# Access to Internet Connectivity: the Major Bottleneck to the Adoption of Technology-Enabled Education
## (The Case of KNUST)

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*Abstract*

*Every organization either corporate or a higher educational institution depends in part on its IT infrastructure to remain competitive and efficient. As this dependency grows, so does the need for providing effective systems to minimize downtime and improve efficiency of support provided. KNUST, is a public university in Ghana with a student population of 34438 and faculty numbering 801, hence a student-faculty ratio of 42:1 [1]. KNUST desires to fully adopt a Technology-Enabled Education platform to supplement the traditional face-to-face session, but this is being impeded by the high cost of internet connectivity which is a critical requirement for e-Learning. This paper seeks to delve into the reasons for the high cost of internet connectivity in Ghana and its effects on the adoption of e-Learning platforms.*

## 1. Background

Based on research undertaken on IT help desk implementation in Kwame Nkrumah University of Science and Technology (KNUST), one main issue that users in the university call for support on was identified. This major issue is related to internet connectivity. This paper aims to delve more into the issue of internet connectivity and its impact on the adoption of technology-enabled education (TEE) such as e-Learning platforms.

### 1.1 E-Learning

Marfo & Okine in their research on the Implementation of e-Learning in Ghanaian Tertiary Institutions refers to e-Learning as the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance. E-learning can be used by lecturers to improve the efficiency and effectiveness of educational interventions in the face of social, scientific, and pedagogical challenges. E-Learning has gained popularity in the past decade; however, its use is highly variable among universities [2].

E-Learning has the potential to transform Ghanaian universities. It is increasingly gaining universal acceptance as a viable means of enabling large numbers of students to access education. Kwame Nkrumah University of Science and Technology, Ghana, realising the enormous potential of e-learning as against the university's ever increasing student population has chosen to adopt e-learning as a platform to transform how education is accessed. This desire is highly impeded by the high cost and unreliability of internet connectivity which is needed for any e-Learning adoption to be a success.

### 1.2 Access to Internet Connectivity

Access to information is the 'life-blood' of the world's knowledge economy, but it is scarcest where it is most needed – the developing nations of Africa which require low cost communications to accelerate their socio-economic development. Few schools, libraries,

universities and research centers on the continent have some access to the Internet but its high cost makes it unsustainable as compared to North America and Europe. For those that can afford it, it is thousands of dollars higher than in the developed world such that some of Africa's most well-endowed centers of excellence have less bandwidth than a home broadband user in North America or Europe, and it must be shared amongst hundreds or even thousands of users [3]. Connectivity in Africa is poor, unreliable, scarce and very expensive. Where available, it is almost never dedicated and users have to contend with frequent service outages at very slow speed [4].

Contrary to more optimistic utopian conceptions, the ''digital divide'' tends to be widening. DiMaggio et al, define this as ''inequalities in access to the Internet, extent of use, knowledge of search strategies, quality of technical connections and social support, ability to evaluate the quality of information, and diversity of uses'' [5]. In other words, the gap rather than closing up, seems to be widening.

## 1.3    Statement of the problem

KNUST, is a public university in Ghana with a student population of 34438 and 801 faculty, hence a student-faculty ratio of 42:1 [1]. It desires to fully adopt a Technology-Enabled Education platform to supplement the traditional face-to-face session.

In this information age, every organization depends on an effective and affordable internet connection to remain competitive and relevant in its core responsibilities. KNUST until recently, had dedicated internet bandwidth of 45Mbps with a monthly charge of US $22,500.00, exclusive of taxes. With the emergence of other Internet Service Providers (ISP) in Ghana, the cost of internet has dropped marginally but it is still not affordable enough to meet the need of the 37850 users in KNUST [1]. This always leads to congestion on the gateway which negatively impacts on its effective use for teaching, learning and research. This is the major bottleneck to KNUST's inability to fully take advantage of the various technology-enabled education platforms available.

## 1.4    Objectives of the study

The objective of this paper is to look at the effect of access to Internet on the adoption of technology-enabled educational tools and also its effect on teaching, learning and research in the university and make recommendations.

## 2.    Research Methodology

## 2.1    Data Collection

Primary data was obtained by interviews and questionnaires, and processed in models. A structured interview was conducted on ICT staff of KNUST to help figure out the current IT infrastructure and how support for them and the applications that run on them are handled. The interviews also sought to find out whether KNUST has the IT infrastructure to support technology-enabled education.

Secondly, interviews were conducted on KNUST faculty members to find if they used any technology-enabled solutions and if these solutions had any effect on their delivery. The interviews also found out the effect of software piracy on teaching and research. The methodology also includes review of literature on technology-enabled education and access to internet connectivity especially on the Africa continent.

## 3. Internet Connectivity

### 3.1 Why High Cost of Internet Connectivity?

There are two main types of Internet subscription in Ghana. A fixed monthly fee for fixed (wired) broadband subscription and mobile broadband subscription, which is based on the amount of data the consumer uses.

Vodafone Ghana Limited has monopoly on the fixed broadband as part of the acquisition of 70% of shares in Ghana Telecommunication Company for 900 million dollars by Vodafone International PLC on July 23, 2008 [6]. In addition to the fixed broadband is also the mobile broadband which has very competitive pricing. Due to Vodafone's monopoly over the fixed broadband, they rather focus on the lucrative mobile broadband connectivity. This makes Vodafone the only source to go to for fixed wired broadband and therefore uncompetitive in pricing. Vodafone has therefore curtailed, for the time being, at least, the expansion of fixed line broadband. Thus, this infrastructure is concentrated in the urban areas and access to telephones are limited to a few elite.

For consumers who are still on the fixed broadband, an unattractive data cap has been introduced. Table 3-1 shows the rates of fixed broadband internet in Ghana as deduced from Vodafone's current rates [7].

**Table 3-1 Fixed Broadband Internet Rates in Ghana 2013**

| Monthly Internet Allowance | Monthly Cost in US $[1] |
|---|---|
| 15 Gigabytes | US $33.44 |
| 25 Gigabytes | US $51.45 |
| Unlimited for personal use | US $92.62 |
| Unlimited for Office use | US $180.10 |

The average mobile broadband costs US $0.10 per megabyte. In the same light, like the fixed broadband internet rates, the mobile broadband has bundle plans, the cost of mobile broadband plans from the Mobile Network Operators (MNOs) in Ghana is shown in Table 3-2. While majority of Ghanaians tend to use mobile broadband to access the internet, provision is quite expensive for the average person, as shown in Table 3-2 and as such, most of these users tend to be at least in the middle or upper-class. However, distance learning via the e-learning platform was supposedly meant to target those in the rural areas but has now become a privilege since only the middle or upper class can afford it.

**Table 3-2 Some of the mobile broadband internet rates by some MNOs in Ghana**

| Mobile Network Operators | Monthly Internet Allowance | Monthly Cost in US $ |
|---|---|---|
| Vodafone[2] | 2.5 Gigabytes | US $15.43 |
| MTN[3] | 2.5 Gigabytes | US $20.58 |
| tiGO[4] | 3.0 Gigabytes | US $11.57 |

Until 2010, Ghana's biggest source of Internet bandwidth (shared with almost every West African country) has been the single submarine fiber-optic cable (called SAT-3) currently

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[1] All Currency Conversions by Oanda. http://www.oanda.com/currency/converter. Accessed on March 16, 2013
[2] Source: http://goo.gl/zUNZe by Vodafone Ghana and accessed on March 1, 2013
[3] Source: http://www.mtn.com.gh/SubPage.aspx?pageid=1586 by MTN and accessed on March 1, 2013
[4] Source: http://www.tigo.com.gh/Internet/SmartBrowse.aspx by tiGO and accessed on March 1, 2013

owned by Vodafone Ghana. This single source of high-speed Internet connectivity rendered the market basically uncompetitive. (There is a fixed cost for getting the Internet into Ghana and there is no real alternative to that method.) Put another way, there has been a single wire that connected Ghana to the Internet [8].

Fast forward to 2013, Ghana has other submarine fiber-optic cable landing sites. These include GLO-1 (Globacom-1), WACS (West Africa Cable System) and Main One Cable. With their presence, it was expected that the cost of dedicated internet bandwidth would reduce drastically but that is not the case.

In the case of KNUST, until 2010, it had a dedicated internet bandwidth of 45Mbps at a cost of US $22,500.00 per month, exclusive of taxes from Ghana Telecommunication Company Limited (now Vodafone Ghana Limited). In 2013, KNUST is paying the same amount for 155Mbps of dedicated Internet. This is obviously not enough for an educational institution with a total population of 37850, especially when most of the content by these institutions are hosted outside the country mostly by companies in the US.

Compare this to the United States, where there are multiple providers; most of the content on the Internet is generated in the United States for people in the United States; and there are many choices for consumers to access the Internet, as well as many choices for Internet Service Providers (ISPs) both to deliver Internet service to consumers and to connect their services to the Internet.

Nevertheless, Internet cost in Ghana is considered to be very competitive compared to other African nations. In Kenya, Safaricom offers 100Mbps at US $49,535.60[5] per month, AccessKenya offers the same 100Mbps at US $36,298.40 per month. Judging from these two ISPs, the average cost of 100Mbps per month in Kenya is approximately US $40,000.00 [9]. If the relative cost were the same in the US, 1Mbps would cost approximately US $40,000.00 per year. This, definitely makes reliable and stable connections needed for effective work by institutions and corporations out of reach for many. Yes, internet penetration in African nations has increased especially with respect to the population but access is restricted to the privileged few who can afford these exorbitant rates. South Africa, a nation contributing two-thirds of the continent's Internet traffic, is also regarded as one of the countries with high cost for Internet.

Even though the internet penetration seems to increase by the day in Africa, its cost is quite expensive. Due to its importance in socio-economic development, individuals and organizations do everything possible to have access to it.

**Listed below are the other reasons for the high cost of internet connectivity:**
- Lower cost internet is not available to the end user though there are five optical submarine cables landing in Ghana. This is because Vodafone has a monopoly on the national optic fibre backbone and telephone lines just like the other monopolistic telecommunication companies in the various African nations.
- There is less competition in the underground fibre-optic field.
- High cost of connectivity to consumers' location by third parties such as ISPs after they purchase from the cable companies due to frequent theft of optic fibre-optic cables.

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[5] All Currency Conversions by Oanda. http://www.oanda.com/currency/converter. Accessed on March 15, 2013

- Frequent termination of fibre-optic cables due to improper blue prints used in road construction and sabotage by competitors.
- Recovery of initial investments, administrative and maintenance costs by cable companies and ISPs.
- High taxes on ISPs by regulatory bodies in the country
- Reduced economies of scale and a high risk for the ISPs caused by the existence of fixed Internet connectivity. This implies few connections for guaranteed bandwidth within the corporate cycles.
- Limited availability and capacity of national fibre-optic backbones.
- Frequent power outages, hence all the cable companies and ISPs run on standby electrical generators at all their cell sites to avoid interruptions in their services.

## 3.2   The Effect of Internet Connectivity in the Deployment of Technology-Enabled Educational Platforms

Internet access in Ghana is primarily through mobile broadband (GSM and 3G technologies). This makes access to e-learning content expensive for the average user. Mobile broadband cost on the average is US \$0.10 per megabyte of data. An average 10 minutes video on YouTube is 20MB. This makes a total of US \$2.00 in a country where the minimum daily wage is US \$2.21 [10].

In the case of KNUST, approximately 70% of the students do not reside on the university campus and therefore do not have access to the campus intranet, hence have to access e-Learning materials via the internet which on the average is expensive. These high prices set by existing local ISPs in Africa also deter the academic and research community from accessing global resources.

Even though, most open source e-Learning platforms can function on an intranet network; for a comprehensive deployment, a reliable internet is needed to make it possible. It therefore becomes less interactive especially for students via distance learning and guest lecturers who want to have live sessions with their students. Institutions in developing economies have fewer alternatives available in their quest to remain relevant and competitive. Based on constraints like the scarcity of internet connectivity, they settle for sometimes inferior options which do not serve their needs in the long run. For instance, KNUST decided to use the Zimbra Mail server, as against the widely used Google Apps mail services due to the fact that, the Google mail client cannot be accessed if the internet is down whilst the Zimbra Mail server is available on the intranet.

A large number of libraries in higher educational institutions (HEIs) in the developed countries are now digital with availability of electronic books, journals and other periodicals. One of the main reasons for a library organization to become so deeply involved in what is a technological project was the urgency of the desire to provide access to content that would really impact the academic community. This opportunity however eludes HEIs in Africa. Unfortunately, universities in the developing world where internet connectivity is so unreliable are prevented from accessing these rich digital resources. [11]. In some instances, the KNUST Network Operations Centre needs to shut out the rest of the users on campus to make it possible for a flawless video conferencing to be transmitted especially when enough bandwidth is required for this to occur.

## 4.  Conclusion

To make Internet access more affordable to the average person, the government will have to pass laws that make the industry more competitive. Companies like Vodafone which is a bulk supplier and distributor of Internet bandwidth and the only company that owns fixed telephone lines should be forced to split into smaller unrelated companies.

Until such interventions are brought in, technology-enabled education with its advantages over the traditional form of education would never fully be adopted in developing economies like Ghana.

## 5.  Recommendations

- Issues requiring immediate attention for the use of the internet include pricing structures, monopoly control of internet access as was done to AT&T by the US government, and licensing charges for content.
- Policies should be directed at liberalization of telecommunication networks and Internet service provision, as well as lower tariffs on computer and telecommunications equipment.
- Negotiating for internet bandwidth through economy of scale by a consortium formed by HEIs in the country instead of the individual educational institutions dealing with the ISPs on a one-on-one basis. Ghana Research Network (GARNET), Kenyan Education Network (KENET) should lead in that pursuit.
- Educational Institutions need to build a database of local contents on a nationwide intranet network so as to avoid the need for constant connectivity to the internet. Also, reliable data centers should be set up within the country to host institutional websites and repositories instead of hosting them on servers in North America and Europe which require the internet to access them.

## 6.  Acknowledgement

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