

Review

An Evaluation of the Nigerian National Information Infrastructure and E-Governance

Chukwudebelu Izuchukwu Vincent

Abstract

Action Word Educational Services
Limited Lagos

E-mail:
izuchukwudebelu@yahoo.com

Nigeria has the fastest growing and most lucrative ICT market in Africa (which fellow emerging economies like South Africa, India, Malaysia and Singapore are making the most of); yet in spite of this significant progress is still being ranked low in e-government provision to its citizens. The need for national information infrastructure cum e-governance framework as a national imperative for a 21st Century Nigeria cannot be overemphasized. National information infrastructure and e-governance policy engineering is important in achieving Vision 2020 and the mission of re-branding and transforming Nigeria. Unless the significance of e-governance is recognized and made the engine room of nation-building, economic and social developments aims in our country may become unattainable. Soonest, intellectual capital, not mineral resources like oil, would be the most strategic and valuable global resource. This paper therefore evaluates and recognizes with great concern that the current national information infrastructure and e-governance readiness framework in Nigeria is grossly inadequate-especially in the areas of National Power Generation and Supply (as the government fixes June 1st as the take-off of new electricity tariff). It highlights the bureaucracies and politics that hamper speedy development of our national information infrastructure and e-governance in comparison to what is obtainable in other evolving economies. The study investigates the limitations and deficiencies of our national information infrastructure and e-governance. The study examines areas of paucities which have contributed to the low e-service delivery in the country despite the success recorded in the country's ICT and telecommunications sector and finally suggests how this situation may be improved for an enviable national information infrastructure and e-governance as a national imperative for 21st century Nigeria of our dream.

Keywords: National Information, Infrastructure, ICT Infrastructure, e-Government

INTRODUCTION

Nigeria has lost its soul. That is probably the tersest way to summarize the decay that has inflicted what could easily have been one of the greatest countries on the face of the earth. The country, with its unlimited potential, has been looted into penury. The future looks very bleak, even to its most upbeat citizens. Indeed, many would argue that the country never really existed and was

merely an artificial experiment that failed miserably. Uninformed people held grip on leadership between 1960-2007 (47 years) and suffocated national intellectual infrastructures. An example was the Freedom of information bill which was signed into law after twelve years of battle until a literate mind (Good Luck Ebele Jonathan) assumed office (Central Bank of Nigeria,

CBN, 2011). For many of its peoples and admirers, emotional detachment has been the safe course to take in order to avoid complete insanity, hence the mass exodus of her citizens to western nations in search of greener pastures. Indeed the proverbial, 'Andrew has finally checked out.' An overhaul of her national information infrastructure that shall offer e-governance services to her citizens as is obtainable in other evolving economies of her size is a sine qua non. Very glaring, the inadequacy of the present national information infrastructure can be seen by the blind as e-governance which is the order of the day in developing countries exists in principle but yet in practice in Nigeria.

Nigeria is rebuilding several of its infrastructures including power, transportation among others, and these laudable efforts should include national information infrastructure. The importance of a vibrant information infrastructure and e-services delivery in relation to economic, social and scientific development of any emerging economy cannot be overemphasized. Equally important is the timing of such a policy to pave the way for an early start towards creating an Information Technology focused economy equipped with the most optimal telecom infrastructure as part of the fuel that will propel Nigeria to meet its development goals by 2020.

Before commencing any significant national information infrastructure development programs, Nigeria's primary political focus should be on ensuring that the country's internal structure, culture, and leadership promote, rather than stymie, national development. The soul of the country needs to be raised from the dead. Its value scale needs to be re-calibrated. Its infrastructure needs to be rebuilt. Only then can any long-term strategic initiative take on any measure of relevance. Once a re-optimized polity is firmly in place, Nigeria should make the Information Age the seed of its strategic national planning for the 21st century. Properly regulated emphasis on repairing its brand, privatization of its state-run enterprises, fixing its educational systems, and generating phalanxes of skilled high-tech workers would set the country on the road to rebirth.

In recognition of the criticality of the Information Age and its potential impact on Nigeria, a *National Information Infrastructure Commission should be established*. This body should be charged with formulating and implementing Nigeria's long-term information infrastructure policy. It should be very well funded and supported, and should be given the necessary latitude to execute its policies, free of undue red tape. The mechanics of its interaction with existing ministries should be explicitly defined in order to preclude bureaucratic contention. The organization should be comprised of intellectuals with expertise in germane fields: computer-science, library science, engineering, economics, education, business, and public policy. Long-

term information infrastructure policy devised therein should be carefully coordinated with strategic educational and economic initiatives. In addition, a 'Presidential Information Infrastructure Advisory Committee,' comprised of members of the private sector and academia, should be incorporated to provide direct and complementary policy guidance to the executive branch.

Once the national information infrastructure is in place, the Nigerian government needs to exploit it in order to improve the efficiency of its own operations. Internal networks, databases, web-sites, and other software should be erected to effect the replacement of the piles of files and papers that currently congest or litter government offices. E-mail services should be installed and used as the primary means of inter-departmental and inter-ministerial communication. In the long-term, this would save costs, as it would reduce the need for cars and travel. Accounting software should be installed to automate billing services. The use of electronic clearinghouses would cut the time and cost it takes to distribute government reports.

Arguments on the composition of the polity should recognize the continual devaluation of oil as a strategic resource. It is posited that voluminous human resources of high intellectual capacity would, in contrast, become the primary tools of 21st century commerce. Long-term regional political strategies might soon be rendered obsolete. The constitution-shapers and policy-makers need to internalize these fundamental changes.

Explanation of Concepts

Information Infrastructure

An information infrastructure is defined by Hansethin Rahman (2021), as 'a shared, evolving, open, standardized, and heterogeneous installed base' and by Pironti (2006), as all of the people, processes, procedures, tools, facilities, and technology which support the creation, use, transport, storage, and destruction of information. The notion of information infrastructures, introduced in the 1990s and refined during the following decade, has proven quite fruitful to the Information Systems (IS) field. It changed the perspective from organizations to networks and from systems to infrastructures, allowing for a global and emergent perspective on information systems. Information infrastructure is a technical structure of an organizational form, an analytical perspective or a semantic network (Antonio, 2012). The concept of information infrastructure (II) was introduced in the early 1990s, first as a political initiative (Gore as cited in Rahman, 2021), later as a more specific concept in IS research.

E-Governance

According to UNESCO (2011), e-governance is the public sector's use of information and communication technologies with the aim of improving information and service delivery, encouraging citizen participation in the decision-making process and making government more accountable, transparent and effective. E-government (short for electronic government, also known as e-gov, digital government, online government, or connected government) is digital interactions between a government and citizens (G2C), government and businesses/Commerce (G2B), government and employees (G2E), and also between government and governments/agencies (G2G). Adeyemo (2011) defined it as the use of internet technology as a platform for exchanging information, providing services and transactions with citizens, businesses and other arms of government. Essentially, the e-Government delivery models can be briefly summed up as (Jeong, 2007).

- G2C (Government to Citizens)
- G2B (Government to Businesses)
- G2E (Government to Employees)
- G2G (Government to Governments)
- C2G (Citizens to Governments)

Objectives

The main objective of this work is to evaluate Nigerian national information infrastructure and e-governance while the specific objectives are to:

1. Examine the adequacy of the current national information infrastructure and e-governance readiness framework in Nigeria.
2. To highlight the bureaucracies and politics that hamper speedy development of our national information infrastructure and e-governance in comparison to what is obtainable in other evolving economies of our size.
3. To investigate the limitations and deficiencies of our national information infrastructure and e-governance.
4. To observe areas of paucities which have contributed to the low e-service delivery in the country despite the success recorded in the country's ICT and telecommunications sector.
5. To suggest how Nigerian national information infrastructure and e-governance present services may be improved for an enviable national information infrastructure and e-governance as a national imperative for 21st century Nigeria of our dream.

An Overview of Nigerian National Information Infrastructure and E-Governance.

It is hard to be optimistic about Nigeria. The economy is in tatters, the country's information infrastructure is in a

state of abject ruin, the standard of living has plummeted, and the middle class has seemingly gasped its last breath after withstanding years of progressive assassination. The country's brand mirrors corruption and international fraud. The Nigerian passport reeks of criminal signature, as anyone who has dared advertise it at international airports can attest. The Nigerian intelligentsia has fled the country's shores, unwittingly improving the economies of foreign lands, while lamenting the state of the motherland in periodic doses - evidence yet of non-zero emotional attachment. Any sense of self-belonging has been eroded by decades of incompetent, venal leadership. Ethnic divisions have resurfaced with manic vengeance. Morale is low. Yet, underneath this thick garb of despair lies a gaunt frame of hope.

The continued decline in service delivery by NITEL in the last decade despite incessant injection of capital to ameliorate its numerous problems contributed immensely to the slow takeoff of Information Technology (IT) vis-à-vis Internet and other information networking applications, which are among the essential bedrock of socio-economic developments of any nation in areas of government, medical, scientific, and business activities.

The concept of information infrastructure may be seen as a combination, or merge, of information and infrastructure technologies. Information infrastructures can be seen as a step in the development of information technologies as well as a step in the development and infrastructure technologies. Its share a number of aspects with other kinds of information technologies while having some unique aspects making them different. The term 'infrastructure' has been used in relation to information technology to denote basic support systems like operating systems, file servers, communication protocols, printers among others. The term was introduced to separate between such underlying support services and the applications using them as the complexity of computing in organizations rose.

Nigeria had in the recent past recorded a phenomenal growth in its telecom sector due largely to the unprecedented upsurge in demand for wireless services delivered on the platform of the Global System for Mobile Communications (GSM). The major impetus that propelled that growth was the government's deregulation of the telecom industry spearheaded by the Nigerian Communications Commission (NCC) as well as the keen participation of both domestic and foreign telecom firms supported by local and foreign direct funds in what was tagged 'the fastest emerging telecom market in the world'.

The mobile wireless sector has been and will continue to be the growth engine of the information industry, as this is a global trend now well established in developed as well as emerging economies. Despite this positive trend in the growth of its wireless sector, the limited availability of landline-based or fixed wireless broadband

networks and services significantly impacted the pace of Information Communications Technology (ICT) developments in Nigeria. The fixed wireless or wireline sector mostly serving the residential, enterprise and government offices have been lying fallow with marginal increase in its customer base. Current subscriber statistics recorded by the NCC attests to the widening growth gap between mobile wireless (GSM) and the fixed wireless/wireline segments of the telecom market.

In an attempt to create a competitive environment that will promote innovation and other developments in the long distance telecom sector, NCC had issued licenses to several firms as 'Long Distance Operators' (LDO). In addition to that, a Second National Carrier License was also issued to Globacom (in addition to a GSM license). The 2nd national carrier license was probably more important to improving telecom services targeting interconnect and trunking capacity which would help increase access to interstate and international markets. The lack of proper enforcement of licensing policies geared towards an all-inclusive development of the sector (other than wireless mobile or 'GSM') led to this lopsided development within the sector, such that capacity was built around mobility and the aggregation points of directing traffic to various destinations including international gateways remained underdeveloped. This has continued to affect the country's national information infrastructure development in no small way, especially in the spread and efficacy of Internet penetration.

There are several other facets of telecommunications technology that Nigeria needs to tap into so as to close the digital divide, hence speeding up the development of the nation towards a knowledge-based society. This includes fiber-based backbone networks which interconnects points of presence of telecom facilities and transmission hubs. Such an infrastructure outlay already exists in some way and most probably underutilized. The NNPC optical fiber network which was extensively deployed through a major portion of the country can be leveraged to help distribute bandwidth capacity to businesses, universities and colleges, government and communities where Internet access can be afforded.

This way, Nigeria can begin to move towards bridging the digital divide in the near term. Subsequently and in the long term, new business paradigms (such as remote call centers as outsourced customer service support units for major multinational corporations) will eventually be established. This was essentially how India began to host customer call centers as outsourced support units for businesses in Western Europe and America. The economic benefits of outsourcing in ICT and related support services is a substantial contributor to the GDP, as this alone launched India to be a major outsourcing market of major multinational corporations.

Although several tertiary institutions in Nigeria now train engineers and scientists in IT, there are not enough platforms to launch their careers and move them to the

next level where they can independently create these new business paradigms such as product development and outsourced software services. Establishing a robust national information infrastructure policy that will enable the spread of high-speed Internet could move Nigeria forward enabling us to replicate similar developments that India benefited from IT. Although the wireless sector will continue to dominate in terms of ubiquity and popularity due to its portability supporting subscriber mobility, it is not cheap enough and adequate enough to fulfill the ICT development requirements that will pave the way for Nigeria to partake in global information transformation of business, healthcare delivery, collaborative research in science, technology, arts and economics.

The argument posed here does not vitiate the already established robustness of wireless technology in meeting the needs of e-commerce, and e-government, however the current wireless infrastructure layout in Nigeria is par excellence voice driven with some support for medium data delivery. The type of applications that runs on the GSM network (including its evolved general packet radio services otherwise known as GPRS) include emails with small attachments and other multimedia messaging services. Further evolution to this involves additional infrastructure deployments that are costly and probably not ready for primetime in Nigeria. With that said the void in affordable high-speed broadband data networks and services that will enable ICT development still remains elusive to most Nigerians.

The NCC has done a great deal of work in promoting the development of the wireless sector, bringing to Nigerians the so many opportunities that come with wireless. This has not only increased on the efficacy of getting things done, but also in cost savings and arguably protecting lives. NCC should continue to work towards improving on the work that they started by ensuring that the services rendered are of near comparable grade as obtainable in other parts of the world, at least those with similar economic and social dispensation as Nigeria. However, there have been complaints of recent, that the wireless services have degraded significantly in comparison to the early days when these networks were launched. The problems have been reported in leading Nigerian Newspapers as multifaceted and not well investigated.

Along the same line, the national carriers and long distance operators should be obligated to provide links between the fiber hubs or termination points and the residential areas, business districts and market centers, as well as industries and educational institutions. It is not cost effective to have Universities and other tertiary institutions, banks and business centers, as well as government offices and secretariats individually deploy Very Small Aperture Terminals (VSATs) to backhaul Internet traffic. It is just as uneconomical as having every house install their generators to get just the energy they need for their day-to-day activities.

The establishment of NigerComSat by the Federal Government could have been geared to fulfill some of this role, and essentially pave the way for better telecom trunking in Nigeria. Network operators such as the mobile wireless companies and other Internet Service Providers (ISPs) spend a decent size of their operational costs on backhauling calls and data traffic from their hub locations to switching centers as well as the all-one destination: the Internet. Therefore, ensuring a decent optical fiber network run through major commercial hubs and state capitals with an equally decent capacity will have multi-pronged economic benefits in the immediate and long terms for the nation.

The Inadequacy of Nigerian National Information Infrastructure And E-Governance Framework.

The notion of national information infrastructure adequacy is characterized by six key aspects which are lacking in ours thereby rendering it inadequate. These are the aspects that make infrastructures qualitatively different from other information systems. A critical examination of our national information infrastructure in relation to these six characteristics shows it is grossly inadequate. I am arriving at these aspects by presenting and analyzing a number of infrastructure definitions provided by others, including the one used in the official documents presenting the US Government plan for the building of the National Information Infrastructure.

The six aspects are

- Enabling
- Shared
- Open
- Socio-technical
- Heterogeneous and
- Installed base.
- Infrastructures have a supporting or *enabling* function. This is opposed to being especially designed to support one way of working within a specific application field. An infrastructure is one irreducible unit *shared* by a larger community (or collection of users and user groups). An infrastructure is irreducible in the sense that it is the same 'thing' used by all its users (although it may appear differently); it cannot be split into separate parts being used by different groups independently. However, an infrastructure may of course be decomposed into separate units for analytical or design purposes. By enabling, the resource must provide the basis for any user or set of users to create, develop, and implement any applications, utilities, or services consistent with its goals.
- The fact that infrastructures are shared implies that their parts are linked and they are defined as shared

standards. This means that standards are not only economically important but a necessary constituting element. By being shareable, it means the resource must be able to be used by any set of users in any context consistent with its overall goals.

- Information Infrastructures are more than 'pure' technology; they are rather *socio-technical networks*. This is true for ISs in general, as they will not work without support people and the users using it properly. For instance, flight booking systems do not work for one particular user unless all booked seats are registered in the systems. But this fact is largely ignored in the thinking about the design of information systems as well as infrastructures.

- Infrastructures are *open*. They are open in the sense that there are no limits for the number of users, stakeholders, vendors involved, nodes in the network and other technological components, application areas, network operators among others. This defining characteristic does not necessarily imply the extreme position that absolutely everything is included in every infrastructure. However, it does imply that one cannot draw a strict border saying that there is one infrastructure for what is on one side of the border and others for the other side and that these infrastructures have no connections.

- While heterogeneity is indeed present in the NII definition of US government, this seems not to be the case in mere engineering inspired definitions. We see the following definition proposed by McGarty (1992), to be representative for communities designing computer communication technologies. He added five different aspects that an infrastructure resource is:

- *Common*: By being Common it means the resource must present a common and consistent interface to all users, accessible by a standard mean. Thus common may be synonymous with the term standard.

- *Physical embodiment of architecture*. The infrastructure is the physical expression of an underlying architecture. It expresses a world-view. This world view must be balanced with all the other elements of the infrastructure.

- *Enduring*. The resource must be capable of lasting for an extensive period of time. It must have the capability of changing incrementally and in an economically feasible fashion to meet the slight changes of the environment, but must be consistent with the world's view. In addition it must change in a fashion that is transparent to the users.

- *Scale*. The resource can add any number of users or uses and can by its very nature expand in a structured manner in order to ensure consistent levels of service.

- *Economically sustainable*. The resource must have economic viability. It must meet the needs of both customers and providers of information products. It must provide for all elements of a distribution channel, bringing the product from the point of creation to the point of

consumption. It must have all the elements of a food chain.

The Bureaucracies and Politics That Hamper Speedy Development And Implementation Of Our National Information Infrastructure And E-Governance

E-governance has been described (by UN e-government survey, 2004, 2005, 2008) as the public sector's use of the most innovative ICTs, like the internet, to deliver to all citizens improved services, reliable information and greater knowledge in order to facilitate access to the governing process and encourage deeper citizen participation. It is an unequivocal commitment by decision-makers to strengthening the partnership between the private citizen and the public sector. However, existing bureaucracies, bottlenecks and politics of the government of the day and policy formulators have largely contributed to the delay in establishing a formidable National Information Infrastructure and e-governance policy.

The most important anticipated benefits of e-government in a developing country (which we lack) include:

- Improved efficiency.
- Increase in transparency and accountability of government functions.
- Convenient and faster access to government services.
- Improved democracy and
- Lower costs of administrative services.

The following factors have been identified by Kamar and Ongo'ndo 2007, as barriers to effective e-government implementation in developing countries (which Nigeria is inclusive):

1. A reluctance to share information by government which has resulted in policies that deny access to information and the creation of 'empty' government ministries websites with information of little value. Many government ministries and parastatals websites are very empty whereas many public issues are beckoning to be heard by the masses. The unwillingness of the leaders to share information is a concern considering the freedom of information Act that has been signed into law after a prolonged battle of twelve years. The goals of National Geospatial Data Infrastructure as shared from the United States Federal Geographic Data Committee (FGDC) as cited in FGDC (2018), are:

- ❖ To improve quality and reduce cost related to geographic information.
- ❖ To reduce duplication of effort among agencies.
- ❖ To make geographic data more accessible to the public.
- ❖ To increase the benefit of using available data.

- ❖ To establish key partnership with local governments, states, academia, and the private sector to increase data availability.

Considering the aforementioned goals cum benefits, it is very clear that lack of information sharing zeal by the government is undoubtedly hampering the speedy development and implementation of our national information infrastructure (F.

2. The government being faced with management challenges in the implementation of e-government. The uncoordinated e-government activities result from low level of public administration of e-services as well as low quality and insufficient e-content information from grassroots levels. Many government ancillaries are highly uncoordinated hence their emptiness and lackadaisical attitude towards e-governance. A visit to Immigration office will shock you as officials air their frustration (in anonymity) concerning the paper work going on where a passport could take about eight hours to be sorted out.

3. Low information technology literacy of the public sector in a country which slows down the process of e-government. It is unbelievable to state that many lawmakers are not internet friendly hence their snail speed approach to national information infrastructure and e-governance policy drive. The reality is that none can support what he does not know. In addition, only a minute number of those in public service are IT literate. A developing nation like ours should have people who are information technology driven at the apex so as to help in fast-tracking national information infrastructure policy, unfortunately, the reverse is the case. Without the assistance of personal staff of some of the legislators and other policy formulators, the shame of many of them in relation to information emptiness would have been very glaring.

4. The uneven distribution of Internet facilities, high cost of connection and in some cases low penetration of high speed connectivity to the Internet. The call for a drastic reduction of the high cost of connection and an improvement on the speed connectivity to the internet has been unnoticeable probably because of the corrupt enrichment of the information infrastructure regulators by the operators. The greatest factors limiting the spread of Internet and e-mail in Nigeria are lack of technical know-how and awareness; the faulty telecommunication infrastructures, the high cost of the computer equipment and the high cost of Internet subscription. Presently the average cost of the Internet annual subscription is N82,000 (about US \$550) and this becomes prohibitive for an average Nigerian. The same subscription fee in Europe and USA has an average cost of US \$150. Moreover if we consider the salary difference between USA/Europe

and Nigeria the final comparison will result that the Nigeria fee is 35 times higher than those of US and Europe. Is there any way out from this frame?

5. Digital Divide which is experienced between the urban rich and poor, the rural and urban citizens, the IT literate and the IT illiterate. This manifests also in the language in which web site content is delivered which can only be understood by a minority elite. Derivation funds shared to states and local governments which ought to be used in abridging the digital divide gap by training them is only made available during political campaigns. Gubernatorial, Parliamentarian, Chairmanship contestants suddenly start sharing computers, laptops, free internet modems and organizing free computer training for all ages and genders to those who align with their party ideals. Therefore contextually, digital divide between the urban and rural settings has its root in the dirty political gimmicks of our political merchants.

6. Insufficient allocation of financial resources due to financial constraints and mixed government policies which has slowed down the rate at which e-government is introduced. Funds meant for the improvement and implementation of our national information infrastructure and e-governance are usually insufficient to disburse to important areas of need. It is no longer news that ministers and permanent secretaries lobby the law makers to influence their lot in the budget.

7. E-government implementations failing due to a mismatch between the current and future systems resulting from the large gap between physical, social, cultural, economic and other contexts between the software designers and the place in which the system is being implemented.

Limitations and Deficiencies Of Our National Information Infrastructure And E-Governance

1. The citizens cannot get connected to the government more easily using electronic means of communication. This results in poor efficiency in public service delivery through slower dissemination of government information to a larger audience.

2. An increase in corruption cases as lack of accountability and transparency are on the increase. This derives from the limited physical contact between citizens and government service providers and their activities cannot be easily monitored. Even the Media, the watchdog of the society can neither bark nor bite considering the high rate of corruption in the land. Information is scarcely accessible and when gotten from the backdoor, arrest and harassment will be the order as in the case of a WAZOBIA Radio broadcaster known as

Diplomatic OPJ. He was reported to have been arrested and detained by the government without link to where and why he was incarcerated.

3. Equal opportunity is not given to all to access information irrespective of the person's physical location or disability and the intensification of the bureaucracy experienced in government offices. Well, a closer observation is being given the implementation of freedom of information Act recently signed into law which guarantees citizens equal and free access to information.

4. The interdepartmental exchange of information and merger of related services is not enhanced between government agencies thereby inhibiting an accompanying reduction of transaction costs, time, space and manpower.

Areas of Paucities Which Have Contributed to the Low E-Service Delivery in The Country

Nigeria should adopt a national information infrastructure policy framework the underpinnings of which are consistent with making the Information Age the nucleus of its long-term strategic national planning. The paucities which constitute stumbling block to e-service delivery in our country are treated here.

1) Lack of brand's fumigation

From an economic perspective, arguably the most urgent policy task facing Nigeria today is that relating to *public relations*. Before embarking on any long-term sustainable national information infrastructure development plan, Nigeria needs to rebuild and re-market its brand. Nigeria's image has been completely desecrated and is in urgent need of reconstruction. The country's brand needs to be fumigated in order to project a fresh image of law-abiding seriousness, stability, and unlimited economic potential. For the next four years, brand refurbishment needs to be at the core of Nigeria's internal and foreign policy objectives: Aggressive re-advertising of the country's image should be one of the top priorities of foreign embassies and missions. The former minister of information, Professor Dora Akunyili started a national image rebranding program (though controversy welcomed it) but left it half way and ventured into politics that eventually consumed it.

There are numerous *Nigerian intellectuals* in the best schools, institutions, and corporations around the globe who, in the aftermath of the country's derailment, cowered into seclusion. Philip Emeagwali, Nigerian born engineer and computer scientist/geologist, a father of the Internet and pioneer of the supercomputer that is (part computer and part internet) known as The Connection

Machine (used in solving a 350 year old packing problem that was considered to be one of the great mathematics problems) which utilizes 65,000 computers linked in parallel to form the greatest computer on earth; in 2004 was recognized as one of the 50 most important blacks in Research Science, living in the United States is an outstanding figure in this context.

Nigeria, through its foreign embassies, should identify, contact, and consult these individuals for the purposes of re-branding and national development. The country would be doing itself a great disservice if it excludes the input of its talented foreign-based information professional citizens from its long-term national information policy planning. The many Nigerian professionals who were forced to flee the country for economic reasons remain an extremely valuable resource that should be harnessed. These intellectuals hold a lot for us and getting them to put hands on the deck shall undoubtedly contribute in making our national information infrastructure and e-governance delivery very efficient.

2) Government Monopoly

The Nigerian government needs to get out of the way. Its direct involvement in the generation and distribution of power, the provision of telecommunications services, the distribution of fuel, and so on is one of the primary reasons for the pathetic state of the nation's information infrastructure. Even the United States, with its huge and vibrant private sector, has detractors who argue that its government is too intrusive. It is widely known that governments all over the world are not exactly models of efficiency. The current efforts towards privatization in Nigeria are in good stead and should continue more aggressively.

While the government should disengage from the provision of telecommunications and other services, it would be imprudent to hands off completely. A public monopoly, while inefficient, is, arguably, preferable to a private one, given that the former usually subsidizes the provision of its services to the populace. The Nigerian government should maintain some measure of regulatory supervision while operating at an appropriate abstraction level in order to preclude bureaucracy-induced ills. This line item is the primary reason why the U.S. currently enjoys a 99 percent penetration rate of telephone service: the very platform that has enabled the permeation of access to the Internet in American homes and businesses, and the rebounding of the U.S economy again bear witness to the benefits of long-term strategic planning.

3) Inappropriate Intellectual Property Laws

While it retreats from prominence, the government also

has an important role to play in optimizing the context and environment in which the private sector operates. In order to protect local software entrepreneurs and foreign investors, the government should formulate a policy to discourage software piracy and enact laws to punish offenders. Intellectual property laws should be promulgated to secure foreign companies who invest in the country. Nigerian software entrepreneurs should be encouraged and supported with low-interest loans and other incentives.

4) Poor Wireless base-stations and systems

The Information Age would not have the envisioned critical-mass impact on Nigeria until the country's infrastructure is revamped. In particular, the power grid and the telecommunications network need to be upgraded or replaced. Wireless base-stations and systems need to be installed. Again, if these measures are going to be implemented by private interests, some amount of regulatory control would be needed. The wireless spectrum would need to be managed carefully in order to preclude congestion. While overhauling its underlying infrastructure, Nigeria should also promulgate a formal policy to develop a new 'National Information Infrastructure,' targeted at providing narrowband and broadband telecommunications services to its citizens.

5) Weak industrial to information economy transformation policy

Information technology development plans in other Third World countries should be studied in lieu of devising similar policies for Nigeria. Singapore, especially, is widely touted as a model for developing countries making the transition to a digital economy. A core part of Malaysia's 'Vision 2020' plan is the wiring of its 'Multimedia Super-Corridor' (MSC), a high-speed telecommunications system scheduled to open soon. The MSC will help transform Malaysia from an industrial economy to an information economy. Taiwan has a 'National Information Infrastructure Project,' whose sole aim is the digitalization of the country's economy and infrastructure. Korea has also begun a similar information technology initiative. The Philippines has developed a 'National Information Technology Plan' with the goal of transforming the country into the 'knowledge center of Asia.' Clearly, there is a pattern here.

6) Lack of accountability and a maintenance culture

The debased state of Nigeria's capital projects clearly indicates our ineptitude at maintaining our national infrastructure. The nation's power plants, telephone

networks, refineries, hospitals, schools, roads, bridges, and national monuments are all in a state of disrepair. Any policy for rebuilding the existing infrastructure or erecting replacements, without a formal recognition of the lack of accountability and a maintenance culture, would be severely flawed. A national maintenance policy needs to be drafted and localized in every sector of the economy. Government-awarded contracts need to be supplemented with maintenance clauses. Aggressive privatization of state-run monopolies would stimulate this process.

7) Lack of pedagogical emphasis on computers and other software skills by factories of intellectual leadership- our educational systems.

As we head into the 21st century, the increasing value of intellectual capital makes it imperative for Nigeria to make long-term strategic investments in rebuilding and enhancing its educational systems. Its great secondary and tertiary institutions, erstwhile factories of intellectual leadership, have been desecrated and need to be reinvigorated. Lesser-known schools, which have been strewn over the land in volumes yet currently serve only to sprout or regurgitate mediocrity, are also in dire need of therapy. Pedagogical emphasis must be placed on computers, mathematics, programming, and other software skills. A commitment to long-term research and development in computer-science should be an intrinsic part of long-term policy on tertiary education. The universities must be properly funded with some focus on software engineering. A 'National Information Technology Foundation,' similar to America's 'National Science Foundation' should be created to fund computing projects in Nigeria's institutions and research laboratories. In order to stimulate innovation, awards and grants should be given annually to top-notch professors and students in the research community. Partnerships between the government, universities and industry should be developed and nurtured. Given the historical imbalance in gender-based representation in the classrooms and fields of science and technology, the government should also encourage the participation by women in the information technology sector.

8) Poor development of a digital mini city

Nigeria needs to develop a digital mini-city akin to America's Silicon Valley (home to many of the world's technology corporations in San Francisco, Northern Carolina), which would be the country's crater of high-tech intellectual power and commerce. Again, this should be funded largely with private capital and foreign investment and should be advertised to high-tech firms around the world as a center in which they can set up

subsidiaries -free of government-induced clogs -with all the benefits of economies of scope.

9) The private sector snail speed in transforming Nigeria into a digital economy

The private sector, its constituents, and other members of society also have a role to play in transforming Nigeria into a digital economy. Businesses should make strategic investments in technology in order to improve their productivity. Nigerian companies should install 'Digital Nervous Systems' to improve communication with their customers, partners, and employees. Expense reporting and other mundane chores should be automated with web-sites and software. Achieving a 'paperless office' should be one of the primary objectives of information technology initiatives in Nigerian businesses.

10) Graduates of Nigerian universities poor acquisition of information age skills

Graduates of Nigerian universities are poor to recognize the opportunities the Information Age presents and regulate their career choices accordingly. They need to proactively acquire the skills that are most relevant in the digital age: software development, database programming and management, web-site design and creation among others. They need to train themselves through self-study and formal instruction programs. Parents need to encourage their children to learn software skills and to study computer-science. Obviously, the country would still require doctors, lawyers and chemical engineers. However, to accelerate the country's rehabilitation, the slant of the distribution of career prodding should be directed towards information technology. The Nigerian media should also help in creating awareness of the opportunities offered by high technology. Its constituent arms should assist in the authorship, creation, and marketing of editorials and programs to advertise the benefits of choosing careers in the computer industry.

Suggestions on How Nigerian National Information Infrastructure And E-Governance Present Services May Be Improved on

As we approach the 21st century, there are many opportunities for Nigeria to rebuild its national information infrastructure. Indeed, serendipitously, the country is being offered a pole position on the road to resurrection on a platter of silver, albeit not 100 percent pure.

1. Subsidization and reduction of Computer prices.
The government should subsidize as well reduce computer prices for the affordability of the masses. The

nature of technology is that once its products or services attain critical mass, they enjoy huge economies of scale. The prices of Personal Computers (PCs) have been dropping steadily for the last several years. Prices under eighty thousand naira (N80,000) are now common place. Indeed, many industry analysts have posited that PCs would eventually be free and their fixed costs shall be subsidized by advertising revenue derived from content and back-end services.

2. Increase universality of information access in the country's governance.

The accessibility of information would make it much more difficult for totalitarian governments to suppress or manipulate information for their own purposes. E-governance could strengthen democracy in Nigeria in that it would empower the common-man to make more informed decisions relating to political issues. With a universal information infrastructure, political candidates can be screened much more easily and thoroughly by their constituents. Public-office holders would find it much more difficult to spread propaganda effectively. News on scandals or corrupt activities by government officials would be disseminated much more rapidly and freely. The universality of information access would also give the Nigerian media - the 'fourth estate' - a much more powerful and strategic role in the country's governance.

3. Alignment of information policies to allied phenomena.

The reach and capacity of information systems are so immense that the attendant economies of scale are too huge for even the entire globe to exhaust. With infinitesimal marginal cost, everyone on the planet can be provided the benefits of the Information Age. In the next twenty years, devices used to access the Internet, as well as communications services, might be free. All Nigeria needs to do, in theory, is demonstrate some measure of commitment, and align its policies to piggyback on these phenomena. With the proper infrastructure in place, Nigeria can get tuned to the digital age at essentially zero additional cost.

4. Provision of communications and Internet access to remote regions.

An intrinsic part of the character of an information economy is what economists term the 'Network Effect.' This refers to the phenomenon wherein the value of a network rises non-linearly as more subscribers are added to it. To illustrate, the first telephone was of zero value. The second was of infinitely more value to users. Market-share or, rather, 'network-share,' is even more critical in the Information Age. This suggests that developed countries like the United States have an economic incentive to ensure the ubiquity of benefits accruing therefrom. To illustrate this, the White House recently announced an initiative, through private-sector funding and World Bank loans, to provide aid for developing nations' Internet projects such as providing communications and Internet access to remote regions

via satellites. The nature of this economic model is a huge opportunity for Nigeria.

5. Replacing physical and natural capital with Intellectual assets.

In addition to mineral resources, Nigeria is blessed with an abundance of human capital. As high technology attains critical mass and prices drop, the attendant low margins can only be offset by high sales volumes. The sheer size of Nigeria's human capital provides the country with the market volume that would attract investors wishing to exploit this business model. Furthermore, as we move into the next millennium, intellectual assets are fast replacing physical and natural capital as the most strategic resource a country can have. Again, this is a tremendous opportunity for Nigeria. With the quality and volume of its brainpower, Nigeria can become globally competitive even with economic powerhouses like the United States and Japan. The country needs to manufacture and export intellectual capital in unseen quantities. The resources are there; they need to be directed, motivated, and exploited. It is expected that intellectual capital and software services to be the hottest export in the global economy. Nigeria's long-term national planning has to be made consistent with this trend.

6. National Information Policy Formulators should exploit the current surge in the economy to attract private and public investment to rebuild its existing information infrastructure.

The morass in which the oil industry currently finds itself has been one of the factors that have fueled the United States' current economic boom. As oil prices continue to drop, the U.S budget surplus would likely increase further, owing to the fact that it is one of the World's largest importers of petroleum. Nigeria should exploit the current surge in the U.S. economy to attract private and public investment to rebuild its existing information infrastructure underpinnings and to build new national information systems that would carry it to the 21st century.

7. Enforce privacy laws.

The pervasiveness of advanced telecommunications networks could also be a threat to personal privacy. Overzealous government agencies or other institutions could exploit the information infrastructure to tap people's phones, read their personal e-mail, or monitor their retail purchases and transactions. Without the enforcement of privacy laws, businesses could, without express permission, track their customers' personal information and buying or usage habits. A major problem that has obstructed the development of the information industry in Nigeria is piracy.

8. Deal with political instability and insecurity.

The virtualization of the resources that would form the bulk of information exports in the 21st century insulates Nigeria from one of many problems that have impeded its development: the unwillingness of foreigners to invest

physical capital in the country for fear of political instability and insecurity, from kidnapping to militancy then Boko Haram. If, in the next three years, Nigeria becomes one of the primary exporters of intellectual capital, investors could tap into its collective brainpower with very little physical presence. This would allay valid fears that many have of making deep commitments that, today, often require the installation of human and physical assets.

9. Protection of both blue- and white-collar jobs.

A full-scale conversion to a digital economy without appropriate policy safeguards can be dangerous. One of the primary features of e-governance is the further devaluation of labor. Professor Chukwuma Soludo erstwhile Central Bank of Nigeria governor, laid off three thousand staff due to computer illiteracy. This implies that many low-skill jobs could get lost due to advances in high technology. The ascension of intellectual capital as the major source of national economic prosperity would hasten the depreciation of existing blue-collar jobs in the manufacturing sector. Making the Information Age the bedrock of Nigeria's information infrastructure policy would achieve a critical aim: the rebirth of the Nigerian middle class. However, it would also lead to further erosion of the lower class. Skills that were in high demand in the Industrial and Oil Ages could suddenly be of little or no value.

10. Fight unregulated access.

A major threat that the Information Superhighway poses is that it would give insurgents, criminal organizations, and terrorists the tools to further facilitate their craft. Drug dealers would be empowered with the infrastructure they need to better coordinate their activities with international rings. Without strong encryption, national security networks could be compromised by treacherous individuals, organizations, and governments. The pervasiveness of electronic commerce would, without the proper application of cryptographic (a security protocol) safeguards, encourage more credit card and bank fraud. With unregulated access, pornographic material could be more easily exposed to children.

11. Avoid balkanization of other economic sectors.

Nigerian information policy-makers must also be careful not to over-invest in a transformation to a digital economy to the thorough detriment of other sectors of commerce. Such a move, while tempting, would amount to bad public policy. Such a euphoric, whole-scale switch in policy focus is one of the strategic errors that led to the mess we are currently in. We must not repeat this mistake. Oil, while likely to be of lesser value, would still be an important national asset. Nigeria's huge gas reserves are yet to be exploited. Other mineral resources, such as gold, still exist in abundance. The agricultural sector has long been neglected and still has a lot of potential to be a major revenue source. While the nation's long-term focus should be on information technology, its policy-makers must be careful not to balkanize other sectors of the

economy.

12. Replace over-emphasis on oil with benefits of e-governance.

In the Nigerian context, over-emphasis on oil as the foundation for any strategic ethnic or regional planning and policy would be a grave mistake. The drops in oil prices, as well as the increasing importance of the educational quality of human capital, would vitiate any such calculations. This, by the way, applies to groups that are blessed with mineral resources as well as to those that are not. On both sides, the need or nature of long-term regional political strategy should be reevaluated based on a recognition that the world is changing. Only those ethnic groups that have a well-educated and sophisticated workforce would be well placed to directly reap the benefits of the digital age.

CONCLUSION

The potential benefits of e-governance to the Nigerian economy are boundless. Nigerians' standard of living would improve, thanks to the efficiency of information access and the obviation of the need for physical movement: Traffic would lessen. Consumers would have all the power to choose the best prices, given the friction-free flow of information. Investors in Nigeria would be able to buy stocks and commodities from the New York Stock Exchange on a regular basis, via handheld devices. Businesses would find it easier to stay in touch with their customers and to make better-informed decisions. Students in Nigerian universities would be able to take courses in the best institutions in the world - e.g., computer-science courses from Stanford and business courses from Harvard -- thereby improving local educational standards at exponential rates. Doctors would be able to communicate with their patients and determine diagnoses and initiate treatment over wireless communication channels. This, in concert with improvements in biotechnology, would result in major improvements in the quality of health-care.

In the long-term, the technological institute should be the source of intellectual information technology leadership in Nigeria. This would provide us the fiscal and intellectual ammunition necessary to compete more effectively on a global scale. Further, they would be able to encourage more foreign investment in Nigeria through their direct contacts with high-tech entrepreneurs and venture capitalists. The government should develop outreach programs to advertise the opportunities of e-governance to her citizens. Training and certification programs should be subsidized or provided for free on the basis of need. Training centers for programming and other software skills should be erected with public and private sectors support and investment. Programming books, magazines, and journals should be provided at affordable costs with the help of grants and investment

capital from high-tech companies in the Nigeria: High-volume discounts can also be negotiated with publishers abroad.

This would ensure that Nigerian software developers remain in touch with the latest technologies and trends in the industry. National and state libraries should be properly equipped and new ones built, specifically targeted at information technology. The application of all these measures would produce millions of qualified Nigerian programmers and web-site creators. Going forward, the omnipresence of computer literacy and sophistication should be the primary objective in Nigeria's national information policy. In synchrony, revamping the country's infrastructure would decelerate the brain-drain scourge that has plagued the country over the last several decades. With the proper national information infrastructure in place, Nigeria's intellectual capital could be exported while its workers remain resident in the country.

With essentially unlimited access to information, unconstrained by the traditional boundaries of space and convenience, the operations of individuals, businesses, governments would be much more efficient. Nigerians would be able to compete globally via virtual channels while remaining physically resident in the country. Unfortunately, the current decrepit state of Nigeria's information infrastructure precludes the country from immediately reaping the fruits of these advances. Ages beget ages. The Information Age could not exist without the benefits provided by the Industrial Age. In the United States, the Internet is an application that sits on a robust platform: the country's power and telecommunications infrastructure. The U.S. made these strategic investments long before anyone even conceived of the Internet or the Information Superhighway. Such a sense of long-term strategic planning, it appears, has eluded Nigeria's policy-makers for too long. Going forward, the primary focus of Nigeria's public policy should be on rebuilding the country's national information infrastructure for sustainable e-governance.

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