PAPER FIVE

" EDUCATION AND TRAINING FOR FUTURE PNG CARTOGRAPHERS "

by

CLEMENT TABUL - Principal Technical Instructor - Department of Survey and Land Studies. University of Technology, LAE.

and

WHYCLIFFE ANTONIO - Lecturer - Department of Survey and Land Studies. University of Technology , LAE.

Education and training for future PNG cartographers

by
C. Tabul (Principal Technical Instructor) and W. Antonio (Assistant Lecturer)
Department of Surveying and Land Studies
PNG University of Technology, Lae.

Abstract

From the colonial days through independence, and to this day, the surveying and mapping disciplines/professions have served Papua New Guinea long and very well. The results and products of their efforts provide the bases on which the activities of planning, development and management of the nations natural resources are carried out.

During the colonial days the surveying and mapping work was done by expatriates, and most of it may be considered as exploratory; measuring and inventorying, in an effort to gather general knowledge of the land and the resources on it.

Since independence, the PNG government has placed considerable emphasis on the development (education and training) of a national human resource base. In its quest to sustain the young and slow growing economy, the government has also depended heavily on the exploitation/development of the country's vast wealth of natural resources; the mineral and oil reserves in particular – the natural forests and agricultural produce, however, also make significant contributions.

The desire for an educated and professional human resource base, and push for the development of the natural resources, (bringing with it some of the latest in scientific and technological developments) are impacting and bringing innumerable changes to every facet of the PNG societies. The societies are becoming increasingly complex, and their needs and aspirations are likewise evolving to newer and higher dimensions. Accordingly the surveying and mapping needs would have changed considerably, and expectations of the users of surveying and mapping data would also be higher.

While the challenge of being continuously conscious of the changing needs of the society, and keeping abreast of technological advancements can be for the professionals both in the industry and in the educational institutions, the academics have the added responsibility of ensuring that training of the future professionals is relevant and useful both for the society and to the professions.

Hence this paper, a synopsis of the underlying principles pertaining to the review of the current cartography course offered by the Department of Surveying and Land Studies, at the PNG University of Technology, is in keeping to that responsibility and provides an overview of the directions of training for cartographers of the future.

1. Introduction

While it may be quite acceptable to begin to discuss what happens after resources have been developed, we are of the opinion, however, that the question of what happens before the resources are developed should remain our primary and immediate concern. How well we plan for the sustainable development and management of our resources depends very much on how best we are able to effectively and efficiently provide data and information relating to land and the natural resources on it to decision makers, planners and managers.

Papua New Guinea is an emerging young nation with considerable prospects for developments. Our economy is young and slow in growing, but we have vast wealth of natural resources which is largely untapped – although that is rapidly changing. There are several major developments on mineral deposits (copper and gold), with other metalliferous deposits elsewhere. Gas and oil exploration and exploitation is intensifying. Forestry and agriculture are significant contributors to the economy, and a few other sectors have potential for developments as well.

Any analysis of potential developments must always take into account the general topography and vegetation of the country. For any effective land use planning, the relief, climate, drainage patterns, and soil types, must be taken into account with other economic and social factors. Generally, the long-term planning and the whole development of the nation depends on the adequate surveying and mapping of the land and the natural resources on it.

Land alone is also one of the most important and controversial issues in PNG life, economy, and society, in which the role of the surveyor is clearly critical (Done, 1984).

This paper briefly reviews surveying and mapping efforts in PNG. It then suggests a coordinated effort by surveyors and cartographers to continuing the surveying and mapping activities in the country, as it examines the status of the cartography profession in PNG. Finally an overview of the underlying principles used in the curriculum review of the cartography course offered at the PNG University of Technology.

2. A brief review of the status of surveying and mapping in PNG

The pioneer surveying and mapping efforts were largely exploratory in nature (eg, Keleny, 1975). They were mostly for the purpose of gathering a general knowledge of the land, and to also seek out and identify potential resource development areas.

A more comprehensive account of the status of later surveying and mapping efforts in PNG is given in Done (1984). The account provides details of the control surveys, topographic mapping, hydrographic surveying and charting, and indications of reviews of other surveying branch activities like cadastral and engineering surveys; all of which were related to resource developments.

There are no known more recent reviews, however there are currently consultancy projects being undertaken by external consultants under the Land Mobilisation project to assist in identifying immediate surveying and mapping issues that need to be improved or addressed. This could imply that there has not been any national strategy towards coordinating surveying and mapping activities in the country, and that the activities occurring had been on ad hoc bases.

3. The professional status of Cartography in PNG

The establishment or refocussing and redirection of the national surveying and mapping strategies requires full participation of all the relevant sectors of the surveying and mapping industry. It also means that the knowledge of both professions needs to be combined to make a unified assault on the common goal – ie. surveying, mapping and monitoring of our environment.

Braund once advanced a case for the amalgamation of cartography and surveyors in PNG. He argued that the roles of measuring and recording of environments was once (historically) accomplished by one man – a cosmographer. And that in this age, we cannot return to the situation of the cosmographer, however, a combined contribution by the two professions is surely more effective (Braund, 1979).

In PNG, the cartography discipline was and is still being regarded by many as a minor branch of surveying, with a technician status. This is correct in many respects for it being a branch of surveying, as cartography in PNG can be said to have emerged from surveying. The training and education provided initially was for technicians, however that has been upgraded with awards of bachelor of technology degree in cartography in the middle of last decade at the PNG University of Technology. There has also being another development that is contributing to the elevation of cartography to gaining a professional status. In the government public servants structure, cartography is now being recognised to be on equal par with the surveying profession. It is emerging to become a sister profession in the surveying and mapping industry, as is the case in the U.S. of America (Rouch and Laphan, 1993) and Canada (Hashimi, et al. 1993). Cartography there is recognised as the discipline for presenting geographic information in both graphic and digital forms (Anderson, 1993).

4. An overview of the cartography course in PNG and the principles underlying the review of the current curriculum

The only formal cartography education in PNG is offered by the Department of Surveying and Land Studies, at the PNG University of Technology. Unlike surveying, its history is very short. It began in Port Moresby in 1967 under the auspices of the Department of Lands and Mines, and the Department of Forests. It then moved to Bulolo, than eventually to its current location at the PNG University of Technology in Lae. The levels of qualifications awarded have also evolved from only certificates through diplomas in survey drafting and cartography, to bachelor of technology degrees in cartography, whose first intakes graduated in 1986.

The cartography course has had minor structural and curriculum changes from time to time, but has yet to have a major review. The cartography section of the Department of Surveying and Land Studies has been working on a proposal of a major review that it intends to submit to the courses committee at the PNG University of Technology.

Following are the main underlying principles considered in making the proposed review to the course.

i) The course should reflect the major technological advances and their impact on the surveying and mapping professions, and the shift of role underway towards management and utilisation of information, away from the traditional role of collecting and storing information.

   This is in line with discussions from an international colloquium on surveying and mapping education in June of 1985 held in Canada. It was organised with the new challenge of "information revolution" in mind. McLaughlin and Gracie (1985) made two significant quotations that noted this new challenge. These are;

   > "innovations in computer science, telecommunications and information technologies have succeeded each other and have been diffused throughout the economy so rapidly that fundamental structural changes have started to occur." (The Science Council of Canada), and
   >
   > "The demand for more and more information about our physical environment presents an unprecedented challenge to the surveying and mapping industry. Our role, our tasks and our objectives will need to be re-assessed and re-oriented to the combined realities of new technologies and new demands for information. We will have to rethink our role to decide whether we should cling to the traditional role of collecting and storing information, or whether we should also become involved in the management and utilisation of information." (The Task force on the Surveying and Mapping Industry in Canada).

Although the above statements may have been made for a more developed country, and that less developed countries have to contend with additional constraints that hinder education programs. However, it must be noted that the technological advances diffuse quite rapidly into less developed countries like PNG, hence we must be prepared for the transfer of the technology.

ii) The education and training processes should be considered as being shared by the professions and the academic institutions, and that their roles complimentary towards common objectives.

In Australia and U.S. of America, the universities are modelled towards a more commercial industry-responsive approach, and the activities of industry and universities, are complimentary and aligned towards common objectives.

Hannigan (1992) suggests an economic analogy to education and training. That today education and training is like investment of capital at the start of an enterprise. And that the university/profession is a joint venture that has to compete in two markets, firstly to attract customers from the school leavers and secondly to be able to sell graduates to employers. The young people should be treated by the whole system, as clients.

Education and training can be seen as two separate yet integral facets of a preparation for economic activity. The University's role is in education, while training must be the direct responsibility of individual firms, as they can best determine what training in needed for their workers in today's rapid changing industry (Hannigan, 1992).

The principles of cooperation between educational institutions and industry, and the young people being considered as clients have relevance in surveying and mapping industry. As there is a decline in the intake of future potential surveying and mapping professionals, it could be considered as an incentive to attracting high quality candidates from school leavers that are interested, motivated and intelligent young achievers who can go through education and training in good time and start producing expected results.

iii) The course should equip the student to be able to adapt easily to the rapid technological changes in society which are having profound effect on organisational structure and the individual.

At present, most organisations, including those of cartography, are based on the hierarchical structure of bureaucracy, which is rigid and formalised. Within this type of structure each individual and group has their place and the specific task allotted. This structure can only endure while means, methods and techniques change slowly, while products and purpose remain relatively slow. A typical example is that of topographic map production. But the increasing flow of information and the accelerated demands for up-to-date knowledge are such that it must now be questioned whether society as a whole can now afford such time lags and still be able to make the necessary decisions for the wise management of the earth's resources, and the affairs of man.

There is a rapid rise of what executives call 'project' or 'task force' management. Here teams are assembled to solve specific short term problems, then disassembled and their human components reassigned. Unlike functional departments or divisions of a traditional bureaucratic organisation, which are presumed to be permanent, the project or task force is temporary in design. These task forces and other ad hoc groups are now proliferating throughout the government and business bureaucracies (Robertson, 1978).

The course is intended to be broad at undergraduate level, with many subjects common to students from related disciplines. This will expose students to working in multi-disciplinary teams and teach them to communicate effectively across discipline boundaries. Specialised courses or education will be offered at post graduate levels.

In essence the course is hoped to be one that is able to keep abreast with technological advances, and produce graduates who are relevant to the society and the industry, and employable. The proposed course review overview in this paper is submitted for your information and comments. Copies of the current and proposed course syllabus (course structure) are included as annex A and annex B.

References:

Anderson, K. E. (1993), "American Cartographic Association", in the Journal of American Congress on Surveying and Mapping, Vol. 53, No. 4, pp.199.

Braund, M. (1979), "A case for the amalgamation of Cartographers and Surveyors in Papua New Guinea", in the Journal of the Association of Surveyors of Papua New Guinea, Vol. 9, No. 4, pp. 23-25.

Done, P. (1984), "Development-related survey work in Papua New Guinea", in Survey Review, Vol. 27, No. 212, pp. 253-267.

Hannigan, B. J. (1992), "Strategies for the management of the education and training process", in the proceedings of the 34th Australian Surveyors Congress, Cairns, May 23-29. pp 423-429.

Hashimi, S. R., Krakiwsky, E. J. and Cannon, E. (1993), "Educating Surveying-Geomatics Engineers: U.S. and Canadian perspectives" in the Journal of American Congress on Surveying and Mapping, Vol. 53, No. 4, pp. 250-255.

Keleny, G. P. (1975), "H. D. EVE, Surveyor", in the Journal of the Association of Surveyors of Papua New Guinea, Vol. 5, No. 4, pp. 16-22.

McLaughlin, J. D. and Gracie. G. (1986), "Report on the 1985 Colloquium on Survey and Mapping Education", in the papers on Professional Education and literature, XVIII International Congress of Surveyors, June 1-11, Toronto, Canada, pp. 143-156.

Robertson, J. C. (1978), "Future shock and its application to cartography", in the proceedings of the 3rd Australian Cartographic Conference, Brisbane, October 4-6, pp 11-29.

Rouch, J. and Lapham, P. (1993), "Overview of the structure and operation of the American Congress on Surveying and Mapping", in the Journal of American Congress on Surveying and Mapping, Vol. 53, No. 4, pp.198.

PRESENT COURSES STRUCTURE

First Year (Common-Surveying/Survey Drafting)

First Semester	**Hours/Week**
SV 122 Computing Applications	2
LA 136 English for Surveying and Cartography I	3
MA 150 Mathematics IS	5
PH 100 Physics for Surveyors	4
SV 101 Surveying I	6
SV 131 Survey Drafting I	4
SV 191 Workshop I	1

	26

Second Semester

LA 136 English for Surveying and Cartography	3
MA 150 Mathematics IS	5
PH 100 Physics for Surveyors	4
SV 102 Surveying II	4
SV 122 Computing Applications	2
SV 132 Survey Drafting II	4
SV 192 Workshop II	2

	24

SV 151 Field Trips - Two Weeks

DIPLOMA IN SURVEY DRAFTING

Second Year

First Semester

SV 223 Spatial Information Systems	4
SV 222 Computing Applications II	2
SV 289 Map Projections	2
SV 231 Engineering Survey Drafting	3
SV 283 Map Compilation I	5
SV 286 Scribing, Type and Masks	4
SV 288 Cartographic Reproduction I	3

	23

Second Semester

SV 202 Surveying II	7
SV 284 Cadastral Survey Drafting	5
SV 207 Land Tenure	2
SV 290 Map Compilation II	5
SV 232 Photogrammetry I	5

	24

SV 251 SURVEY CAMP - Two Weeks full-time

SV 300 Industrial Training - two semesters full-time

BACHELOR OF TECHNOLOGY IN CARTOGRAPHY

Fourth Year

First Semester

SV 482	Cartographic Reproduction II	4
SV 483	Cartographic Design and Layout	5
SV 485	Thematic Mapping	4
SV 487	Production Control I	2
SV 486	Computer Assisted Cartography I	3
LA 441	Research Methods	3
SV 489	Mapping Project	1

		22

Second Semester

SV 489	Mapping Project	5
LA 436	English for Surveyors and Cartographers II	2
SV 490	Geodetic Computations for Cartographers	4
SV 496	Computer Assisted Cartography II	4
SV 492	Special Topics in Cartography	4
SV 488	Production Control II	2
SV 321	Introduction to Satellite Remote Sensing	3

		24

SV 452 MAP PRODUCTION OPERATIONS - Two Weeks full-time.

REVISED CURRICULUM

First Year (Common with Surveying)

Semester One		**Hours/Week**
LA 136	English for Surveying & Cartography	3 ex.
MA 150	Mathematics IS	5 ex.
PH 100	Physics for Surveyors	4 ex.
SV 101	Surveying I	6 ex.
SV 131	Survey Drafting I	4 ex.
SV 122	Introduction to Computing	2 C.A
SV 191	Workshop I	2 C.A
		26

Semester Two		**Hours/Week**
LA 136	English for Surveying & Cartography I	3 ex.
MA 150	Mathematics IS	5 ex.
PH 100	Physics for Surveyors	4 ex.
SV 102	Surveying II	4 ex.
SV 122	Introduction to Computing	2 C.A
SV 132	Surveying Drafting II	4 ex.
SV 192	Workshop II	2 C.A
		24

Second Year-Diploma in Survey Drafting

Semester One		**Hours/Week**
SV 289	Map Projections & Geographic Referencing	3 ex.
SV 283	Topographic Cartography	4 ex.
SV 286	Cartographic Techniques	4 ex.
SV 223	Introduction to Geog Info Systems (GIS)	4 ex.
MA 250	Mathematics IIS	3 ex.
MA	Programming with Basic	4 C.A
SV 297	Geography I	4 C.A
		26

Semester Two		**Hours/Week**
SV 202	Surveying II	7 ex.
SV 290	Thematic Cartography	2 ex.
SV 232	Photogrammetry I	5 ex.
SV 296	Computer Aided Cadastral & Eng. Drafting	3 C.A
SV 321	Introduction to Remote Sensing	3 C.A
MA 250	Mathematics II	3 ex.
MA	Database Processing	3 ex.
		26

Year Three

Whole Year
SV 300 Industrial Training

Fourth Year

Semester One		**Hours/Week**
SV 489	Integrated Mapping and GIS Project	1 C.A
SV 486	Digital Cartography	5 ex.
SV 422	Digital Image Processing	4 ex.
SV 487	Cartographic Practice and Management I	2 ex.
MA	Statistics for Cartographer	5 ex.
SV 483	Cartographic Design and Layout	4 ex.
LA 441	Research Methods	3 C.A

		26

Semester Two		**Hours/week**
SV 489	Integrated Mapping & GIS Project	5 C.A
LA 436	English for Cartographers & Surveyors	2 C.A
SV 496	Advanced GIS Theory	4 ex.
SV 488	Cartographic Practice and Management II	4 ex.
SV 492	Special Topics in Cartography	4 ex.
SV 498	Geography II	4 ex.
SV 406	Special Referencing Systems	3 ex.

		26

SV 452 FIELD WORK AND EXCURSION - Two weeks full-time