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Federal government assistance for web-based secondary education under poor socio-economic development conditions in Nigeria: Geodemographic and qualitative analyses

Richard Ingwe¹, Judith E. Otu², S. P. I. Agi³, Eja I. Eja⁴ and J. K. Ukwai⁵

¹Centre for Research and Action on Developing Locales, Regions and the Environment (CRADLE), Calabar, Nigeria.

²Department of Sociology, University of Calabar, Calabar, Nigeria.

³Department of Political Science, University of Calabar, Calabar, Nigeria.

⁴Department of Tourism and Hospitality Studies, Cross River University of Technology (CRUTECH), Calabar, Nigeria.

⁵Department of Sociology, University of Calabar, Calabar, Nigeria.

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Within barely 15 to 20 years, information and communication technologies (ICTs)-driven new digital economy and high competition for global market share has engendered hunger for knowledge as one of the main drivers of economic development factor for cities, states, nations and organizations in advanced nations. For Nigeria, presenting scandalous poverty, afflicting 70 to 89% of its mostly rural and digitally excluded people, the need for building capacity in ICT is urgent and imperative. This paper examines the problem of lopsidedness in web assistance to secondary schools by Nigeria's Federal Government through the *Schoolnet's Diginet* programme. Models for promoting Internet use in Africa and Asia are presented. The method of geodemographic analysis was used to highlight inequalities in web assistance to Nigerian secondary (high) schools by computing per capita web assistance for secondary schools in Nigeria's 36 states and Federal Capital Territory (Abuja). The results show that the highest share of web assistance to schools went to Nigeria's Federal Capital Territory (Abuja), with a per capita web assistance of 3.56×10^{-6} . The lowest web assistance shares were given to Kano and Lagos with per capita web assistance of 4.26×10^{-7} and 4.44×10^{-7} respectively. The value added by geodemographic analysis is demonstrated by highlighting the lowest per capita shares for Kano and Lagos highlighting interaction between high population sizes of these two most populous states (Kano: 9,383,682 and Lagos: 9,013,534) compared to other Nigerian states. It is argued that greater success in delivering social justice is achievable by applying evidence-based policy derived from geodemographic analysis in sharing web assistance that is commensurate with the populations' need. While the use of population size is the starting point of this geodemographic method, other demographic variables (school aged youth, gender and so forth) may be used in further studies of this and related subjects. Such a transparent method promises to attract public-private partnership that Nigeria's Federal Government has been inviting to manage schools in the country. Moreover, it avoids recurrent problems of inequality in resource allocation that has perpetually decimated Nigeria's development programmes and processes.

Key words: Information and communication technologies (ICTs), internet, high schools, geo-demographic analysis.

INTRODUCTION

The advent of the Internet recently (about 15 to 20 years

ago). With the merger of the IT to the Internet and ago) has invigorated surges in economic growth arising from the application of the information technology (IT) or electronic computing invented and popularized over 50 other Communications technologies, the Information and Communication Technologies (ICTs) which has resulted pro-

*Corresponding author. Email: ingwe.richard@gmail.com or Cradle.Africa@gmail.com Telephone: (+234) 8051740656.

promises to further add to the economic growth surge beyond the 2.0% credited to the information technology (IT). Moreover, other advantages which have been identified with the applications of information and communication technologies (ICTs) have made ICTs the first choice adds-on to traditional economic growth factors and strategies.

ICTs are being rapidly deployed by cities that commonly operate independently from the political and economic influences of states, provinces, and national governments in most advanced nations especially the UK, USA, Finland to mention only but a few (Webster 2001). Cities in the advanced nations are rapidly creating information hubs within their jurisdictions by providing robust infrastructure on which ICTs could be planted to enhance business activities. To optimize the application of the ICTs, educational programmes for the youth are being redesigned to incorporate curriculum (curricula or curriculums) designed to offer as much ICTs ideas, practical experience and principles as could be possible. Cities, states (provinces) as well as nations are increasing their electronic readiness in terms of infrastructure as well as human capacities to use the new digital economy by creating knowledge workers. Ruefully, Nigeria has been entrapped in a vicious cycle of poverty irrespective of its enormous wealth in natural and human resources, about 70% of Nigerians wallow in poverty. The poverty is being aggravated by the exclusion of the poor from the digital economy or their deprivation from the ICTs, which create access to the digital economy. This article examines the provision of web-assisted educational infrastructure and services in Nigerian high schools by the Nigerian government under the schoolnet's dignet project.

The problem

Despite the distinctive contribution (and widespread use of the Internet) to educational institutions in some countries (e.g. Germany) to the extent that it is currently expected to become a mass medium that is useful for the inculcation of education (knowledge, skills and information), the use of the Internet in Nigeria generally and in secondary (or high) schools in particular remains rather low.

The imminence of adopting the Internet as a mass medium for mass education in Germany and elsewhere is based on the fact that the use of the web has increased rapidly at a higher rate than the Radio and television, which took 30 years and 14 years respectively, before reaching the degree of popular use of the Internet within Germany in 2004, when the Internet was just a few years old (Feibig, 2004). The administration of web assistance to Nigerian high schools is yet to be well known as effective and based on sound principles. These justify the

need for analyzing the use of the Internet in Nigerian high schools and the degree in equity or inequity in public assistance to high schools to use the technologies.

Resource allocation challenges to public policy in Nigeria: The background to the problem of study

The quest for understanding the system of allocating web assistance by the central Federal Government to states and local government areas forming Nigeria must be founded on the larger culture of resource allocation existing in the country. Resource allocation poses tremendous challenges to public policy in Nigeria. Although the system of government being operated since Nigeria gained flag independence in 1960 has been described as federal, most commentators have contested or contradicted the appropriateness of the description. Critics of Nigeria's federalism argue that the system of government that has been operated for most of the oil boom era in Nigeria has been more of unitary than federal. They have supported their arguments with the "unfederal" manner of sharing of the benefits and cost of economic growth especially the revenue derived from exporting crude oil and gas that have been drilled out of the Niger Delta-the hydrocarbon energy-rich part of Nigeria. The critics have also pointed out that unlike in other federal systems such as in Switzerland and elsewhere that the sub-national federating states enjoy or exercise substantial powers or sovereignty, Nigeria's own version of federalism is characterized by a central federal government that is rather too powerful and controls a disproportionately large portion of the nation's earnings from oil and gas to the detriment of the second and third tiers of government (the states and local councils).

The rather high frequency of revision of revenue allocation formulae and the creation of commissions to determine the appropriate or acceptable formula for allocating revenue testifies to the near intractability or difficulty of the problem. The evolution of an acceptable formula for allocating revenue to Nigeria's constituent regions has been most contentious to say the least. Attempts to achieve this difficult task started in the era that the British colonialist were in-charge of affairs in Nigeria by the creation of several revenue allocation commissions including: the Phillipson (1946); Chicks (1953); Hicks-Phillipson (1957); and Raisman (1958). After Nigeria attained political independence in 1960, many more revenue allocation commissions have been established including: Binns (1964); Dina (1968); Aboyade (1977) and Okigbo (1979). From Nigeria's Second Republic in 1979 to 1994 –the heydays of military dictatorship-other revenue allocation commissions and committees have been established and charged with developing a viable revenue sharing formula for Nigeria's federal system.

The revenue allocation principles that have been used

Table 1. Nigeria's demographic characteristics and educational attainment in 1991.

S/No.	Education type	Male	Female	Both sexes	% of total population (males & females)
1	None	623,577	893,608	1,517,185	1.70
2	Primary	451,082	370,628	821,710	0.92
3	Junior Secondary School Modern	130,488	107,894	238,382	0.27
4	Senior Secondary School /Technical/Teachers Training College	162,757	118,275	281,032	0.32
5	Polytechnics & Colleges of Education	37,388	20,454	57,842	0.06
6	University	22,099	7,178	29,277	0.03
7	Others	202,677	150,012	352,689	0.39
8	Not stated	10,703	5,696	16,399	0.018
Total		1,640,771	1,673,745	3,314,516	3.72
Nigeria's Total population		44,529,608	44,462,612	88,992,220	

Sources: National Population Commission (Nigeria): Report of the national census of population and housing in 1991.

comprise two basic considerations. The first is derivation—a principle that considers the source of the revenue being allocated in the states and local government areas as a basis for rewarding such source regions in the sharing process. The second principle is financial need, even development and minimum national standards. This second principle considers with compassion or whatever, the financial requirements of the constituents of the federation irrespective of their contribution to the generation of the revenue.

However, as at 1996, the major principles that were being applied in allocating revenue to Nigeria's states and local councils were the following factors and percentages: equality (40%); population (30%); social development (10%); landmass or terrain (10%) and internal revenue generation effort (10%). The above system of revenue allocation has been criticized as one which unduly concentrates enormous political and by extension economic power and resources in the center: where the federal government holds sway thereby exercising controlling influences on and at the detriment of the states and local government councils (Okurounmu, 1997). Other criticisms and recommendations have been provided. For example, Harvey (1979), who was concerned with issues of social justice and the creation of geographical principles and methods for remedying these problems of injustice, argued that centralization of federal government in the United States of America is rather exploitative contrasted to that in Scandinavia where equality is emphasized. Therefore, the achievement of territorial social justice must consider effective ways of tackling inequality arising from these historical and political factors (1979)

Objectives: The objective of this paper is to contribute towards improving web assistance to Nigerian high

schools as a means of preparing the youth for the highly competitive knowledge and globalize economy that is founded on ICTs. The specific objectives are: To highlight some models in web provision and assistance to the public in some nations; To analyze the web assistance to high schools in Nigeria including identification of its defects and strong points; To describe the context of development in Nigeria as a basis for the implementation of web assistance to high schools; and, To recommend methods and strategies for sharing web assistance to Nigerian high schools.

The paper is organized into sections. After this first introductory section, which introduces the background including Nigeria's demographic characteristics and educational attainment in 1991 (Table 1),

we present in the second section, a conceptual framework and literature review including: models for Internet service delivery in other nations in Africa and Asia, policy by presenting international models in low-cost pricing of Internet bandwidth for educational institutions in Africa by showing how valuable lessons could be drawn from: Uganda's telecommunication regulation, described as a model or one of the best on the African continent; Egypt's 'free' Internet project and the Asian model in fixed telephony lines expansion in Taiwan and South Korea.

The third section presents the context for social and economic development in Nigeria. The fourth section discusses the materials and methods (geo-demographic and qualitative analyses), the data used in the study, the results obtained and the interpretation of the information produced. In the fifth section, we discuss the findings, describe the history and characteristics of the schoolnet's diginet project, the collaborators in the project and its objectives, future plans and the problem of lopsidedness in the sharing of its equipment and services to Nigerian

schools spread across the national landscape. We conclude and recommend solutions for policy on resource allocation in Nigeria.

Literature review and conceptual framework

Globalization's third wave and increased competition as justifications for calls for equalizing (increasing) web-based approaches to high school education in Nigeria

The need for adopting ICTs as the more preferable model for educating Nigerian children could be justified on several grounds. Apart from the reasons given by the schoolnet's coordinator as presented herein, it is more urgent and imperative to expose Nigerian children to ICTs because of the advent and operation of the new digital economy at a global level. Moreover, Ingwe (2008) and others have stated the need for Nigeria to increase its e-readiness as a means of enabling the nation's citizens to participate actively in and gain from the global IT market. Ingwe (forthcoming) has shown that India's earnings from the global IT market has been as high as \$8 billion to \$10 billion or about seven percent of the global IT market. It was predicted that by 2008, India's earnings from the global IT market will increase to the tune of about \$50 billion which will be very much compared to Nigeria's earnings from the export of petroleum and gas. That is while Indians have been earning so much (and promise to earn even much more from the provision of knowledge services under the ongoing globalization's Third Wave), Nigeria's economy has rather remained stuck to the monocultural approach of expecting national income from the rather unreliable export of crude oil and gas.

The Third Wave came as a big relief and a source of optimism to Africa and the developing world. Advocates of the Third Wave proposed that humanity generally, but especially poor developing countries will use ICTs to leapfrog into the 21st century of economic growth by circumventing the hurdles, which impeded economic development in previous economic development (agrarian and industrial manufacturing) waves. The previous wave (the industrial revolution) was accompanied by exploitation of human labour as well as other resources; agricultural produce or cash crop export, and so forth failed woefully. Evidence shows that the Third Wave job shifts which are already operational- ICTs would enable a mass of developing world professionals or experts to offer higher remuneration yielding 'knowledge services' or 'white-, and gold-collar jobs or services' to the advanced nations clients. Put differently, the white-collar and gold collar services are expected to shift (or they are already shifting from the advanced nations to the developing nations. The white-collar jobs are massively shifting from the advanced nations because companies in advanced nations' are

increasingly preferring to outsource such white collar services, which are rather more expensive in those destinations. Considering the urgency of economic diversification that has been a recurrent wishful thinking and discourse by those interested in the Nigerian economy, the need to expose Nigerian high school pupils to the ICTs as a means of increasing their e-readiness and capacities to participate in and profit from the new knowledge economy, which is driven by ICTs has attracted attention.

Models for cost-effective delivery of the internet

Uganda's telecommunication regulation, described as a model or one of the best on the African continent lags behind the Taiwanese model (described elsewhere in this article). Compelled by the World Bank and the International Monetary Fund (IMF) to restructure her telecommunication sector laws and practices before she could benefit from some assistance from the organizations, the Ugandan telecommunication company succeeded in offering one of the cheapest Internet connection fees of about US\$150 per month for 64 Kbps Internet service- described as 'excellent' because the fee payment by one customer allows multiple educational institutions to share the connection without the requirement of paying additional fees as secondary link-up for users. Compared to the fee of only US\$23 per month for the superior broadband Internet connection in Taiwan, the Ugandan customers might be paying more except for the multiple-user allowance. However, comparing the Ugandan situation to other African nations where the monthly fee for Internet connection is as high as about US\$4,500, the Ugandans might be enjoying cheaper Internet connectivity on the continent. Uganda is expected to maintain or improve on that standard based on an agreement reached between her with the World Bank and the IMF that the Ugandan national state owned telecommunication enterprise would forfeit its monopoly to a private company, should it fail to offer the encouraging fees and services. The incentive led in the year 2000 to increases in Internet training programmes in Ugandan secondary schools focusing on e-mails, website design, browsing and so forth (Computers in Africa, July/August 2000: 35).

Egypt's 'free' Internet project launched on the 14th January 2002, is said to be offering one of the best Internet connections on the African continent 'at the cost of a local phone call without any increase of any kind'. The software used for the voice over Internet protocol (VoIP), the free Internet service offers advantages and indicates the Egyptian government's willingness to lower the cost of the Internet and most likely related services including the VoIP to the Egyptians. Additionally, the project enables all of Egypt's 6.6 million fixed telephone lines (substantially higher than the 500,000 for fixed lines for Nige-

Nigeria, Ghana's 240,000 and equally poor for other African nations. Therefore, Egypt presented a good case of considerably high fixed tele-density translating to higher Internet connectivity and the telecommunication regulator's appreciation of the difficulties faced by the Internet users and so forth (Computers + Telecommunications in Africa. 2002).

Asian models of web services as lessons for Africa-

Some strategies employed by some nations to rapidly improve tele-density deserve attention at this juncture. Taiwan, the small Asian nation with a population of 22 million presents a good example that deserves emulation by African counterparts. Every Taiwanese households had at least one telephone line. To achieve that feat recently, Chunghwa Telecom, a company whose 95 percent ownership is held by the country's Ministry of Transport and Commerce, initiated a telephone line price war in 2000 by slashing by half (50%) its subscription fee. This newly slashed price became the price point to beat by the three other fixed line operators (Taiwan Fixed Network, Eastern Broadband Telecom and New Century InfoComm Tech), which entered the telecommunications market later. Therefore, the new operators resorted to price slashing strategy culminating in a truly 'quantum leap' in telephone line ownership: at least one line for each household and eight million Internet users (representing about approximately 21% of the national population of 22 million). Taiwan rose from a low 25th position in the global broadband Internet penetration in 2001, to an enviably high second position in 2003, that is, within a few months -a truly quantum leap. The rapid growth rate of Taiwanese broadband subscribers has been very interesting: it was 170,000 at 2000 ending; it rose to two million in October 2002 and is expected to rise to a high three million by the end of 2003 (Chung, 2003).

Only South Korea was ahead of Taiwan in terms of broadband subscription (connection) with over 50% of the South Koreans linked to the broadband Internet. The broadband Internet has been regarded as one of the most effective systems of Internet subscription because of its numerous advantages as follows: It is ten times faster than the traditional modems and the dial-up Internet; it is cheaper when used intensively by paying a flat monthly fee of about US\$23 (in 2003 Taiwan- it could be different elsewhere) instead of paying for the time spent online. The Taiwanese telecommunications regulators' offer a model for Africa by successfully adopting the foregoing approach to rapidly increase the tele-density and by extension the superior broadband Internet connectivity. For Taiwan, the small nation which suffers severe territorial limitations especially the shortage of space for outdoor recreation for her citizens, who had resorted to the Internet for recreation by playing Internet-based games (Chung, 2003). This model, which promotes

access to fixed telephony rather than restricts access to the Internet, was inevitable. The model is relevant to the improvement of fixed telephony, Internet penetration, the VoIP in Africa because, when Africans are connected to the Internet especially, they can automatically deploy the VoIP by adding the required modems and increase their chances of taking their destinies in their hands and moving as much as 33 African nations forming the membership of the unenviable 49 least developed countries (LDCs).

Context of socio-economic development in Nigeria: Why web-based education is urgent and imperative

Nigeria's mind-boggling development statistics in the last decade include: very poor human development indicators (HDI), compared to those of other developing countries such as: Cote d' Ivorie, Ghana, Kenya, Zambia, Indonesia and China among others) Nigeria's HDIs place lowly on several services. For example, Nigeria's Gross Primary School Enrolment (1993), Gross Female School Enrolment was second but last on illiteracy rate (1995), and was only better than three of her counterparts on population living below poverty line (1992 - 1996). Nigeria did badly by placing mostly last or second but last positions) on other indicators as follows: infant mortality, life expectancy (short 52 years), high death rate, total fertility rate and dependency ratio. Nigeria placed a scandalous last position on access to safe water (1993). She placed seventh or last on GNP per capita, 1995 (Canagarajah / World Bank, 2000). She had a miserable 36% household access to electricity, in addition to prolonged poor Gross National Income. Nigeria's roughly decadal Human Development Indices profile have been life expectancy at birth: 39 years (1960), 49 (1980), 53.2 (1991) and 52 (1992); far below those of less developed countries (LDCs) average of 63 years (2001); infant mortality rate (for ages 1 - 4) poor: 185 (1960), 135 (1980), 93 (1991), 77 (2000) and 75 (2001) that is, far worse than the LDC average of 61 (2001); population per physician (medical doctor) ratio: 73,710 (1960), 15,740 (1980), rather high crude death rate (per 1000): 25 (1960), 17 (1980), 13 (2000), 14 (2001) almost always worse than the LDC average of eight in 2001 (Okowa 1987, UN yearbooks over the years). Most recently (in 2002), these indicators deteriorated to emergency levels that is, worse than the previously unacceptable levels and lower than those for most developing countries (Voice of America, 2003). Local reports claim that, in the first half of 2003, average poverty (the number of people earning and spending less than US\$1) rose above 70% that is, worse than the African average of 60 to 70% of Nigerians are unemployed (contrary to government's earlier promise in 1999 to offer jobs). During the period, the real sector of the economy performed poorly, there was/is a reduction in public trust in the banking sector's

capacity to effectively function as financial intermediary because it was/is being threatened by the resurgence of distress affecting about eleven banks presently seeking leverage elsewhere (The Punch, 2003: 1-2 citing the Nigerian Association of Chambers of Commerce, Industries, Mines and Agriculture, NACCIMA). Although, the tele-density is improving with the recent addition, since August 2001, of about two million Global System for Mobile Communication (GSM) telephone lines, in 2000/2001 it was disappointingly, one telephone for 600 persons and nominally between 0.36 - 0.38% far below the International Telecommunications Union's recommendation of one telephone for 10 persons. That represented a deficit of about 12 million telephone lines to reach the minimum requirement for Nigeria's over 120 million populations.

This poor tele-density has seriously reduced Nigerians' chances of succeeding in the present highly digitalized, informationalised and competitive economy (Yaqub, 2002). However, the popular literature has reported that due to the launching of the global systems of mobile telecommunications (GSM) in Nigeria in the early 2000s, the mobile phone density rose rapidly to about 40 million subscribers and is still increasing (The Punch, several issues). The foregoing miserable development statistics are enough warning to jolt geographers and regional planners to seek new ways of increasing welfare in Nigeria because, their professional responsibilities and activity areas are mainly to improve the level of development of sub-national regions which translate aggregatively into national development. For over a decade now, the federal roads linking the South-eastern region or states (Cross River, Akwa Ibom, Bayelsa, Rivers, Imo, Anymore and Abia) and to some extent the mid-western states (Edo and Delta) to the nations business (commercial) capital city of Lagos have been impassable to the extent that the states' population are planning protests against the federal government. There is need to further examine Nigeria's unmet need for high school education because of its significance for the future of the children and the quality of life that education would endow them with to enhance their own and the general societal welfare. Owing to the woeful failure of Nigeria's enormous wealth in natural and human resources and the huge cash to be equitably distributed to the various groups, including the university-level graduates, it has been argued that other approaches which could be adopted to salvage the deprived include programmes aimed at increasing the poor's access to the resources of the digital economy: IT, the Internet and related communications technologies altogether described as ICTs. Moreover, this strategy had been earlier identified as globalization's Third Wave knowledge service shift- a means of freeing developing nations' population from the stranglehold of the earlier revolutions (agrarian and industrial manufacturing), which failed due to inherent problems in

their nature.

Although most commentators have pointed out that Nigeria will do as well as India in taking up and offering globalization's Third Wave knowledge service, the official Nigerian National Population Commission (NPC) data on the population of Nigerians who had university-level degrees was barely 29,277 that is, including 22,099 males and 7,178 females as at 1991 when the NPC's Post Enumeration Survey probed this characteristic of the population. If the population of graduates of polytechnics and colleges of education of 37,388 males and 20,454 females is added, only a marginal increase which results in 87,119 graduates of tertiary institutions generally (including universities, polytechnics and colleges of education) representing barely 0.09% of the total population of Nigerians put at 88,992,220 in 1991. This rather low level of university or tertiary level education indicates that the need to increase investment into tertiary education generally and also to prepare secondary school children with ICTs-based education in readiness for 21st century type of knowledge required for the information economy is urgent and imperative.

The above figures suggest that about 96.28% of Nigerians had no education of any sort as at 1991 census enumeration and post-enumeration survey.

MATERIALS AND METHODS

The methods used are geodemographic and qualitative analysis of secondary data. Geodemography has been defined as a methodology comprising the application of geographic information science (a variant of geographic information systems (GIS) that involves advanced modeling of datasets of variables endowed with spatial attributes), spatial analysis and spatial analytic tools towards developing sophisticated statistical techniques for analyzing datasets concentrating on demographic variables and distributions of human population in geographic space to development issues. Geodemographic analysis is reported to have led to immense improvement in the performance (that is, profit making by marketers of goods and services in the United States of America and elsewhere (Goss, 1995).

Demography defined the scientific study of human populations including their size, composition, distribution, density, growth and the population's other social, economic, and political characteristics within a delimited territory or region (National Population Commission (Nigeria) 1990) adds value to information for policy when analyzed geospatially. In this study, geodemography involves the analysis of Nigeria's population data by states and the Federal Capital Territory, Abuja by treating the data with the number of Internet (or web) (Table 2), "infostructure" (describing infrastructure pertaining to information and communication technologies and distinguished from conventional infrastructure) provided by the public budget to secondary schools.

The spatial analysis component of geodemography has been explained by Ingwe et al (2008 forthcoming) who described how they applied the method of spatial analysis, which is based on the concept of space as espoused or described by Harvey (1969) to analyzing the perpetration of offences by ocean-going vessels in Nigeria's territorial waters. Although these methods have already been described in the literature, we describe them in this paper due to the need for clarification and the way some of the basic concepts

Table 2. Geospatial distribution of population and per capita web-assistance to high schools by states and Federal Capital Territory, Abuja

S. No	State/Territory	Population	Web-assisted schools	Per Capita web-assistance
1	Abia	2,833,999	4	1.41×10^{-6}
2	Adamawa	3,168,101	4	1.26×10^{-6}
3	Akwa Ibom	3,920,208	4	1.02×10^{-6}
4	Anambra	4,182,032	4	9.56×10^{-7}
5	Bauchi	4,676,465	4	8.55×10^{-7}
6	Bayelsa	1,703,358	4	2.35×10^{-6}
7	Benue	4,219,244	4	9.48×10^{-7}
8	Borno	4,151,193	4	9.64×10^{-7}
9	Cross River	2,888,966	4	1.38×10^{-6}
10	Delta	4,098,391	4	9.76×10^{-7}
11	Ebonyi	2,173,501	4	1.84×10^{-6}
12	Edo	3,218,332	4	1.24×10^{-6}
13	Emit	2,384,212	4	1.68×10^{-6}
14	Enugu	3,257,298	4	1.23×10^{-6}
15	Gombe	2353,879	4	1.70×10^{-6}
16	Imo	3934,899	4	1.02×10^{-6}
17	Jigawa	4348,649	4	9.20×10^{-7}
18	Kaduna	6066,562	4	6.59×10^{-7}
19	Kano	9383,682	4	4.26×10^{-7}
20	Katsina	5792,578	4	6.91×10^{-7}
21	Kebbi	3238,628	4	2.24×10^{-6}
22	Kogi	3278,487	4	1.22×10^{-6}
23	Kwarra	2371,089	4	1.69×10^{-6}
24	Lagos	9013,534	4	4.44×10^{-7}
25	Nasarawa	1863,275	4	2.15×10^{-6}
26	Niger	3950,249	4	1.01×10^{-6}
27	Ogun	3728,098	4	1.07×10^{-6}
28	Ondo	3441,024	4	1.16×10^{-6}
29	Osun	3423,535	4	1.17×10^{-6}
30	Oyo	5591,589	4	7.15×10^{-7}
31	Plateau	3178,712	4	1.26×10^{-6}
32	Rivers	5185,400	4	7.71×10^{-7}
33	Sokoto	3696,999	4	1.08×10^{-6}
34	Taraba	2300,736	4	1.74×10^{-6}
35	Yobe	2321,591	4	1.72×10^{-6}
36	Zamfara	3259,846	4	1.23×10^{-6}
37	FCT (Abuja)	1405,201	5	3.56×10^{-6}

Sources: Authors' computation from data obtained from; Schoolnet's Dignet Project 2004; and Nigeria (Federal Government) Report of 2006 Census by National Population Commission 2007.

deserve explanation for our current purposes.

Space

Philosophers of science have observed that Euclidean space (that is, space that is based on the Euclid and measured in metrical units) constitutes a suitable form of measurement of physical distance on terra firma. The concept of space has offered geographic research both advanced as well as simple geometric "language" that provides tremendous value (Harvey 1969). It is on this basis that Euclidean space is presented as a multi- (that is, two or more)

dimensional scheme for analyzing geospatial problems. For example, the first two dimensions of a conceptual framework designed to resolve a geographical problem comprises the distance between the two axes in space namely: "x" and "y". The remaining two dimensions could be: "z" denoting the magnitude of an event or feature (e.g. demography) and "t" describing the time over which the event occurred or the feature developed (Harvey, 1969). Owing to the relevance of the concept of space to geographic analysis and the high frequency of its application by most geographers, it has become synonymous with geography or what is considered to be geographic is considered to be spatial in the literature. Therefore,

the term spatial is commonly used to describe the application of geographic space meaning the distribution of things (features, phenomena and so forth) on the earth's surface (Demers, 1999).

The purpose of applying geodemographic analysis in this study was to derive per capita of Internet infrastructure for secondary schools by Nigerian states. It involved the simple computation of the number of establishment of Internet infrastructure provided through the use of public funds for secondary schools in Nigeria by the 36 states and the Federal Capital Territory in Abuja. While, geodemography offers the opportunity to apply data on several variables or aspects of demography (size, composition, distribution, density, growth and the population's other social, economic, and political characteristics and so forth), the inclusion of more of these variables to the study is dependent of the objectives of the study. In this study, the emphasis was on stimulating interest in the use of the method. Therefore, only population size was considered necessary for achieving the objectives of the study.

Data

The data on the establishment of Internet infrastructure in high schools were obtained from the Schoolnet's Diginet Project (an Internet Service Provision firm working on contract for Nigeria's education sector and a representation of the Federal Government of Nigeria).

Data on population of the 36 states and the Federal Capital Territory, Abuja were obtained from the National Population Commission reports of the 1991 and 2006 national census projects. For this geodemographic analysis, data on the 2006 census for the 36 states and the Federal Capital Territory was used to compute the per capita web assistance to each state or territory in Nigeria. This computation involved the division of the total number of secondary schools assisted (by the Federal Government) with web facilities by the total populations of each of the sub-national regions (states or territory). This was justified because education is accepted as a process of acquisition of formal training and skills improvement that yield benefits to both the individuals who undergo the process of education as well as the wider society or community. The latter is believed to gain from the improved skills and knowledge of the former. The literature has reported how this subject of ICT provision has been examined at supranational and national scales. For example, in proposing innovative ways of guaranteeing a hitch-free and long-term availability of workers who are skilled in the fields of information and communications technologies in the European region (comprising several nations), Professor Richard Straub recommended among others that all teachers, lecturers and education officials in the European region be compelled to become IT literate and also to actively encourage the application of ICT across both curricula and extra curricula programmes (Straub 2001).

Therefore, since it is the entire society that benefits from ICT-based education, it was considered appropriate to use the total populations of the 36 states and Abuja (Federal Capital Territory) to compute per capita web assistance given by the Federal Government of Nigeria. Therefore, the geodemographic method used in this study can also be separately implemented using demographic data that targets only the enrolled students of secondary schools in order to measure the absolute degree of accessibility of this stratum of the regional population to web facilities and to assess unmet need for web-based education.

RESULTS

Lopsidedness in the Pilot test Diginet centers

The spatial distribution of web assistance to secondary

schools (that is, schools which have been provided with the digital online equipment and related services) under the Diginet project could easily be described as rather unequal or lopsided. This is presented in two forms here: The first presentation involves interpreting the raw data without rigorous geodemographic analysis). The second presentation is based on results of the geodemographic analysis.

Interpretation of inequality based on unprocessed data

An examination of the data matrix comprising population of the states and Federal Capital Territory and the number of web-assisted schools casually reveals inequality in sharing of the facilities across the sub-national regions. There seems to be a higher concentration of the Diginet centers in Abuja – Nigeria's Federal Capital Territory. While it has been gathered that only a few (about four) schools were selected per state in some of the nation's 36 states to benefit from the diginet equipment consisting of about 24 Internet-linked electronic computers; Abuja mayoralty (which is not statutorily accorded the status of a state but in this scheme as well as some other important projects, has always been treated like an equivalent of the 36 states, if not better treated) has a rather disproportionately higher number of Diginet centers. These centers were located in the following five high schools: Abuja zone: (i) Model Secondary School, Maitama. (ii) Government Technical College, Garki. (iii) Government Secondary School, Wuse. (iv) Government Secondary School, Garki. (v) The Gifted Children School, Gwagwalada. To better appreciate the implications of the lopsidedness in the provision of the diginet educational aids, there is need to present some background on the nations educational service provision and use as well as other development indicators. Therefore, it is easy to conclude that rather than aim towards reducing the digital divide, the Schoolnet's Diginet project seems to be excluding school pupils who are in dire need of exposure to web-based education increasing the digital divide for most of the millions of secondary schools in Nigeria.

Geodemographic analysis and clarification of the degree of inequality in web assistance

Figure 1 better highlights the significance of population in affecting the shares of web assistance or inequality in web assistance to high schools. Although the figure 1 (histogram) does not show the per capita web assistance *per se*, it does makes it easier to visualize the likelihood of the result of geodemographic analysis to reveal deep seated variation in population sizes of the regions at the general level and of those enrolled in the high schools in particular. This shows that there are deeper variations in

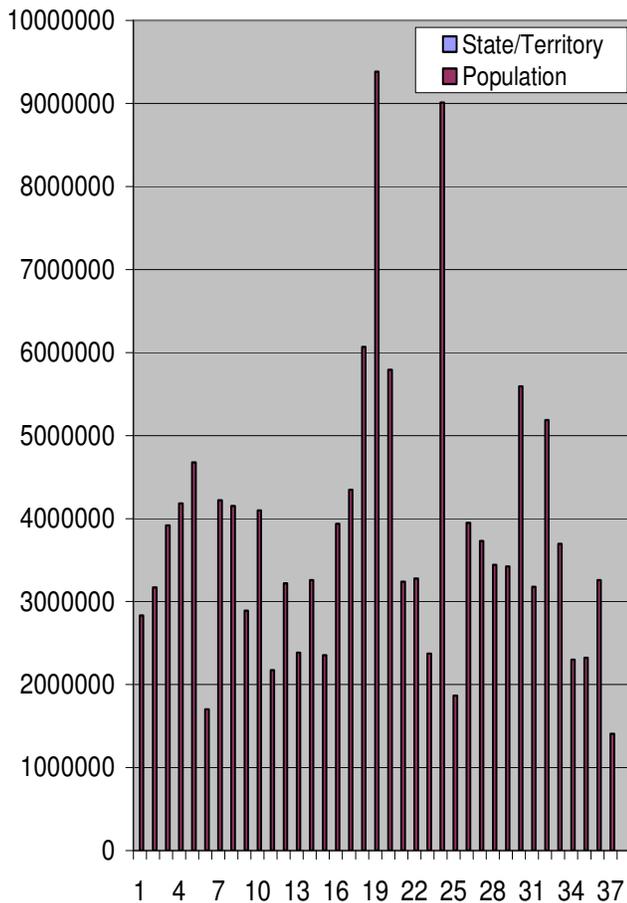


Figure 1. Population of Nigeria's 36 states and Federal Capital Territory (Abuja). Sources: Authors' analysis based on data derived from Federal Government of Nigeria's representatives (National Population Commission, 2007 and Schoolnet's Diginet Programme).

benefit-cost situations of the states and territory receiving web assistance due to the inclusion of basic demographic variables in the analysis. This is a significant point that was ignored by Nigeria's Government and its representatives responsible for distributing the facilities. The results show that the highest share of web assistance to schools went to Nigeria's Federal Capital Territory in Abuja, which had a per capita web assistance of 3.56×10^{-6} . The lowest shares of the web assistance were received by Kano and Lagos which had a per capita web assistance of 4.26×10^{-7} and 4.44×10^{-7} respectively). In these cases (of Lagos and Kano), the interaction of high population sizes become evident when it is considered that these two states bear the highest populations (Kano: 9,383,682 and Lagos: 9,013,534) possessed by Nigeria's states.

The result of per capita web assistance for Lagos in this study is likely to be different if the population figure of

17.55 million people that the Lagos State Government claimed is its rightful population size (in 2006) is used in the analysis. After the National Population Commission released its provisional report of the 2006 census, the Lagos State Government contested the result pertaining to its population. International organizations have similarly estimated the population of Lagos to be between 15 and 20 million while United Nations agencies project the population of the megacity to be 23.2 million by 2015 (Ingwe et al., 2008; Nigerian Tribune, 2007; UN no date). Therefore, using the self-acclaimed population of Lagos (that is, 17.55 million), the per capita web assistance based on the four schools that were given web assistance would be the lowest share out of all the 36 states of Nigeria with 2.28×10^{-7} . However, for convenience and the need to maintain uniformity in the analysis, the self-acclaimed population of Lagos was not used for the analysis reported here.

DISCUSSION OF RESULTS OF DATA ANALYSIS AND RELATED ISSUES

A major point that emerges from the policy on sharing web services to schools spread across Nigeria's 36 states and Federal Capital Territory in Abuja is the ignorance or indifference to the specific demographic, geo-spatial and other socio-economic peculiarities of the various sub-national regions. This represents a flaw in policy that urgently deserves redress. However, it typifies the plague in planning development programmes without reliable data and information in Nigeria. This culture was identified by Wolfgang Stolper as far back as in 1966 when he released the thesis: "Planning Without facts" in Nigeria and provided "lessons on resource allocations from Nigeria's development experience" in his classic book published by Cambridge University Press. More recently, the Secretary to the Federal Government of Nigeria (Alhaji Baba Gana Kingibe) publicly acknowledged that this culture of planning without facts has persisted or changed its way of manifestation. In a report entitled "incorrect data may impede attainment of Millennium Development Goals" by Nigeria the Secretary to the Federal Government of Nigeria recently expressed government's frustration with the inadequacy of data in the country, the poor state of data collection and management, pointing out that this problem threatens the achievement of the 2000 Millennium Development Goals in the country (Saturday Punch, 17 November 2007; The Punch, 33rd August 2007).

Organization and funding of the Schoolnet Nigeria

Brief history and characteristics of the schoolnet's diginet project

The Diginet (Schoolnet) project was inaugurated recently

(13th November 2003) by the Federal Government of Nigeria in collaboration with the Education Tax Fund (ETF), and Schoolnet Nigeria. While the Federal Government of Nigeria (FGN) requires no introduction, the ETF and Schoolnet need to be introduced due to their relative newness.

The Schoolnet Nigeria

Dignet's Project Coordinator: Mr. Olaolu Sasore, described the initiative as one which (a) Transcends the mere provision of equipment but one evolved to advance the standard (quality) of teaching and overall learning in Nigerian schools by deploying the appropriate ICTs and tools (b) Involves technical education (training) of the schools' population aiming to develop 'a first line of technical support within the schools' (c) To design sound environments for schools' education by establishing liaisons with public agencies and international organizations. "It essentially provides digital access (computers and Internet) to Nigerian (high) schools, while incorporating all other dimensions of effective use of ICTs in education". Sasore claims that Dignet "is a fully integrated programme, which includes an elaborate 6-month teacher development programme, in which teachers learn how to use technology to enhance the teaching and learning of specific subjects and not mere computer training and appreciation".

Self-acclaimed objectives of the Schoolnet's Dignet project

The objectives of this project are: To alleviate the problem of severe deficiency in digital electronic computing infrastructure in Nigerian high schools under the context of the digital information economy; To place Nigerian high school pupils on the same pedestal with their counterparts in the advanced nations in terms of the availability of digital infrastructure required for learning in the highly competitive knowledge economy; and to position Nigerian high school pupils strategically in order to compete with their peers in the global educational community where Information and Communication Technologies (ICTs) have become part and parcel of the educational environment or process.

Schoolnet project plan

Schoolnet has been credited with the following plans: (i) to increase the availability of equipment to schools through the introduction of special education rates (e-rates) on Internet transmission bandwidth pricing. It was reported that the Dignet's coordinator was negotiating with the SNNC and the Nigerian Communications Com-

mission, the nation's telecommunication regulator to provide a special rate for Internet band with transmission for educational institutions in Nigeria. (ii) Schoolnet was also collaborating with IMFUNDO-the British Government's Department for International Development (DfID) and the British Broadcasting Corporation (BBC) to "develop content for policy maker(s)' empowerment in Nigeria and Africa.

The Education Tax Fund (ETF)

The ETF was created after an industrial action embarked upon by Nigerian university teachers under the aegis of the Academic Staff Union of (Nigerian) Universities (ASUU) in 1992 to demand for urgent measures for drastically reducing the severe problems which have been plaguing the Nigerian university system for the past two to three decades. The ASUU-FGN face-off resulted in the publication of the Federal Government of Nigeria-ASUU (FGN-ASUU) Agreement of 1992, which listed the ETF among other things that the FGN had agreed to do to ameliorate the dwindling educational fortunes of Nigerian universities. Initially called the "Higher Education Tax", it encapsulated 'various creative measures that were mutually acceptable to both parties on sources of funding for universities (ASUU, 2000). The FGN-ASUU Agreement of (September) 1992 has been described as "beneficial to the university system, students, parents and the people of Nigeria. By encouraging medium and long term planning, it, in a desirable way, made policies more stable and less prone to arbitrary and irrational changes stemming from political instability and changes. The agreement was meant to halt 'Brain Drain', which had become (and is still) a threat to the survival of the university system. It contained a provision for periodic (3 year) reviews in order to consolidate its benefits to the system and the country (Ibid)"

Some years after the creation of the ETF, ASUU has complained bitterly against the inappropriate management of the fund. ASUU publications including posters, letters, and directives to its members have frequently expressed serious concerns about "high level fraud" in the management of the fund and "attempts by Government to transform the fund into something else and destroy the initial concept. Other charges have included shady deals that have characterized the management of the fund and undue bureaucratization of the fund through the establishment of large offices, appointment of a large battalion of officers (bureaucrats) who would certainly be paid large salaries and allowances from the fund in the same manner as the Nigerian Government has come to be known for operating a large bureaucracy which gulps about 70% of Government revenue spent on recurrent activities while a paltry 20 – 30% has been spent on capital projects (ASUU-UCB 2000).

Table 3. Nigeria's projected school age population by sex (medium variant) 1990 - 2010.

Age/Education level	Sex/total	1990	1995	2000	2005	2010
3-5/Nursery	M	4,025,512	488,603	5,707,784	6,575,321	7,422,788
	F	3,992,102	4,819,686	5,446,800	6,348,614	7,156,788
	T	8,017,614	9,702,289	11,154,584	12,923,935	14,579,418
6-11/Primary	M	7,071,623	8,087,551	9,622,484	11,300,985	13,005,896
	F	6,940,883	8,040,256	9,351,583	10,853,367	12,524,758
	T	14,012,506	16,127,807	18,974,067	22,154,352	25,530,654
12-14/Junior Secondary	M	4,276,505	4,603,166	5,314,507	6,323,520	7,444,324
	F	4,226,093	4,503,150	5,302,641	6,124,545	7,152,703
	T	8,502,598	9,106,316	10,617,148	12,448,065	14,597,027
15-17/Senior Secondary	M	2,924,482	3,354,079	3,603,996	4,325,397	5,118,568
	F	2,922,175	3,291,060	3,545,757	4,297,163	4,899,141
	T	5,846,657	6,645,139	7,149,753	8,622,560	10,017,709
18-25/Tertiary	M	5,907,180	7,415,921	8,560,870	9,437,225	11,120,512
	F	6,521,025	7,538,349	8,445,273	9,337,476	11,016,884
	T	12,428,205	14,954,270	17,006,143	18,774,701	22,137,396
Age 26+	M	15,028,821	16,904,581	19,740,750	23,353,188	27,215,867
	F	14,540,264	17,148,763	20,357,202	24,136,121	28,127,192
	T	29,569,085	34,053,344	40,097,952	47,489,309	55,343,059

Sources: National Population Commission (Nigeria): Report of the national census of population and housing in 1991.

Poor quality of the diginet's Internet service

Owing to some problems connected with the choice of and the technical and management competence of the contractors handling the diginet service, it has been observed that the quality of Internet service offered under the schoolnet programme has been disappointingly poor. The downtimes of the Internet service has been rather too frequent, while the computers do not seem to have been selected or procured in a way that shows the contractors ability to offer the best ICTs service reflecting the current state of the advancement of ICTs hardware, software and people-ware available in the market. The computers are mostly very slow while services required for trouble-shooting are seriously inadequate. The poor service seems to pervade most of the industry defined criteria (or key attributes) known to determine Internet service quality: connection speed, downtimes, and ISP or independent consulting support for cyber-cafes and users. Since the observation of poor service quality has been based on mere comparison of the schoolnet's service with other commercial cybercafes and Internet Service Providers (ISPs), further analysis of this needs to be undertaken based on ISPs and the schools' cyber-cafes but it is likely to be more cost-effective to generate data on this variable attribute from ISPs because since they supply bandwidth to several cyber-cafes simultaneously,

time and other resources should be saved by avoiding visits to numerous cyber-cafes instead of fewer ISPs.

Unmet need for web-based education in Nigerian high schools

Nigeria's projected school age population by sex (medium variant) 1990 – 2010 (Table 3) could elucidate on the unmet need for web-based education for the secondary school age population, which is not necessarily organized into the number of available secondary schools because web-based education could be delivered even without the formal schools. An examination of Nigeria's projected school age population by sex (medium variant) 1990 - 2010 shows that the total number of junior and senior secondary school aged children (12 - 14 and 15 - 17 years old respectively was projected at 8,502,598 and 5,846,657 in 1991. The figures were projected to rise to 10,617,148 and 7,149,753 respectively the year 2000 and 12,448,065 and 8,622,560 in 2005. Therefore, the Schoolnet's diginet project is presently serving a very low percentage of the secondary school aged population.

Conclusion

The use of geodemographic analysis has enhanced the examination and understanding of equity and inequity in

sharing web assistance to high schools in Nigeria by states and Federal Capital Territory. Considering that web-assisted high school education (that is, the infrastructure and services for applying ICTs) constitute infrastructure required for leveraging competitiveness in economic activities in the new knowledge economy and society, the results of this study show that there is much room for improvement in web assistance to high schools in order to attain a level that promise to create the desired number and quality of human capital required by Nigeria to be competitive in the new economy. It is evident that for Nigeria to gain more of the global market share of the IT or ICTs sectors and the globalization's Third Wave; the equipment of high schools with ICTs infrastructure and services is urgent and imperative. Considering the enormous inequality demonstrated by the recently inaugurated schoolnet's diginet project does not show signs of changing before some of the pupils graduate from the high schools, urgent policy measures for radically easing the burden of schools yearning to increase their pupils' access to the Internet need to be taken to engender drastic cost reductions in the pricing of Internet bandwidth for educational institutions. Appropriate models drawn from Africa (Uganda, Egypt, Morocco) and Asia (Taiwan and South Korea) among others could be used to formulate solutions to fit Nigeria's circumstances.

It must be recommended that in order to attain a more equitable sharing of web assistance to the high schools requiring connection to the Internet in Nigeria, the geodemographic method comes in handy. As demonstrated in this paper, appropriate methods can be developed and applied based on the specific needs of the states by carefully determining the factors that deserve consideration. The geodemographic method, which comprises geospatial information science, is modular that is, allows the researcher to include as many variables as are appropriate in a study. Therefore, further analysis could consider including more variables such as the areas of states and territory, locations of various schools and/or human settlements including those that are web assisted and otherwise (in order to assess the distances existing between the web assisted schools and others), among others.

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