Mobile Internet Service Penetration Amongst Ghanaian Tertiary Students

The Case for Internet Service Provision as a Public Good

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Mobile Internet Service Penetration Amongst Ghanaian Tertiary Students : The Case For Internet Service Provision As A Public Good.

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***Abstract*—These instructions give you guidelines for preparing papers for WWRF conference papers. Use this document as a template if you are using Microsoft *Word* 6.0 or later. Otherwise, use this document as an instruction set. Define all symbols used in the abstract. Do not cite references in the abstract. The paper should not exceed 10 pages.**

***Index Terms*—About four key words or phrases in alphabetical order, separated by commas. For a list of suggested keywords visit the IEEE web site at** http://www.ieee.org/organizations/pubs/ani_prod/keywrd98.txt

I. INTRODUCTION

Buchanan (1968), observed that "people are observed to demand and to supply certain goods and services through market institutions. They are observed to demand and to supply other goods and services through political institutions. The first are called private goods; the second are called public goods."

Wollrad (2007), traces the concept of public goods (in economic discourse) a long way back to David Hume's 1739 discussion of the "common good" and finds that in 1954 Paul Samuelson developed a general theory of public goods in his article "The pure Theory of Public Expenditure" which stimulated a sizeable literature from which three interrelated characteristics of public goods emerge: first, public goods generate significant externalities; second, they are to a considerable degree "non-rivalrous" and "non-excludable"; and third, they create opportunities for the enhancement of welfare through collective action.

Although the strict definition of a public good is characterized by the twin properties of non-rivalry and non-exclusivity, it can be argued that the term has come to be widely associated with most goods provided by the state, as is noted by Mueller (2009) when he observes that resources do not fall unambiguously into the categories of public, private, club, and common pool resources, but that their status can change. As an example, he mentions encryption technology, which made it possible to exclude owners of a radio (or Television) receiver from access to a broadcast signal, transforming it from a public good situation to a more normal private good, however, as most observers are aware, the public broadcast service is provided in most countries as a public good, primarily by the state, but often by private broadcasters as well.

"In the autumn of 1982, the plenipotentiary Conference of the International Telecommunication Union (ITU) at Nairobi decided to set up an independent Commission for World-Wide Telecommunications development. For the first time in the history of the union, those present at Nairobi recognized "the fundamental importance of communications infrastructure as an essential element in the economic and social development of all countries" to which the General assembly of the United Nations had drawn attention in Resolution No. 36/40 of 1981. In essence, the mandate they gave the Independent Commission was to recommend ways in which the expansion of telecommunications across the world could be stimulated." [The Maitland Commission Report (1984)]

As far back as 1984, the Maitland Commission Report recognized that the existence of an efficient telecommunications system confers direct and indirect benefits which entitle it to be regarded as a public good.

In his section on the implications of network externalities, Varian (1996) identified the role of governmental policy as pivotal in determining the size of new markets brought on by technological advancements. Citing the internet as an example, he noted that once a critical mass of users had been connected to the internet, its value to the new users increased dramatically, and this is clearly evident in the number of uses to which the internet is put, that far exceeds what was originally intended by its creators.

In a developing economy, 'the invisible hand of the free market system' is often biased in favor of the urban dweller as a result of, e.g., different levels of wealth and as the main barrier to internet access in most developing economies is affordability, the overriding objective of this paper is to present the results of the recently conducted survey and make the case that the provision of internet access as a public good to tertiary students culminates in growth in the human capital.

Recently, there is a developing trend in the world, championed by institutions such as the Global Policy Forum, the IMF/World Bank, and the United Nations Development Programme, to push for the adoption of certain key services as global public goods.

Reisen et al (2004), note that since the late 1990s, the UNDP Office of Development Studies has raised the awareness of

the development and donor communities that the enhanced provision of international public goods will be of critical importance to achieving the Millennium Development Goals (MDGs). They go further to mention the setting up of an International Task Force on Global Public Goods (GPGs), created by an agreement between France and Sweden signed on 9 April 2003 whose mandate is to assess and clarify the notion of international public goods, global and regional, and make recommendations to policy makers and other stakeholders on how to provide and finance them. They state further that not all of the eight Millennium Development Goals constitute pure global public goods; and in turn, there may be GPGs relevant for development that are not included in the MDGs. Citing a recent study (Speight, 2002), they state that the UK Department for International Development (DFID) has identified key development GPGs, on the basis of matching the GPGs with the MDGs, first on the list was "knowledge generation and dissemination".

In his article on knowledge as a global public good Joseph E. Stiglitz (1999) emphasizes the role of knowledge for development, and makes the case for its treatment as a global public good. Drawing on the Non-Rivalry characteristic of Public goods, he quotes Thomas Jefferson that: "He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening me."
But does increased access translate into improved performance? A Survey of 2 Silicon Valley based schools [Cuban, L., Peck C., and Kirkpatrick, H. (2001)], does not seem to support this belief. But then, one might say, that is Silicon Valley! Would the same be true of the rural based African High School?

Not too long ago, there was a research effort (Skouby and Tadayoni, 2001) funded by the Danish International Development Assistance Programme (DANIDA) and the Federation of Library Associations and Institutions (IFLA) which set out to connect certain key libraries in Ghana, to the internet. This effort suggested that the development of ICT be included as part of foreign assistance to developing countries – for research cooperation and assistance.

However, as the results of the research effort clearly showed, the appetite for internet services amongst Ghanaian academics (even back then) was so huge that they quickly overburdened the system with requests for service – continued to do so even as the system had been continuously upgraded.

With this in mind, we set out to conduct a survey that will gauge the readiness of Ghanaian Tertiary Students, by way of ownership of or accessibility to "internet capable devices". As stated earlier, the government may provide free radio broadcasts (the public good), but will rarely supply the radios, just as it may construct the roads (the public good), but not supply the vehicles. The results will show whether, if the state were to provide internet access as a public good, the students will be ready with the devices capable of taking advantage of the service.

II. Survey Results

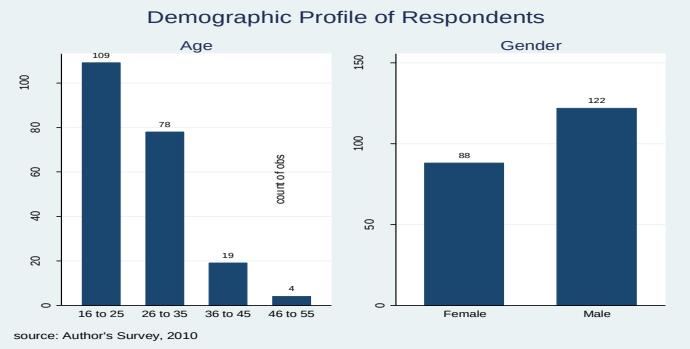
The survey was carried out in universities and polytechnics across the country addressing current students and national service persons.

Survey Distribution	Obs.	% Frequency
Female	88	42.00
Male	122	58.00
Total	210	100.00

A. Demographic Profile of Respondents

The age and gender profile of respondents is shown in figure 1. Figure 1 shows a modal age of respondents between 16 to 25 years. Less than 5 respondents are above 45 years. 78 of the 210 respondents, representing 37%, were between 26 and 35 years. The age distribution is a reflection of the overall age structure of Tertiary Institutions in Ghana. The gender distribution shows that about 58% (122 of 210) respondents were males and about 42% female. This reflects the gender distribution of university students and enrolments across the country.

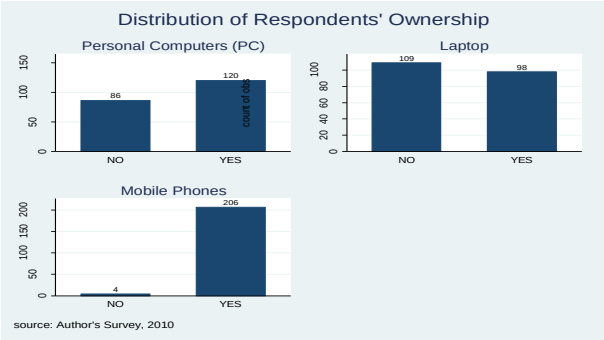
Figure 1: Demographic Profile of Respondents



B. Respondents Ownership of Basic Internet Devices

Respondents were asked if they owned any of personal computers, laptops and or mobile phones. The results are shown in figure 2. 120 of the 210 respondents, representing 57%, owned personal computers (PCs), whereas 98 (representing 47%) use and owned laptops. Overwhelming 206 respondents (accounting for more than 95%) owned mobile phones.

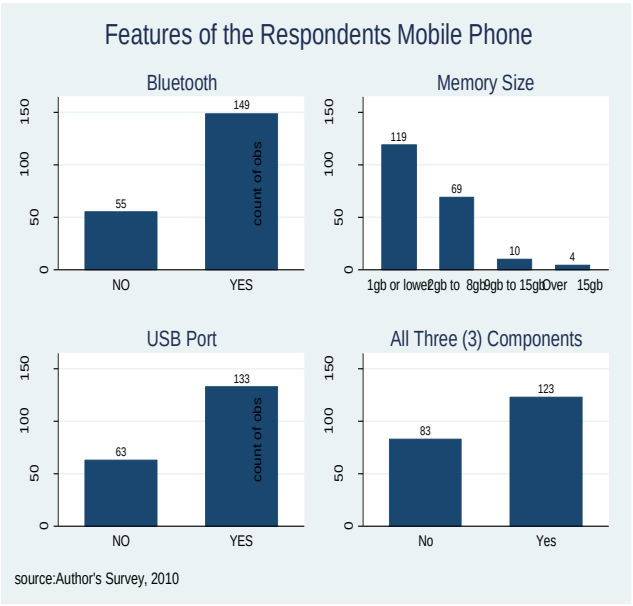
Figure 2: Respondents' Ownership of Computers and Mobile Phones



C. Features of the Mobile Phone

The type of phone used by the respondents (students for that matter) is very relevant for assurance of total access to internet facility. The respondents were asked if the mobile phones used possessed basic internet access tools. The results indicate that 149 respondents had Bluetooth on their phones, 133 had USB ports and more than 50% (119) had phones with less than 1Gigabyte storage capacity. 123 (59%) respondents had phones with all three features (or parts).

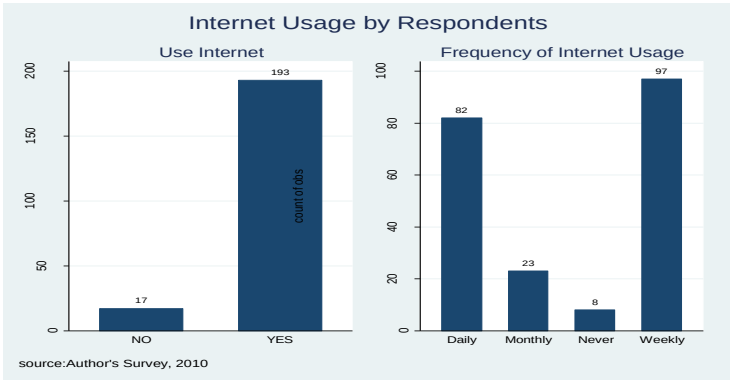
Figure 3: Features of the Mobile Phone



D. Internet Usage by Respondents

Of the 210 respondents 193 (representing 92%) use the internet while less than 10% do not use the internet. The frequency of usage is shown in figure 4. 82 of the 210 respondents (accounting for 39%) use internet daily and 46% use internet once weekly and 11% of the respondents use internet once a month.

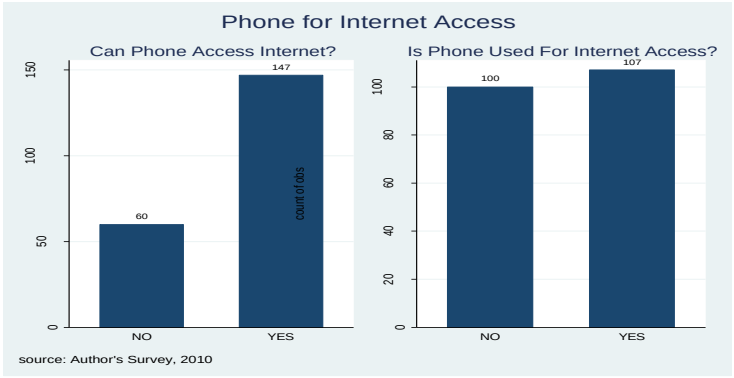
Figure 4: Usage and Frequency of Internet Facilities



E. Mobile Phones for Internet Access

Of the 206 respondents who owned mobile phones, 147 representing 70% said their phones had internet accessibility and of these 107 (73%) use the mobile internet.

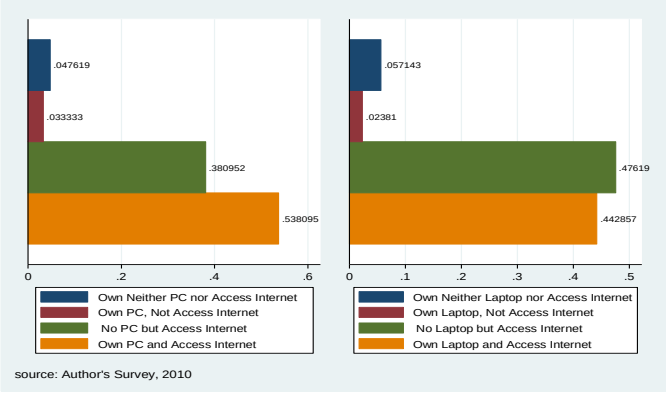
Figure 5: Mobile Phone for Internet



F. Ownership of Computer and Internet Access

Figure 6 shows the relationship between internet access and ownership of computers. 4.7% of the respondent neither owned personal computers nor ever used the internet. Another 3.33% owned PCs but never used internet. 38% of the respondents who use internets had no computers. Majority of the respondents owned PCs and had internet access. Similar results are obtained for laptop usage. Majority of the respondents who did not own laptops, had internet access; 44% had laptops and internet access.

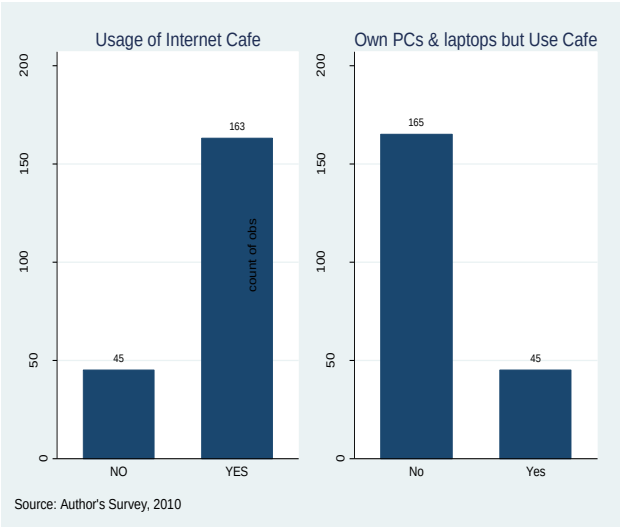
Figure 6: **Ownership of Computer and Internet Access**



G. Use of Internet Café s

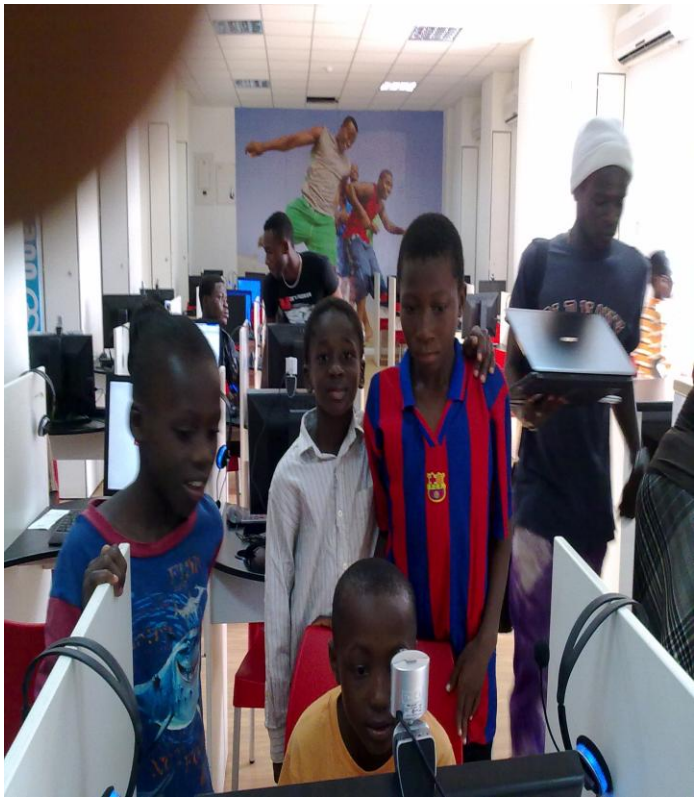
183 of the 210 respondents, representing 87%, use internet cafes. Of the respondents who use internet cafes 45, representing 25%, owned laptops and personal computers.

Figure 7: Internet Café Usage



H. Current Internet Costs

Current Costs for Internet Access at the Vodafone Internet Café is 90 Ghana Pesewas (about 60 cents [US]) for half an hour and is "cheap" enough for even primary school kids to go and browse during their free periods (as shown in the picture below).



Some kids of the High Street SDA school in Accra browsing the internet (ages 8 to 12)

Currently, students of the University of Ghana pay about GH¢50.00 (about US$$38.48) per year as technology fee which gives them access to computers at the ICT directorate and other computing facilities on campus. Users of the computer laboratory (which has about 20 computers) at the Balme Library (the main library on campus) are charged about 40 pesewas (about 28 cents) per hour for use of the computers. The ICT directorate has about 350 computers for a student population of about 27,000, so students are given 2 hourly quotas, as a way of rationing access to the computing facilities at the ICT Directorate.

M-learning initiatives are gaining momentum with various researchers looking into how this resource can be harnessed for the delivery of educational content to students. The high percentage of mobile phone ownership amongst the survey respondents is perhaps a strong indicator of their readiness to embrace internet service provision as a public good.

The survey seems to confirm the theoretical and empirical need argued above for a public service internet facility. The case is made that, given the current level of the penetration of mobile internet facilities amongst Ghanaian tertiary students, internet service provision as a public good, at least, for students, is economically feasible and leads ultimately, to human capital development and economic growth.

I. The Ghana Situation.

In Ghana, the Policy document guiding the development of ICT issues is the Ghana ICT for Accelerated Development (ICT4AD) Policy document (www.ict.gov.gh) and was based on a national consultative process that involved all key stakeholders. It reflects the national development aspirations set out in such documents as the Vision 2020 Socio-Economic Development Framework; The Ghana Poverty Reduction Strategy (GPRS) (2002-2004); and; The Co-ordinated Programme for Economic and Social Development of Ghana (2003-2012).

The Priority Focus areas of the Policy document is built on 14 pillars, with Accelerated Human Resource Development, and , The Promotion of ICTs in Education (the deployment and exploitation of ICTs in Education), occupying the topmost priority areas.

Per the policy statement of the Accelerated Human Resource Development Pillar, "The Government acknowledges that the young people of Ghana of close to 60% under the age of 25 years can be transformed into an asset by adding value to human resources and providing the environment for utilizing these resources for socio-economic development process."

Helping in the attainment of the vision set out in the ICT4AD policy document is the Ghana Investment Fund for Electronic Communication (GIFEC). GIFEC is an agency of the Ministry of Communication with a mandate that includes the provision of access to electronic services including ICT, broadcasting, multimedia service and the internet to the unserved and the underserved communities in Ghana. Among GIFEC's objectives is the commitment to the provision of internet points of presence in the unserved and under served communities.

In pursuit of its vision, GIFEC has embarked on The Universal Access To Electronic Comuinications Programme (UAEP) which comprises several projects (some in collaboration with other parties) all aimed at the delivery of its vision of extension of access to the unserved and the underserved. These are:

- The Common Telecommunications Facilities Project
- The Last Mile Initiative Project
- The Community Information Centers Project
- The School Connectivity Project
- The Rural Payphone Project
- The Easy Business Centers Project
- The Library Connectivity Project
- The Prisons Connectivity Project
- The Post Office Connectivity Project

Despite the laudable efforts of GIFEC, It is instructive and worthy of note that the thrust of their efforts (eg. The School Connectivity Project) are aimed mainly at second cycle institutions, via the provision of ICT equipments and other infrastructure. This, as laudable as it is, is however insufficient due to the huge student to PC ratios in these schools.

According to a recent survey of computer usage in second cycle institutions (Government of Ghana: Policy framework for the deployment of ICTs in education) the average ratio of students to computers at the **national level is 42:1** (i.e. forty two students to one computer), with the Northern Region having the highest (or worst) at 50:1 and Volta Region the lowest at 33:1.

REGION	Student: Computer Ratio*	REGION	Student: Computer Ratio*
Northern	50:1	Western	41:1
Ashanti	48:1	Upper East	41:1
Upper West	48:1	Central	39:1
Brong Ahafo	44:1	Eastern Region	38:1
Greater Accra	43:1	Volta Region	33:1

Further analysis revealed that only **8.3%** of the total number of computers in the system was connected to the Internet.

The University of Ghana's main centre for ICT activities is the ICT Directorate and they have about 350 computers. There are computer labs at some of the departments but if these are all put together, against a student population of about 27,000, the ratios are still lopsided against the students. The autonomous nature of most of Ghana's tertiary institutions means that those institutions themselves are responsible for the acquisition and deployment of computing facilities. However, as demonstrated by the figures from the University of Ghana, which is by far the largest tertiary institution in Ghana, the student to PC ratios is highly uneven, and this picture is reflected across all the other tertiary institutions in Ghana.

J. Comments on Survey Results

"28% of Africans now have a mobile phone subscription, according to data released by the ITU earlier this year, part of a larger trend that sees two out of every three mobile subscribers around the world living in a developing country. The flagship ITU publication Measuring the Information Society notes that two-thirds of the world's cell phone subscriptions are in developing nations, with Africa, which has a 2% subscriber rate as recently as 2000, growing the fastest. And it is not only adults who are making use of this new technology. Survey work at a low-income high school in South Africa's Samora Machel township suggests that mobile penetration among youth in some places might be higher than one might suspect.

While the explosive use of mobile phones in developing countries is well-documented -- and undeniable -- and evidence is emerging that phones are slowly making their way into the hands of teens, just what this might mean for the delivery of education in developing

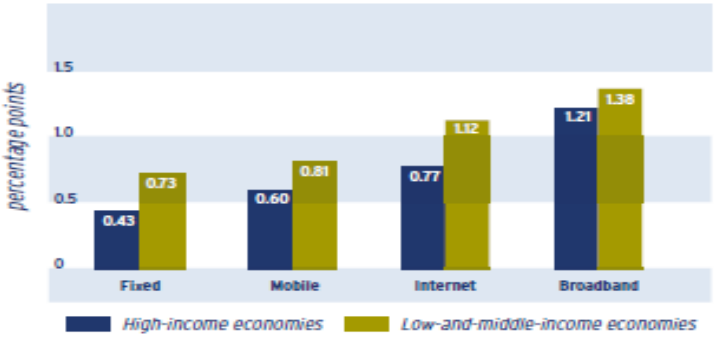
countries is a little less clear. This topic first started to get serious attention among small groups of people in international donor agencies around 2005, with a 'mobile learning' workshop in Tokyo sponsored by ADBI and UNESCO serving as a sort of landmark event for the topic. The workshop report (published as *Mobile Learning for Expanding Educational Opportunities*) is in many ways typical of work around this time, focusing largely on the possible usage models and relevance for using mobile phones in a variety of ways to support new teaching and learning processes. Further afield, Dfid began to support work in this area in Africa, and papers written on mobile learning in Africa sounded similar notes to what was being discussed in Asia, as revealed in titles like *The Potential for Using SMS to Support Learning and Organisation in Sub-Saharan Africa* and *Transforming learning through technology: the case of using SMSs to support distance students in South Africa* "

From the above quotations (Source: The World Bank), it is quite clear that our survey provides an important gauge of youth mobile penetration in a developing country (Ghana), with the survey showing that an overwhelming 95% of the respondents owning mobile phones most of them (70%) saying that they use their phones for the internet.

The results of the survey also show that although the respondents have the "internet capable devices", they do not always use them for the internet and do often visit the internet cafes. This could be narrowed down to the cost of subscription, which as a permanent feature, could be high.

Evidence abounds on the correlation, and even a causal link, between investments in telecoms technology and growth in the Gross domestic product (GDP) of countries. Roeller and Waverman (2001) use evidence from 21 OECD countries over a twenty-year period to examine the impacts that telecommunications developments may have had and find evidence of a significant positive causal link between investments in telecoms infrastructure and economic growth. Qiang (2009), citing a recent world bank study on the impact of telecommunications penetration on economic growth rates at country-level, notes that, of the 120 countries surveyed, for every 10 percentage point increase in the penetration of mobile phones, there is an increase in economic growth of 0.81 percentage points in developing countries, versus 0.60 percentage points in developed countries. She goes on to assert that access to the Internet can provide an even bigger boost to economic growth than access to mobile phones.

Figure 3 : Growth effects of information and communication technologies



The y axis represents the percentage point increase in economic growth per 10 percentage point increase in telecommunications penetration.
Source: Qiang, 2009

Again, Qiang and Rossotto (2009) cite Hardy (1980), Cronin (1991) and Norton (1992) who examine the relationship between GDP and telecommunications and essentially find that GDP and telephone penetration have causal effects in both directions, thus making
telecommunications both a cause and a consequence of economic growth.
Qiang (2009) and Qiang and Rossotto (2009) find a robust and significant growth dividend from broadband access in developed countries. In high income countries, broadband penetration of 10 subscribers per 100 inhabitants corresponds to a 1.2% increase in per capita GDP growth.

The LECG (2009), reports the findings of an econometric investigation into the
impact of broadband on productivity growth in 15 OECD nations, 14 European
nations and the United States and finds that an increase of 1 percentage point (1 more broadband line per 100 individuals) in these "medium or high ICT" countries increases productivity by 0.1%. But perhaps most importantly, they also find that the productivity
benefits of ICT are best realised when there is sufficient investment in complementary factors such as "re-skilling" of the workforce and general population, and an environment is created where the costs of technology adoption are minimal.

Table 2: Impact on GDP for each additional broadband line per 100 persons (2000 US dollars)

Country	1 additional line	5 additional lines	10 additional lines
France	1,769m	8,846m	17,692m
Finland	157m	783m	1,567m
Germany	2,023m	10,115m	20,229m
Sweden	274m	1,368m	2,736m
UK	1,845m	9,225m	18,451m
USA	11,528m	57,640m	115,280m

Source: LECG(2009)

K. The Recognition of the need for a Public Good

Rawls (1973) said that a doctrine of political economy must include an interpretation of the public good which is based on the conception of justice.

Mansell (1993), noted that if telecommunication networks are regarded as being analogous to the nervous system of society, then, in principle, they should be all pervasive, just as oral and paper-based networks of communication have been.

The essential nature of telecommunications networks, and its indispensability as far as economic life in the twenty-first century economy is concerned, is given emphasis by Melody (2006) when he notes that as these new ICTS (Information and Communications Technology Systems) are being applied ever more widely and intensively there is
increasing evidence that the economies of technologically advanced countries are
in the process of moving beyond the industrial capitalism of the twentieth century
to information and communication based 'knowledge economies' for the twenty-
first, that is, economies where the major driving force for economic growth and
development is activities relating to the generation, distribution, and application of
knowledge.

Thus, if the knowledge capital is to be the currency of the new economy, then economic agents must empower themselves appropriately, so as to take full advantage of the new paradigm. This fact was recognized by the United Nations and led to the setting up of the Maitland Commission (The Missing Link), which recognized and recommended the provision of Telecom (and by extension, Internet) services, as a Public Good. It is again recognized by such organizations as the UNDP and The DFID as well as France and Sweden (amongst other countries) who set up an International Task Force on Global Public Goods (GPGs), created by an agreement signed on 9 April 2003 with a mandate to assess and clarify the notion of international public goods, global and regional, and make recommendations to policy makers and other stakeholders on how to provide and finance them. Finland (and Estonia) has gone even further by declaring internet access a fundamental human right! (Source: BBC News Report of Thursday, July 1st 2010).

In this context then, what role must the state play in ensuring that its citizens, are offered equal opportunities in this new market? Mansell (1993), identifies the need for effective policy intervention to counter the disparities in network access conditions that will continue to arise. She went further to state that this requires that the powers of the state be exercised through the public regulatory process, and that, telecommunications policies in the networked economy will need to be grounded by policy analysis that goes beyond aggregate statistical indicators of the innovation and diffusion of technical systems and the performance of firms involved in their production. Investigation of the factors shaping the contours, dynamics and biases of evolving telecommunication markets is needed. Many of the most controversial policy issues in this area concern disparities in the conditions of access to the electronic communication environment.

L. The Argument for Investments in the Human Capital

It is obvious that focus on Human capital is required for governments to position their economies in the new knowledge economy. For developing economies it is a real chance to build competitive advantage in regional and global markets, and thereby activate them as actual economic players.

Some Countries have recognized this need and are investing heavily in their human capital growth, by advancing Information and Communications Technology education amongst their citizenry. Some have embraced the One Laptop Per Child Project in an effort to inculcate in their youth, the skills and discipline that is required for the new knowledge Economy. Others, through their universal service obligations requirements have set up universal access and service funds (UASF) with the view to using the proceeds from these funds to extend service to needy communities.

According to Hudson (1995), in the U.S., the Lifeline program subsidizes basic monthly services charges for low income subscribers. The subsidy funds come from a combination of carrier contributions and surcharges on subscriber bills. Some 4.4 million households receive Lifeline assistance. Also in the U.S., the Linkup program subsidizes connection to the network for low income households.

Various innovative strategies are being used to provide access to the Internet. South Africa plans to assign e-mail addresses to every post box address in the country, thereby providing e-mail to about 8 million households; Public Internet terminals are to be installed in all post offices; using an encoded card with a personal ID number, users will be able to send, retrieve and print e-mail messages (ITU, 1998; cited in Hudson, 1995). South Africa is also supporting the installation of telecenters equipped with phone lines, facsimile, computers with Internet access, etc., through a Universal Service Fund. Many other countries are extending community access to the Internet through some form of telecenter, teleboutique, or telekiosk. African Communications Group plans wireless kiosks for Internet access, with web pages enabling artisans, farmers and other small entrepreneurs to set up shop in the global marketplace (Petzinger, 1998; cited in Hudson 1995).

III. Concluding Remarks

Galbraith (1987) notes that nothing has so engaged economic attention over the centuries as the need to persuade people that the price given by the market has a justification superior to all ethical concern and yet, if exiguously, the notion of a higher order of justice than that of the market has also survived. A legislated minimum wage is seen as a necessary manifestation of such justice.

If the call for the provision of internet service, as a public good, by several academic and economic luminaries appears to tilt more towards the normative side of economics rather than the positive side, then probably it is because, as Galbraith puts it, the great truisms of economics have no clear discoverers; they are evident for all to see.

But as North (1986) points out, if normative statements about public policy are to be made, they must be based on solid positive theory that can draw inferences with respect to the consequences of different kinds of public policy. It is our hope that with the empirical evidence provided by the survey results, we have provided some positive foundations on which the normative statements are based. The evidence is out there. It is for researchers to get out there and gather the data, and from it tease out the latent information, and then from the information, proceed to assemble the knowledge that can transform our societies for the better.

Samuelson (1954), recognized that the failure of market catallactics in no way denies the truth that given sufficient knowledge, the optimal decisions can always be found by scanning over all the attainable states of the world and selecting the one which according to the *postulated ethical welfare function* is best. According to him the solution exists; the problem is how to find it!

The autonomous nature of Ghana's tertiary institutions means that although the overall policy is set by the government, the actual plans for rollout is left to the various tertiary institutions who typically employ the methods of the setting up of computer labs as the means of granting access to students, but evidently, the overwhelming student populations make this approach, an inefficient method, as far as the rapid extension of access to these students are concerned.

The argument must be made then that, as the results of our survey showed, most of Ghanaian tertiary students already possess the facilities for connecting to the internet (PCs, laptops and mobile phones), therefore a more innovative approach must be adopted which will enable these students to access the internet wherever they are, and not necessarily only when they are within the confines of the university campuses.

Such innovative approaches can include access subsidization schemes that allow students to access the net via selected Internet Service Providers (ISPs), either via subsidized internet vouchers, or indeed coded access protocols that grant access to educational libraries, journals, etc. etc.

The LECG (2009) report summarizes why they are so confident about the economic impact of broadband by quoting the noted economist, Paul Romer: "Every generation has underestimated the potential for finding new recipes and ideas. We consistently fail to grasp how many ideas remain to be discovered. Possibilities do not add up. They multiply". We believe that mobile internet service provision as a public good, is such a recipe, for human capital development, and ultimately, economic growth.

A. Directions of Further Research

It is quite obvious that the results of this survey only serve as a pointer to the need for even more research work in the future. It is important to find out what the cost of internet service provision, as a public good to tertiary students, to the state will be, and to weigh its costs against its benefits. To what use is the Universal Access and Service Fund (USAF) being put? The efficacy of the mobile phone as an educational aid has also to be examined fully. Will increased access (in the Ghanaian environment) translate into improved performance? What is the evidence on that? To what extent will there be short or medium term benefits to industry that can pay part of the costs? Issues of inter-generational transfer of wealth arise as some of the beneficiaries of such investments, will be the generations, yet unborn. What will be the impact of Internet service provision as a public good on the Internet Service Providers (ISPs) and what measures can be instituted to mitigate the effects of this "creative disruptive technology", to paraphrase Schumpeter.

ANNEX 1: THE SURVEY QUESTIONNAIRE

Reproduced below is the one page questionnaire that was administered to some 210 students of various tertiary institutions in Ghana.

Mobile Universal Internet Service Penetration Survey
Focus: Ghanaian Tertiary Students

Institution				
Gender	Male ☐	Female ☐		
Age Group	16 to 25 ☐	26 to 35 ☐	36 to 45 ☐	46 to 55 ☐
Do You Own a P.C?	Yes ☐	No ☐		
Do You Own a Laptop?	Yes ☐	No ☐		
Do You Use the Internet?	Yes ☐	No ☐		
Internet Use Frequency	Daily ☐	Weekly ☐	Monthly ☐	Never ☐
Do You Use Internet Cafes?	Yes ☐	No ☐		
Do You Have a Mobile Phone?	Yes ☐	No ☐		
Does It have Bluetooth?	Yes ☐	No ☐		
What's its memory size?	1gb or lower ☐	2gb to 8gb ☐	9gb to 15gb ☐	Over 15gb ☐
Does it have a USB port?	Yes ☐	No ☐		
Can Your Phone Access the Internet?	Yes ☐	No ☐		
Do You use your phone for the internet?	Yes ☐	No ☐		

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