

## Survey

# Software development: an attainable goal for sustainable economic growth in developing nations: the Nigeria experience

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Recently, there has been increasing demand in the knowledge and application of quality software to improve the socio-economic growth in Nigeria. This becomes necessary in the face of unique position software products and processes helping to generate revenue in most advanced nations and some developing nations in the world. This paper surveys software development and its impact to both developed and developing nations with emphasis on the Nigerian economy. We outlined the range of considerations specific to software within Information and Communication Technologies (ICTs) planning and discuss government role in accelerating and shaping that growth in support of social, culture and economic priorities. The problems faced by software growth in the industry are also addressed with a view to proffer solutions.

**Keywords:** ICT, IT, Software, Software development, Information, economic growth.

## INTRODUCTION

We live in a world that is driven by information technology (IT). IT is changing every aspect of human life, including communications, trade, manufacturing, culture, entertainment, education, research, national defense and even our national security. We are at a new epoch of economic growth and sustainable development. To be one of the winners of this new epoch, nations have to identify their areas of comparative advantages and develop policies and guidelines that will enable them derive maximum benefits from those areas. In the past, growth was a measure of natural resources, but countries competitiveness today is through knowledge-based industries, which depends on expertise and wisdom. ICT usage in Nigeria has increased tremendously within the recent past: communication infrastructure, e-government program, e-banking, e-learning, intellectual property, government-sponsored research program, incubation and technology parts, engineering education and the potential for export revenue. It is in the last area, the potential for dramatic economic growth that first brings software to the forefront as a separate issue within ICT.

ICT is considered by many developing countries as le-

verage for socio-economic development. This view is encouraged for example by India's success in the software industry (Nidumolu and Goodman, 1993).

Software is a relatively low-investment, environmentally friendly: high-growth global industry, a good target growth industry for many countries but it has also become the most critical and expensive element of the government and business systems that every nation must built for itself. It is an essential, high-risk and increasingly expensive component of ICT-related programs to increases government effectiveness that is capable of bringing local firms up to globally competitive performance sale.

The growth of the global demand that made software exports a growth industry is driven by the continued consumption of software by our countries and business enterprises. Software and its continued maintenance has become the dominant cost of business and government information systems around the world (Gertner, 2001). Good strategic planning about government projects and investment incentives to domestic business can have a positive impact on the growth of a country's software exports compared to relying on market forces alone, and creating certain types of software exports requires coherent long-term planning and investment strategies to complement and augment market driven activity.

Every software exporting country have evolved a uni-

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que industry, shaped by its own resources and situation and by the particular global opportunities presented at the time. For example, Japan exports mostly software games, India exports primarily software services to large software development and Israel mostly exports software technology which is subsequently provided by firm in the US and Europe.

The world has moved from agricultural, industrial and post-industrialization to the era of globalization and liberalization of the economy. Hence, information assets are now seen as the key driver for economic growth, competitiveness, and business improvement. With the convergence of ICT, the world is now a global village. The driver is the handshake between hardware and software. The software arena is now a global village. The software arena is therefore a key strategic resume for value creation in an economy, intellectual capital and investment opportunities.

In this paper, we investigate the existing approach of software development as an attainable goal to sustainable economic growth in Nigeria. In achieving this objective, we seek to achieve the following aims:

- Examining the strategy deployment of nation software capacity.
- Successful nation strategies for exporting software.
- Balancing software export with domestic needs.
- Understanding the role of government in software development.
- Examining the elements of a software industry - development strategy.
- Unveil the competitiveness of nation and economic development.
- Economic impact of software development brought into focus.
- Understanding the key software system that are in use in Nigeria as well as the imperativeness for the Nigeria software industry.
- Know software ICT policy issue and examining how Nigerians have embrace ICT Policy.
- Underlying the problems associated with the Nigeria software development vis-à-vis software sustainability and the growth emanating from software products and processes.

### **Strategic deployment of national software capacity**

With so many ICT related concerns pressing government policy planners, it is obvious why software development requires attention and consideration. Reason being that software has become a core competency and general purpose technology that is critical to the global competitiveness of most of our industries and to the effective deployment of government services. Apart from being a critical part of modern industrial infrastructure and an important industry in its own right, it serves as a vehicle for implementing the other key elements of a knowledge economy namely: responsive and transparent govern-

ment; a supportive business environment with low transaction costs; enhanced learning environments; and effective social programs. It is crucial at this point to distinguish a software related policy from industrial policy general software which is deployed across almost all sectors of our economy. More also, being a fast changing technology, market forces alone are often not adequate to harness the industry potential to address public services and social problem vis-à-vis the needs of the poor, down-trodden rural communities, small and medium enterprises (SME) and civil societies.

Barr and Tessler, (1997) viewed software capacity as the total amount of software that an organization can build and maintain. It is a key to participation in the global knowledge economy. Nigeria software capacity is thus a limited resource that must be deployed strategically.

A nation's capacity to produce and maintain software is deployed across a variety of business and social factors. To this extent, government policies and programs must affect the deployment of software resources, and its decision must reflect the country's economic and societal properties. For example, industrial monetization, employment, government effectiveness, hard-currency exports, foreign direct investment, and increased national patronage.

In ensuring that the above objectives are realized, the nation's software capacity can be deployed in the following ways:

- Government effectiveness and social program.
- Global competitiveness and linkages for existing business.
- Exports of software series, products and technology
- New IT-enabled business opportunities.
- Education of the software workforce and provision of facilities for this purpose.
- Research on new software technology and proffering solutions when needed.

### **Balancing software export with our domestic need**

The global shortage of software engineer and the fast growth of demand for software applications in advanced economics have attracted the attention of both software talent and policy makers in emerging economies. The global opportunity has led to an almost exclusive focus on software exports. This bias, is further reinforced by planner's tendencies to focus on a single concern: generating hard-currency exports, driving up employment, or pursuing idiosyncratic first projects for political reasons. In order to achieve any reasonable goals in a sustainable basis, a strategy must be towards social and Governmental applications, opposed to export- focused strategies (Hanna et al., 1991, 1994).

Domestic industry software includes the development and maintenance of government, business, finance and telecommunications software system, as well as any pro-

ducts and services supplies into that development. It also includes the locally developed software for consumers, including educational and game software. It is important not to lose sight of the potential impact of software exports. National strategies must balance export potential with internal growth. Software continues to be a high-growth industry compared to most industries in either manufacturing or services sectors. In Nigeria, it is one of the few modern industries that is open to new entrants with limited financial resources which, if properly managed can make the nation's economy boom and sustainable. Hence, it should be an attractive target for emerging economies.

### Government role

Government can play several roles in support of the development of software exports and in the application and diffusion of software or ICT in private sectors of the economy. For example, creating of a supportive regulatory environment for telecommunication and internet; protection of intellectual property rights; targeted investments in software education and research; and broad promotion of ICT literacy programmes and action that would promote long-term progress in both domestic and export activities.

In addition, government can promote its domestic software industry effectively in a number of ways, such as investing in government automation and e-government projects and adopting competitive procurement practices for software products and services. Government can undertake a variety of actions to develop its export industry.

The range of government roles is expanding and lessons of relevance to emerging economies are accumulating, although much more systematic evaluation of various programs in this emerging field is urgently needed for the sustainable economic development.

The Federal Government of Nigeria should fund research that will be targeted to semi-conductors, telecommunications, neural networks, Robotic and computing facilities, which should also be complemented by wealthy individuals.

The role of government in promoting software and knowledge industries in Nigeria cannot be compared to the advanced nations like USA being that government capabilities in investing, influencing and partnership vary significantly and as a developing nation, she is limited by severe financial misappropriation, lack of adaisical approach and huge human resources constraints.

Government action may also involve reforming policies to aid software development and eliminating regulatory impediments and unnecessary bottleneck, creating and enforcing needed regulations, or providing long-term investment, direct investment, tax incentives and of course expenditure for government automation and if possible electronic delivery of services if need be.

### A comparison of software development initiatives and strategies by other nations

According to World Bank report, from economic growth to exports and employment, software and other IT plays an increasing vital role in the US economy. The US software drives about 114 of all increase in GDP during the 1990s (about \$90 billion per year) and 166 of all productivity growth efficiency with GDP. In the last five years, software development drove about \$1.5 trillion of economic and productivity growth over the last decade. The US has the largest and most technologically powerful economy in the world. Software and the use of IT have been designed to raise awareness among citizens, economists and policy makers in the relevance of software and IT to the US economy (White, 2004).

India is the second exporter of computer software in the world. Yet, the average India is no more educated than the average Nigerian. Software is one of the fastest growing sector of the economy of India and this has enhanced India economy in providing high quality employment, earn significant revenues all from the sales and exports of software. Today, India's software export earnings are in the range of USD 20 billion a year (CNN, 2006).

In Africa, South Africa IT market is the largest in Africa. South Africa is related to be 20<sup>th</sup> in the world in overall market size, and 8<sup>th</sup> in IT spending as a proportion of GDP.

Ghana has also growing IT markets; the government built a very strong initiative by developing national IT policy where implementation is vigorously pursued and creation of policy frameworks to ensure the harmonization of computers hardware and software standards.

The Nigerian case is slightly different and that is why we may regard Nigeria as "information poor" country, as the level of ICT gathering mechanism is still weak. Nigeria is still struggling with increasing awareness of software usage day-to-day with a slow pace of software industry growth. Moreover, earnings from software exports cannot be determined as we have in the oil sector. In spite of all these, Nigerians are enthusiastic in software development to complement the oil sectors in terms of revenue generation. This can be achieved by sponsoring the youth with software development skill to come together so to build local software that can be internationally utilized through a formidable team from government agency.

### Problems of software development in Nigeria

Despite the enthusiasm by Nigerians, we still have some problems facing software development in Nigeria. They are:

- Poor development practice and project management
- Problems of software with dependability, safety, reliability and security.

- Lack of software quality assurance
- Maintainability of software development that is, lack of concentration in hardware/software sales.
- Drive for immediate profit. Normal software development cycle is not completed and which will render the software substandard.
- Scalability: Most of the software lack scalability and cannot meet future demands of the users.
- Less recognition of local software in Nigeria
- Continuous use of customized software in banking sectors and other government agencies.

### **Elements of a software industry development strategy**

Many elements of software industry development will be driven by private initiative while true industry problem however require policy and regulatory reform in both human resources and governmental actions. Some of the elements are:

#### **Developing the telecommunications infrastructures**

Dependable telecommunications and internet infrastructures are critical to software exports and its deployment through the economy. Most economic development is increasingly dependent on this infrastructure and some countries are comfortable making the required infrastructure investment. E.g. the government of India initiated a program for developing software technology parks, which helped prime the pump for software exports in the early 1990s and enable SME in the country.

#### **Developing human resources**

It is observed that the global market for IT professionals and workers of all sorts is increasing. At times, it fluctuates from one period to another, more from one technical specialty to another, and often results in brain drain of the most talented people to advanced nations. It is worth knowing that very few IT professionals are software programmers. Every software team is composed of people with a variety of skills. People who design programs are at a different level of talent than those who test and maintain them and they use different tools and need to know about software technologies. We must also look at youngsters with innate talent who must be attracted into the field of software development. The best option is to create enabling environment and stable long-term software career paths that will attract talented people into it.

The curriculum of most universities should be changed by Nigeria University Commission (NUC) and enforced to reflect practical experience with software projects being as important as the theoretical aspects students are exposed to.

Labour laws of any nation also have critical impact on human resources for the production and development of software. Nigeria needs to adjust her labour laws to address issues relating to the software industry, most importantly to the start up industries that are good in software development.

### **Supporting software exports**

Software publishers and service providers as well as ICT – enabled services vendors have some special difficulties related to global marketing. Example, the initial investment in language training and system set up of countries not versed in English Language is considerable. This problem is particularly apparent in customer support for software publishers and for ICT-enabled services vendors selling low-cost program and rendering services to foreign companies. Another problem in developing nations is lack of domestic market in the initial stages to market their services that means that these companies must market abroad without the benefits of experience and validation from domestic customers. Thankfully, this is not a thrust in Nigeria as we have companies to market software services.

### **Mobilizing the Diaspora**

Some developing nation shave considered links to sizeable communities in the USA and Europe and these play critical bridging roles (Hanna et al., 1998).

In Silicon Valley, for instance, India and Chinese immigrants are playing a major role in keeping the valley and cost competitive. Between 1995 and 2000, the Chinese and Indians were found to be running about 35% of the regions high-technology companies (Hanna and Boyson, 2002).

Driven by active government incentives, our talented youngsters in Diasporas (Philip Emeagwali of Nigeria, for example) who are wizards in the IT world would like to come home and develop the Nigeria software and IT industry. As we try to preach the benefits of information revolutions to Nigerians, we need trained personnel's (the software engineers) to design and implement networks that are robust and cost effective. While the 'digital digital divide' conventionally refers to inequality of access to ICT services such as telephones, computer and Internet, the 'knowledge divide', refers to the inequality in the capability and skills to generate and use knowledge (Ndukwe, 2004).

In several aspects of ICT, satisfactory solutions to problems have not found particularly in developing country. Nigeria is not left out in these quests for solutions to the above problems. Hence, she must ensure a well organized, human resource development approach in this vital sector such that professionals education and

training in areas of software development and engineering in our institutions must be well adapted to a well articulated set of objectives for the economic growth of Nigeria.

Nnebe and Agbasi (2005), argue that progress has been made in the past decade, the narrowing of the gap in terms of ICT indications are such that developing nations may be lagging further behind in areas like Software engineering and development. Nigeria must therefore expand and modernize educational facilities in order to facilitate the creation of an all-inclusive knowledge base.

From the foregoing, it is evident that Nigeria nation continue to accord priority to software development and engineering with a view to develop necessary infrastructures for the citizenry. Sustainable policies aimed at facilitating widespread availability of these essential infrastructures must be accorded top priority. Investment in Software development and engineering is therefore crucial to bridging the knowledge gap as well as leading to the development of the capacity for integrating knowledge into the socio-economic activities and our participation in today's digital economy.

### **Relevance of software engineering**

Software engineering affects economies and societies in several ways:

#### **Economic**

Software engineering is a goal driving economic and it is of note that the economy drives the nation. No wonder that in the United States, software drives  $\frac{1}{4}$  of all increase in GDP during the 1990s, and  $\frac{1}{6}$  of all productivity growth in 2000 (World Bank Report). Software development is one of the major income earner to the US and Western world. The Microsoft is a case in hand to exemplify the impact of software development in the US economies. However, in Nigeria, software development is still in the infancy stage and when properly harness, it could be the very media for attracting new business and enhancing the workforce as well as creating jobs for our teeming jobless graduates. It can assist the government improve service levels for businesses by establishing or producing various software which can lower the administrative and economic development which involve collaborative process of companies, individuals and teaching/research institutions that can be guaranteed by software development.

### **Software engineering change the world**

This can be seen from the way we think, behave and possibly relate with our surroundings. E-mail, worldwide web (www) and instant messages enable people to inter-

act in new ways and these changes in culture are due to the usage and application of software which is occasioned by the use of computers. Software covers the cost and improves the quality of health care, and other important social services. Successful projects where SE methods and practices have been applied include LINUS, space shuttle software and automated Teller Machines (ATM).

### **Relevance of the Nigerian software industry**

Why do we need to improve the standard of software development in Nigeria to the world standard? To achieve this objective, strong government participation is needed. Government has to:

- Formulate policy to encourage software development
- Create the enabling environment.
- Provide the right infrastructures.
- Create some areas as national IT parks, IT villages or IT designated centers with appropriate state of the art equipment and facilities to the reach of every body.
- Put in place appropriate policy in infrastructural development, human resources development, incentives and business policy development.
- From the foregoing, the growth of Nigeria software industry can be enhanced by massive awareness campaign on the gains of IT.

### **Conclusion**

From our detailed survey, we can boldly referred software as the implementation vehicle for social program such as distance learning, telemedicine and on-line cultural offerings. Strength in software has become a paramount factor in foreign direct investment and also a major component of modern industrial and commercial infrastructure and government administration. While the development of software is all embracing, software support policies should be re-engineered as in no distance time, it will be an integral component of the social-economic development agenda, which will make Nigeria a credible participant in the global knowledge economy.

### **Recommendations**

Having seen the trend in software development and some of the problems faced by software industry, the following are points to be taken into consideration to bring about improvement in the target area.

The Federal Government of Nigeria should encourage big multinational information technology companies such as Microsoft, Netscape, IBM sun micro-system, etc, to not only come and set up shops here but also carry out development and manufacture of their product in the country.

Government should provide basic amenities and infrastructures to encourage the development of software industry.

The federal government should make it a duty of ensuring a sustainable and viable economy that is at least 50% IT-driven and wholly a knowledgeable economy.

Federal government should create an enabling environment for research and development of standard software that can guarantee sustainable economic development.

Establishment of a policy that discourage the use of foreign software by firms in the country. This will greatly encourage the indigenous software industry.

Practitioners should be encouraged to embark on researches in the key areas of software engineering

## REFERENCES

- Barr A, Tessler S (1997). The globalization of software R & D: The Search for Latent, Council on Foreign Relations. Globalization of Industrial R & D, Study Group.
- Cable Network News (CNN) (2006). Report on information Technology.
- Hanna N, Guy K, Arnold E (1998). The Diffusion of Information technology: Experience of Industrial Countries and Lessons for Developing Nations. World Bank Discussion Papers, No. 2.
- Hanna N, Boysin S (2002). Informal discussion about her research in incubation in China. Standard Project in Reforms of Innovation and Entrepreneurship.
- Nnebe SE, Agbasi KC (2005). Software Engineers and ICT development in Nigeria: the challenges, opportunities and potentials. Proceedings of the Nigeria Computer Society (NCS) on Information Technology Capacity Building: the future of Nigeria's Economic Growths (ICABUILD 2005) 8<sup>th</sup> International Conference 16: 145-152.
- White L.H. (2004). "The technology revolution and monetary revolution" The future of money in the information age, Ceo Institute of Annual Monetary Conference, Washington DC.