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**NEW TRAINING MANDATES FOR SURVEYING AND GEOINFORMATICS INSTITUTIONS IN NIGERIA**

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**ABSTRACT**

Recent advances in computer, satellite, digital technologies and geographic information system have had a tremendous impact on the field of surveying and mapping. It has affected the scope, methods, volume and speed of data acquisition, management and rate of delivery of maps and map products. With the development in information technology, the world has become a global village.

These developments have affected the training of surveyors and mapping professionals all over the world. Some training institutions or departments have had to change their names in order to incorporate these challenges. Names such as Geomatics, Geomatics Engineering, Surveying and Geoinformatics have been common. In Nigeria, the Department of Surveying, University of Lagos has changed her name and degree programmes to Surveying and Geoinformatics while the Federal School of Surveying, Oyo has changed her surveying programme to Surveying and Geoinformatics. Other surveying and mapping training institutions are also giving the issue of change of name serious considerations.

The training programmes in some of the institutions have been modified. The new surveying and mapping training curricula now include acquisition and management systems such as global positioning systems, remote sensing, digital photogrammetry, digital cartography and geographic information system. In addition, courses in environmental management and coastal management have been introduced. Furthermore, there is a need to add a course on legal issues in geoinformation technology.

In order to meet the goals of the new training mandates, there is a need to train new manpower for the institutions and retrain the trainers. Furthermore, training institutions need equipment and financial support from the international community and institutions.

**1. INTRODUCTION**

Recent advances in computer, digital, information and satellite technologies have influenced tremendously the practice of surveying all over the world. Rapid technological development has positively affected the scope, methods, volume and speed of data acquisition, processing, storage, management and production of maps and allied products. The evolution of Internet has also revolutionised the field of Information Technology, and made the world a global village.

With the advances in technology, the definition of Surveying as the science and technology of taking measurements on, above and/or under the surface of the earth and the representation of it on a plan or map has been broadened. Grun (1998) referred to these enlarged tasks of Surveying as Geomatics. He defined Geomatics as the science of acquisition, management, modelling, analysis and representation of spatial data and processing with specific consideration of problems related to spatial planning, land use/land development and environmental issues.

The advances in computer, communication and digital technology, acquisition, processing and management methods have occasioned broadening of the training programmes in the Surveying profession all over the world. Data, which hitherto were acquired with analogue theodolites, levels, stereoplotters are now acquired with their digital equivalents. Satellite methods of data acquisition and positioning such as remote sensing, digital photogrammetry, and global positioning systems (GPS) are now available. Availability of very fast computers with large memories and improvement in digital and communication technologies now make the production of maps and map information almost possible on real time basis. It is now possible to move large volumes of data from one location to another through the internet, intranet and other means of data transfer. These developments have made many institutions training manpower in surveying or practising surveying to change or contemplate a change of their names to reflect the

new changes. The profession of Surveying in Nigeria is not left out of the new developments. The Federal and State Surveys departments and Survey departments in the oil and gas sectors have either embraced the new developments or in the process of doing so.

The training of survey manpower in the country is done at three levels. Professional training is carried out mainly in the universities, the technologists are trained mainly at the polytechnics, colleges of technologies and the Federal School of Surveying, Oyo, while the technicians are trained in the polytechnics, or on the job. The Nigerian Institution of Surveyors (NIS) on its part, has instituted a Mandatory Continuing Professional Development programme for all members as a way of exposing the members to the current developments in the field. The first phase of the programme was held in Lagos between the 22<sup>nd</sup> and 24<sup>th</sup> of March, 2000. The aim of the programme was to acquaint the members on the basics of Geoinformation Technology and Management.

## 2. ISSUES ON NAME

The developments in the field of Surveying led to a world wide debate on the appropriate name for the profession. During the debates a school of thought held the view that current advancement in technology has not changed the role of surveyors, but has helped in improving the quality of our jobs and in reducing the time of executing our tasks. However, many people felt that the time has come to effect a change in the name of the profession because of the expanded roles of surveyors. Names such as Geospatial Engineering, Geomatics and Geoinformatics were notable among the suggested names. As a result of these debates, many institutions changed their names. The Land and Hydrographic Survey Division of the Royal Institution of Chartered Surveyors has changed its name to Geomatics Division. Other Institutions that have changed their names include:

- i. Department of Geodesy and Geomatics Engineering  
University of New Brunswick  
Canada
- ii. Department of Geomatic Engineering  
University College London  
Gower Street, London

Currently, there is a big campaign for change of names of surveying related institutions in Nigeria. It is the opinion of most surveyors in Nigeria, that the profession should not make a total break from the past. It is believed that people outside the profession will not be able to easily associate a completely the name with the profession. In addition, the change of name of the profession has a constitutional implication as shown in Decree 44 of 1989. All these notwithstanding, a number of departments within the private and public organisations have changed their names from Surveying to Geomatics or to Surveying and Geoinformatics or to Geomatics and Geodesy. Some of the these institutions include:

- i. Department of Surveying and Geoinformatics  
Faculty of Engineering  
University of Lagos  
Nigeria.
- ii. Department of Surveying and Geoinformatics  
Federal School of Surveying, Oyo  
Nigeria.
- iii. Department of Geomatics and Geodesy  
University of Nigeria  
Enugu Campus, Enugu - Nigeria
- iv. Geomatics Division  
Shell Petroleum Development Company  
Nigeria.

Arriving at the changes in name did not come so easily. There was a need for proper education on the underlying reasons for the call for change. The Department of Surveying and Geoinformatics, University of Lagos organised a workshop on Surveying and Spatial Information Technology in July 1999. The objectives of the workshop were to determine the appropriate name and direction for the profession in the department as well as in the country. Experts in the profession across the country and key management leaders in the profession delivered papers at the workshop. At

the end of the workshop the department adopted the name " Surveying and Geoinformatics". The University has since approved this name.

At the Annual General Meeting of the Nigerian Institution of Surveyors in Awka, Anambra State, Nigeria in 1999, members deliberated on the latest developments in the field. The need for training on the new technology, change of name, a review of the ethics guiding the profession and legal implications of Geoinformation technology featured prominently.

### 3. TRAINING PROGRAMMES IN SURVEYING IN NIGERIA

Surveying is one of the oldest professions in Nigeria. Before the turn of the twentieth century, modern surveying was already in existence (Nwilo, 1999a; 1999b). The first map of Lagos township was produced in 1876. One Mr. Lawson, a Nigerian and the first indigenous assistant colonial surveyor played a vital role in the production of this map (Fajemirokun, 1988). There were surveying departments in the northern and southern protectorates of what is now the Nigeria nation.

It is often claimed that the Nigerian Surveyor was the first professional man to be exposed to formal training locally. Indeed, a school for training of surveyors was first opened in 1908. That school was later moved to Ibadan in 1927 from where it finally moved to Oyo in 1935. When the Yaba College of Technology was established around 1932 as the highest institution in Nigeria, a provision was made for prospective surveyors to undergo basic educational studies in the institution for two years, followed by two years of surveying at the Survey School, Oyo. Successful candidates were subsequently to be awarded diploma of the College. The first exposure to University education came in 1947 when the first university in the country was established as the University College of Ibadan. There, provision was made for the training of professional surveyors for the country. The programme was later discontinued following a change in the policy of the colonial administration. After the closure, the training of surveyors was again an overseas programme while technicians and instrument men were trained at Oyo from 1952. The Nigerian College of Arts, Science and Technology, Enugu was opened in 1955 and in 1956 a 4 year survey programme was started there. Surveying students in this institution were prepared for the first and intermediate professional examinations of the British Royal Institution of Chartered Surveyors (R.I.C.S). Some of the students later had to travel overseas to complete their professional courses (Fajemirokun & Nwilo, 1994; 2000). Today Surveyors are trained in the universities, polytechnics and colleges of technology as can be seen below.

#### 3.1 University Education

In 1962, the Enugu College of Technology became part of the then two year old University of Nigeria, Nsukka and the Nigerian Surveyor was again exposed to University education. The first set of 5 students of surveying from the University graduated in 1966, 58 years after the first Survey school was opened in Lagos (Fajemirokun, 1976).

The University of Lagos admitted the first set of students in 1970 to do a 2 - year conversion M. Sc. programme in Surveying. In 1974 session, the first set of five students were admitted to pursue a three year B.Sc. programme after obtaining 3 A' Level papers or having completed a one year preliminary programme in Engineering in the Faculty of Science. In addition, a postgraduate diploma programme for graduates with relevant degrees was introduced the same year. (Department of Surveying, University of Lagos, 1980). The three-year undergraduate programme was later changed to a four-year programme to allow for enough practical experience before graduating. Today, admission is by a Joint Admissions and Matriculation Board (JAMB) conducted examination and the course is a five year programme after passing the Senior Secondary School Certificate Examinations (Fajemirokun & Nwilo, 2000). The Department of Surveying, University of Lagos now admits yearly an average of 50 students although some of these later change departments. Prior to all these, the Faculty of Engineering of the University of Lagos in 1967 arranged for a few students who were surveying undergraduates of the University of Nigeria, Enugu Campus and who were displaced by the Civil War, to complete their degree programmes in the Faculty, and earn a degree of the University.

The Department of Surveying, Ahmadu Bello University, Zaria was, set up at about the same time that the University of Lagos started offering Surveying at postgraduate level. At present apart from what may be regarded as the first generation university surveying departments, it is known that surveying is offered at degree level at the Universities of Science and Technology, Port Harcourt; and Enugu; the Universities of Technology, Minna and Yola, and the University of Uyo, Uyo. The establishment of more departments tends to deplete the number of qualified staff available to each university, as there are very few lecturers in surveying. This is however, not peculiar to surveying as most other courses are similarly affected.

#### 3.2 Technological and Technical Education

Surveying is offered at Higher National Diploma level at the Federal Survey School, Oyo and the Kaduna Polytechnic.

A number of Polytechnics and Colleges of Technology offer surveying at National Diploma level. The details of the exact number of these institutions are not readily available but according to Yabani (1989), 13 Polytechnics were accredited to offer courses at National Diploma level, while only one was accredited at the HND Level in 1989. The Regional Centre for Training in Aerospace Surveys (RECTAS), Ile - Ife offer courses leading to Postgraduate Diploma in Photogrammetry & Remote Sensing; and Geographic Information Systems (GIS)

A few institutions such as the Federal Survey School, Oyo and some State Survey Departments offer trainings leading to Technical certificates in surveying, photogrammetry and related subjects.

### **3.3 Driving Forces for the New Programmes**

The training curricular for surveyors was geared towards producing professional surveyors for the mapping and general land surveying practices. At that time the duties of the surveyor consisted solely of spatial data acquisition and production of the same as paper plans or maps. It was deeply rooted in the fundamentals of land surveying, astronomy, geodesy, photogrammetry, hydrographic surveying, cartography, mathematics and physics.

This situation has since changed. Surveyors apart from producing paper maps and plans now produce the same in digital formats. These information can now be stored in large databases incorporated in a geographic information system environment. The scope of professional practice for the surveyor has also increased tremendously and as earlier mentioned has necessitated the change of name in some cases to Surveying and Geoinformatics.

The technical system of Geoinformatics is a sum of techniques and methods for spatial data acquisition, processing, management, analyzing, representation, as well as applications. The parts of this great discipline are Global Positioning Systems (GPS), Geographic Information Systems (GIS), Remote Sensing and Information Technology (IT) (Li & Zhou, 1999). The GPS is a modern positioning tool, which has substituted in several applications the classical positioning methods and is opening up a whole new world of applications. The more accurate mode (DGPS) makes it also a suitable tool for accurate positioning up to geodetic requirements. The GIS on the other hand are basically computer-based systems for the capture, storage, analysis and presentation of spatially referenced data. It combines the power of digital maps and database technology to open up a very big worldwide industry with useful applications.

Remote Sensing is now a well-developed technology for deriving information from objects on and beneath the earth surface without physical contact. Multi-sensor, high-resolution and multi-temporal imageries are now available. The field of digital photogrammetry can now be treated under remote sensing where the aircraft is referred to as neo-satellites and several remote sensing and GIS software also provide digital photogrammetry modules. Information Technology (IT) is clearly the thrust of the whole world as it entered into the new millenium. With the advances in communication networks and its integration into the mainstream IT (ICT- Information & Communications Technology), ICT serves as a major factor driving Geoinformatics. The increased use of the Internet for more and more activities is a pointer in this direction. The development of Geoinformatics depends to a large extent on developments in these parts and there is an increasing trend in the integration of all the parts into one smooth system.

The training of surveyors must be towards this direction in Nigeria, otherwise the products of our institutions will not meet the expectations of the 21<sup>st</sup> century Surveyor.

### **3.4 New Programmes in Nigerian Higher Institutions**

We shall use the new training curricula of two institutions in Nigeria namely: the Departments of Surveying and Geoinformatics, University of Lagos and Federal School of Surveying, Oyo to show the trends in Nigeria.

The Department of Surveying and Geoinformatics, University of Lagos has reviewed her undergraduate and post graduate programmes. Part of the reason for a review is that the department is at pain to balance the professional discipline against the need to give our graduates a sufficiently broad educational knowledge base to which to develop and adapt over time in a world of rapid change. Therefore in drawing up the new programme, the department has apart from the core geoinformatics courses brought in some peripheral courses, which might be useful to our graduates later in developing and adapting to the rapid changes in life.

The Institution is presently running B.Sc., M.Sc. and PhD degrees programmes in Surveying and Geoinformatics. The Department will also be running a Master of Geoinformatics Degree Programme with effect from the next academic session. As part of the efforts to modernise and broaden her programmes, the Department has included the following courses in her undergraduate programme:

Computer Application in Surveying I & II  
Principles of Geoinformation I & II

Digital Mapping I & II  
 Special Studies in Analytical and Digital Photogrammetry  
 Special Studies in Analytical and Digital Remote Sensing  
 GIS Tools & Applications  
 Introduction to Coastal Mapping and Management  
 Satellite Geodesy  
 Mathematical Geodesy  
 Operational Methods  
 Surface Water Hydraulics  
 River Engineering

At the M.Sc. Surveying & Geoinformatics and Masters in Geoinformatics programmes, the following new courses listed below have been added:

Principles of GIS  
 Data Acquisition Systems I & II  
 Elements of Computing & Computer Graphics  
 Spatial Data Structures  
 Spatial Statistics I & II  
 Advanced Concepts in Geoinformatics  
 Policy Issues in GIS Implementation  
 GIS Implementation Strategies and Procedures  
 Data Quality  
 Digital Cartography  
 Digital Image Processing in Remote Sensing  
 Knowledge -Based Systems  
 Coastal Management  
 Analytical/Digital Photogrammetry  
 System Integration in Surveying  
 Guided Studies in GIS  
 Digital Surveying  
 Fundamentals of Environmental Management.

Details of all the programmes including the traditional courses are in the Department of Surveying and Geoinformatics 1999 Prospectus. It is important note, however, that the B.Sc. programme generally lasts for a minimum five (5) years while the M.Sc. programme lasts for twelve (12) months.

The National Board for Technical Education (NBTE) in collaboration with the Federal School of Surveying, Oyo in March 1998, held a workshop to review the curricular for surveying in polytechnics in Nigeria and Federal School of Surveying, Oyo. At the workshop, the following programmes were recommended:

- (i.) National Diploma (ND) in Surveying and Geoinformatics
- (ii.) Higher National Diploma (HND) in Surveying and Geoinformatics
- (iii.) Professional Diploma (PD) i.e. Post HND in Surveying and Geoinformatics.

The new courses in the new course structure for the Higher National Diploma (HND) programme include:

Principles of Geoinformatics  
 Analytical and Digital Photogrammetry  
 Digital Mapping  
 Automated Surveying  
 Geographic Information System Tools  
 Management in Surveying  
 Digital Cartography

The following new courses are also offered at the Professional Diploma level:

Advanced Computer Programming  
 Computer Aided Surveying  
 Principles of GIS

Database Design & Creation  
GIS Hardware & Software  
Advanced Digital Mapping  
Digital Terrain Modelling  
GIS Applications  
GIS Project Planning & Management (Kufoniyi and Ajibade, 1999)

The above courses are already being implemented in these institutions. It is however observed that the courses being implemented in these institutions do not include legal issues in Geoinformatics and communication. It is our view that these courses are very important to successful implementation of the reviewed programmes.

#### **4. CONCLUSIONS AND RECOMMENDATIONS**

##### **4.1 Recommendations**

The following recommendations will go a long way to solving some of the problems confronting the surveying and mapping industry, and ensure its growth and its survival in this new millennium.

1. More survey training institutions must review their curricula, and re-align same to fall in line with modern developments in the field of surveying. In view of the phenomenal changes in methodology and instrumentation, emphasis must now be shifted in training from data acquisition only, to data processing presentation and management in addition to acquisition. The scope of training must also be expanded to include electives in areas such as Coastal Mapping and Management, Operational Method, Valuation, Geology, Hydrology and Environmental Management. For the ones that have already reviewed their curricular, the absence of legal issues in geoinformatics was observed. This aspect is very important and should be included.
2. There should be a review of the names of the departments of surveying to reflect the changes, which their curricular had undergone. Names such as Geoinformatics, Geomatics, Geomatic Engineering, are now appropriate, so as to accommodate the new roles of the Surveyor in the management, analysis and presentation of spatially related data.
3. There should be a programme for the training and re-training of existing survey manpower so as to acquaint them with new developments in Surveying and GIS. To this end, the continuous and Mandatory Professional Development Programme of the NIS must be encouraged to take a strong foothold. Moreover, institutions of higher learning should also be encouraged to mount programmes for the retraining of survey personnel in the country through short-term courses, workshops and seminars. The orientation of survey seminars of personnel needs to be changed through a nationally planned, co-ordinated, and systematic retraining process.
4. The staff of the various institutions needs to be exposed to industry. As it happens in other practical oriented professions, instructors in institutions need to acquire hands on experience in industry concurrently with teaching in the classroom.
5. The level of funding by Federal, State and Local governments, for Surveying and Mapping activities must significantly improve. Sporadic and "fire-brigade" approach to geospatial data acquisition by each government organisation when they perceive a need for it, is wasteful and must be replaced by a systematic, and "holistic" approach to mapping and geospatial data acquisition and management. There is a need to get decision-makers better informed and educated on the benefits of proper funding of this sector of the economy.
6. There is a need for funding surveying training institutions in the country so as to train and retrain surveyors in the modern trend and direction. Offer of international fellowships to the trainers and deserving young lectures and graduates would be of immense assistance in developing the much needed capacity

##### **4.2 Conclusions**

Having dwelt extensively on historical development of the surveying profession, training of surveyors including the new directions in training, the obvious question is where does the profession go from here? To start with, for more departments of surveying to become attractive to prospective students, more of these institutions must adjust their

curricula just as it has been done at the University of Lagos, and Federal School of Surveying, Oyo. The departments must become stronger in computing and information technology. They must include, apart from the geoinformation courses, those courses that have hitherto been referred to as peripheral courses. The focus should not only be to train professional surveyors but also graduates who may decide to practise in other spheres of human endeavour such as information technology, environmental management, coastal management and geophysics. Experiences from our past students have shown that surveyors can easily get into other areas and perform excellently in these areas.

In the experience of the University of Lagos, this name and curricula change has positively affected the students. They are now more committed to these programmes and the students intake has shot up. Also the different areas where they can now practice armed with these skills is a plus for all. Several of the graduates end up in mainstream IT either as programmers, web-designers and system analysts.

Although Nigeria is endowed with qualified manpower in the field of Surveying and Mapping, several of them having been trained in some of the best institutions in the world, there is a need for re-training of the available manpower. The political and economic situation in Nigeria between 1984 -1999 adversely affected Nigeria's relationship with other nations and therefore made the available manpower rusty and the equipment outdated. There is therefore a need for increased funding from the Federal Government of Nigeria and the International community for re-training of the trainers and trainees.

Our profession must ensure that its members are conversant with new instrumentation such as the global positioning system (GPS) and competent in new areas such as Geo-information system, digital photogrammetry and remote sensing. This can be achieved through formal and informal training. The Nigerian Institution of Surveyors has taken the right step through its new MCPD Programme, which kicked off in March 2000.

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