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# Aligning the Consulting Engineer's Role to the vision of Africa Infrastructure Development

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**Stakeholders Interventions in Capacity Building and Skills Evolution in Africa; Past, Present and Future.**

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Prepared by:

**Engr. George Chukwulewa Okoroma**, CEng FNSE MNIM JP

**Managing Partner/CEO, Gapec Consultants Limited**

(An Engineering & Technical Consulting Company)

[gcokoroma@gambetagroupe.com](mailto:gcokoroma@gambetagroupe.com)

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## **PROFESSIONAL PROFILE**

Engr. George Chukwulewa Okoroma has distinguished himself as a professional, a philanthropist and a leader who believes that integrity, honesty and professionalism remain the core value for professional practice. His mission for the industry is to bridge the gap between local companies, best practices and excellence, in Engineering and other technical services, for a sustainable development.

George graduated as a Civil Engineer in 1981 from the Paul Sabatier University, France. Years after he co-founded **Gapac Consultants Limited** an engineering and project management consulting firm in Nigeria.

He is an active member and fellow of various professional associations and has received several awards which include; Distinguished Service Award by the Nigerian Society of Engineers and Association of Consulting Engineering in Nigeria (ACEN), Justice of The Peace by the Nigerian Government. He is the current vice president of ACEN.

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## **ABSTRACT**

Reports and studies have shown that Africa is the continent with the least level of infrastructural development. According to the World Bank's Africa Infrastructure Country Diagnostic (AICD) project findings in 2009, it was estimated that Africa needs to invest US\$93 billion yearly to be able to attain a success story in infrastructural development. This infrastructure deficit requires capital expenditure on human and material resources. These resources are scarce and must be adequately utilized. This report highlighted the approaches to capacity building for maximum productivity. It also discussed strategies to overcome the challenges of attracting, developing, motivating and retaining talent using case studies applicable to the consulting engineering sector in Africa. Basically, the role of a consulting engineer is to provide independent advices to clients through interactions on the most suitable approach for executing infrastructural projects. This approach may involve the use of latest engineering tools and techniques for optimum performance. Therefore, it is essential that engineers continue to explore new knowledge and keep up with digital trends like Building Information Management, Virtual Reality, and other digital engineering tools emphasized in the study. The study is littered with critical reviews on projects executed within the continent and their success story so far.

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## **1. INTRODUCTION**

NASA images of the earth at night are a dependable representation for measuring the condition of regional infrastructure. It is almost impossible to have transport, telecom and water infrastructure without electricity. It is quite evident that regional infrastructure has not advanced much in Africa. This problem of lack of infrastructure is costing the continent a cut in GDP that is estimated to be between 2-3%.

### **Challenges in infrastructural development**

The major factors impeding Africa's regional infrastructural development are the lack of adequate data, lack of plans and programs, weak political commitment, inadequate financing, weak government environment, corruption, and environmental issues. Exploring the issues of plans and programs, there have been major contributions by the local, national and international community aimed at tackling Africa's infrastructural deficit. The World Bank sponsored Africa Infrastructure Country Diagnostic (AICD) estimated that Africa needs to spend about US\$93 billion per year to achieve success story in infrastructural development.

Achieving success requires a critical review of the consulting engineers impact and contribution towards infrastructural development in Africa. Consulting engineers are at the forefront when it comes to infrastructural development projects because without their critical skills there can never be conception, design, procurement, construction, operation and maintenance of any infrastructural asset. Unfortunately, most African countries lack the critical mass

of indigenous consulting engineers. This is a major root cause of our infrastructural deficit holding back the continent from being a major world economy.

## **2. STAKEHOLDERS INTERVENTIONS**

Building indigenous consulting engineering skills require the interventions of government, professional bodies and institutions, as well as consulting organisations to contribute at the various stages of the pipeline.

### **Government interventions**

Nigeria in the 1960 for example, seriously lacked indigenous engineering manpower. The government embarked on sponsoring students to western nations for their university education. This opportunity to study in Europe or America encouraged students to take up science subjects. Successful students were awarded scholarships, while students who studied at Nigerian universities got educated by a mix of foreign and local lecturers.

At university level, the Nigerian government introduced a Student Industrial Work Experience Scheme (SIWES) aimed at giving students an opportunity to gain some workplace experience by partnering with engineering companies who offer students a paid internship. Students undergo this exercise during their third year of study, in a five-year engineering course. This paid internship motivates students to complete their studies and join reputable engineering

construction or consulting firms and in most cases the students are employed immediately upon graduation.

In 2007, the Nigerian government introduced “The Bureau of Public Procurement” as the regulatory authority responsible for monitoring and overseeing public procurement to increase transparency, competitiveness and efficiency. The strategy encouraged indigenous consulting engineers to actively participate in public procurement due to the increased transparency in all government infrastructural projects. The successes recorded in this strategy spurred the establishment of the “Nigerian Content Act” aimed at enhancing the development of local engineering capacity within the oil and gas industry.

The act promotes the development and utilisation of in-country capacities for the industrialisation of Nigeria’s Oil and Gas activities. Since the inception of this act, there has been a tremendous transfer of technology and engineering skills to Nigeria professionals. Following on this trend, the recent introduction of the Presidential Executive Order 5–2018 by The President is aimed at ensuring the promotion of Nigerian Content in the planning and execution of projects, in Contracts relating to Science, Engineering and Technology. This order will certainly engage local consultants in activities that will bring about the development and improvement of engineering skills in the country.

South Africa having a hosting right for 2010 Soccer World Cup, was required to deliver the infrastructure needed to host this big game event planned to industrialize the country. This infrastructural need required a critical mass of skilled professionals to accomplish this mandate. At that point, it was

discovered that many engineering professionals, trades and operators were found to be in short supply. It became imperative to instate apprenticeship and artisan training and develop graduates towards the competence required to build stadia, hotels, new power stations, and other infrastructures. This strategy combined with expanding university capacity to take more students, and encouraging retired engineers to return to the industry enabled the projects to be completed on time.

There is no doubt that such intervention policies and programs in local engineering skills development are being implemented by some other governments across Africa. Zimbabwe struggles with shortage in technical skills in its mining sector, due to the high rate of emigration to neighbouring countries. In addressing this problem, the government set up qualifications with a shorter time to certification. The government also developed a cadet program aimed at attracting youths toward the mining sector. These strategies combined with attractive salaries for academics, significantly improved the number of skilled technicians.

### **Interventions by professional associations**

Another strategy to capacity building are the contributions of professional bodies and associations. The Association for Consulting Engineering in Nigeria (ACEN) and some Member Associations (MA), are constantly putting efforts to ensuring that there is Continued Professional Development (CPD) of her members through professional skills trainings. This ensures that engineers keep up to date and remain creative and innovative with problem solving. The



associations organise series of workshops, seminars, and other educative events throughout the year to cover high proportion of the technical and other commercial skills essential to all those engaged in the consulting business. In executing this task, ACEN runs a school of engineering to improve the skills of member firms. Consulting Engineers South Africa (CESA) is also in the frontline of such skills development strategy. The consulting engineer's activities extend beyond its core discipline to include, commercial risk assessment, contract documentation, financial reporting, and dispute resolution.

### **Interventions by consulting organisations**

Engineering consulting organizations or member firms are expected to be at the centre of the whole process of engineering and technological skills development. Incubation of science, engineering and technology skills must be encouraged at the grassroots level. Procurement of local engineering software, its constant usage and identification of its limitations for improvement should be encouraged by practicing engineers. Organisations and firms need to encourage and invest in local engineering capabilities in innovations and in software development. One typical example is that of CivilsoftQuickStructure Technologies for civil structural design of multi-storey buildings developed by a Nigerian engineer. At its development stage, Gapec Consultants Limited encouraged and supported the technology by offering its facilities as a regional training hub. Today, the technology has gained good traction in Nigeria and is expanding into the wider African Market. It is important that consulting engineers continue to encourage and build capacity to meet the ever-growing

demands of clients. Capacity building involves developing the human resources and processes within the profession and organization.

### **Summary on capacity building**

The aforementioned strategies help consulting engineers to engage in knowledge transfer activities that combine mentoring, informal and formal training to grow and improve the engineering practice. There is another capacity building opportunity that consulting engineers need to embrace or risk being disrupted.

## **3. TECHNOLOGY: CAPACITY BUILDING & SKILLS EVOLUTION**

Technology is the application of scientific knowledge for practical purposes such as human development and transformation of society. As civilization and cities develop so does the value of engineers. In our rapidly changing, hyper-connected world, information and communication technology is driving economic growth, productivity, and cost saving.

### **Evolution of technological advancement**

Innovation and technological advances are transforming people's lives by forecasting what society needs and then providing it. Advances in technology, computing power and just sheer volume of data at our fingertips, are transforming how infrastructure is operated and what it can do for the public. Technologies enabling smart highways, smart meters and the "Internet of Things" is changing our expectations of what our physical infrastructure can

and should do for us. Autonomous vehicles are set to change the future of mobility and mass transit, and potentially even the fabric of our cities and towns.

Major cities in the world are adopting digital engineering, a combination of Building Information Management (BIM) (the creation, collation and exchange of shared 3D models of the infrastructure's architecture, structure, and associated services) and Virtual Design and Construction (modelling software and techniques to design and evaluate possible construction processes). These digital tools are saving time, reducing cost, encouraging collaboration and improving the overall ability for consulting engineers to deliver projects.

### **Challenges in technology adoption in Africa**

The adoption of these technologies in Africa have seen several bottlenecks, caused by the lack of awareness among stakeholders, lack of standard to guide implementation, lack of information technology infrastructure, lack of education and training, and lack of government direction. Generally, in Africa, there is a reluctance by consulting firms to train staff due to the high cost of adoption and other technology related barriers. A study in Nigeria, showed that social and habitual resistance to change, legal and contractual constraints, and lack of awareness among stakeholders are problems confronting the successful adoption of these technologies.

### **Maximization of impact using digital engineering tools**

There is evidence of adoption of digital engineering tools in a Nigerian project. The Eko Atlantic City is an on-going construction project located in Lagos, the commercial city of Nigeria. It will be a dynamic new city, rising from the Atlantic Ocean. The project is a public-private partnership set to become Nigeria's most exclusive suburb and a symbol of Africa's future. As a case study, the focus is on BIM adoption, in which the geometries, structural systems of the city, and its buildings were designed using BIM. The primary stakeholders collaborating on the project are a mixture of foreign and local talents, thereby, creating an ideal environment for knowledge transfer. Information models are being generated and integrated by both international and national engineering consulting firms in the conceptualisation, design and implementation stage of the project.

### **Lessons learnt from case study projects**

There is a limited level of integration across the whole supply chain, as some tradesmen are not conversant with BIM. However, the adoption of BIM in African projects will enable a better visualization of the infrastructure and an improved communication and collaboration among project team members. In general, the project team were able to visualize and understand how to better undertake the tasks. This can be referred to as a form of digital prototyping technology that aids a better understanding of the project. Africa is a unique continent that requires technologies developed in the western countries to be locally innovated to increase market penetration. Even when Africans are not

inventing new technologies, we do always need to be innovative in how we deploy existing knowledge.

#### **4. EXPLORING TECHNOLOGIES AND TRENDS WITHIN AFRICA**

Gapec Consultants Limited in collaboration with Burnsley Technologies Limited(also an indigenous engineering company) is deploying a vehicle telematics solution aimed at monitoring drivers on the road and providing an added level of security against vehicle theft. The technology is owned by an American firm but has struggled to penetrate into the African market despite recording some success in the European and American market. Taking this technology and doing some local innovation, a partnership agreement was reached with a Moroccan company to redesign the solution to appeal to the African customer. Therefore, it is important that consulting engineers continue to explore new knowledge and keep up with digital trends.

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