TANZANIA NATIONAL FIBRE BROADBAND BACKBONE: 
Challenges and Opportunities

Eliamani Sedoyeka6 amani@rightclick.co.tz
John Sicilima, johnsicilima@gmail.com

ABSTRACT

The study on operational efficiency brought by the National ICT Broadband Backbone (NICTBB) to service providers was conducted in mobile communication companies in Tanzania. The study wanted to identify the status of fibre infrastructure in Tanzania and East Africa, to examine factors which cause low utilization of the Tanzania National ICT Broadband Backbone (NICTBB) and to determine strategies to improve the applicability of the National ICT Broadband Backbone. This paper presents the results from that study.

Using case study, the study found out of 90 respondents 40, (44.4%) identified the coverage of the fibre infrastructure is satisfactory. The study concluded that the status of the NICTBB satisfactory in terms of coverage since it covers major parts of the country. It is also concluded that NICTBB meet capacity requirements. Moreover, the study concluded that price is a major reason for underutilization of the fibre infrastructure, other factors involves; lack of awareness, slow internet growth, lack of local contents and unfavourable government policies. The study recommended that there is a need of increase awareness to public to foster full utilization of the NICTBB. The connectivity prices should also be regulated and affordable to huge number of users, special rate to Government institutions and research centres.
The study brings more insight to policy makers to come up with proper mechanisms on challenges impeding telecommunication companies in ICT operations. It would also inform the ongoing policy debates on the effectiveness of National ICT Broadband Backbone for Tanzania economy. It will also be useful to all stakeholders in the industry including ISP, scholars and investors.

IJCIR Reference Format:


INTRODUCTION

1.1 National information and Communication Technology Broadband Backbone (NICTBB) Project

The Government of Tanzania through its project embarked on the National information and Communication Technology Broadband Backbone (NICTBB) Project [Lange, 2009; Mfungahema, 2006]. The NICTBB roll out began in 2009 aimed at installation of the National fibre optic broadband backbone connectivity which will enable to get fast, reliable and affordable the internet connections. In line with the National ICT Policy [2003], currently under review, Tanzania has already built a high capacity state-of-art NICTBB that offers high quality services at utility prices, having reduced the backhaul tariffs by 99% compared to 2009 tariffs [Koutroumpis, 2009]

Phase I and II of the project which was completed since 2012 created 7560km backbone that has point of presence (PoPs) at all regional headquarters [NICTBB, 2016]. By design the NICTBB addresses national needs and those of the landlocked neighbouring countries by offering both cross-border connectivity and access to four International submarine cables: SEACOM, EASSY, SEAs and TEAMS (at Mombasa, Kenya). This broadband readiness, supplying abundant national and international bandwidth, is fast enabling eMarkets in Tanzania to emerge and are growing, leveraging the growing popularity of
eTransactions already backed by Mobile electronic money transfer services. These eTransactions will continue to permeate people’s life styles extending to eLearning, eHealth and eGovernment [Wellenius, 2003].

Phase III aims at enhancing the infrastructure to reach the all the district headquarters in order to facilitate the provision of services such as data centres as well as supporting public organization, research and academic institutions [NICTBB 2016].

Figure 1: The NICTBB Architecture of the IP Backbone Network [NICTBB 2016]

Phase IV will engage private sector especially telecom operators to roll out Metro Rings Networks in urban areas while Phase V will focus on implementing last mile broadband connectivity national wide to link institutions and most importantly, general public.
Moreover, NICTBB has the potential to accelerate ICT adoption and can be sustained to create a higher socio-economic impact through aggressive content development that will be delivered using the available broadband connectivity as it is extended to cover communities, schools, higher learning and research institutions, hospitals and associated health facilities, government offices, and businesses [Lange, 2009]. Prospectively, the broadband connectivity opportunity is a multibillion-dollar eMarket for content and other e-services [TCRA, 2006].

The introduction of Backbone networks in Tanzania has a major impact on the commercial viability of ICT services, particularly broadband. In a typical mobile phone network, the backbone network accounts for 10–15 percent of total network costs [Smith et al, 2006]. The cost of backbone networks is much higher for operators providing broadband connectivity, particularly in small towns and rural areas. If an area does not have a backbone network offering low-cost network services, broadband connectivity is unlikely to be commercially viable [TCRA, 2012].

1.2 The Challenge

The NICTBB set up began in 2009, the overall objective was the installation of the National fibre optic broadband backbone connectivity which will enable to get fast, reliable and affordable the internet connections. This would boost the nation’s internet connectivity/coverage rate [Stephen 2008]. The Government of Tanzania spent over 250 billion in investment of this National fibre optic [TCRA, 2012]. Notwithstanding of the effort done by the government of Tanzania still the NICTBB is not being fully utilized to its full potential. By 2010, the backbone was operating at less than 10% of its installed capacity and even lower at its design capacity [Lange, 2010]. This was also because there was only phase one and two completed, connecting regional headquarters.

There is a need for full utilization of the NICTBB, full utilization of the NICTBB will; reduction in transport, travel and distribution costs. Furthermore ICTs applications enable
efficient communication online, where information and reports can be shared amongst members without physical gathering, meetings can be held remotely, and some assignments can be carried out from homes or without necessarily travelling all the way from homes to the work places or in another country, particularly in cities where traffic jams are order of the day [Lange, 2009]. Generally, the study presented in this paper intended to assess operational efficiency brought by the National ICT Broadband Backbone [NICTBB] to service providers. Starting with identifying the status of fibre infrastructure in Tanzania and East Africa, the study also wanted to examine factors which cause low utilization of the National ICT Broadband Backbone [NICTBB] and finally to determine strategies to improve the applicability of the National ICT Broadband Backbone.

LITERATURE REVIEW

2.1 Status of ICT in Tanzania
Tanzania has made remarkable progress in deploying ICT which has been well received by the citizens and service providers who are striving to address unmet demand and competition in newly liberalized markets [TCRA, 2012; Mfungahema, 2006]. Tanzania’s tele-density is low, with the number of fixed and mobile cellular lines currently standing at 12 telephone lines per 1000 people (a teledensity) and the number of mobile phone subscribers currently stands at 81 per 10,000 inhabitants. Tanzania’s Public Switched Telephone Network (PSTN), using fibre optic, microwave and satellite-based links, is now over 95% digital. This paves the way for allowing the provision of new services enabled by ICT (August, 2012). The coverage of the network infrastructure is limited to urban areas and thus lack of telecommunications and other infrastructures in the rural areas remains a basic impediment to the provision of such new ICT services [Hughes and Lonie, 2007].

By 2005, as observed by Mfungahema [2006], the Tanzania Communications Commission [TCC], now TCRA had licensed nine companies to provide public data communication services including Internet bandwidth. These data operators had isolated
initiatives of connecting their Points-of-Presence (PoPs) to the global Internet backbone. As a result, Tanzania lacked cheaper and high capacity connections to the global Internet. All connections, regardless of the data service provider, are small capacity international links that connect to the global Internet backbone in different countries such as Norway and the United States. Therefore, the limited international Internet bandwidth was scarce and extremely expensive. The lack of a national Internet Exchange Point [IXP] also meant that much of Tanzania’s local traffic was routed via international routes [Mfungahema, 2006].

Availability of personal computers is still very low in Tanzania: less than 1%. Multipurpose Community Telecentres (MCTs), offering basic telecom services like telephone, fax, Internet, e-mail and computer facilities designed to serve both individuals and businesses, and to provide training and distance learning services, are few and far between [Holcomb and Hitt, 2007]. However, most Tanzania have adopted quickly to the use of cellular phones, in which over 38 million phones are registered [TCRA 2016].

Tanzania’s first MCT was established in 2000 by the Tanzanian Commission for Science and Technology [COSTECH] in partnership with the Canadian International Development Research Centre, UNESCO, the Danish International Development Agency and TTCL. Evaluation of these centres may reveal important information about the best way to expand the service. In the period under review, Vodacom established Internet cafes in three towns: Dar es Salaam, Dodoma and Arusha, using its 3G mobile network under the ‘Wireless Reach’ initiative. In collaboration with the GSMA Development Fund and Qualcomm, the initiative encourages the cafes to be run by local entrepreneurs [Stephen, 2008, Sedoyeka, 2015].
2.2 Internet Coverage

Tanzania’s Internet sector had remained underdeveloped due to the limited reach of the traditional fixed-line network and the lack of international fibre connections [Koutroumpis, 2009]. Until the arrival of the first international submarine fibre cable in July 2009, the country relied entirely on satellite links for its international Internet bandwidth, which resulted in high retail prices that were unaffordable to the majority of the population. Internet cafes have contributed to some degree of Internet usage, but in terms of Internet penetration Tanzania still lags behind other countries in the region with similar GDP per capita and literacy levels [TCRA, 2010]. Mobile network operators are well positioned to become key players in Internet service provision with their extensive national infrastructure, following the introduction of mobile data and 3G broadband services [Lankford and Parsa, 2009].

The Internet market in Tanzania is likely to be driven by businesses that can use a combination of Internet and mobile telephone technology to offer enhanced but affordable services. Potential areas include payment of utility bills, accessing news, radio, mobile banking, election campaigns, and education. The landing of the Seacom submarine cable in Dar es Salaam has already impacted on cost. Effective October 2009, the TTCL reduced its Internet prices by more than 50% [Mfungahema, 2006]. According to the TTCL, high volume Internet users like banks, large businesses and corporations, government agencies and educational institutions were expected to be the main direct beneficiaries thus far. However, with the availability of cost effective internet services from mobile companies and the increase use of smart devices such as smart phones, the number of citizens with access to information has increased significantly with over 34% (of the population) internet penetration [TCRA 2016].
Tanzania like most of the developing world has witnessed a significant rise on the number of Internet users [ITU, 2014]. In 2009, Tanzania received $100 million in credit through the World Bank International Development Association under the Regional Communications Infrastructure Programme (RCIP3) to promote affordable communications services in the country [Yonazi, 2012]. The RCIP3 grant is planned to enable Tanzania to leverage developments in the telecommunications sector and overcome associated challenges through a combination of sound policy and regulatory frameworks, competitive market structures, and catalytic investments into public-private partnerships to accelerate the rollout of infrastructure networks that are aimed at enhancing universal access [Yonazi, 2012]. Building the national backbone and the establishment of the Universal access fund are such developments. Despite considerable developments in the ICT sector, Tanzania has only 1.3 percent telephone and Internet user penetration as compared to 6.7 for Africa [Holcomb and Hitt, 2007].

In November 2009, Convergence Wireless Networks (Convergence Wireless), a joint venture between Convergence Partners and Comsol Wireless Solutions (Comsol), acquired a 35% stake in the WIA Company Limited (WIA), a Tanzanian wireless connectivity provider focused on the enterprise market segment (Lange, 2010). Convergence Wireless aimed to providing high-level support at strategic and operational
levels and facilitate access to resources across the wider convergence partners’ network. As observed by Stephen, [2008], WIA’s growth strategy focuses on upgrading its core network around Dar es Salaam, deployment of a new national WiMAX access network covering key business centers, as well as the broadening of its value-added solutions to include virtual private networks, managed network services and applications hosting for large enterprises across the country. So far, traditional cellular companies have turned up to be the champions for internet penetration in Tanzania as users have turned into mobile devices to access the Internet [Gupta et.al., 2013, Meeker and Wu, 2013].

2.3 The National Fiber Backbone

The national fibre backbone, which is owned by the government under the operational management of the TTCL [NICTBB], aimed at installation of the National fibre optic broadband backbone connectivity which will enable to get fast, reliable and affordable the internet connections. According to TCRA, [2010], the national fibre optic broadband, which began rollout in 2009, enables cheap and efficient internet connectivity. The backbone has networked all regional headquarters within the country and connect Tanzania with its eight neighbours: Kenya, Uganda, Rwanda, Burundi, Democratic Republic of Congo, Zambia, Malawi, and Mozambique. Investment in 3G network development is evident, especially from the main mobile phone operators, Vodacom, Zain, Tigo, the TTCL and Zantel. In 2009, Zain Tanzania Ltd. secured US$270m from a mix of local and international lenders to support its continuing network expansion. In total, by the end of 2009, Zain had invested over US$500m in network infrastructure development [Lange, 2009].

Vodacom secured a syndicated loan of US$90m to finance its company capital expenditure. A dormant project, initiated with support from the Ericsson Group and UNEP, to establish bio-fuel powered radio base stations in two regions in Tanzania was activated in 2009. Undertaking the feasibility, Diligent Energy Systems BV noted that if Ericsson would get the backing of one or two major mobile phone operators, the project would be commercially viable. The project aims at bringing reliable but environmentally safe mobile phone services to rural people in Mtwara and Lindi. There is concern about
the operational safety of the increasing number of base stations, antennas and other facilities that support mobile phone transmission [Koutroumpis, 2009].

The Internet backbone is a conglomeration of multiple, redundant networks owned by numerous companies. It is typically a fibre optic trunk line. The trunk line consists of many fibre optic cables bundled together to increase the capacity. The backbone is able to reroute traffic in case of a failure. The data speeds of backbone lines have changed with the times. In 1998, all of the United States backbone networks had utilized the slowest data rate of 45 Mbit/s. However the changing technologies allowed for 41 percent of backbones to have data rates of 2,488 Mbit/s or faster by the mid 2000's [Helpman, 2012]. The economic geography of the Internet's infrastructure. Fibre-optic cables are the medium of choice for Internet backbone providers for many reasons. Fibre-optics allows for fast data speeds and large bandwidth; they suffer relatively little attenuation, allowing them to cover long distances with few repeaters; they are also immune to crosstalk and other forms of EM interference which plague electrical transmission [Hughes and Lonie, 2007].

Thus far, the implementation of the Tanzania National IP backbone network which started in June, 2015 completed in January, 2016. This network that has been designed to withstand emergency failures, consists of planes A and planes B which apart from being redundancy of each other, work together to balance traffic. This network is being linked to the newly built Government Internet Data Centre [NICTBB 2016].

2.4 Advantages of Fibre in Tanzania

NICTBB has the following advantages; Reduction in Transport, Travel and Distribution costs: ICTs applications enable efficient communication online, where information and reports can be shared amongst members without physical gathering, meetings can be held remotely, and some assignments can be carried out from homes or without necessarily travelling all the way from homes to the work places or in another country, particularly in cities where traffic jams are order of the day [Lange, 2009]. A typical example of heavy traffic congestions is the Dar es Salaam City. “Every month with 22 working days, Dar es
Salaam city residents lose three hours a day, making it a total of 66 hours, which is equivalent to 792 hours per year in traffic jams [TCRA, 2010]. It is equivalent to one tenth or 10% of the worker’s active life. For an average worker, paid a monthly salary equivalent to US$ 450, or US$ 20.50 per day, or US$ 2.60 per hour, his/her employer loses US$ 169 per month per employee, leave alone other loses due to fuel consumption, tear and wear and depreciation of a car or a bus. All these have negative impact to the national economy but with ICTs applications, these challenges can be addressed [Karjakina and Semtsenko, 2010].

E-government services; these includes e-services comprising of e-education, e-schools, learning, online studies, e-health, Tele-medicine, e-agriculture, e-tourism, e-procurement, and other applications such as video conferencing. With introduction of video conferencing facilities between MDAs, a lot of cost saving would be realized [Srai and Gregory, 2008]. For example; the Government would save hundreds of millions of money if video conferencing facilities were used to provide communication services between officials who are supposed to travel from Dar es Salaam all the way to Dodoma to submit a few copies of report documents to Members of Parliament who spend almost 3 months discussing Government Annual Budgets [Lange, 2009].

The intervention of building the National Information Communications Backbone [NICTBB] provides robust platform whereby government, business, civil society, and international organization initiatives and interventions can coexist. Mainstreaming the ICT for achievement of Tanzania Mission Vision 2025 and realizing the Millennium Development Goals [MDG] must quickly be diffused by hard data connectivity, on development impact and the real potential to scale and up and replicate process of Last Mile connectivity [Wellenius, 2003].

2.5 Contribution of the Telecommunications Sector to the Development in Tanzania

Telecommunication sector pay a meaningful contribution to economic and social development in Tanzania. Apart from communication facilitation, telecommunication companies now offer money transfer and servings, by so doing, telecommunication
companies’ foster economic development in Tanzania. According to Helpman, [2012], telecommunication sector assist the development of investments, attract Foreign Direct Investment [FDI] and creates the opportunities for economic growth and development.

Tanzania has a fully competitive telecommunications sector. There are two fixed-line operators and seven operational mobile networks, with four additional players licensed. The national fixed telephone operators are the TTCL and Zantel. They also offer national and international mobile telephone services. The TTCL fixed-line network has been digital since 2004. However, teledensity for fixed-line has remained extremely low, with only around 300,000 lines installed and many out of service. The TTCL offers Integrated Services Digital Network [ISDN] with Basic Rate Interface, Primary [Mfungahema, 2006].

Since the connection of the country to the international fibre-optic cable [SEACOM], new services and products have been introduced [Cameron, 2011]. Currently, the TTCL offers voice services which include Bongo Phone, Prepaid Services, Prepaid Calling Card, Post Paid Services, Rafiki Public Phone, and TTCL Mobile. Data communication services include broadband, wireless broadband, Mobile Internet, Virtual Private Network [VPN] providing dedicated end-to-end connectivity to multiple sites in different geographical locations with scalable and guaranteed bandwidths of 64Kbps to 100Mbps, and leased digital and analogue circuits. Zantel is based in Zanzibar, but with the liberalization of the market got license coverage to the mainland. It has a fixed-line and mobile telephone network. Zantel is fast penetrating the mainland, offering lowest rates in fixed, broadband and mobile telephony. Zantel offers mobile banking branded Z-Pesa [Lange, 2010]. By the end of 2016, TTCL, Vodacom, and Tigo have launched a 4G services in some parts of Tanzania [TCRA 2016].

While the number of mobile uses is growing [ITU, 2014], the Tanzanian mobile telephone market is the fastest growing sector, with more than 23 million subscribers in a population of about 43 million. The major operators are Vodacom, Zain, TiGO and TTCL-mobile, Zantel-mobile and Halotel [TCRA, 2016]. While bandwidth may have
been a problem, there are many other factors that contribute to Tanzania’s low Internet penetration and use. This situation may call for research based information and home-grown solutions to sustainable use of the Internet for development [Mfungahema, 2006].

With regard to Internet access and use, Tanzania lacks comprehensive data giving details of Internet users across the country. The data available is mainly aggregated from Internet café surveys and this does not depict the real situation of Internet usage. The number of telephone users has grown exponentially in the last 5 years to over 39milion by mid-2016 [TCRA 2016].

<table>
<thead>
<tr>
<th>Telecom Companies</th>
<th>Subscribers</th>
<th>Total:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel</td>
<td>10,715,438</td>
<td>39,436,645</td>
</tr>
<tr>
<td>Smart</td>
<td>10,517,805</td>
<td>38,100,884</td>
</tr>
<tr>
<td>Halotel</td>
<td>11,371,431</td>
<td></td>
</tr>
<tr>
<td>Tigo</td>
<td>11,371,431</td>
<td></td>
</tr>
<tr>
<td>TTCL</td>
<td>12,374,151</td>
<td></td>
</tr>
<tr>
<td>Vodacom</td>
<td>12,374,151</td>
<td></td>
</tr>
<tr>
<td>Zantel</td>
<td>12,714,297</td>
<td></td>
</tr>
<tr>
<td>Total:</td>
<td>39,436,645</td>
<td></td>
</tr>
</tbody>
</table>

Telephone users; Source TCRA 2016.

Furthermore, TCRA estimates that in Tanzania there are over 11 milion internet users, which can be viewed as conservative estimates as a good number of mobile users can now access internet from their phones.
METHODOLOGY ADOPTED

The study was conducted in Tanzania’s telecommunications companies based in Dar es Salaam since most of the companies have their headquarters located in the city. This study used both a qualitative and quantitative research approaches. Both approaches were used so as to complement each other and overcome the weaknesses of a single design, therefore enhance validity. Therefore, a case study research design was used in this study because the researchers intends to gain a deep and thorough understanding of the phenomena and because of its flexibility of the data collection methods. Also this approach was used because participants come from a single case, also an experimental study design is not appropriate because there was no random assignment of participants into control and treatment groups.

For the purpose of this study, staff from private and private companies, ministry and regulators were involved. Their roles in the industry and their experience meant that they collectively had materials rich for the study. The sample size of the study includes about 95 respondents from telecommunication companies, the sample was selected because there is a few number of employees; therefore this is a representative sample according to the nature of the study. The sample size indicated in the table below.

**Table 1: Sample Size Distribution**

<table>
<thead>
<tr>
<th>Areas</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer</td>
<td>47</td>
</tr>
<tr>
<td>Supervisor</td>
<td>14</td>
</tr>
<tr>
<td>Other employees</td>
<td>34</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
</tr>
</tbody>
</table>

The researchers prepared questionnaire, structured and unstructured questionnaires and were administered to participants. The researchers also prepared the interview guide questions in connection to research questions.

Secondary data collection will involves, documentary review. A number of documents
including official documents from telecom companies, Government departments, reports and seminar papers in relation with the problem were reviewed to supplement the primary data collected by the researcher. Documentary review guide was used as an instrument during data collection from different documents.

Data was analysed in accordance with the objectives of the study. Qualitative data will be collected and processed. Qualitative data refers to data representing qualitative phenomenon, example phenomena relating to or involving quality or kind. Editing was done immediately after receiving questionnaire from respondents. Coding was done in order to ensure whether the response categories were appropriately classified and exhausted to the problem under the study and arrange data collected according to group or classes they base on the basis of their common characteristics. Tabulation was done to assemble data into concise and logical order. The researchers analysed data collected qualitatively where words were used to explain findings and quantitative analysis where the data used numbers, computation of total and percentages, data analysis will be based on research objectives.

THE FINDINGS
Background characteristics of the respondents were asked in terms of age, occupations and working experience. It’s important to establish the respondents profile in order to determine the capability of the respondents to participate in the study.

The study found that, majority of the respondents (61.1%) was aged between 25 to 34 years. This implies that majority of the experts in telecommunication sector are aged between 25 to 34 year. Furthermore, this suggests respondents are capable to provide responses for the study, therefore their opinions were considered. The study found out of 95 respondents 4, (4.2%) was between 18 to 24 years old. Also the study found undersized number of the respondents (27.4%) and (7%) were aged between 35 to 44 years and 45 to 54 years respectively. The study found majority of the respondents (61.1%) were aged between 25 to 34 years, as illustrated in Figure 4.1
Figure 4.1: Age of the Respondents

Source: Field Data.

The study found that the larger group of the respondents (49.5%) were engineers. This implies that, respondents were capable to participate in the study. Furthermore, the study found that majority of the employees (51.1%) has the experience of 3 to 6 years. This implies majority of the respondents were capable to provide responses, therefore their opinions and suggestions were considered. Moreover, the study found, minority of the respondents (7.4%) and (41.1%) have the working experience of less than one year and more than 6 years respectively, as illustrated in Figure 4.3 below

Figure 4.2: Working Experience

Source: Field Data, 2013

The Status of Fibre Infrastructure in Tanzania and East Africa

The study was interested to examine the status of fibre infrastructure in Tanzania and East Africa. In terms of total kilometre covered, it’s discovered that, fibre infrastructure has satisfactory coverage, 7560km, 2000Km in Rwanda, 4233Km in Kenya (private) and Uganda 2000Km.

“We cover 21 regions except SIMIHU in Shinyanga, it has a single POP in these regions and hence only one drop off point where the Service Provider/client must connect. We cover all the major boarders and have POPs in the bordering countries”.

This is similar to responses obtained during interview, one of the interviewed expert from the ministry, revealed that:

“A total of 7560km is covered in Tanzania, where 2112km are from TANESCO and 5448km were built for this project. In EAST AFRICA: 2000Km in Rwanda, 4233Km in Kenya [private], Uganda 2000Km and Burundi are having plans to build”

In terms of region covered in Tanzania the fibre infrastructure has good coverage. It’s found the large part of the country it’s covered with fibre infrastructure. It’s discovered that the requirements of the telecommunication companies are; 2xSTM-16 P-t-P unprotected, 5xSTM-4, 12xSTM-1and 1Gbps (1000Mbps or 7 STM1). Moreover, various reasons were found to be the factors for NICTBB to meet capacity required.

“We meet capacity required by the telecommunication companies because; a designed capacity of NICTBB is 400G whereas the installed capacity [boards] 20G, used capacity is still only10G”
Factors Which Cause Low Utilization of the NICTBB

The study was interested to determine factors which cause low utilization of National ICT broadband backbone. Respondents were required to identify factors which cause low utilization, in their reply the study found majority of the respondents (67.78%) identified high price, as presented in figure 4.5. The study found majority of the respondents (58.9%) identified lack of demand as the major factor impedes full utilization of National ICT broadband backbone. This is similar to respondents obtained during interview, on of the interviewed engineer of the telecommunication company revealed that:

“I think lack of Public awareness about National ICTBB is a major cause of low utilization of the fibre. Also Government itself doesn’t utilized fully the use of ICT—Supposed to be a big customer, no connection to last miles, Mobile Companies have invested more on wireless TRM infrastructures already. To let private company build their own fibre Network. Example, VTL built from Dar-Dodoma”

Moreover the study found significant number of the respondents (67.8%) stated high price hinder full utilization of the NICTBB. In fact high price impede small telecommunication companies to use NICTBB. Insignificant number of the respondents (28.9%), (24.4%) and (20%) identified, lack of local contents, unfavourable government policies and lack of demand as a factors which cause low utilization.

Furthermore, the study found out of 90 respondents 36 (40%) identified as a major factor hindering full utilization of the NICTBB. The study found small number of the respondents (17.8%) stated lack of technical skills as a factor hinder full utilization. Also, it was found out of 90 respondents 14 (15.6%) and 16 (17.8%) identified poor design and poor after sale support respectively. As illustrated in Figure 4.5.
Factors that can foster full utilization of the NICTBB, the study was interested to examine factors that can foster full utilization, respondents were asked to identify factors. In their reply the study found majority of the respondents (67.8%) suggested lowering price could foster full utilization of the NICTBB, as presented in figure 4.6.
The study found majority of the respondents (67.8%) identified lowering price could foster full utilization. Respondents suggested that NICTBB should review and implement a lower tariff rates plus a good capacity provisioning timelines. Also the study found significant number of the respondents (62.2%) stated NICTBB should stimulated awareness to foster full utilization of the fibre. This is similar to what observed during interview, one of the respondents revealed that:

“There is a need of increase awareness to public to foster full utilization of the NICTBB. Also the Connectivity prices should be regulated and affordable to huge number of users, Special rate to Government institutions and research centres. Moreover, joint arrangement with a Consortium of Operators and Government, this will reduce investment cost and hence make commercially realistic”

Also the study found out of 90 respondents 40 (44.4%) stated there is a need of stimulate supporting sectors that foster ICT growth. The study found small number of the respondents (11.1%), (18.9%) and (22.2%) identified, redesign the infrastructure, improve after sale support and training to improve technical skill respectively.
Effects of low utilization, the study were interested to assess the effects of low utilization of NICTBB. Respondents were asked to identify the effects of low utilization, in their respond the study found out of 90 respondents 32, (35.6%) identified low utilization hider ICT growth, as shown in Figure 4.7

![Diagram showing the effects of low utilization](image)

**Figure 4.7: Effects of Low Utilization; Source: Field Data, 2013**

The study found out of 90 respondents 32, (35.6%) identified low utilization hider ICT growth. This implies that, low utilization of the fibre infrastructure has unenthusiastic impact on ICT growth. Moreover, the study found small number of the respondents (3.3%) and (16.7%) identified high price for voice services and High price for data services respectively. This is similar to findings obtained during interview. One respondent from the ministry started that:

"Low utilization of the fibre infrastructure hinder ICT growth and high pricing for data/voice services, Lower quality Data/voice services and Missed business opportunities via ICT development [e government, e commerce etc] Hamper innovation due to bandwidth bottlenecks."

---

Moreover, the study found insignificant number of respondents (21%) identified low utilization hinder economic development. The study found out of 90 respondents 7 (7.8%), (5.6%) and 3 (3.3%) identified slow data connections, unreliable internet connections and reduce employment opportunities respectively.

“The major weakness of the current strategies are; Tariff and Marketing strategies, Internal Procurement process between NICTBB and its Project Manager [TTCL] and Vulnerability of OSP network infrastructure to frequent FOC damages/cuts”

Strategies to Improve the Applicability of the National ICT Broadband Backbone

The study was interested to assess strategies that can improve the applicability of the National ICT broadband backbone. Respondents were required to identify the weakness of the current strategies. It was observed that of 87 respondents only 17 (19.5%) identified project mission. Also the study found small number of the respondents (22.9%) and (10.3%) identified project vision and choice of the technology. This is different from what observed during interview. Moreover, the study found significant number of respondents (51.7%) identified Positioning (Product and Target Customers) as a major weakness of the current strategies. this is well illustrated in Figure 4.8

One of the interviewed engineers stated that:

“The major strategies that are current applied involve; Work in close coordination with the regulator [TCRA] to ensure the community rips the benefits of NICTBB example tariff drop for off net is a result of diminishing costs brought by the NICTBB which has allowed TCRA to lower the price ceiling, also Capacity will be increased to 120G and We work in close coordination with TTCL to ensure efficient delivery of services and identification of any
Figure 4.4: Weakness of the Current Strategies

ANALYSIS AND DISCUSSIONS

5.1 The Status of Fibre Infrastructure in Tanzania and East Africa

The study was interested to examine the status of fibre infrastructure in Tanzania and East Africa. The study found out of 90 respondents 40, (44.4%) identified the coverage of the fibre infrastructure is satisfactory. This implies that the status of fibre infrastructure in Tanzania and East Africa is acceptable.

Although the status of fibre infrastructure in Tanzania and East Africa is convincing the infrastructure remains tangible coverage to rural and remote areas. In Tanzania the fibre infrastructure covers all regions except Simiyu. All regions have one POP, This is observed to be a major challenge impede the efficient of the fibre infrastructure. In East Africa, 2300Km are covered in Rwanda, 4233Km in Kenya (private), Uganda covered 2000Km and Burundi are having plans to build. This implies the coverage of the fibre infrastructure in Tanzania is superior compared to other East African countries.
The NICTBB was designed to have a maximum capacity of 400Gbps based on the chassis of the active components. The installed capacity is currently at 20Gbps. The next phase will involve an upgrade to 120Gbps based on the global growth for data and demand from clients.

Moreover, study was interested to examine the National ICT Backbone capacity requirements. The study found majority of the respondents (56.7%) accepted that the fibre infrastructure meet required capacity, this implies the fibre infrastructure met the required capacity of its current clients. Despite the massive growth of the internet and
global data growth, the NICTBB is not being fully utilized to its full potential. The study found, the backbone is currently operating at less than 50% of its installed capacity and 2.5% of its design capacity.

NICTBB met current capacity required by its clients, It’s discovered that major requirements came from the telecommunication companies are; 2xSTM-16 P-t-P unprotected, 5xSTM-4, 12xSTM-1 and 1Gbps (1000Mbps or 7 STM1). Telecom companies currently comprise approximately 90% of the total capacity being utilized on the NICTBB.

5.2 Factors Which Cause Low Utilization of the NICTBB

The study was interested to determine factors which cause low utilization of National ICT broadband backbone. There were a number of factors which cause low utilization of the fibre infrastructure. The lack of demand, poor management, high pricing, lack of awareness, slow internet growth, lack of local contents, unfavourable government policies, poor service quality, poor management, lack of technical skills, poor after sale support and poor design of the fibre infrastructure.

The study found majority of the respondents (67.8%) identified high pricing as the major factor which impedes full utilization of National ICT broadband backbone. The underutilization is due to low purchasing power of the consumers which means the service providers have to match supply, demand and market pricing and fit in required margins. It is a fact that high pricing impede small telecommunication companies to use NICTBB. This reduces the overall demand for National ICT broadband backbone.

Furthermore 40% of the respondents identified poor management as a cause of the underutilization. Most high level managers who have worked with NICTBB through its care taker (TTCL) found many challenges during procurement and operation of the IRU capacities. Many cross boarder operations also believed it was difficult to work with the current manager suggesting that a lot could improve if a managerial assessment is made.

Moreover, the study found that 28.9% attributed the lack of local content to be a cause for
the underutilization. Most of the data received by the Tanzanian market is hosted outside the country and thus requiring massive capacities to the internet using operators such as SEACOM and EASSY who have hubs in Dar es Salaam. This suggests that local content stored in different parts of the country would have accelerated the requirement for utilizing the NICTBB.

Above all, the study was interested to examine factors that can foster full utilization, respondents were asked to identify factors. The study found majority of the respondents (67.8%) suggested lowering price could foster full utilization of the NICTBB, 62.2% of the respondents suggested to stimulate awareness by marketing, 44.4% advised to support supporting sectors to foster ICT development and increase the utilization. Overall there are various factors that can foster full utilization of the fibre infrastructure. These involves, lowering price, stimulate awareness, training to improve technical skills, improve after sale support, management change, redesign the infrastructure, improve government policies, invest more to improve coverage, change of business strategies and stimulate sectors that foster ICT growth.

5.3 Strategies to Improve the Applicability of the National ICT Broadband Backbone

The study was interested to assess strategies that can improve the applicability of the National ICT broadband backbone. The study establish the weakness of the current strategy, the study found majority of the respondents (63.2%) identified management as a factor that contribute to weakness of the current strategies. This implies, the management of the National ICT broadband backbone, is not well performed, the reasons for this could be, the management of the National ICT broadband backbone are not well trained in business aspects. Management is concerned with the establishment of the strategies, therefore should be well trained and full equipped.

The Government of Tanzania has mandated Tanzania Telecommunication Company Limited (TTCL) to supervise project implementation and management of the NICTBB. But a lot of complains were observed from telecom operators due to poor management of
the National ICT broadband backbone

Furthermore 51.7% suggested there is a need to redefine the positioning aspects of the business. This calls for a need to properly identify the targeted market, currently NICTBB targets the service provider but the customer base suggests only large service providers such as telecom companies are able to invest in the IRU requirements on the NICTBB. Positioning also means making sure the correct product is available to serve different customer needs.

Additionally, 29.9% acknowledge the need to review the completion better. Any business has competitors and pricing alone cannot be a competitive advantage. Currently there are private fibres being built by operators some individually e.g. Vodacom with fibre to Dodoma others forming consortiums. Analysing the competition will allow the NICTBB to be more strategically aligned with the market environment and ultimately increase utilization and profits.

Other factors that contributes contribute to weakness of the current strategies, involves; project mission, project vision, choice of technology, positioning (product and target customers), lack of proper analysis of competition and management. This implies project mission and vision were note well designed in line with purchasing power of the telecommunication companies. Moreover, the product is not well positioned by targeting customers.

Furthermore the study found different strategies that are current applied by NICTBB, this involve; Work in close coordination with the regulator (TCRA) to ensure the community rips the benefits of NICTBB example tariff drop for off net is a result of diminishing costs brought by the NICTBB which has allowed TCRA to lower the price ceiling, also capacity will be increased to 120G. But this is not enough without considering the purchasing power of the telecommunication companies.
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Based on the findings of the study, the study concluded that the status of the NICTBB is satisfactory in terms of coverage to the major towns. However, last mile connectivity is still a challenge. By end of 2015, NICTBB covered all the regions of the country. Generally, comparing the NICTBB status in Tanzania with other East African countries, coverage is much better with exception of Rwanda which has more coverage if size is taken into account. The study concluded that price is a major reason for underutilization of the fibre infrastructure, other factors include; poor management, lack of awareness, slow internet growth, lack of local contents and unfavourable government policies.

Moreover the study concluded that, there are different strategies that are applied to foster utilization of the fibre infrastructure. Despite the fact that the Government of Tanzania used a lot of money for installation of NICTBB but utilization is still very minimum and operational cost won’t change much with increase in utilization. This is due to the scanty knowledge and public awareness about NICTBB. It implied that few people know about or existence of NICTBB, but most of them they don’t know the advantage and disadvantage of this NICTBB.

Another challenge is the lack of local contents was found to be one the reason for low utilization. Government itself is yet to start getting basic services to citizen via ICT. Schools for example, could be the major traffic creator if students were accessing knowledge whilst utilizing the backbone. Properly used and coordinated will bring the desired effect and passing the knowledge information to the public as anticipated. By sharing backbone network infrastructure, builders of backbone networks can reduce costs, improve quality and gain profits. This will reduce the need to make such heavy investments as those borne by investing in fibre privately or via consortiums. This is particularly relevant for fibre-optic networks in urban areas, where the costs of laying new fibres can be high, or in the rural areas; where the revenues generated by such networks are low.
6.2 Recommendations
The authors recommend that the government promote the use of the network by creating awareness campaign. It should also set special rates for institutions that drives public services such as education establishments. It is also suggested that government should create a world class data centre and initialise a special project to create local contents. This will create a cloud like systems where organisation will plug into the data centre to access knowledge, entertainment etc.

REFERENCES

August, K. [2012], Exploiting the Potentials of the National Information and Communication Technology Broadband Backbone (NICTBB) in Tanzania. Tanzania Country Level Knowledge Network, Dar es Salaam


Yonaz, J. [2012]. Broadband Backbone [NICTBB] and Prospects for Local contents Development in Tanzania, Centre for Research and Innovation, IFM, Dar es Salaam


Holcomb, T. and Hitt, M. [2007]. Toward a Model of Strategic Outsourcing. Journal of
Operations Management 25[2], 464–481.

International Telecommunication Union [ITU], ICT Fact and Figures 2013.

International Telecommunication Union [ITU], ICT Fact and Figures 2014

Meeker, M. and Wu, L. INTERNET TRENDS CONFERENCE, KPCB, 2013


Lange, P [2009]. _Tanzania Telecoms, Mobile and Broadband_. Bucketty NSW Paul Budde Communication Pty Ltd.


TCRA [2006]. *Public Consultation Document on Subscription Broadcasting Services in Tanzania*, Dar es Salaam


TCRA [2012]. *Annual Telecommunication Performance*, Tanzania Communication Regulatory Authority, Dar es Salaam

TCRA [2015]. QUARTERLY COMMUNICATIONS STATISTICS REPORT, September 2015 [accessed on January 2016]
TCRA [2016]. QUARTERLY COMMUNICATIONS STATISTICS REPORT, March 2016 [accessed on June 2016]