A New Curriculum for Surveying Education in Nigeria

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Key Words: Curricula Review, Surveying Education, Funding, Capacity Building, Environmental Protection, Economic Development

SUMMARY

The Nigerian Surveyor was one of the first professionals to be exposed to formal training locally in the country. As early as 1908, a survey school was opened in Lagos. Formal training of surveying personnel in Nigeria is at present done at all tertiary levels.

Surveying as a profession had many definitions applied to it over the years. Geoinformation Technology also known as Geoinformatics is a product of the marriage between the Geosciences and Information Technology. It is a more recent terminology, which has evolved within the past three decades. Many branches of the Geosciences such as surveying, geodesy, photogrammetry and remote sensing use various types of sensors to capture and measure spatial data, which in turn are computer processed with other data. These are then stored, analysed, manipulated, interpreted, displayed and made available to a wide range of applications, within the context of Geographic Information Systems (GIS).

With the advances in computer technology, space technology and communication, there is a need to train and re-train surveyors, not only for better relevance, but also for added versatility. Departments responsible for training surveying personnel in Nigerian tertiary institutions should as a matter of priority, embark on a review of their curricula as some are already doing. However, the training of survey personnel must recognize the need to incorporate aspects of geoinformatics in a new curriculum, such that newly produced professional surveyors can be appropriately repositioned to take full advantage of geoinformation technology. Furthermore, there is a need to equip and modernise the Surveying and Mapping training institutions to keep pace with advancing technology. The new curriculum in use at the University of Lagos and the model curriculum for the Polytechnics in the country are highlighted.

Governmental and non-governmental agencies should give education the right priority and make funds available to universities; polytechnics and all other relevant training organizations to enable them train future surveyors appropriately.

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Francis A. FAJEMIROKUN and Olusegun T. BADEJO, Nigeria

1. GROWTH OF SURVEYING EDUCATION IN NIGERIA

The Nigerian Surveyor had been one of the first professionals to be exposed to formal training locally in the country. As early as 1908, a survey school was opened in Lagos, but was later moved to Ibadan and finally to Oyo in 1935 (Coker, 1971). At its early stage, duration of the course offered was three years for holders of the equivalent Secondary School Certificate. Graduates of this school were recruited into the public service as Surveyor grade IV (and later as Surveyor grade III) (Adebekun, 1980).

Formal training in surveying received a boost when the Yaba Higher College was established in 1932 as the highest institution of learning in the country. At that time, provision was made for prospective surveyors to undergo a two-year survey course at the Survey School, Oyo. Successful candidates were, at the end, awarded a Diploma of the College.

In 1947, when the University College, Ibadan was established as a College of the University of London, the professional surveyor in Nigeria was exposed to university education, although this was short-lived. At the College, a school of surveying was established but later closed down as a result of a change in Colonial Government Policy. Training in the profession, at professional level then became an overseas programme, but the Survey School at Oyo was reopened in 1952 to train technicians and instrument men.

In 1956, the Nigerian College of Arts, Science and Technology at Enugu started a four-year course, which prepared candidates for the First and Intermediate professional examinations of the British Royal Institution of Chartered Surveyors. This was discontinued in 1962 when the College became part of the University of Nigeria and a degree programme in Surveying was established as part of the academic programme of the University. The first set of five graduates in surveying trained in Nigeria graduated in 1966, some 68 years after the first survey school was opened in Lagos. At least seven other universities have since developed degree programmes in surveying. These are the Ahmadu Bello University at Zaria, the University of Lagos, the Rivers State University of Science and Technology, Port Harcourt, and Enugu State University of Technology, Enugu. Others include the Federal University of Technology, Minna, the Federal University of Technology, Yola and the University of Uyo at Uyo.

Formal training of surveying personnel in Nigeria is at present done at all levels. Institutions exist in the country for the training of technicians, technologists and full professionals. Training in the past, especially at professional level, were specially geared to the needs of the country - a developing country with a rapid rate of development. Under these conditions, the surveyors have special roles to play with regard to the Economic Development of the country.

They are concerned with national mapping, location (and identification) of natural resources and provisions of various types of surveys for physical development and land administration. Their product output serves as the basic input into any developmental project, as well as efforts to prevent environmental degradation.

2. GEOINFORMATION TECHNOLOGIES AND SURVEYING

Surveying as a profession had many definitions applied to it over the years, changing even as the role and duties of the Surveyors had been also dynamic. For example, a rather outdated definition in Webster's Dictionary is given as "the science of determining the location, form or boundaries of a tract of land by measuring the lines and angles in accordance with the principles of geometry and trigonometry". In the 1980s, surveying was defined as "that branch of the geosciences which deals with the location of points on the earth's surface, the graphical representation and visual presentation of such points, and the determination of the figure of the earth and its gravity field, using the methods of mathematical physics as the basic tool (Fajemirokun, 1983). The Surveyor, even by the '80s, was seen as a professional with several methods available to him to achieve his aim, including terrestrial and air-based observations, as well as methods dependent on space techniques. FIG, however, defined a Surveyor as "a professional person with the academic qualification and technical expertise to practice the science of measurement, to assemble and assess land and geographic related information, to use that information for the purpose of planning and implementing the efficient administration of the land, the sea and structures thereon, and to instigate the advancement and development of such practises" (NIS, 1997).

Geoinformation Technology (GIT), also known as Geoinformatics is a more recent terminology that has evolved within the past three decades or so. It is one of the products of the digital revolution, and a product of the marriage between the Geosciences (Geo) and Information Technology (Informatic) (Ayeni, 1999). Many branches of the Geosciences such as surveying, geodesy, photogrammetry and remote sensing use various types of sensors to measure and capture spatial data, and these in turn are computer processed, sometimes *with other data*. The processed data can then be stored, edited, analysed, manipulated, interpreted, updated, displayed and made available to a wide range of applications, within the context of Geographical Information Systems (GIS).

GIS, which is also called Geospatial Information System is a system of computer hardware and software for capturing, storing, retrieving, analysing, manipulating and displaying *spatially referenced data*. The essential features are the existence of a spatial Database Management System and spatial analysis capability.

It is easy for one to see the symbiotic relationship between Surveying and Geo-Information Technology, as well as the potentials for a professional that is proficient in both fields. Indeed, in the Human Capacity Building of any nation, in order for her to be able to apply geoinformation to the development and management of her resources, the survey personnel, who are already knowledgeable in geospatial data acquisition systems, are likely to be the first choice to be "converted". The common ground for GIT and Surveying is the GIS, with the

capability for attribute data linkage with geo-referenced data. However, the training of survey personnel must recognize the need to incorporate aspects of geoinformatics in a new curriculum, such that newly produced professional surveyors can be appropriately repositioned to take full advantage of geoinformation technology.

3. RATIONALE FOR CHANGE

Certainly, there is the feeling within the surveying community that there is the need for a change in curricula. But in what direction, and the modalities for effecting such change are generally left to individual institutions to determine, although sometimes within a constrained framework. Yet it is the survey community that will receive and make use of the products of such new curricula. To a large extent, they are 'stake holders' in the process of change, and preparations for effecting the change should not be withheld from them. We note, for instance, that in the "Memorandum on Surveying and Mapping" to VISION 2010 Committee in Nigeria, it was generally accepted that there is a "need for training and retraining of personnel for the constantly improved changing system". But there was no elaboration whatsoever. As part of the strategic objectives necessary for the realisation of the VISION, the document advocated that the country should "equip and modernise the Surveying and Mapping training institutions to keep pace with advancing technology, and develop adequate staff training and re-training programmes in order to provide the country with competent manpower who can meet the ever changing needs of the sector:"

The need to review curricula therefore seems to be obvious even from the above quoted piece from the memorandum submitted to the VISION 2010 Committee. Yet it is incumbent on us to further justify this need to change.

The discipline of Surveying has grown rapidly in the last 50 years. Initially, it was survey and mapping requirement of the Second World War that led to the development of aerial survey techniques, known as photogrammetry, which has in turn revolutionised mapping methods. The discovery of RADAR gave the first impetus to the development of methods and instrumentation for distance measurement other than taping or chaining. Later, the tremendous development in the field of electronics had been rightly applied to the development of new family of equipment in surveying known as Electromagnetic Distance Measuring (EDM) equipment. And even more recently, particularly in the last 15 - 20 years, advances made in computer software and hard ware, and space techniques have again greatly influenced survey methods both in data acquisition, processing and management methods. This is why

Geographic Information Systems (GIS), geoinformatics, remote sensing techniques and digital mapping methods have become increasingly popular. Indeed, the above represent the trend and the direction of growth of the science of Surveying with emphasis shifting from mere data acquisition, to the inclusion of data storage, retrieval, manipulation and management. Surveyors must of necessity, become familiar with, and be proficient in the new techniques, so as to remain relevant and productive. Indeed, our task of training must include the re-training of already qualified personnel.

It is in the light of the above that it has become rather imperative for survey institutions and departments to review their programmes in order to align their curricula with new developments in surveying and allied fields. Departments in developed countries have already led the way. Their survey programmes have being appropriately reviewed. In many cases, departments have even had to change the names of their departments to Geomatics Engineering, Geoinformatics, Surveying and Geoinformatics etc, as the case may be, so as to reflect these developments. The surveying and mapping industry in Nigeria has suffered so much neglect in the past years, particularly as regards funding, because classical survey products aroused very little political interests. But opportunities presented by modern survey and mapping techniques offered through digital technology, can make surveying and mapping products attractive to decision makers as to be prepared to adequately fund the industry.

4. THE NEW DIRECTION

It is now necessary to also discuss what the new curricula must contain. The objective is to train a new set of survey personnel at all levels, who are well exposed to new survey methods, digital and information technology and information management. We cannot however, recommend that in Nigeria, total break should be made with the past at this time, as it is in some developed countries. There is already in the country, huge investments in instrumentation, which operate in the analogue mode and which can still be of good use in the industry. What should be acceptable to us in the profession is to ensure that new entrants, while retaining some degree of proficiency in the analogue methods are also sufficiently exposed to digital and information technology so as to be capable of the versatility, which the modern trend demands. Such new entrants, as well as the old ones who would have to undergo retraining, should also be well exposed to methods of converting analogue data to digital. As a pacesetter, the University of Lagos has recently reviewed its programme both at undergraduate and at postgraduate levels.

Since then, we are aware that other Departments of Surveying in Nigerian Universities and Polytechnics have either carried out a review in their curricula, or are in the process of doing so. Some, (including the Department at the University of Lagos) have changed the names of their departments to reflect the changes in curricula. We are also aware that some in the industry have effected changes in names. For example, the erstwhile TOPO Division of Shell Petroleum Development Company has been renamed GEOMATICS Division. Even some professionals have advocated a change in the name of the Professional association for Surveyors in Nigeria, currently known as the Nigerian Institution of Surveyors. The University of Lagos model, in the changes instituted at the undergraduate levels will be briefly given below. The details of the new programme as reflected in University publications is beyond the scope of this paper. However, the new course requirements are summarised below. The trend, in the training of technicians and technologists in Nigerian Polytechnics are also given below.

5. THE UNIVERSITY OF LAGOS MODEL

The Department of Surveying of the University of Lagos recently made a comprehensive review of her programmes and curricula to align the programmes of the Department with the new developments in the field of Surveying. As one of the first steps taken, the Department

held a workshop on “Surveying and Spatial Information Technology: Issues of Name, Concept and Functions” at the University on July 5, 1999. The workshop, which had a wide cross-section of participants in and outside the universities had as its aims:

– Charting the direction of growth, and identifying new areas of knowledge to be added to the curricula in view of recent advances made in computer, digital and information technologies, which have in turn revolutionised the techniques of spatial data acquisition and processing.

– Choosing a new name for the Department, which will reflect the new orientation of the department and the slant of the programmes being run in the department

The need to change the name of the department which it had been identified with for almost three decades was also partly due to the very narrow interpretation given to the term “Surveying” by the general public and the resulting difficulties in student recruitment, in addition to the need to reflect the tremendous impact the advances in technology and modern techniques had on the surveying profession. The name adopted was “Surveying and Geoinformatics”, which was thought to portray a discipline that deals with acquisition, analysis, storage, distribution, management and application of spatially - referenced data.

The surveyor, as defined and produced at the University of Lagos, is a professional and a Geoscientist, well equipped to provide spatial and other environmental information necessary for designing and planning of engineering works as well as in the location and exploitation of

natural resources. His excellent background in computer science, mathematics and physics, gives him added confidence to tackle problems of diverse nature. He is given comprehensive training in Geoinformatics, which include *inter alia***,** Land Surveying, Geodesy, Hydrography, Photogrammetry, Remote Sensing, Cartography and GIS.

In conformity with other departments in the Faculty of Engineering, the undergraduate curriculum is a five-year programme. To give an engineering flavour to our programme, our first year students share the same courses with students in the other departments of the Faculty. They also take the same Engineering Mathematics at all levels. The long vacations of the second and third years, and the whole of second semester of the fourth year are meant to be spent in the industrial attachment scheme. As part of the degree requirements, each student is also required to undertake an independent research project, supervised by an academic staff.

The bachelor’s degree curriculum at University of Lagos has been reviewed to include new subject areas such as Computer Applications, Geographic Information System (GIS), Remote Sensing, Digital Mapping, and Environmental Management. The new curriculum is expected to prepare the students, in addition to their traditional roles as surveyors, for a new role also as information managers, environmental and coastal management experts, as well as remote sensing experts. The new programme also incorporated the General Studies (GST) courses as stipulated by the University.

5.1 Graduation Requirements

To be eligible for the award of a degree, a student must pass a minimum total number of units in a five-year programme, including the university course requirements as follows:

–	University Requirements General studies (GST, GAS)	12 units
–	(i) Faculty Requirement	54 units
–	Departmental Requirement	126 units
	Total	**192 units**

5.2 Courses

The courses, as well as their units (in brackets) are given below according to the levels.

I YEAR 1 - 100 Level

1st Semester	**Unit/s**	**2nd Semester**	**Unit/s**
History of Surveying	(1)	Basic Surveying	(1)
Pure Maths I	(3)	Pure Maths II	(2)
Applied Maths I	(3)	Applied Maths II	(2)
Workshop Practice I	(1)	Workshop Practice II	(1)
Technical Drawing I	(2)	Technical Drawing II	(2)
Introductory Physics I	(3)	Introductory Physics II	(2)
Nigerian People & Culture	(2)	Introductory Physics III	(3)
Logic & Philosophy	(2)	Lab (Physics)	(2)
Use of English I	(2)	History & Philosophy of Science	(2)
		Use of English II	(2)

II Year II - 200 Level

1st Semester	**Unit/s**	**2nd Semester**	**Unit/s**
Basic Surveying II	(3)	Engineering Surveying	(3)
Cartography	(3)	Intro. Engr. Stat.& Comp. Sys	(3)
Engineering Maths I	(3)	Intro to Astrophysics	(2)
Fund. of Elec. Engr I	(3)	Photogrammetry I	(3)
Classical Mechanics	(2)	Practical Physics II	(1)
Practical Physics I	(1)	Gen. African Studies	(2)
Geophysics I	(2)	Remote Sensing I	(3)
Gen. African studies I	(2)	Computer Application in Surveying I	(2)
Optics	(2)		

III Year III - 300 Level

1st Semester	Unit/s	2nd Semester	Unit/s
Cadastral Surveying I	(3)	Geodetic Surveying	(3)
Spherical and Field Astronomy	(3)	Cadastral Surveying II	(3)
Applied Town Planning	(2)	Geodetic Astronomy	(3)
Adjustment Comp. I	(3)	Principle of GPS Surveying	(3)
Hydrographic Surveying I	(3)	Computer Appl. in surveying II	(3)
Principles of Geo. Information System I	(3)	Principles of Geo. Information System II	(2)
Classical Mechanics II	(2)	Digital Mapping 1	(2)
Elective			
Intro. to Swimming I	(1)	Industrial Training	(4)

Plus at least 2 units of Electives below

Operational Methods	(2)
Intro. to Swimming II	(1)
Engineering Geology	(3)

IV Year IV - 400 Level

1st Semester	Unit/s	2nd Semester	Units
Map Projection	(3)		
Photogrammetry and Remote Sensing I	(3)	Industrial Attachment	(8)
Geodesy I	(3)		
Digital Mapping II	(2)		
Engineering Statistics	(2)		
Numerical Methods in Engineering	(3)		
Tech. Communications	(1)		

Plus 5 units of Electives below

Mining & Underground Survey	(3)
Potential Theory and Spherical Harmonics	(2)
Special Surveys	(3)

V Year V - 500 Level

1st Semester	Unit/s	2nd Semester	Unit/s
Adjustment Comp. II	(3)	Adjustment Computation. III	(3)
Survey Laws and Regulations	(2)	Prof. Practice and Ethics	(3)
Engineering Economics	(2)	Project	(3)
Project	(3)	Engineering law & Management	(2)

Plus 7 units of Electives below:		Plus 9 units of Electives below:	
Special Studies in Digital Remote Sensing	(3)	Physical Geodesy	(3)
Geometric Geodesy	(3)	Hydrographic Surveying II	(3)
Photogrammetry (& Remote sensing II)	(3)	Marine Surveying	(2)
Introduction to Coastal Mapping and Management	(2)	Ground Water Hydrology	(2)
GIS Tools & Applications	(3)	Special Studies in Analytical and Digital Photogrammetry	(3)
Surface Water Hydraulics	(2)	Satellite Geodesy	(3)
Mathematical Geodesy	(2)	Applied Geophysics	(2)
		Close-Range Photogrammetry	(3)

6. THE MODEL IN POLYTECHNICS

In 1999, the National Board for Technical Education held a workshop on modernisation of curriculum of surveying courses in Colleges of Technology and Polytechnics. This brought in courses like GIS, Environmental Management, Knowledge-based Systems, Digital Surveying and Internet Technology into their programme. Unlike in the University System, the Polytechnics that run courses in Surveying are supposed to have and run the same curricula at National, Higher National and Diploma levels. It was also agreed during the workshop that all surveying courses in the colleges of Technology and Polytechnics should change their names to Surveying and Geoinformatics (Nwilo and Badejo, 2002). At the workshop, the following programmes were recommended:

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

The curricula for the programmes above were given by (Nwilo and Badejo, 2002) and are contained in tables 6.1 to 6.3 below.

Table 6.1: Curriculum for National Diploma in Surveying and Geoinformatics

S/N	Course	S/N	Course
1	Basic Principles in Surveying I and II	14	Field Astronomy I & II
2	Introduction to Photogrammetry and	15	Surveying Instrument I
	Remote Sensing I and II	16	Control Surveys
3	Basic Principles in Cartography I and II	17	Elements of Geo-Informatics
4	Introduction to Computer	18	Database Creation and Use.
5	Introduction to Statistics	19	Optics, Waves, Electricity&Magnetism.
6	Logic and Linear Algebra	20	Calculus.
7	Mechanics & Properties of Matter & Heat	21	Introduction to Sociology.
8	Use of English I	22	Engineering Surveying I.
9	Citizenship Education I & II.	23	Topographical Surveying I.

10	Cadastral Surveying I, II & III.	24	Trigonometry & Analytical Geometry.
11	Computer Application I.	25	Final Project.
12	Algebra & Elementary Trigonometry.		
13	Communication in English I		

Table 6.2: Curriculum for Higher National Diploma (HND) in Surveying and Geoinformatics

S/N	Course	S/N	Course
1	Cadastral Surveying IV & V.	15	Principles of Geo-Informatics.
2	Astronomy III & IV.	16	Advanced Calculus.
3	Survey Instrument.	17	Hydrographic Surveying.
4	Geodetic Surveying I & II.	18	Analytical and Digital Photogrammetry.
5	Topographical Surveying I & II.	19	Digital Mapping.
6	Electromagnetism; Terrestrial and Planetary Physics.	20	Automated Surveying.
7	Fundamentals of Computers.	21	Geographical Information Tools.
8	Elements of Photogrammetry.	22	Management in Surveying.
9	Advanced Algebra.	23	Digital Cartography.
10	Communication Skill III.	24	Introduction to Environmental Studies.
11	Engineering Surveying.	25	French for Beginners.
12	Adjustment Computation I & II.	26	Outline History of Africa.
13	Physical Optics; Atomics & Nuclear Physics.	27	Final Project.
14	Computer Application.		

Table 6.3: Curriculum for Professional Diploma (Post HND) in Surveying and Geoinformatics

S/N	Course	S/N	Course
1	Advanced Computer Programming.	12	Database Design & Creation.
2	Computer Aided Surveying.	13	GIS Hardware & Software
3	Satellite Geodesy	14	Advanced Digital Mapping
4	Principles of GIS.	15	Professional Practice
5	Remote Sensing	16	Surveying & Allied Regulations.
6	Advanced Analytical & Digital Photogrammetry.	17	Digital Terrain Modeling.
7	Advanced Hydrographic Surveying	18	GIS Applications
8	Advanced Maths.	18	GIS Project Planning & Management
9	Advanced Map Projections & Co-ordinate Systems	20	Seminar
10	Geometric Geodesy.	21	Final Project
11	Physical Adjustment Computation.		

7. CONCLUSIONS AND RECOMMENDATION

7.1 Conclusions

The National University Commission (NUC) has directed all institutions offering surveying to modernise their curricula in line with the technological development. Some Universities have already complied with the instruction of the NUC. Similarly, the National Board for Technical Education has modernised the curriculum of surveying courses in Colleges of Technology and Polytechnics.

In Nigeria, the introduction of Geoinformation Technology is already making its mark. It promises to contribute immensely to the development and management of Nigerian resources, if properly and systematically handled. The development of a Nigerian Geospatial Information Infrastructure is a task that cuts across disciplines. The Surveyors are expected to play a key role and should therefore be prepared to undergo appropriate training as significantly contributing to the needed *capacity building.*

Periodic reviews of the academic programmes and curricula in Universities and Polytechnic offering surveying are necessary if such programmes are to keep abreast of new developments in the subject area. Such review is even more necessary as advances in computer hardware and software, digital and information technologies have revolutionised the techniques of spatial data acquisition and processing in the profession.

7.2 Recommendations

Departments responsible for training surveying personnel in Nigerian tertiary institutions should as a matter of priority, embark on a review of their curricula, in order to reflect geoinformation technology related courses, amongst others. However, the importance of such curricula review throughout the University and Polytechnic systems is so great that the choice cannot be left with each institution or department.

The NUC and the NBTE should continue to spearhead the review of the survey programmes in the Universities and the Polytechnics. After all, these are the bodies charged by law to define minimum academic standards in the universities and polytechnics respectively. The Surveyors Council of Nigeria (SURCON) also has a role to play in ensuring compliance by all institutions.

There is the need to mount an aggressive re-training programme for Nigeria's surveying personnel at all levels, so as to build up Nigerian Human Capacity for Geoinformation Technology. The institutions will not find this task difficult if they reach out through the Nigerian Institution of Surveyors (NIS) and SURCON.

Government should give education the right priority and make funds available to universities, polytechnics and all other relevant organisations and firms so that the necessary equipment would be purchased to facilitate the training being offered by these institutions.

Tertiary institutions should also look beyond government subventions for funding of geomatics education. They could for example seek for help from non-governmental agencies such as oil companies and international organisations.

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BIOGRAPHICAL NOTES

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Prof. Fajemirokun has a bachelor's degree in Surveying of the University of Nigeria, Enugu Campus and the Master of Science and Ph.D. degrees in Geodetic Science of the Ohio State University, Columbus Ohio.

Prof. Fajemirokun was one of the pioneer staff of the Department of Surveying at the University of Lagos where he has been since 1973. His higher degrees were in Geodesy (Celestial and Physical). He has been editor to the Map Maker, African Geodetic Journal and the Nigerian Journal of Engineering and Technology. He was national president of the Nigerian Institution of Surveyors 1992-1994. A Nigerian registered surveyor, he holds the Fellowship of the Nigerian Institution of Surveyors and the International Association of Geodesy. He is also a member of the Nigerian Institute of Management, and has held many administrative positions in the University, including the Deanship of both the Faculty of Engineering and the School of Postgraduate Studies.
Professor Fajemirokun, a former visiting professor at the California State University in Fresno, USA, is a Professor of Surveying at the University of Lagos and has several publications in learned journals and conference proceedings.

Mr. Olusegun Temitope Badejo

Mr. O.T. Badejo graduated from the University of Lagos with a Bachelor of Science (B.Sc.) degree in Surveying in 1992. He also obtained a Master of Science (M.Sc.) degree in Surveying, in University of Lagos in 1996. His B.Sc. Project was on Sea Level Variation in a Coastal Seaport, while his M.Sc. research work was on Tidal Prediction Using Least Squares

Approach. He is currently an M.Phil/Ph.D candidate and also a Lecturer in Department of Surveying and Geoinformatics, University of Lagos. He is developing a Mathematical Model for Simulating Oil Spill Positions on Nigerian Coastal Waters.

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