CURRICULUM DEVELOPMENT OF SURVEYING AND GEOMATICS PROGRAM IN ZIMBABWE

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ABSTRACT

For the past years the polytechnics and universities in Zimbabwe, which teach Surveying and Geomatics, have been focused on producing cadastral surveyors and technicians. This was so because of the historical background of the country. This focus on cadastral surveying as if it was the only discipline of surveying made the public perception of surveying narrow and significant efforts are required to broaden this perception. The impact of new technology has filtered through only slowly to the practising surveyors in the country. The practising surveyor seems more concerned with boundary surveying than any other activity. The degree and diplomas offered by the different institutions in the country are sometimes seen as simply padding out surveying curriculum in order to keep academics employed, teaching staff that no surveyor ever really uses. This concentration of the curriculum on one branch of the profession created a gape in the whole system. This article will discuss the survey education curriculum at polytechnic colleges and universities in Zimbabwe in an effort to direct the re-thinking of the curriculum contents.

1. INTRODUCTION

The history of surveying education in the country dates back to 1897 when the first triangulation in the country was carried out. The first surveyors in the country had to educate their survey hands so that they would carry out their work efficiently and effectively. Over the years the surveying education curriculum has been dictated by the norms of practice in the country. In Zimbabwe a lot of emphasis has been predominantly cadastral surveying since the first settlers arrived in the country. It is important however to note that education of surveying practitioners needs to follow that of the various disciplines involved in the total survey area. The public perception of surveying comes in two parts, the first is the professional surveyor and the second is the survey technician. The history of the development of surveying curriculum in Zimbabwe should also be treated along two lines, for the professional surveyor and the survey technician respectively.

2. BRIEF HISTORICAL BACKGROUND OF LAND SURVEYING IN THE COUNTRY

The history of Land Surveying (geodetic and primary triangulation) in Zimbabwe (then Southern Rhodesia) commenced some seven years after the occupation of the country by the Pioneers. In the year 1897 Mr. Alexander Simms started the chain of Triangulation eastwards from Bulawayo that lasted for four years covering the most populated and important part of the country at that time. Owing to various difficulties that had arisen Mr. Simms party was disbanded in 1901. In 1903 Dr. T. Rubin commenced the extension of the Thirteenth Arc of Meridian Northwards towards Lake Tanganyika from where Simms left off in 1901 south of the Zambezi. In 1906 a party under Captain H.W Gordon took to the field and by the end of that year had completed off fieldwork that covers the gap between Simms and the Transvaal System. The following years geodetic work in the then Southern Rhodesia was dormant until 1928 when the Trigonometrical Survey section of the Surveyor General's Department came into being. Until today geodetic work has been carried in the country with stoppages during the Second World War and a partial stoppage during the Zimbabwe Liberation struggle (1963-1979).

The profession until early 1990s was dominated by surveying for the security of land title. Infact the idea of the geodetic triangulation of the country by the settlers was to establish Geodetic Control so as to facilitate the title surveying of the then Southern Rhodesia. To quote one of the practising land surveyors Mr. R. A. Fletcher, June 1928, he introduced as a motion in the parliament "That, with the object of terminating the wasteful methods of the past and of ensuring permanent security of land title and the systematic mapping of this colony, the Government be urged to consider the necessity of taking initial steps to inaugurate a trigonometrical survey of Southern Rhodesia, and, where possible, the coordination, with this survey, all cadastral, topographical and other survey work which has either been performed, or is being carried on, under the Government Departments". As a result of the skewed perception of the profession towards cadastral work the history of the curriculum development in the country has also been inclined towards cadastral surveying to the disadvantage of other disciplines of the profession.

3. SURVEYING EDUCATION AT THE UNIVERSITIES IN ZIMBABWE

Until 1984 practising Land Surveyors in the country were trained outside the country and mostly in South African Universities. The University of Zimbabwe (UZ) surveying department was established in 1984 and admitted its first intake of six students in 1985.

The reasons and aims for the establishment of the department can be summarised as follows:

- Until 1980, the qualifications required for registration of land surveyors to practise in the country in terms of the Land Survey Act were not locally available. There was no local educational institution, which could provide the academic qualifications for students wishing to pursue other disciplines of surveying at degree level.
- The Council of Land Surveyors was particularly concerned with number of land surveyors who were being lost through death, retirement and emigration. These losses were not being adequately balanced with the replacement of qualified young men and women.
- The idea of establishing the department had received widespread support from international organisations such International Federation of Surveyors (FIG), and the Commonwealth Association of Surveying and Land Economy (CASLE). FIG supported the idea on the grounds that such a venture ensured proper services to the public and the maintenance of the status of professional surveyor in the country. CASLE at a seminar to review progress in national development programmes of seven commonwealth countries in Southern Africa region noted that the provisions of full survey services were hampered by manpower shortages. A manpower survey of the region carried out by Professor Denman showed a shortfall of 350 land surveyors in the region.
- The need for professional land surveyors in the provision of services for the development of rural and urban economies of Zimbabwe. Services were required in agriculture, title land surveys, mining and civil engineering works such as the survey of roads for the transport networks.

According to Dr F. N. Lugoe (1987) " the curriculum development for the courses offered by the department of Surveying was a slow process which covered seven (7) years". The first draft of the curriculum was made by the Education Sub committee of Survey Institute of Zimbabwe (SIZ) in 1980 to the Vice Chancellor of the University of Zimbabwe with the request to establish the department. There was a second draft in 1984, a third draft in 1986 and the curriculum was finally completed in 1987. The curriculum development had contributions from the following institutions in the form of consultations or from their syllabuses; FIG, University of Cape Town, University of New Brunswick, University of Toronto, Mississauga, University of New South Wales, The School of Surveying of the Institute of Technology in Stockholm, Survey Institute of Zimbabwe (SIZ), Zimbabwe Council of Land Surveyors and Department of the Surveyor General.

The contributions from the different institutions meant that the curriculum covered the most essential aspects of surveying. However the profession in the country developed at different rates in the various disciplines. The most emphatic development was in the cadastral surveying discipline, which as mentioned earlier was the backbone of professional development in the country. This development also influenced the teaching of the curriculum in the department of surveying. Up to 1996 most of the graduates from the department went into professional cadastral surveying. A few furthered their education or ventured into the other disciplines of the profession.

There were basically three (3) reasons why the profession allowed the dominance of cadastral surveying in the teaching of the curriculum:

- The were very few practising cadastral surveyors in the country, numbering 31 registered practising land surveyors in 1983 with most of them having reached retirement age, by the end of 1987 only 15 surveyors were left still practising in the private sector and 6 were with the department of the Surveyor General (Lugoe 1987)
- There were also many cadastral survey jobs on the market, because of the increased awareness among Zimbabweans of the need to have land title on their parcels of land.
- The prospects of high rewards in cadastral survey jobs proved to be one of the reasons students' preferred cadastral surveying when they graduated from the department.

In the early 1990s the department saw the global declining interest in traditional surveying involved with the transformation data from the real world into some kind of map. Interests on what happens to the information after the map has been produced took centre stage, the birth of Geomatics in the department. The University of Zimbabwe survey department was forced to re-think the contents of its survey curriculum and to strengthen some of the courses in the curriculum. A post graduate diploma which would lead to a masters degree in GIS and LIS was introduced in 1994 and had its first graduates in 1995 for the diploma level and in 1996 the masters graduates. In line with global trends in the profession the department changed its name to the Department of Surveying and Geoinformatics in 1997.

Although the department changed its name, some people in the country felt that the curriculum did not capture all they perceived as geomatics concepts. They felt that geomatics promises a much more professional and responsible role for what was currently called surveying. When Midlands State University was established in the year 2000 a department in

the Faculty of Science, the department of Surveying and Geomatics was founded. Its curriculum does not differ much from that at the University of Zimbabwe but merely compliment some of the modules. The major distinction is that the curriculum has more modules that deal with Geomatics and that students go for work related learning in their third year of learning. The work related learning period is to allow the students to blend the theoretical concepts learned at the college and practical skills in the industry. It also allows the industry to make an input into their future employee. Another interesting concept in the curriculum is the idea of flexible packaging. It allows students to shop modules from other departments at the university; these other modules are mostly from the departments of computer science, information systems and business management. The shopped modules are meant to compliment the modules offered by the department and at the end of the day produce a graduate with both academic skills in surveying and entrepreneur skills to start their own business. To date the new university have a student population of 75 Surveying and Geomatics students and have not produced any graduates. It is anticipated that when it does the graduates are going to make a difference in the survey profession in the country.

4. SURVEYING EDUCATION AT THE POLYTECHNICS

Following the trends in the survey profession in Southern Africa since 1897, there was a need to train technicians who would work with the professional surveyors. The training of technicians just like that of professional surveyors was done mostly in South Africa. The few who had been trained including the professional surveyors were used by the respective government departments to train their own people who would be certificated on writing some trade tests. These departments were the Ministry of Roads, the Surveyor General's Department and the National Railways of Rhodesia. The Harare Polytechnic Division of Construction Engineering established the department of surveying in 1969 following recommendations from the Southern Rhodesia Survey Institute, the Council of Land Surveyors and the different institutes who needed the services of qualified survey technicians. Survey technicians were required to complement the work of the few professional land surveyors in the country. The first intakes of 5 National Intermediate Diploma (NID) in surveying students were admitted to the institution in 1969.

After the independence of Zimbabwe in 1980, the new government decided to decentralise the training of technicians, which was done in Harare. Another department of surveying was established in Bulawayo at the Bulawayo Polytechnic. At first the Zimbabwe School of Mines that occupied the same buildings with Bulawayo Polytechnic's Division of Construction Engineering hosted the department. The department adopted the survey education curriculum exactly from the Harare Polytechnic and the two institutions centralised the setting and marking of examinations, which they have maintained until today. Although the two were running the same curriculum the training of technicians for cartography and photogrammetry remained centred at Harare polytechnic because of the limitation of personnel and equipment.

The surveying curriculum was structured in such a way that the students were supposed to be cadets and would spend the first term of the year on NID at the college, second term they would go back to their respective work places and third term was finished at the college (block release system). After NID the students were supposed to gain work experience for at least one year to proceed to National Diploma in surveying, the same system was applied to those who wanted to specialise in cartography and photogrammetry. One class was taken at the college at one time because of the limitations of staff and equipment. The curriculum was meant to train technicians for cadastral surveying, engineering surveying, cartography and photogrammetry. The dominance of cadastral surveying was also felt in the same way as the university education and hence most of the college graduates were from cadastral survey firms.

The curriculum was changed in 1988 to accommodate direct entry students who were fresh from high school and not cadets. Instead of the block release program the NID was done in one year and the students would go for at least one year of supervised work experience to proceed to the National Diploma. In 1994 the polytechnics curriculum was amended and a new name for NID was introduced, it became the National Certificate (NC) in Surveying. For an NC student to proceed to ND level, beside the one-year industrial experience, the student had to pass 6 courses including all the compulsory courses. For a student to graduate at ND level the student had to pass all compulsory course plus some elective courses.

5. ANALYSIS OF THE STUDENT INTAKE AND GRADUATE PROFILE OF UZ AND HARARE POLYTECHNIC STUDENTS

Statistics of student intake for Bulawayo Polytechnic and Midlands State University were not available at the time of writing this paper. Trends of the student intake from 1969 to 2002 are shown on Figure 1.

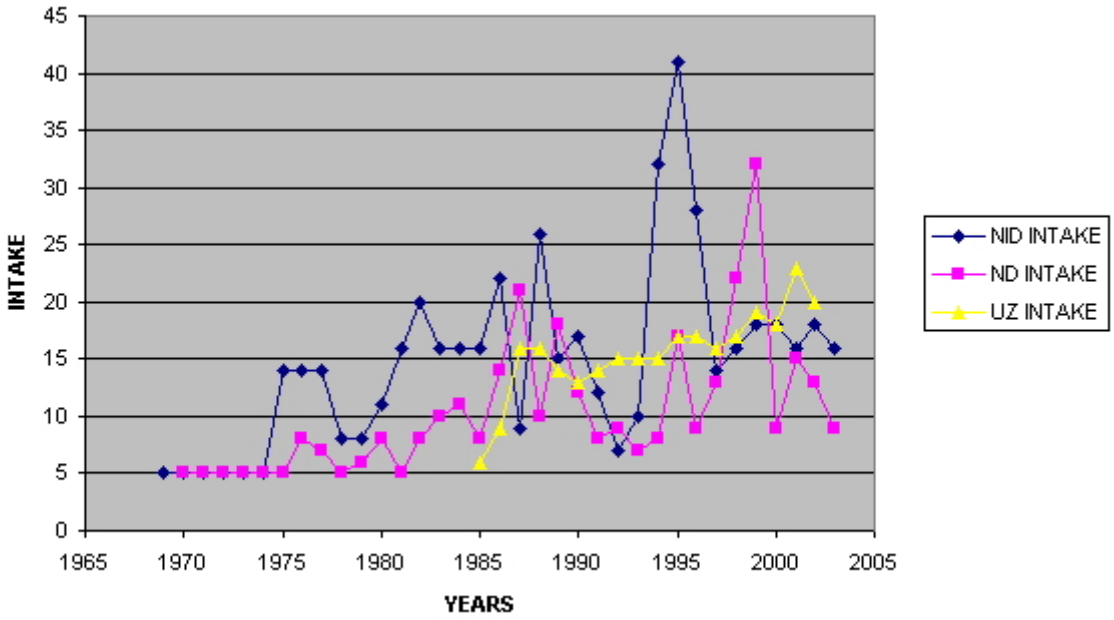

Figure 1. Trends in the intake of students UZ and Poly

There has been generally an upward trend in the intake of students. The upward trend could be attributed to:

- The general increase in the rural and urban economic activities from 1969 until 1994, which required the services of technicians and professional surveyors.
- The shortage of professional land surveyors in the country meant that some survey work, which was supposed to be carried out by the professional land surveyors, had to be carried out by technicians hence the rise in NID and ND intakes from 1969 to 1985.
- Generally there were high rewards in the profession and so it became a factor that draws students to the colleges.
- Between 1994 and 1997 there was a sharp increase in the intake of NID (NC) students because the Surveyor General was bringing in a lot of cadets and this coupled with the rise in awareness on the survey profession to high school graduates.
- The ND trend has been lower than that for the NID (NC) because the NID (NC) program was terminal especially for cadets who found no need to pursue the ND program and therefore not everyone who completed NID came back for the ND.
- For the University of Zimbabwe, most students felt proud to be associated with the new department and thus it was a measure of prestige to be associated with surveying.
- ND Graduates from the polytechnic choose to further their education at the university because of the payment associated with surveyors with degrees, hence the rise in the UZ intake.
- Surveying blends outdoor with office life. The survey profession has lot of fieldwork that is mainly preformed outdoors. This offered an ideal working environment to some survey students
- Influence from those in the field and carrier advisory teams brought some people to surveying.
- There has increase in number of high school graduates in the country and most students find enrolment at a collage as a preoccupation until they find something else to do with their lives.

The University of Zimbabwe Survey Department graduate profile is as shown in Table 1.

The graduate profile as indicated in Table 1 is not conclusive because of the following reasons:

- The graduate profile from 1988 to 1994 was conducted by a student who was doing a final year project Mr Mason Sibanda, and thereafter the department have not carried out another survey
- The author of this paper who graduated in1995 produced the profile from 1995 to 1997 by asking colleagues who were in the same class and those who were in classes behind.

Table 1.

YEAR	CADASTRAL SURVEY	ENGINEERING AND MINING SURVEY	PHOTOGRAMMETRY AND CARTOGRAPHY	ACADEMIC	GIS AND LIS	TOTAL
1988	2	0	0	1	0	3
1989	2	0	0	1	1	4
1990	11	0	0	0	0	11
1991	9	0	0	1	0	10
1992	6	1	0	1	0	8
1993	10	0	0	0	0	10
1994	10	0	0	2	1	13
1995	7	1		1		9
1996	7			1		8
1997	3					12
1998	5					16
1999	4					11
2000	3					14
2001						13
2002						8
Total	79					150

From 1997 to date the only data available was from Surveyor General's Office and cadastral survey companies who were conducted by the author using either personnel or telephone interviews

The general upward trend in the UZ students' intake has not matched with an upward trend in the employment of the graduates. By the end of 1996, 84% of the graduates were employed in cadastral surveying (64 graduates out of total of 76 graduates by the end of 1996). To date 53% are employed in cadastral surveying (79 students out of total of 150 graduates in 2002). Of the remaining 47% a few have gone into academic work, some into GIS and LIS and others are still looking for employment or are working in areas outside the profession.

The decline in the number of graduates who got employed in the field of cadastral surveying could be attributed to the following factors:

- There was generally a decline in the number of cadastral jobs in the country and therefore the once big market for the graduates was negatively affected
- Most survey firms had enough graduates who were still under articles and therefore they could not accommodate new graduates according to the Land Survey Act, not more than 2 land surveyors- in- training are allowed at a time to be supervised by one mentor.
- There was a rising interest in spatial data management (Geomatics) and some students could have moved into the new discipline although there is no statistical evidence
- The country's economy was not performing very well and there was a decline in the funds available for rural and urban economic activities which required land survey work
- The cost of employing a professional land surveyor was so high that most civil engineering and mining companies preferred survey technicians who were readily available from the polytechnic colleges.
- There was generally a decline in the activities of the Zimbabwe Council of Land Surveyors and the Survey Institutes of Zimbabwe who for long have been guarding jealously the interest of the profession. Incidences of bogus land surveyors carrying out survey work in the country had increased and in some cases local authorities were using town planning technicians to carry out professional survey work.
- The training of land surveyors-in –training was no longer professionally carried as laid out in the Land Survey Act. There was no longer a transparent time table for law examinations and as a result land surveyors-in –training was spending more than the stipulated time in training.

There has generally been an upward trend in the number of graduates who have gone into GIS and LIS, this could be derived from the increase in the number of consultations from the industry to U.Z survey department on spatial data management. There has been a further increase in the number of institutes and companies that have introduced departments and sections, which deal with management of spatial information in the country.

Until 1994 all polytechnic graduates were cadets and therefore there was a 100% employment of the graduates, the situations changed when direct entry students started to graduate, as there was no longer a guarantee from the employers for their employment. Collections of graduate profiles have not been a priority for the polytechnics and hence this information was not available at the time of writing this paper.

6. THE FUTURE OF SURVEY EDUCATION IN ZIMBABWE

There are several significant issues with which the Zimbabwean survey education has to deal with. These can be listed as follows:

- Judging from the historical developments, the challenge for academics and survey professional in the country is to educate the next generation of graduates to deal with the next wave of technology before it has actually appeared. Today, technology allows anyone with a modicum of intelligence to operate a total station, a GPS receiver or digital level. Computations are simple and in many cases you can buy a package that does all the work for you. To capture this new wave of technology, the survey education curriculum need to be refocused and therefore revisiting the entire curriculum is inevitable.
- The upward trend in the enrolment of students at all institutions puts a strain on the available resources. The shortage of equipment and qualified personnel is one of the greatest challenges that both institutions face. Most of the instruments need repairs and the remuneration offered by the colleges is not attractive. There is a big need to share these resources and an improvement on the remuneration of staff.
- The skewed approach to cadastral surveying as has been the case was mainly due to one discipline of the profession being allowed to contribute to the running of the curriculum. All stakeholders involved in survey education should be made responsible for the future survey education, probably a stakeholders workshop should be organised now.
- The wave of change that has affected the university curriculum should not spare the polytechnics. There is need for their curriculum to incorporate course that capture GIS and LIS concepts.
- The courses or modules taught at the polytechnics should be complementary to those offered by the universities. This will enable a polytechnic graduates to proceed to a degree within a short period of time. The current situation seems not to recognise the polytechnic graduate qualification. All students at the university are required to do the same number of course or modules and years at the university regardless of whether one has a diploma or not.
- The Council of Land Surveyors should standardise survey education of cadastral surveyors in the country. Graduates from the two universities should all be qualified to do articles according to the Land Survey Act. Currently the act recognise the University of Zimbabwe degree only.
- There seem to be no coordination in the different GIS and LIS organisations. There is need to formulate a body that should coordinate operations of these organisations.
- A body that used to run the affairs of photogrammetry and cartography seems to have died a natural death so did the Zimbabwe Institute of Surveyors. Such bodies should be revitalised if the survey education is to capture the global trends in surveying.
- The decline in the traditional employment market of college graduates (cadastral surveying) can only be addressed if the curriculum embraces the new technological developments.

7. CONCLUSION

In this paper, the discussion has focused on the historical development of the survey profession in the country from 1897 when the settlers first came into the country to the present status. Events in the survey profession have been focused on cadastral surveying for a long time and this have influenced the development of the survey curriculum on all academic institutions in the country. It is hoped that the coming of new institutions like Midlands State University will a provide field of competition with existing institutions in terms of producing the best graduates which the profession will benefit from. The new wave of technology promises to force even more re-thinking of what we are trying achieve in the survey profession as efficiently and effectively as possible.

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