

A Survey of Internal and External Challenges Experienced by Kenya's Telecommunication Industry

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Abstract-

Telecommunication, being the process of transferring information from one location to the other, makes the whole world to be a small village and by using this service life has become more comfortable and easier. This paper reviews the present condition of the telecommunication sector in Kenya giving special emphasis on the cellular phone operators, the major challenges they face and also tries to find out what can be done to improve the situation through provision of a set of recommendations based on this analysis. The study was based on extensive literature review, primary and secondary data sources like Communication Commission of Kenya.

Keywords: Communication, Telecommunication, Cellular phone, review, Information, challenges.

1 INTRODUCTION

Communication is the process of transferring information from one location to the other. It encompasses several aspects that include Telecommunication which is the science of transferring information over long distances by electrical and electromagnetic waves through telegraph, telephone, radio, television, satellites and internet. Can also be said to represent any process or group of processes that allows the transmission of audio, video information or data over long distance by means of electromagnetic or electrical signals. The invention of a practical telegraph in the late 1830s and the telephone in 1876 brought humanity into the era of electrical telecommunications. After over 100 years of triumph, public telegraphy left the communications market. But telex took over and evolved into massively popular forms such as SMS and email, while telephony remains the most widely used means of communication in the world today. Over the past century or so, communications technologies have advanced from manual to automatic switching and from analog to digital communications, alongside many other major technological revolutions.

However, the greatest changes in consumer experience did not occur until mobile phone and the Internet came out and became common elements of life, and which continue to generate even larger changes [1].

In our study it represents transfer of information from one location to the other using mobile phone or cellular phone. We totally separated cellular phone from other telecom services like telegraph, telephone (land line), television, radio and others to make our selected sector more specific.

In earlier times a "Telephone" was a symbol of status. It was quite a difficult and lengthy process for one to have a telephone connection at his/her home. This time provided by on-

ly telecom Kenya up to around 2000 when we had the entrance of mobile operators Safaricom and Celtel. In case of an emergency when someone needed to call abroad there was so much harassment in getting a line or if you were lucky to get it, was not clear, distance call rate was so high that sometimes poor people could not afford. Even locally for those who were not lucky enough to get a line had to make long queues behind a telephone booth (located at long distances from one's home) to make a call. But now the situation is totally changed in that technology is available which can avail the information within a very short time thanks to mobile phones. This has drastically changed our lives by making it easy for us as everyone can attest to this. Employment opportunities have increased whereby most graduates get placed in formal employment in the telecommunication sector which can take graduates from various fields. For instance telecommunication, information technology, human resource and other graduates can easily fit into this sector. Government has also been benefited by the revenue from this sector taking an example were companies like Safaricom give a tune of several billions in a year. Also information technology has got a big boost by mobile phone technology growth more so in the mobile application software development section. These rapid changes have been made possible with the mobile technology growth. From information found out yearly reports in CCK reveals that mobile phone subscription in Kenya has reached the 31million mark. The amount one spends per minute has been reducing with time where we started with as high as Kshs 27 a minute in 2000 up to around Ksh1 a minute in 2013. This makes it good enough and affordable for the customers even though it reduces government revenue.

1.1 Statement of the problem

Telecommunication is an important sector in any country where it plays a very important role in a nation's economy. However many researchers have not looked into the study of the challenges and problems facing this very vital sector. This research is intended to going through the challenges facing this industry in Kenya and maybe world over. It is believed

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that the study will enable post graduate students to pick their research topics from some of the problems discussed. The telecommunication industry can also get to know some of the problems they are likely to face as they start a new telecommunication company.

The telecommunications industry in Kenya has been undergoing rapidly changing environmental conditions in terms of the regulatory framework and competition. The Communications Commission of Kenya has in the past 14 or so years licensed four mobile operators (Safaricom, Airtel Telkom Kenya (Orange) and Essar (Yu); all of which are global operators) and several internet service providers. Clearly, competition in this sector has greatly intensified [2].

1.2 Research objectives

The broad objective of the paper is to make an extensive study on the challenges facing telecommunication sector in Kenya. The specific objectives are:

- To identify the problems, challenges and prospects of the telecommunication sector.
- To find out the determinants that affects the expansion (growth) of the sector.
- Determine the significance of the competitive challenges facing Telecommunication industry.

1.3 Importance of the study

The study would be valuable to several stakeholders for the following reasons:

- i. It will help telecommunication companies identify some of the challenges they face or are likely to face.
- ii. Telecommunication companies can use the findings to develop appropriate policies and strategic responses to the challenges, to further better the performance of their companies.
- iii. The study would also provide a source of inspiration to the researchers for self-professional development and enrichment.
- iv. It can help researchers to justify their research in regard to challenges facing the telecommunication sector.

2 LITERATURE REVIEW

2.1 Telecommunication Sector in Kenya.

At present there are four mobile operators in our country. According to the number of subscribers and profitability Safaricom Ltd is in the top position among the four operators. The other companies include Airtel, TKL (Orange) and Essar Telecom Kenya but their main companies are some of the world's famous and big organizations. They have invested a lot and also they have more plans for investment having in mind that their key objective is to earn profits. The Government should create a conducive environment for profit while preserving consumer's rights.

By the end of the first quarter of the 2012/13 financial year (Sep. 12), there were a total of 30.4 million subscriptions in the mobile telephony market segment up from 29.7 million posted in the previous quarter.

The following tables show the number of mobile subscribers and mobile penetration in % in Kenya from 1999 to September 2012 in table 1 and table 2 the mobile subscriptions per operator as of September 2012 [2].

TABLE I: MOBILE SUBSCRIPTIONS PER OPERATOR

Name of operator	Sep-12		
	Pre-paid	Post-paid	Total
Safaricom Ltd	19,045,713	175,496	19,221,209
Airtel Networks Kenya Ltd	4,997,807	116,189	5,113,996
Essar Telecom Kenya Ltd	3,001,808	1,490	3,003,298
Telkom Kenya Ltd (Orange)	3,089,814	4,465	3,094,279
Total	30,135,142	297,640	30,432,782

2.2 Challenges

A challenge is a general term referring to things that are imbued with a sense of difficulty and victory [3]. Organizations are facing many large challenges today, including containing costs while delivering increasingly more complex services and providing a consistently higher level of customer service across wide geographical areas, enhancing the effectiveness and efficiency of communications with citizens and other stakeholders, utilizing emerging technologies to improve staff productivity ensuring the reliability, availability, survivability and security of telephone, data network and Internet platforms and services and implementing centralized administration of services provided at satellite sites. With increasingly limited resources and time, ICT staff is challenged to stay current with the fast pace of technological change. Communications and information technology can no longer be viewed as merely a utility but as a strategic asset to an organization's goals. The following sections give a detailed coverage of some of the most common challenges that the telecommunication sector faces world over [4].

2.3 Environmental challenges

Environmental challenges are issues facing the business organization from within and without that threaten the ability of the organization to compete successfully in the market. Therefore, in today's highly turbulent business environment, it is important for the organization to engage in continuous scanning of environment in order to promptly identify the issues facing the organization and undertake timely responses. This section will look at the environmental challenges which can be divided into two sections i.e. internal challenges and external

challenges.

2.3.1 Internal Environmental Challenges

These are challenges experienced internally to the organization that significantly disfavours the organization, that is compromise its effectiveness in the competitive business environment. If the organization has to survive in the turbulent environmental conditions, then it has to adopt appropriate strategies to eliminate or at the least minimize the effects of its internal weaknesses. Internal weaknesses for an organization could include any of the following combinations: Poor corporate governance, negative organizational culture, poor financial performance, slow business growth, poor quality of products and services, poor marketing strategies, inefficient distribution channels, high inefficiencies in production, bloated workforce, unskilled and inexperienced key employees, poor staff compensation, and retention incentives and low staff morale. Each organization should clearly identify its internal weaknesses against the major competitors and put in place strategies to overcome these weaknesses [5].

2.3.2 External Environmental Challenges

External environmental challenges are factors presented to the organization by the external environment that threaten or hamper the organization from achieving its business objectives and targets. PEST analysis categorizes environmental influences as political, economic, social and technological forces. It is important to examine the impact of each of these factors (and their interplay with each other) on the business. The results can then be used to take advantage of opportunities and to make contingency plans for threats when preparing business and strategic plans. Political factors include areas such as: Tax policy, employment laws, environmental regulations, trade restrictions and tariffs, political stability, elections, consumer protection, competitive regulations, inter-country diplomatic relationships/attitudes, war, terrorism and governance/country leadership. Political factors can either favour or disfavour the organization, thus affecting its ability to successfully conduct business.

2.4 Competitive challenges

Competitive challenges can be classified under the micro-environmental (industry) external factors. The forces which drive competition, contending that the competitive environment is created by the interaction of five different forces acting on a business. The original competitive forces model, as proposed by Porter, identified five forces which would impact on an organization's behaviour in a competitive market. These include the following: The rivalry between existing firms in the market, the power exerted by the customers in the market, the impact of the suppliers on the sellers, the potential threat of new firms entering the market and the threat of substitute products becoming available in the market.

Understanding the nature of each of these forces gives organizations the necessary insights to enable them to formulate the appropriate strategies to be successful in their market.

2.4.1 The Rivalry between firms

High competition in mobile or telecom sector in our country is one of the main problems. In our country the only telecommunication company we ever had before the entrance of other operators was Telkom Kenya Ltd. After the introduction of other telecommunication companies more so mobile operators like Safaricom, Celtel and Essar everything changed for the national telcom company in terms of its fortunes. People moved to the use of cellular phones as opposed to landline. This made the competition very stiff whereby Telkom Kenya could not handle which resulted to a merger with Orange Telkom. In total we now have four operators i.e. Safaricom, Airtel, Orange and Essar (Yu) which signifies a very high level of competition. Safaricom being one with lion share is accused in several occasions using its share to muscle the other operators in many ways.

2.4.2 The Threat of New Entrants

Both potential and existing competitors influence average industry profitability. The threat of new entrants is usually based on the market entry barriers. They can take diverse forms and are used to prevent an influx of firms into an industry whenever profits, adjusted for the cost of capital, rise above zero. In contrast, entry barriers exist whenever it is difficult or not economically feasible for an outsider to replicate the incumbents' position. The most common forms of entry barriers, except intrinsic physical or legal obstacles, are as follows: Economies of scale - for example, benefits associated with bulk purchasing, cost of entry - for example, investment into technology, distribution channels - for example, ease of access for competitors, cost advantages not related to the size of the company - for example, contacts and expertise, government legislations - for example, introduction of new laws might weaken company's competitive position, and differentiation - for example, certain brands that cannot be copied.

2.4.3 The Threat of Substitute Products

The threat that substitute products pose to an industry's profitability depends on the relative price-to-performance ratios of the different types of products or services to which customers can turn to satisfy the same basic need. The threat of substitution is also affected by switching costs, that is, the costs in areas such as retraining, retooling and redesigning that are incurred when a customer switches to a different type of product or service. It also involves: Product-for-product substitution (email for mail, fax), is based on the substitution of need, generic substitution - for example Video suppliers competing with travel companies, substitution that relates to something that people can do without - for examples cigarettes, alcohol.

2.4.4 The Bargaining Power of Customers

The bargaining power of customers is one of the two horizontal forces that influence the appropriation of the value created by an industry. The most important determinants of buyer

power are the size and the concentration of customers. Other factors are the extent to which the buyers are informed and the concentration or differentiation of the competitors.

2.4.5 The Bargaining Power of Suppliers

The bargaining power of suppliers is a mirror image of the bargaining buyer power. As a result, the analysis of supplier power typically focuses first on the relative size and concentration of suppliers relative to industry participants and second on the degree of differentiation in the inputs supplied.

2.4.6 Unstable Political Situation:

The political situation of a company is a very important consideration to a company. For instance the political history of our country is not quite stable. This was at its peak in 2007/2008 when we had post-election violence which led to loss of lives, many people getting displaced and losses of up to several billions of Kenya shillings. This real slowed down our economy. Other types of political violence, corruption and many more problems make our country instable and also has made this sector and many other sectors insecure. For the last few years our democracy has faced a few ups and downs. Most investors have shied from investing in the country as the election period for 2012/2013 goes on. This can also slow down the economic growth of the country in general.

2.4.7 High Rate of Corporate Tax:

Corporation tax is a form of Income Tax that is levied on corporate bodies such as Limited Companies, Trusts, and Cooperatives. Resident Companies are taxable at a rate of 30% while non-resident companies are taxable at the rate of 37.5% on their taxable profits. Therefore the telecommunication sector with companies falling under Limited Companies pay high corporate tax which is 30%-37.5% which is another major problem or challenge to the operators.

2.4.8 Regulatory compliance

One factor influencing which technology to use in the telecommunication industry is regulatory policies. There are many new technologies on the market for instance UMA, WiMAX, LTE (4G), to name a few. Adoption of such technologies entails a risk.

2.5 Security Challenges [6]

There are different types of security challenges that face the telecommunication sector in Kenya and most probably world over. Before giving examples the following give a few forms of security that can be affected by the challenges.

2.5.1 Physical Security

Describes security measures that are designed to deny access to unauthorized personnel (including attackers or even accidental intruders) from physically accessing a building, facility,

resource, or stored information; and guidance on how to design structures to resist potentially hostile acts. Physical security can be as simple as a locked door or as elaborate as multiple layers of barriers, armed security guards and guardhouse placement. [7]

2.5.2 Communications Security

This is the discipline of preventing unauthorized interceptors from accessing telecommunications in an intelligible form, while still delivering content to the intended recipients. In the United States Department of Defense culture, it is often referred to by the abbreviation COMSEC. The field includes cryptosecurity, transmission security, emission security, traffic-flow security and physical security of COMSEC equipment.

COMSEC is used to protect both classified and unclassified traffic on military communications networks, including voice, video, and data. It is used for both analog and digital applications, and both wired and wireless links [8].

2.5.3 Emissions Security

These are defined as unintentional intelligence-bearing signals which, if intercepted and analyzed, may disclose the information transmitted, received, handled, or otherwise processed by any information-processing equipment also called compromising emanations.

Compromising emanations consist of electrical, mechanical, or acoustical energy intentionally or by mishap unintentionally emitted by any number of sources within equipment/systems which process national security information. This energy may relate to the original pre- or non-encrypted message, or information being processed, in such a way that it can lead to recovery of the plaintext. [9]

2.5.4 Computer Security

This is information security as applied to computers and networks. The field covers all the processes and mechanisms by which computer-based equipment, information and services are protected from unintended or unauthorized access, change or destruction. Computer security also includes protection from unplanned events and natural disasters [8].

2.5.5 Network Security

It consists of the provisions and policies adopted by a network administrator to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. Network security involves the authorization of access to data in a network, which is controlled by the network administrator. Users choose or are assigned an ID and password or other authenticating information that allows them access to information and programs within their authority. Network security covers a variety of computer networks, both public and private, that are used in everyday jobs conducting transactions and communications

among businesses, government agencies and individuals. Networks can be private, such as within a company, and others which might be open to public access. Network security is involved in organizations, enterprises, and other types of institutions. It does as its title explains: It secures the network, as well as protecting and overseeing operations being done. The most common and simple way of protecting a network resource is by assigning it a unique name and a corresponding password [10].

2.5.6 Information Security

This is the practice of defending information from unauthorized access, use, disclosure, disruption, modification, perusal, inspection, recording or destruction. It is a general term that can be used regardless of the form the data may take (electronic, physical, etc...). Sometimes it is shortened to InfoSec [11]. There are four primary categories of attacks that can pose as challenges to the above forms of security and they include; Access, Modification, Denial of service, Repudiation.

2.5.6.1 Access attacks

An access attack is an attempt to gain information that the attacker is unauthorized to see. This attack can occur wherever the information resides or may exist during transmission. This type of attack is an attack against the confidentiality of the information. Which include snooping- looking through information files in the hopes of finding something interesting, eavesdropping- someone listens in on a conversation that they are not a part of and interception- an active attack against the information [11].

2.5.6.2 Modification attacks

A modification attack is an attempt to modify information that an attacker is not authorized to modify. This attack can occur wherever the information resides. It may also be attempted against information in transit. This type of attack is an attack against the integrity of the information that involves changes, insertion and deletion.

2.5.6.3 Denial-of-service attacks

Denial-of-service (DoS) attacks are attacks that deny the use of resources to legitimate users of the system, information, or capabilities. DoS attacks generally do not allow the attacker to access or modify information on the computer system or in the physical world. DoS attacks are nothing more than vandalism. It includes denial of access to information, applications and systems.

2.5.6.4 Repudiation attacks

Repudiation is an attack against the accountability of the information. In other words, repudiation is an attempt to give false information or to deny that a real event or transaction should have occurred. They include masquerading- an attempt to act like or impersonate someone else or some other system, and denying an event- disavowing that the action was taken as it was logged [6] [13].

2.5.7 Thermal challenges

Thermal challenges in telecommunication systems and data centers Immediate and future thermal challenges. They can be divided into component level and system level.

2.5.7.1 Component Level

Thermal Effects on Transistor Operation:

The power dissipation of a transistor can be decomposed into dynamic power dissipation (depending on the switching frequency) and a static contribution due to leakage. For a typical CMOS transistor operated at normal temperatures (below 100 °C), the total leakage current is the sum of sub-threshold leakage and gate oxide leakage.

2.5.7.2 System Level

Multiple Heat Transfer Interfaces:

The multiscale nature of electronics cooling from chip to ambient results in the presence of multiple heat transfer interfaces and cycles. To achieve overall gains in energy efficiency, efforts should be made to eliminate intermediate interfaces wherever possible. A possible approach is to integrate direct refrigeration cooling cycles into individual racks, although the feasibility of this approach should be investigated on a case-specific basis. Different techniques and cooling fluids (air, water, refrigerants and others) exist, yet no single coolant or technique can cover the entire cooling cascade from chip to ambient for current datacom equipment.

[14].

2.5.8 Power Supply

There are two main challenges that the telecommunication sector and maybe other sectors face in terms of power supply that is erratic power supply and low coverage as far as power supply is concerned.

2.5.8.1 Erratic Power Supply

Power supply is listed as one of the main problems resulting to poor quality of service in the telecom industry. You can agree with me that a day goes without power supply disruption in Kenya.

It has become a central theme, unfortunately, government functionaries who should know have refused to calm public nerves. The issue of irregular public supply runs across in the country and has cost several industries to shut down due principally to the high operational cost [15].

2.5.8.2 Lower power coverage

This is a very big challenge in Kenya more so when it comes to the rural areas. Most of us can agree that in Kenya most rural areas don't have electricity supply. This makes it very difficult for mobile phone operators who incur very high initial and running costs for the power supply they employ in rural area stations of which is again passed to the consumers who are already burdened with high call rates. One of the mobile operator's technical manager indicated that they are looking for ways of tapping into the renewable energy as they try to solve the problem.

2.6 Technology challenges

Telecom firms usually have a huge base of complex legacy systems. These systems are disparate with their own data. Integration (system and data) of such systems has been a problem. All this has a heavy toll on Customer loyalty, Product lifecycle management, and Process improvements.

Moreover, technologies are swiftly 'Converging'. This boils down to;

- Greater penetration of broadband is necessary, to deliver the converged product bundles.
- Quality of Service (QoS) needs to be of higher standards [16].

'Cloud Computing' as one of the new technologies brings many challenges as to how the telecommunication companies can use to their competitive advantage.

2.6.1 Interference

In physics, interference is a phenomenon in which two waves superimpose to form a resultant wave of greater or lower amplitude. Interference usually refers to the interaction of waves that are correlated or coherent with each other, either because they come from the same source or because they have the same or nearly the same frequency. Interference effects can be observed with all types of waves, for example, light, radio, acoustic, and surface water waves.

2.6.2 Interference Management

Clearly, the issue of interference will become more severe than today when the density of base stations is increased and a growing portion of them is consumer deployed. This will lead to interference scenarios that are frequently changing (e.g., due to users turning on and off access points or simply by opening or closing windows) more complex (due to 3-D deployment of base stations differing in access rights, bands, and transmit power) out of operators' control and less structured, i.e., less suitable for the application of signal processing-based interference mitigation and cancellation schemes.

2.6.3 Mobility and Session Management

A further challenge in the context of dense heterogeneous networks is user or device mobility. This is due to the fact that handover between base stations has to be performed more often, based not only on radio conditions but potentially also on other aspects such as service availability for a certain type of traffic or QoS level. Further, handover may also be needed between classical device-infrastructure-device communication and direct D2D communication, which is clearly of different nature than handovers in third (3G) and fourth generation (4G). Again, some fundamental network features are needed:

2.6.4 Network Infrastructure

The final challenge to be addressed in this article is how device-related data are conveyed to and from access points or how information is exchanged among access points for the purpose of coordination and cooperation. As infrastructure

connectivity will be one of the main cost drivers in the LTE of cellular systems, it is essential that any future mobile communications system makes most efficient use of the general degrees of freedom involved here such as the extent of network aggregation and the corresponding choice of infrastructure topology the technologies used for infrastructure connectivity and the usage of predefined or ad hoc connectivity [17].

2.6.5 Signal Propagation quality levels.

Signal Propagation is the behavior of radio waves when they are transmitted, or propagated from one point on the Earth to another, or into various parts of the atmosphere. As a form of electromagnetic radiation, like light waves, radio waves are affected by the phenomena of reflection, refraction, diffraction, absorption, polarization and scattering [18]. Signal propagation can be divided into two main categories namely outdoor and indoor signal propagation.

2.6.5.1 Outdoor signal propagation

Today, wireless networks are absolutely ubiquitous and the importance of their role in our daily lives cannot be underestimated. To a large extent, our ability to build and understand these networks hinges on understanding how wireless signals are attenuated over distance in realistic environments. By predicting the attenuation of a radio signal, we can better plan and diagnose networks as well as build futuristic networks that adapt to the spatiotemporal radio environment. For instance, today's network engineers need methods for accurately mapping the extent of coverage of existing and planned networks, yet the efficacy of those approaches is determined by the predictive power of the underlying path loss model (or interpolation regime). Similarly, researchers that investigate dynamic spectrum access networks require accurate radio environment maps to make appropriate and timely frequency allocation decisions, yet the performance of these systems is tied intimately to their ability to make meaningful predictions about the current and future occupancy of the radio channel.

Since the 1940's, researchers and engineers have pondered this problem and have developed myriad schemes that purport to predict the value or distribution of signal attenuation (path loss) in many different environments and at different frequencies.

Before implementing designs and confirming planning of wireless communication systems, accurate propagation characteristics of the environment should be known. Propagation prediction usually provides two types of parameters corresponding to the large-scale path loss and small-scale fading statistics. The path-loss information is vital for the determination of coverage of a base-station (BS) placement and in optimizing it. The small-scale parameters usually provide statistical information on local field variations and this, in turn, leads to the calculation of important parameters that help improve receiver (Rx) designs and combat the multipath fading. Without propagation predictions, these parameter estimations can only be obtained by field measurements which are time consuming and expensive. The outdoor signal propagation prediction is also one of the challenges facing telecommunication

engineers and therefore the telecommunication sector since inaccurate prediction can lead to mislocation of the base station and hence poor signal quality.

2.6.5.2 Indoor signal propagation

An important consideration in successful implementation of the personal communication services (PCS) is indoor radio communication; transmission of voice, data and video to people on the move inside buildings. Indoor radio communication covers a wide variety of situations ranging from communication with individuals walking in residential or office buildings, supermarkets or shopping malls, etc., to fixed stations sending messages to robots in motion in assembly lines and factory environments of the future [19]. Network architecture for in-building communications is evolving where of late we have even wireless routers installed within buildings.

Study by ABI research shows that in the future, more than 50% of voice calls and more than 70% of data traffic is expected to originate from indoor users. Another survey shows that 30% of business and 45% of household users experience poor indoor coverage [20]. The new multimedia services and high data rate applications intensifies the need of good quality indoor coverage. Hence, providing good quality indoor voice and data services is of great importance. This would also be beneficial for the cellular operators in the form of increased revenue and reduced churn.

Mobile cellular networks have gained reputation for poor indoor coverage resulting in inferior call quality, Quality of Service (QoS) issues becomes more predominant as mobile users begin using 3G services. Due to the penetration losses, the indoor user requires high power from the serving Base Station (BS), which means other users would have less power and as a result the overall system throughput is reduced. It is also very expensive to have a large number of outdoor BSs to meet the needs of a high capacity network. The large number of BSs would pose larger burden on network planning and optimization as well. The modulation and coding schemes for high data rates used in the standards mentioned above, require good channel conditions, which means that in the case of indoor coverage, QoS can't be guaranteed due to the variations in channel conditions [21].

To achieve high data rates, signals with high Signal to Interference plus Noise Ratio (SINR) should be received, keeping in mind that transmitter should not cause significant interference to other users by transmitting high power signals. High data rates also require higher order modulation and coding schemes, which are currently used in the above mentioned standards. However, higher order modulation and coding schemes are more susceptible to noise in a given environment. On the other hand, capacity is generally increased by providing larger number of channels per area (cell). This is possible by reducing the area of each cell and thus increasing channel reuse. Classical approaches like Cell Splitting and Cell Sectoring are widely used in current wireless standards to increase system capacity [22].

This also is one of the main challenges to mobile operators where many engineers can agree that it is the most complex environment (indoor) to deal with.

2.6.6 Content and data

As content providers increasingly use more and more network capabilities it is difficult to see how operators can benefit. Could they and should they explore ways of securing revenue from content providers and disruptive players?

Operators may have the opportunity to become more than resellers of content and actually become content providers in their own right. But how can they do this? What new business models would need to be developed? The challenges of creating a sustainable content delivery model is crucial to the future of operators as data and content being to play an increasingly bigger part of customers lives.

2.6.7 Customer loyalty

Most operators offer similar products for similar prices and it is very difficult to develop a long term-big impact customer loyalty programme that is successful. How can operators ensure high levels of customer retention and increase their volumes of new customers?

2.6.8 New growth opportunities

Operators are finding it exceptionally difficult to grow in highly saturated markets, increased competition and limited opportunities mean it is necessary for the companies to look to assess new growth regions where saturation rates are much lower. What regions and countries will offer the greatest growth opportunities? Should a company develop strategic partnerships with growth market operators? What form should these partnerships take [23]?

3 RESEARCH METHODOLOGY

3.1 Research Design and data Collection

In this research, we took some little information from telecommunication companies managers. Much of the information was obtained from secondary sources i.e. the internet e-journals, e-books and websites like the CCK website.

In purposive sampling, sampling is done with a purpose in mind. With a purposive sample, one is likely to get the opinions of the target population. Both primary and secondary data was collected. Primary data was collected from some telecommunication companies' staff i.e. Safaricom and Orange, via personal interviews. The Orange officer from whom the data was collected were: Manager/Telkom Wireless. Secondary data was collected from the reports of the Communications Commission of Kenya (CCK), via the internet, e-books and e-journals. An interview guide, consisting of a single part was used for collection of primary data in this study. The part contained request for information on the competitive challenges faced by telecommunication companies. The above interviews were administered personally by the researcher.

3.2 Sources of Data/ Data use:

Both primary and secondary data have been used. However, the major reliance was on secondary data at national and international levels. Primary data were collected through interviews and discussions with some officials and experts of different telecom service providers. Also annual reports of different telecom, articles published in newspapers, conference papers and seminars proceedings have been carefully studied to procure the needed information.

3.3 Data Analysis

For this study, the content analysis technique was employed to analyze the data. Data from the respondents was analyzed for content, i.e. relevance and level of significance. In addition, each response was confirmed by at least one other respondent. The level of significance was graded as "High, Medium, and Low" and the overall result was taken as the predominant view (where there was a tie, the lower grading was taken); the main aim being to pick only the key issues. The full report on the key findings of this study by the researcher are presented in section below.

4 FINDINGS AND DISCUSSIONS

4.1 Introduction

This section deals with analysis and discussion of the research findings. Data was collected from telecommunication Engineers in TKL (Orange), Airtel, Essar and Safaricom who are involved in the technical sections of the companies. The respondents had worked for the companies for between three and eight years. Because of their varied nature of the responsibilities and long years of service, they have a thorough knowledge of the organization, its activities, programs and challenges. Each response from the respondents was analyzed for content, i.e. relevance, level of significance and confirmation by at least one other respondent. Following is a report on the key findings of this study by the researcher.

4.2 Challenges:

4.2.1 Internal Challenges

From the study, the researcher realized that the telecommunication companies faces two major internal environmental challenges. First, are the huge disparities in remuneration, between the newly recruited staff (with better terms on similar or even lower qualifications) and the old staff. The differences in remuneration between the two groups are up to five times. This has created a cold attitude between the two categories of staff.

4.2.2 External Challenges

The researcher also established that the major external challenges facing the telecommunication companies are: the general perception that regulator favours competitors, old network equipment and customer needs that exceeds the current telecom services. The first two external challenges are classified as political-legal. At the moment competition has mainly been on the area of mobility. Over the last few years, some companies has not been able to effectively fight regulatory issues due to perceived bias by the regulator, towards the competitors their competitors. The old network equipment poses a technological challenge to the companies by limiting their capabilities to offer modern services demanded by the customers, in the rapidly evolving telecommunications sector. From table 1 above, the other key competitive challenges that threaten the companies' competitive position, as determined by the researcher are: rivalry in the Kenya telecoms industry, substitute products, high bargaining power of customers and poor quality of service. There is intense rivalry in the Kenyan telecoms industry, from pricing to aggressive advertising and sales promotions. Substitute products in the form of alternative calling methods like voice over the internet (VOIP) and wireless local loop are eating into the companies' market share. Wireless local loop is also a close substitute to mobile telephony, especially for customers whose operations are concentrated in the major urban centres. The telecommunication customers in Kenya possess significant bargaining power, as a result of the several similar service providers, i.e. TKL (Orange), Safaricom, Celtel, Essar, Flashcom and Emcom. On the other hand, poor quality of service is hitting hard on some of the companies. Other challenges that face the telecom companies include; high rate of corporate tax, security challenges i.e. access attacks, modification attacks, denial-of-service attacks, repudiation attacks. Also thermal challenges in telecommunication systems and data centers (component and system level), erratic power supply, lower coverage (power supply), interference management, mobility and session management, outdoor signal propagation and indoor signal propagation. High rate of corporate tax, security and indoor signal propagation seem to have the highest significance with most companies while the rest have medium and low significance.

Indoor signal propagation

The challenge of indoor propagation is a serious problem more so when there are no indoor solutions. This is evident in most buildings where several calls are dropped due to poor signal quality. For places where indoor solutions are provided the problem is not that preferent as opposed to places without. Indoor solutions come with an extra cost which is one of their biggest limitations. This makes it necessary to develop good models which can make use of the existing outdoor transmitters by performing accurate planning in optimizing their locations.

TABLE II: CHALLENGES AND THEIR SIGNIFICANCE

Challenge	Significance
Internal	Medium
External	Medium

Internal Challenges	Significance
Cultural blending between foreign staff	Medium
Harmonization of HR issues, including remuneration (there exists big disparities in salaries)	Medium
Change management during restructuring (ineffective communication, communication, low staff morale, processes nor clearly defined)	Medium
External Challenges	Significance
New Licensing regime is just about to be introduced (unified license)	Low
The company's wireless service faces regulatory restriction on mobility	Low
The regulator is perceived to favour the competitors of your company.	Medium
Economic Challenges	Significance
The current tough economic conditions fuelled by increase oil prices is causing the company's customers to cut down on communication expenses	Medium
The pre and post-election effects hurts the Kenyan economy	Low
Social-cultural Challenges	
Poor perception on the company's "efficiency". Expectations are high for a complete turnaround.	Low
The company is being perceived to be sidelining "old" staff in favour of the "new"	Low
Generally Kenyans are receptive to the company's products. But negative treatment of old employees could have negative impacts	Low
Poor staff remuneration may impact negatively	High
The company is losing highly experienced staff to competitors	Medium

Technological Challenges	
Network infrastructure is old and requires complete overhaul	Low
Customer needs are ahead of current company's services. This may force the company to be reactive instead of proactive	Low
New technologies will require acquisition of advanced skills by respective company staff	High
Competition Challenges	
Rivalry in the Industry	Medium
Threat of New Entrants	Low
Threat of Substitute Products	High
Others	
High bargaining power from the customers comes from the several choices available from mobile, Local Loop Operators, Voice over Internet.	Medium
Poor quality of service	Low
Suppliers used to have significant bargaining power before the coming in the Strategic Partner. But now the new partner enjoys volume discounts because of their large worldwide networks.	Low
High Rate of Corporate Tax	High
Access Attacks	Low
Modification attacks	Medium
Denial of service attacks	Medium
Repudiation attacks	Low
Thermal challenges in telecommunication systems and data centers (component and system level)	High
Erratic power supply	Medium
Lower power coverage	Low
Interference management	Low
Mobility and session management	Low
Outdoor signal propagation	Low
Indoor signal propagation (without indoor solutions)	High

4.3 Summary

The objectives of this study were to determine the challenges experienced by telecommunication industry in Kenya. The researcher found out that telecommunication companies are battling with internal, external, competitive and technological challenges. The major internal challenges are poor pay and harmonization of huge disparities in staff remuneration. The key external challenges are the advanced customer needs that are ahead of telecommunication sector's current services and a poor state of network infrastructure that cannot offer modern telecommunications services. The top competitive challenges to within the telecommunication companies are intense rivalry among the telecom players, existence of cheaper substitute products to traditional telecommunications services, high bargaining power of customers and poor quality of service (QoS). Indoor signal propagation, in cases where there are no indoor solutions, also featured as one of the major challenges the telecommunication companies are experiencing.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

In conclusion, many telecommunication companies are indeed facing internal, external, competitive and other challenges mentioned above. According to the researcher, the above challenges could result to significantly slowing down the telecommunication sector steady progress towards matching up to competition in Kenya. Secondly the rollout of fully fledged mobile services would give telecommunication sector a cutting edge technological advantage on the telecommunications infrastructure, supporting highly modern services that meet and exceed customer expectations. The market penetration, market development and product development strategies adopted by most companies are expected to turn in the customer numbers required to lift the companies to high profitability levels.

Major limitation of the study was lack of available information and previous workings on the topic. There are not enough supportive articles to make an extensive literature review. Besides this the persons whom we interviewed for primary data were reluctant to provide the proper information. Also, most of the secondary data obtained and used were scattered.

5.2 Recommendations

In the light of the foregoing findings by the researcher, Telecommunication companies should keenly implement the following:

- Enhance the current marketing strategies with convincing incentives for customers to switch to their products.
- Develop proactive, long term customer retention policies.
- Bring the quality of service to significantly new competitive levels.

Future research agenda should include a survey of strategic responses to the highly turbulent environment faced by telecommunications firms in Kenya; to look at and compare the various strategic approaches by the different telecommunica-

tions operators in Kenya to these different challenges. Another area of study would be look at the impact of key strategic responses on the competitiveness of Kenyan telecommunication companies.

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