SPATIAL INFORMATION EDUCATION IN KENYA: EVOLUTION AND DEVELOPMENT OF GEOINFORMATION TRAINING PROGRAMMES AT JOMO KENYATTA UNIVERSITY

Dr. Moses K. GACHARI, Kenya

Key words: Training, programmes, curriculum, geomatic, spatial.

ABSTRACT

The paper gives an overview of spatial information education and its development in Kenya in general and Jomo Kenyatta University of Agriculture and Technology (JKUAT) in particular. The gradual development of Geoinformation training in the institution and current status of the programmes is discussed. The impetus of this growth, envisaged direction, expected impact on the practice of Geomatic Engineering and associated disciplines in Kenya and the Eastern Africa Region are explored. The anticipated challenges and strategies for meeting the same are discussed.

INTRODUCTION

Efficient management and utilisation of spatial information is central to coherent and sustainable spatial physical development. Spatial information handling is the core activity of surveying. FIG (1991) defines the surveyor as "a professional with the academic qualifications 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 land, the sea and structures thereon; and to instigate the advancement and development of such practices". The surveyor's role is thus defined to include the collection, storage, management, processing, analysis, modelling and dissemination of geospatial information. This involvement cuts across the whole spectrum of geospatial information activity.

In order for this professional to perform efficiently and meet the challenges of these vital tasks, sound training is crucial at various levels so as to impart the required skills and style.

Spatial information systems are multidisciplinary in nature. Various disciplines (including Surveying and Mapping based disciplines) are involved at various levels and from different perspectives. Other disciplines include, Planning, Engineering, Computer Science, Geography, Environmental Studies, Mathematics, Operations Research, etc.

OVERVIEW OF SPATIAL INFORMATION EDUCATION IN KENYA

Spatial information education is multi-disciplinary and covers a wide range of activities and various disciplines including, Land Surveying and Mapping, Land (Spatial) Planning,

Valuation, Land Management, etc. This paper dwells mainly on Education in Land Surveying, Mapping and associated disciplines.

EDUCATION AND TRAINING ON SURVEYING, MAPPING AND ASSOCIATED DISCIPLINES IN KENYA

A few institutions currently offer training in these disciplines in Kenya at varying levels. These include;

- The University of Nairobi
- The Kenya Polytechnic
- The Kenya Institute of Surveying and Mapping
- Regional Centre for Mapping of Resources for Development
- Jomo Kenyatta University of Agriculture and Technology

The University of Nairobi

The University of Nairobi has been offering training at Bachelor of Science degree level since the mid-1960s. The programme has variously been known as Surveying, Surveying and Photogrammetry at various times during its history. The number of graduates from this programme has typically ranged between 10-20 per year. Until the mid-1970s, the programme was the only one training Land Surveyors at degree level for the three East African States of Kenya, Uganda and Tanzania. The postgraduate programme has had rather a low-key existence, hardly maintaining an average rate of 1-2 graduate students at any one time.

The Kenya Polytechnic

The Kenya Polytechnic (Dept. of Surveying and Mapping) offers training in Land Surveying, Photogrammetry and Cartography at Diploma and Higher Diploma level. The Department also offers short courses in Geographic Information System (GIS).

The Kenya Institute of Surveying and Mapping

The Kenya Institute of Surveying and Mapping (KISM), established in 1994 offers training in Land Surveying, Cartography, Photogrammetry and Remote Sensing. Courses are offered at Diploma and Higher Diploma level. The Institute also offers short courses in Global Positioning System (GPS) and in GIS.

Regional Centre for Mapping of Resources for Development

Regional Centre for Mapping of Resources for Development, formally Regional Centre for Services in Surveying Mapping and Remote Sensing is based in Nairobi, Kenya. The centre serves the Eastern Central and Southern Africa. The centre offers short courses in Surveying, GPS and GIS among others.

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY: EVOLUTION OF GEOMATIC ENGINEERING EDUCATION AT JKUAT

The Institutional Evolution

JKUAT evolved from its inception in 1981 as technical college (Jomo Kenyatta College of Agriculture and Technology (JKCAT)). In 1990, the college was upgraded to a University College affiliated to the nearby Kenyatta University, becoming, The Jomo Kenyatta University college of Agriculture and Technology (JKUCAT). In 1994 the University College attained full-fledged university status through legislation (Jomo Kenyatta University Act, 1994) finally becoming, The Jomo Kenyatta University of Agriculture and Technology (JKUAT).

During this evolution period, the Department of Building and Civil Engineering which offered Diploma in Civil Engineering as well as a Diploma in Construction evolved to become the present Department of Civil Engineering which now offers degree programmes in Civil Engineering (B.Sc., M.Sc., and Ph.D.).

Along with Civil Engineering, other degree programmes were initiated in 1990 including Bachelor of Architecture, Bachelor of Science in Agricultural Engineering, Horticulture etc. These new degree programmes ran parallel to the then existing Diploma programmes.

EVOLUTION OF THE JKUAT GEOMATIC ENGINEERING PROGRAMME

Since inception of the Diploma and B.Sc. in Civil Engineering programmes, some form of surveying, mapping and related course units have been taught as part of the civil engineering programmes. The department has also provided services in surveying, mapping and related courses to other programmes in the University (Architecture, Agricultural Engineering, Horticulture, Construction). The department thus has had four (4) academic members of staff with Surveying/Mapping background who have been engaged in teaching and research in those and closely associated subjects.

In keeping with advances in technology and market demands, the surveying and mapping courses at JKUAT have been reviewed, updated and expanded along with other . In the last review (1997), three (3) additional course units were introduced as electives in the Civil Engineering programme. These are, Geographic Information Systems (GIS), Remote Sensing and Photogrammetry. The new courses are popular with Civil Engineering students, a number of whom have taken final year project topics from the courses.

IMPETUS AND JUSTIFICATION FOR INCEPTION OF THE B.Sc. IN GEOMATIC ENGINEERING PROGRAMME

- The increasing demand for Surveying, Mapping, GIS Remote Sensing and Engineering surveying services within the entire University partly provided the initial impetus and justification for establishment of a specialised Department or Institute that would be dedicated to the provision of those services.

- Only the University of Nairobi offered a closely related programme at degree level in Kenya at the time with approximately 15 graduates per year.
- There had been rapid expansion in surveying and mapping education at Diploma and Higher Diploma level in Kenya without a corresponding expansion at University degree level.
- Due to rapid advancement in space, computing and instrumentation technology, there was need for establishment of a modern programme in geospatial information technologies at a sufficiently advanced level to meet the current and future market needs of such specialised services in the region.

The proposal for establishment of the programme at JKUAT was then developed. The same was finally approved by the university in the year 2000.

THE DESIGN AND DEVELOPMENT OF THE B.Sc. IN GEOMATIC ENGINEERING PROGRAMME AT JKUAT

Background and Philosophy

Rapid advancement in computing, space and instrumentation technologies has had a tremendous impact on the practice of Surveying, Mapping and associated disciplines.
The advent of the information systems age has largely contributed to the demise of the traditional (analytical) approach to mapping practice and training. Our profession traditionally comprised of several fairly distinct disciplines of Land Surveying, Geodesy, Cartography, Photogrammetry, Remote Sensing etc. The prevailing trend is towards increased integration of the traditional disciplines. This has given rise to a "systems approach" in the treatment of geospatial information systems (Bédard et. al., 1988, Aduol et. al. 1995). Indeed, the future of the profession may depend on how efficiently it adapts to this approach.

New curriculums need to be developed so as to be consistent with this advancement and emerging trends. There is also need for existing programmes to be regularly reviewed and updated to make them relevant to prevailing societal market needs.

The JKUAT Geomatic Engineering programme is designed and developed against this background. Care has however been taken not to lose sight of some traditional practices, which may still be relevant especially in a developing country environment. The programme is designed so that the graduate is versatile, and with a capacity to practice across the board from the modern integrated information systems environment to the conventional/traditional as need arises.

PROGRAMME OBJECTIVES

These include;
- Provide a broad based education, intellectual development as well as analytical skills development so as to facilitate adaptability in a rapidly changing environment.

- Provide skills in application of modern space and computer technologies in handling tasks using an integrated information systems approach.
- Provide sufficiently sound skills in application of conventional methods and equipment that may be useful in some circumstances.
- Impart management, computing communication and entrepreneurship skills.
- Introduce sufficient background knowledge in key disciplines that are involved in spatial information handling to allow more efficient and productive interaction across disciplines.
- Introduce some advanced topics and basic research skills for possible postgraduate studies and research.

The broad aim of the above objectives is to train a professional who is not only well versed with the modern trends in geospatial information systems but also adaptable to the rapidly changing technologies and economic circumstances. This trend is characterised by an integration of traditional Surveying and mapping disciplines including Land Surveying, Geodesy, Photogrammetry, Remote Sensing, Cartography and GIS. This integration has been accelerated rapid advances in Computing, Space and instrumentation technologies.

Integration into a "systems approach" has resulted in more efficient collection, processing, storage, management, analysis and dissemination of geospatial information.
This emergent trend has long been observed (e.g. Bédard et. al. 1988, Aduol et. al. 1995). The reality of this trend is much more clearer today.

CURRICULUM DESIGN

In order to meet the cited objectives a well-trained professional should be well grounded with knowledge in some key areas of study, the content and proportion of which should be given due consideration in the curriculum design. The broad areas may be classified as;
- Basic sciences, mathematics and other foundation courses
- Social Sciences (including law) and communication skills
- Computing
- Core technical courses
- Entrepreneurship and management skills

The JKUAT B.Sc. Geomatic Engineering curriculum was designed following the "systems approach" and these general design guidelines.

THE CURRICULUM DEVELOPMENT

Based on the above general design guidelines, a five year programme of study was developed covering in all eighty (80) course units. Each course unit covers a duration of fifty hours on average. The number eighty (80) is a requirement for all Engineering programmes at JKUAT according to current regulations.
In general the first two years of study are taken up mainly by basic sciences, Mathematics, Computing, Social sciences, Communication skills, Electrical and Electronic Engineering Principles, Applied Electromagnetics and other foundation courses. In the third, fourth and

fifth years of study core technical subjects, management and other supporting courses are covered. These include; Land surveying, Geodesy, Cartography, Remote Sensing, GIS, Digital Mapping, Photogrammetry, Positioning, etc. In the second, third and fourth years of study, practical attachment/industrial attachment of at least eight weeks at the end of the academic years are offered. In the final year of study, each candidate carries out an independent project supervised by a member of academic staff.
The distribution of the eighty (80) units within the broad classifications is as follows:

Table 1: Distribution of the units in the five year programme

Classification	**No. of units**
Basic sciences, Mathematics, and other foundation courses	28
Social Sciences, Law, Communication	8
Computing	5
Core technical courses and Project	35
Entrepreneurship and Management	4

Notes:
- It should be noted that in the final year of study, candidates are offered limited electives (four) selected from the following groups; Geoinformatics, Geodetic Science, Engineering Surveying and Transportation, Real Property Management and Environment. This would imply that the unit distributions given on the table 1 is a general average of the actual situation.
- Though computing is reflected as five (5) courses, it should be emphasised that computing applications cover many other units including Geodetic computing, Computer Aided Cartography, Digital Mapping, GIS, Digital Image Processing, etc. Computing technology is thus central to many of the core technical units.
- The programme is designed for direct entry by fresh school graduates from the 8-4-5 (8 years basic primary education, 4 years high school and 5 years university) education system followed in Kenya. This student background coupled with the need to impart a broad based education, would account for the rather large proportion of units taken up by Basic Sciences, Mathematics and other foundation courses. However, for applicants who may have stronger backgrounds, provision has been made for suitable entry points into the programme, hence, reduced duration for completion of the programme.

NAME OF THE PROGRAMME

It is generally agreed today that the term Surveying no longer describes adequately, the nature, scope and practice of today's integrated form of the traditional disciplines of Land surveying, Mapping, Cartography, Remote Sensing, GIS, Photogrammetry, Geodesy, etc. – i.e. the fusion of the disciplines each of which deal with an aspect of geospatial information in different perspectives.

Various names have been adopted at various institutions at different times. The evolution of the names continues (internet websites-geomatic, 2001). This lack of a single term or set

of terms to describe the current status and reality of our profession may have contributed to the current apparent global identity crisis. The apparent identity crisis may impact negatively on the global image and marketing of the profession.

After considering various possible names, Geomatic Engineering was adopted as one that was appropriate for the new programme at JKUAT. The term captures the three core components inherent in the current theory and practice of our integrated disciplines and adequately describes possible future trends. The term geomatics is an acronym formed by "geo" (Earth), information and "automatics" (Bédard et. al. 1988). The "Engineering" extension which has in the past been used (as in Surveying Engineering), may be useful in conveying the "professional" aspect of our practice that may not be immediately obvious in the word "geomatics" , to the casual observer.

Programme Launch

The first group of students was admitted to the University in April 2001 marking the beginning of the programme.

THE CHALLENGES FACING THE NEW PROGRAMME

These include:
- Identity of the new programme in view of the current apparent global identity crisis
- Teaching facilities and personnel – need to expand, recruit and train personnel
- Employment opportunities for graduates

SOME STRATEGIES FOR MEETING THE CHALLENGES

These include;
- Promoting awareness with a view to expanding the market for geo-spatial information services
- Marketing the programme
- Collaboration with other institutions
- Legal interventions e.g. in the land registration process to take advantage of emerging technologies as recommended by local professional bodies (ISK, 2001)

It is envisaged that graduates of this programme will have a positive and perhaps revolutionary impact on the currently dominant traditional approach to surveying and mapping practice in the region. A change of this approach to one that is more consistent with modern trends in spatial information technology would in turn result in an expanded demand of geo-information services and more employment opportunities for the graduates.

CONCLUSION

An overview of spatial information education in Kenya with emphasis on Land Surveying and Mapping disciplines has been given. The evolution of spatial information education in this context at JKUAT in general and the B.Sc. Geomatic Engineering programme in

particular has been described. It is emphasised that the advent and rapid advancement in Computing, Space and Instrumentation technologies has had a tremendous impact on the practice of our profession and continues to do so. The distinctions between the traditional disciplines continue to be blurred. This has resulted in the integration of the disciplines into one wholesome discipline involved in among others, the collection, storage, management, processing, analysis, modelling and dissemination of geospatial information. A popular term for this all-encompassing discipline is Geomatic Engineering. If our profession is to survive and prosper in this information technology age, it is crucial that it adapts to this new reality.

The new reality in turn demands that training be consistent with the changing trends in technology and that mechanisms be put in place to ensure rapid adaptability of the training. This calls for regular review and updating of the curricula.

The new B.Sc. Geomatic Engineering programme at JKUAT has been designed and developed to be in tune with the systems approach that is consistent with the current trend. This has been done without loosing sight of some traditional practices, which may still be relevant especially in a developing country environment. Sufficient coverage of such possibly applicable techniques has been provided in the programme.

It is envisaged that the graduate of this programme will be broad based in outlook, skilled in modern technologies and adaptable to the rapidly changing technologies and economic circumstances.

REFERENCES

1. Aduol, F.W.O, Syagga, P.M., Mbatha, C.M., Mulaku, G.C., 1995. Education of a Modern integrated Survey professional: A model curriculum with special Reference to developing countries. Unpublished paper.
2. Bédard, Y, Gagnon, P, Gagnon, P.A., 1988. Modernizing Surveying and Mapping Education: The programs in geomatics at Laval University. Canadian Institute of Surveying and Mapping Journal, Vol. 42, No. 2, 1988, pp 105-114.
3. Institution of Surveyors of Kenya (ISK), 2000. Land Reforms in Kenya – The Institution of Surveyors of Kenya perspective.
4. International Federation of Surveyors (FIG), 1991. Definition of a Surveyor. FIG Publications, No. 2, Helsinki, 1991.
5. Internet websites- Geomatic. 2001.
6. The Jomo Kenyatta University of Agriculture and Technology Act, 1994.

BIOGRAPHICAL NOTES

Dr. Moses Karoki Gachari is Senior Lecturer and Coordinator, Geomatic Engineering Programme at the Department of Civil Engineering, Jomo Kenyatta University of Agriculture and Technology. He holds B.Sc. (Hons.) from the University of Nairobi (Surveying and Photogrammetry), M.Sc from the University of Oxford (1985) and Ph.D. from the University of Oxford (1996).

CONTACT

Dr. Moses K. Gachari
Department of Civil Engineering
Jomo Kenyatta University of Agriculture and Technology
P.O. Box 62000
Nairobi
KENYA
Email: civil@nbnet.co.ke