software version are you running on your switching equipment						
B5. How many Base Stations have you rolled out?						
B6. Who is the manufacturer of your Base Stations						
B7. What software version are you running on your Base Stations?						
B8. How many Base Station Controllers have you rolled out?						
B9. Who is the manufacturer of your Base Station Controllers?						
B10. What software version are you running on your Base Station Controllers?						
B11. How many Trans-coders have you rolled out?						
B12. Who is the manufacturer of your Trans-coders?						
B13. What software version are you running on your Trans-coders?						
B14.What is your Voice transmission rate?	Full Duplex					
	Half Duplex					

B15. Does your equipments allow for interconnectivity with other equipments?

( ) Yes ( ) No

B16. What is your current Billing system?

Per Second ( ).

Per Minute ( ).

Both ( ).

B17. What Value Added platforms do you offer? (Tick all that apply.)

( ) VMS ( ) WAP ( ) Prepaid Roaming

( ) SMS-SC ( ) Mobile Fax ( ) Mobile Banking

( ) USSD ( ) Mobile Internet Access ( ) Location Service

( ) SMS to Email ( ) Email to SMS ( ) IVRS

( ) GPRS

B18. What Supplementary Services do you offer? (Tick all that apply.)

( ) Calling Line ID Presentation ( ) Calling Line ID Restriction

( ) Calling Line ID Restriction Override ( ) Call Forwarding

( ) Call Holding ( ) Call Transfer

( )Call Completion to Busy Subscriber ( ) Multiparty

B19. What is the Capacity of SIMs in use (KBs)	1998	1999	2000	2002

B20 . What would you say is the philosophy of the company in terms of coverage? Mass ( ). Quality( ). Both ( ).

B21. What is the emphasis on cell planning criteria?

Outdoor ( ). Indoor ( ). Both ( )

B22. What challenges do the company face with the rapid changes in technology?

.....

B23. How does the company respond to changes in technology? .....

.....

.....

B24. To what extent does the company utilize technology as a competitive tool?.....

.....

B25. In terms of adopting new technologies does the company lag or lead its competitors?.....

.....

SECTION C: PERFORMANCE INFORMATION

C1. Would you say it is profitable for you (Company) to be in the Telecommunication industry?

Yes ( ).
No ( ).
Don't Know ( ).

C2. How would you range the competition in the industry?

Very intense ( ).
Intense ( ).
Moderate ( ).
Don't Know ( ).

C3. Please fill the table below.

Year	1998	1999	2000	2001	2002
Number of subscribers					
Sales Turnover (Kshs)					
Average Revenue Per User (ARPU)					
Market Growth Rate					
ROI					
Operating Cost					
Operating Profit					
R&D Costs					

Total Assets					
Number of products in the market					

THANK YOU VERY MUCH FOR YOUR TREASURED ASSISTANCE