

CHALLENGES FACING EDUCATION AND TRAINING OF CONSTRUCTION INDUSTRY LAND SURVEYING PERSONNEL

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Abstract

This paper focuses on the requirements of land surveying (LS) education and training for effective delivery of reliable, affordable and comprehensive LS services to the construction industry (CI) in Tanzania in the new Millennium. It highlights the background of LS and its role in the construction industry. This is followed by exploring the factors associated with education and training which affect LS practitioners from fulfilling their obligations in the industry. Subsequently, the paper analyses the challenges facing education and training of geomatics undergraduate students at Ardhi University in Dar es Salaam, and the hurdles they encounter as graduates in the practice of their profession. The outcomes from the discussions are expected to expose challenges to improve policies and regulations governing provision of LS services in the CI. Remedial measures to mitigate these challenges are also proposed. Regular updating of education and training programmes, practising according to the rule of law and professional conduct, developing a culture of tackling existing and surfacing problems, and using the national and first language of Tanzanian society, that is Kiswahili, in teaching, could facilitate and sustain development of academic and professional needs of LS in the CI. The regular updating though, should match the current and prospective socio-economic and technological advancements.

Throughout this paper, the words Land Surveying (LS) and geomatics have the same meaning and they are used interchangeably. The term however, appears more frequently than geomatics because it is the mostly used in the CI in Tanzania.

Key words: *challenge, land surveying (geomatics), education, training, construction industry*

1.0 INTRODUCTION

1.1 Evolution of Land Surveying

The history of Land Surveying (LS) has revealed its dynamism with time. Originally, the discipline was embedded in mapping, surveying, photogrammetry, hydrography, and cartography. Its execution by then relied on conventional equipment which include magnetic compasses for azimuth determination, chains for distance measurement, theodolites for angles observations, facet machines and logarithmic tables for computations, and aeroplanes for taking aerial photographs. There were also sounding rods and sextants for offshore (water-bodies) hydrographic surveying.

The invention of Electromagnetic Distance Measurement (EDM) equipment using infra-red radiation, and microwave Tellurometers, digital theodolites, echo sounders, and electronic calculators revolutionised surveying operations. The speed and quality of data collection in the field and processing in the office improved tremendously. Today, these types of instruments have been superseded by electronic technologies. Electro-optical instruments such as Total Stations, Remote Sensors, Global Positioning System (GPS), Terrestrial and Airborne Laser Scanning, Computer Hardware and Software, have changed the LS operations and its definition to geomatics. While LS is known as geomatics, surveyors are referred to as geomaticians.

With all the sophistication of the modern instruments across-the-board, they are still limited to work independently under certain conditions. For example; the GPS receivers cannot receive satellite signals for accurate positioning under non-open skies. Performance of laser scanning technology is affected by the surface reflectance. Therefore, the collection of data in the field requires a strategic mission planning that incorporates conventional technologies prior to embarking on the task.

Nevertheless, the modern technologies are still expensive for practising surveyors in the third world countries including Tanzania. The price of this equipment for data collection, processing, storage, management, analysis, modelling, retrieval, and dissemination is quite high. However, with this new types of equipment, efficiency of LS services has improved dramatically. These improvements have extensively expanded the scope of the tasks of surveyors. That is why surveyors worldwide believe that the term LS does not represent adequately their professional activities. They have thus opted for the term geomatics instead.

Currently, in Tanzania, specific LS components are taught in various academic programmes such as water, agriculture, mining, forestry, lands, marine, and civil engineering. However, in Tanzania, the institutions specialized in training in LS programmes are three. The Ardhi Institutes in Morogoro and Tabora offer diplomas and certificates respectively; while the Ardhi University (ARU) in Dar es Salaam offers a four year undergraduate and post-graduate degree programmes.

The challenges of development of LS education and training in Tanzania are many. First, is the status of socio-economic development of the nation. Second, is the culture of not creating and sustaining professional development opportunities, handling and forecasting forthcoming challenges by LS stakeholders. Finally, is the use of English language in teaching geomatics at all levels of certificate, diploma and degree programmes instead of using the national language of the Tanzanian society, namely Kiswahili as a medium of instruction.

1.2 Definitions of Land Surveying Versus Geomatics

Some traditional Land Surveying (LS) higher learning institutions have changed their LS programmes to geomatics or have integrated them with other names. Today, undergraduates at Ohio and California States Universities in the USA, and the University of Calgary in Canada offer Bachelor of Science (BSc.) in Geomatics Engineering; the University of New Brunswick in Canada, offers BSc. in Geodesy and Geomatics Engineering (Gachari, 2004). In Tanzania, the former department of Land Surveying at Ardhi Institute and the then University College of Lands and Architectural Studies (UCLAS) has expanded to become a School of Geospatial Sciences and Technology of Ardhi University. The school offers Bachelor of Science (BSc.) in Geomatics.

Apart from these changes, different literatures define LS discipline differently but with retention of the core concepts. Schofield (2007) for example, defines it as “the science of determining position, in three dimensions, of natural and man-made features on or beneath the surface of the earth”. Engineers on the other hand, take LS as “the process of measuring lengths, height differences and angles on site either for the preparation of large-scale plans or in order that engineering works can be located in their correct positions on the ground” (Uren, 1994).

Similar to LS, the term Geomatics is defined differently but with insignificant difference in the main points. Melbourne (2008) for example, defines geomatics as an art, science and technology “concerned with measurement, representation, analysis, management, retrieval and display of spatial data concerning both the Earth’s physical features and the built environment”. The definition recognises that geomatics is within the fields of mapping sciences, land information system and management, geographic information systems (GIS), two dimensional (2D) and three dimensional (3D) features visualisation, geodesy, photogrammetry, remote sensing and surveying. In addition, UCLAS (2006) and Gachari (2004) on their part share the idea that geomatics is the field of digital spatial data acquisition, analysis and visualisation on the computer screen or on paper.

Although the cornerstone of geomatics is LS, some people argue that, the technological changes which have occurred around LS are so enormous that continuing to use the term “LS” for the discipline is unjustified. For the purpose of this paper, it is argued that the term geomatics is merely a more detailed coverage of land surveying of today. The details include improvements of the former LS activities and modern technologies currently in application. The argument is built up further by the fact that those practising geomatics are the very ones who used to practise LS. Hence, the author finds it difficult to differentiate between the two, and instead considers geomatics as simply a new terminology for LS.

2.0 LAND SURVEYING IN THE CONSTRUCTION INDUSTRY

2.1 Importance of Land Surveying in the Construction Industry

Land surveying services are the basis for taking off an implementation of any component of building and civil engineering works. These works are found in almost all public and private sector institutions. The sectors include agriculture, forestry, fisheries, defence and security forces, transportation and communication, production, energy, aviation, lands and mapping, statistics, research, exploration and construction. Therefore, the irrigation channels are built in the agricultural sector, hydropower dams in energy, channels dredging and docking wharfs in marine, tunnelling and shafts excavations in mining, high precision installation of machines in industrial production, just to mention a few, do require high quality surveying services. The identified land surveying activities required by the construction industry include the following:

- Selection of appropriate maps for preliminary study of the construction viability
- Identification of location of the construction site for clearance
- Production of topographical maps for landscaping, architectural and engineering designs
- Setting out of horizontal and vertical critical points for erection of structures, calculation of earthwork quantities, and checking for approval the completion and/or the beginning of a particular task, e.g. filling and cutting levels in route projects
- Fixing and checking the alignment of the buildings and floors of rising structures as per specifications
- Preparation of as-built plans of the constructed infrastructures for proper management.
- Monitoring the magnitude and behaviour of deformation displacements of the structures as surveillance mechanism of preventing fast deterioration and disastrous occurrences; e.g. collapsing of structures.

In the Construction Industry (CI), the Land Surveying (LS) inputs need to be made available competitively whenever they are required for undertaking professional engineering works and providing professional engineering services (ERA, 1997). However, these LS inputs need to be abundant and easily available, of high quality, efficiently delivered and affordable. This is possible only if they are offered by professional land surveyors (PSRA, 1977). In practice, these requirements are hardly achievable. They are hampered by unimpressive social-economic progress of our nation, and partial adherence by professionals on the Laws and regulations governing the execution of construction industry activities. The occurrence of these shortfalls is related to various challenges.

2.2 Challenges of Land Surveying in the Construction Industry

In Tanzania, land surveying profession is almost dormant, but with retarded growth. It is unpopular among most of the stakeholders of the construction industry. Most people rarely seek for its services and/or are unaware about its activities. Unfortunately, those who are aware, keep on violating its Laws and regulations unquestioned. The number, size and capability of LS firms are also too small to employ a substantial number of graduates. It has also been found that most graduates of LS are engaged or involved in non-LS activities. Furthermore, surveyors are hardly invited to attend seminars (short courses, etc) organised for engineers, architects and quantity surveyors. It is difficult to find surveyors appointed in probe teams on disastrous occurrences. Besides, LS does not appear among the professions which their skilled and qualified practitioners offer “consultancy services” (PPR, 2005, page 215).

In the construction industry, Land Surveying (LS) tasks are commissioned to and carried out by non-surveyors instead of professional surveyors. Execution of these tasks is still carried out using old technology as the modern instruments are few and expensive to buy or hire particularly by the existing offices which are relatively small. Furthermore, the profession is still lagging behind in researching for exploitation and exploration of abundant new areas of practice. They include the following:

- Surveys for utility services underground and above, and within structures; e.g. power, sewerage, telephone, and water distribution/supply networks
- Surveys for precise installation of industrial machines
- Surveys for determination and monitoring deformation and displacements of structures
- Hydrographic surveys for preparing navigation charts for exploitation of marine resources
- Application of Global Positioning System (GPS) in deformation monitoring, boundaries demarcation, and setting-out on site

- Application of laser scanning in mapping features extracting and monitoring deformation of existing structures.

As it has already been mentioned, LS has application in infrastructure facilities of both the government and private sector institutions. However, the professionals in this area have not been active on critical matters of national interest. For example; their contribution would have been very crucial in probing the causes of the train derailment in Dodoma in 2002 which killed hundreds of people. The causes of the accident could have been caused by inconsistency and inaccuracy in the geometrical parameters of the rails against the designed parameters, which include alignments, slopes, and super-elevations. Non-professional LS is also a potential cause of collapsing structures (Ambogo, 2008). Frequent blackouts due to low water levels in the hydro-dams also need hydrographic surveying to determine the nature of dredging to increase the depth and eventually the capacity of the dams. Land slides and earthquake occurrences in tectonically active areas, especially around the rift valleys, could be predicted by LS techniques to foresee disastrous consequences.

2.3 Effective Communication Skills

Land surveyors face problems associated with communicating effectively, verbally and in writing to help them in marketing and safeguarding their works and welfare. Therefore, their education should support subjects and assignments which advance such communication skills. Poor communication in English by LS students is associated with specialization in science and technical subjects' during their secondary school education. The students with poor English are unable to follow instructions during their lecture and practical sessions.

In practice, cadastral surveyors present survey reports to the Directorate of Surveys and Mapping (DSM) in a formatted Survey Form No.17 (SF 17). Reporting by completing SF17 facilitate 'Examination or checking" done by the DSM as it ensures that all necessary areas for reporting are covered. On the other hand, it denies surveyors the opportunity to report on the project background, challenges encountered, and thus to exercise and improve their communication skills. Some surveyors present only data collected and processed without written reports to other report recipients. Presentation of reports written freely provides training in communication skills.

3.0 LAND SURVEYING EDUCATION IN TANZANIA

3.1 Land Surveying Programmes and Enrolment

Currently, Ardhi University (ARU) runs geomatics programmes in its School of Geospatial Science and Technology (SGST) from the levels of undergraduate to post-graduate. The under-graduate programmes offer Bachelor of Sciences degrees in Geomatics, Geoinformatics and Geodetic Sciences. On the other hand, post-graduate programmes offer the following specialities:

- Technologist Diploma in Geoinformatics (GFM4)
- Postgraduate Diploma in Geomatics
- Master of Science in Geomatics (by thesis only)
- Master of Science in Geomatics (by coursework and dissertation)
- Ph.D in Geomatics

The undergraduate programmes take four years of course work. While the fourth year incorporates dissertation work. Details on the programmes and facts data on the SGST development trend are given in UCLAS (2006) and ARU (2007). The challenges facing Land Surveying (LS) education for the Construction Industry (CI) are the same as those facing LS academic programme as a whole. The extract from ARU (2007) records identifies these challenges as follows:

- To increase enrolment
- To offer programmes relevant to the needs of the construction industry
- To introduce programmes that cover dormant and newly developing areas in the construction industry
- To improve teaching resources

3.2 Raising the Number of Applicants in Geomatics Programmes

In 2006/2007 academic year, the School of Geospatial Science and Technology (SGST) had 149 students which is an average of 37.3 students per intake (ARU, 2007). The number of female students dropped consecutively to four (4) in 2006/07 from 13 in 2002/03. The percentage of female students against male applicants also dropped from 10.2% in 2002/03 to 2.7% in 2006/07. According to the Directorate of Postgraduate Programmes, 60 students out of 112 applicants have been enrolled in the 2008/09 academic year. This enrolment has almost doubled that of 2006/2007 due to the improvements in teaching resources including number of lecturers, survey equipment, and physical space. However, this intake has accommodated only 50% of the applicants.

One of the potential ways of increasing the number of applicants is to ensure that academically potential students get interested and apply to study Land Surveying (LS) courses. (Kennie, 1995). This promotion of interest should go in tandem with building up the teaching capacity to accommodate as many qualified applicants as possible. Marketing LS programmes and future prospects is therefore, very crucial for attracting potential students who now join other programmes such as engineering, accounting, information technology and medicine.

Availability of such students also needs sustained efforts to encourage primary and secondary school students, especially females, to pursue mathematics and science subjects. Currently, enrolment at SGST demands two principal passes in Mathematics, Physics, and Chemistry or Geography or Biology for Form Six Secondary Education, or equivalent qualifications. This fear continues to haunt students already enrolled in the programmes so that they refrain from pursuing LS programmes based on higher mathematics/calculus and science subjects. Such fear needs to be addressed for the purpose of making improvements. Otherwise, SGST cannot attract more students and retain them in such programmes which are important to the activities of the Construction Industry.

3.3 Land Surveying Prospects

The number of applicants in the geomatics programmes is likely to increase if the future of Land Surveying (LS) profession guarantees employment with attractive remuneration packages. At the moment permanent employment for geomatics graduates is difficult. LS firms are few and small in size. Today, there are less than 40 firms, most of which are one man-run or two men-run based. Apart from this, most of the large and small construction and consulting engineering firms in building and civil engineering works hardly employ graduates whenever vacancies exist. These engineering firms employ professional LS services on contract basis for specific projects. Besides, when they need surveying services, they opt for LS technicians and sometimes for on-job trained personnel, so as to minimize costs for the services. Such a phenomenon can compromise the quality of land surveying services. This scenario is rampant despite the fact that the laws and regulations governing the procurement of consultants prohibits such malpractice. Even when the professional surveyors are the ones approved by the tender board (Ambogo, 2002), they are not engaged during the execution of the projects. Prevention of this malpractice will therefore, prevent LS intruders and thus create employment opportunities for the professional surveyors.

Improving the quality of land surveying services will increase the confidence of LS clients. This situation will also enable the professionals to earn justifiable income from their profession (Lugoe, 1996). The gains could be invested to improve the capacity of LS firms to engage more professionals and trainees. The inputs of the National Council of Professional Surveyors (NCPS) and Institution of Surveyors of Tanzania (IST) are needed to curb the exiting malpractice. These institutions have the obligation to work in collaboration with other professional institutions like Public Procurement Regulatory Authority (PPRA), Contractors Registration Board (CRB), Engineers Registration Board (ERB), Architects and Quantity Surveyors Registration Board (AQRB) to achieve their objectives.

Remunerations should be adequate and justified so as to take into account of harsh environmental conditions of practising field surveying. The improved conditions might entice and motivate land surveying graduates to work with satisfaction on their profession and deliver quality services to the construction industry. Currently, the wages are low and ignore hardships and dangers that surveyors are exposed to. They include long walking, severe sun heat, air pollution, high winds, rains, wet/muddy swamps and wetlands, climbing hills and mountains, sailing in deep waters and against high-currents, and facing dangerous wild animals.

3.4 Teaching Resources

The institutions offering courses in Land Surveying (LS) need to device viable teaching modules, and equip themselves with adequate teaching resources. Theory and practical sessions require guidance of qualified and competent lecturers and tutorial assistants (TA). Timely employment of young and potential tutorial assistants could sustain the capability of academic staff in running the LS programmes. These youngsters however, must be educated further to become future replacements of their retirees' counterparts. The demand for employment of TAs is high in order to maintain and/or improve the ratio of 1:92 for academic staff to students (ARU, 2007).

The libraries and a bookshop ought to be fully stocked with various quality collections of LS literature. Currently, LS books are expensive. Even the international edition books which are usually intended to be sold in developing countries are equally expensive to Tanzanians. Supplement of this shortage of books is digital technology using internet. However, accessibility to such technologies is a challenge to most Tanzanians.

Education is also affected by the high prices and maintenance costs of modern technological equipment and facilities needed for the teaching of students, operation and maintenance costs of air-conditioned rooms/stores; computer hardware, LS software and computer viruses; and total stations and GPS instrument sets are high. Efficiency in teaching and learning is also affected by power supply fluctuations in our homes and offices, classrooms and laboratories. This is because; the new technological operations are power dependent. Even field equipment like total stations and Global Positioning System (GPS) batteries must be charged in order to use them on site. Power fluctuations however, damage the batteries and thus shorten the lives and operational time of the equipment.

Experienced and skilled LS technicians are necessary in ensuring sound welfare of survey equipment, assisting students during practicals, servicing and repairing defective instruments. Availability of these technicians is expected to facilitate teaching and safety of equipment from unnecessary damages, thereby prolonging their lifespan. Currently, the services are offered at ARU's laboratory, the only one in the country. Otherwise, a nearby optional laboratory is the Regional Centre for Mapping of Resources for Development (RCMRS) in Nairobi, Kenya.

3.5 Language of Instruction

Kiswahili which is a national language for Tanzania is used in the Parliament Assemblies more frequent than any other language. It is the medium of communication between people of different tribes. All subjects except English, in the seven years of primary schooling, are taught in Kiswahili, as opposed to the following four and two years of ordinary and advanced levels of secondary education up to the university level, whereby English is the medium of instruction. Likewise, all subjects in LS degree programmes are taught in English. The transition from learning in Kiswahili in all subjects to English and vice versa, have a lot of side effects to the academic performance and professional progress of the undergraduates and graduates respectively.

Sharma (2007) reports this challenge from Spanish speaking Civil Engineering students and lecturers at the University of Puerto Rico (where Spanish is more prevalent than English). He elaborates the challenges by stating that “the challenge is that a student may not fully understand a test question, or a video conference, or a textbook, and therefore won’t do as well academically; although, intellectually he/she has the capacity, but it will not show on his/her grades.” He acknowledges that students do not understand well their lecturers who also in turn are unable to clearly convey complex ideas related to research and scholarly subjects. He further discloses the following issues:

- Students spend most of their time translating vocabularies
- Students find problems in communication, both in writing and speaking
- Ph.D. holders in sciences and engineering specialities cannot construct a cohesive sentence in English

Many contradictions arise from using English in teaching in Tanzania. One, to most Tanzanians, English is not even their second language. Two, non-primary school students, taught in English still communicate with their fellow students, lecturers in Kiswahili. This happens after and sometimes during the class sessions and when a student visits her/his lecturer’s office for tuition on a specific problem or for consultation on their dissertations. Three, Tanzanian professionals and academic staff hold their respective meetings in Kiswahili. These scenarios indicate that students and their lecturers find Kiswahili more convenient (fluent and understandable) to communicate in. Hence, it is the sensible language for teaching in Tanzania. Thus, teaching in Kiswahili should produce graduates who are capable of understanding, discussing and innovating LS issues in depth for the development of the construction industry.

Teaching in English reduces the comprehension of students, since they think in their first languages and write in the second language. Such students are on the disadvantage of acquiring effective learning (Sharma, 2007). Primarily, lecturers convey partial information that is partially understood by students. With this trend, there will never be many capable LS personnel for the CI development to compete in the global market. We should learn from experts from non-English speaking countries working in construction industry projects in Tanzania. They are able to deliver successfully though they communicate through interpreters, sketches, calculations, signs. They are definitely very poor English speakers and writers but very good experts in bridges, buildings, and highway engineering which are the objected deliverables in CI undertakings.

Developed nations worldwide, use their first languages in teaching. Canada, Austria, Belgium, and few others, use more than one language. In any case, nationals are allowed to use their effective means of communication to deliver and receive information. Tanzania should therefore imitate these countries and use its first languages, Kiswahili, in teaching. There could be a strong correlation between a national development and its use of first language in teaching. Looking at developed countries like Russia, China, USA, and Japan, apart from having their own languages, each has its own lettering system. In the case of Tanzania, since Kiswahili lettering system is already foreign, the teaching language should not be foreign.

For education to be helpful to the national development, it has to be shared among people in that society. The use of English therefore, excludes the majority of Tanzanians from their obligatory contribution to their national development. Most Tanzanians never study beyond primary school and those who did cannot communicate comprehensively in English. This defect therefore, to a great extent curtails the application of their experiences needed by experts for national development. Using Kiswahili at all levels of our national education should not be a matter for discussion but for immediate enactment. Ongoing discussions and failure to reach consensus show the existence of differences in culture among the Tanzanian people and thus failure in resolving matters of national interest.

4.0 TRAINING LAND SURVEYING FOR THE CONSTRUCTION INDUSTRY

4.1 Training Opportunities

As mentioned in this paper, graduate surveyors do not find employment opportunities easily due to a number of impediments. Unemployment affects their world practice to gain experience and skills development. Those few who find employment also lack supervision from reliable, experienced and competent surveyors. Another setback in training is due to using inferior and out-dated LS instruments. Conditions for registration as registered surveyors and specifications of surveys execution are impractical and thus difficult to fulfil under normal circumstances. The Public Procurement Regulations (PPR) (2005) on the selection and employment of consultants exclude LS firms from bidding for Construction Industry (CI) projects.

Consequently, surveyors become employed by the bid winners who are employed by the project clients. This employment by the bid winners rather than the client is likely to affect performance of LS practitioners in executing construction industry (CI) works.

4.2 Malpractice of Construction Industry Stakeholder Bodies

Training of Land Surveying (LS) professionals in the Construction Industry (CI) has suffered whenever professional bodies and major stakeholders of the local CI such as National Council of Professional Surveyors (NCPS), Engineers Registration Board (ERB), National Construction Council (NCC), Public Procurement Regulatory Authority (PPRA), Contractors Registration Board (CRB), and Architects and Quantity Surveyors Registration Board (AQRB), practice contrary to the enacted Laws and Regulations governing the activities of the construction industry. Generally, these Acts have to do, with other things, regulate and monitor standards of conduct and activities of their respective professionals and firms.

Section 19 of PSRA (1977) for example; is violated since individuals and institutions continue to hire non-surveyors to offer services restricted to professional surveyors. Though the hiring and hired entities are both committing an offence, usually punitive measures are not taken against them. Likewise, Section 14 of ERA (1997), restrict employers from engaging unregistered engineers in place of professional engineers. However, professional engineers and engineering firms continue to employ non-professional surveyors contrary to the requirements of the existing laws and contract agreements. It could be possible that LS professionals are not employed in order for their employers to save money by paying little wages and professional fees to non-surveyors. Nevertheless, this behaviour affects the built infrastructure facilities to be of substandard, expensive, and unsafe.

Some of the clauses of the Public Procurement Act No. 21 of 2004 and its Regulations of 2005 also have negative impact on the performance of Land Surveying (LS) services in the Construction Industry (CI). The Act and Regulations do not allow LS firms (not invited) to bid for the CI projects similar to their counterparts; i.e. architectural, quantity surveying, and engineering firms. Acceptance of names of individual LS professionals in the technical proposals of the bidding firms has lead to the employment of LS practitioners by these firms. This situation has to a great extent denied the LS professionals and firms the opportunities to practise fairly and freely to gain experience and a living from their profession (Lugoe, 1996). Losses incurred by the professional surveyors due to the Act and Regulations are associated with many loopholes utilised by these firms. Hence, land surveyors face the following consequences:

- Their names get into the proposals, and consequently projects are executed without their knowledge (but who signed their CVs) – the projects are executed by someone not approved by the tender board

- Their names get into the proposals without their participation in budgeting for the component of survey works – the budget might be underestimated or overestimated
- Those in the proposals are replaced by non-surveying professionals or sometimes on-job trained surveyors to execute surveying – survey accuracy is at stake
- They are contracted by the bid winners who have the ability to terminate their contracts for unjustifiable reasons – possible in order to save money
- Sometimes they are forced to provide services contrary to the standards LS profession and get fired when they disobey the instructions
- Names of LS firms in a project do not appear on the sign boards at the construction sites, so no one will know (including the approved project surveyor) who is the project surveyor.

Therefore, these challenges call for review of PPA (2004) and PPR (2005) to ensure that the approved LS professionals are involved in the projects and practice accordingly. This will improve LS services imparted to the CI in order to realise the Millennium goals.

4.3 Professional Development

Continuous Professional Development (CPD in land surveying profession in order to improve and sustain professionalism of land surveyors has not been in practice. Opportunities for surveyors to participate in the CPD sessions, and relevant seminars, workshops, and conferences should be created to widen their professional knowledge and skills. Surveyors also need to participate in similar activities organised by different Construction Industry (CI) stakeholders. Active Institution of Surveyors of Tanzania (IST) and National Council of Professional Surveyors (NCPS) are the organs to initiate and run these training programmes through sharing experiences, new findings and feedbacks in the construction industry.

Land Surveying professionals need to explore areas of LS that were not common but essential to the CI in Tanzania. Apart from deformation surveys for determining nature, scale and behaviour of structures displacement, establishment of viable integration of LS with other professions is important to improve CI undertakings. Other areas of application include:

- Terrestrial and airborne laser scanning for both indoors and outdoors modelling or mapping
- Global Positioning System (GPS) in setting-out, sections profiling, cadastral surveys, built urban, dense vegetation and deformation measurements.

4.4 Contract Conditions

Many Land Surveying (LS) firms are small in size and capital reserves. Likewise, their cash flow is also low and irregular. It is therefore, difficult for such firms to borrow easily from the financial institutions for lack of guarantees. Liquidity of a firm at the beginning of the project is paramount because mobilisation of reference data, staff and equipment is costly. In the past years, clients of LS projects used to give advance payments for mobilisation, but this has stopped.

Currently, conditions of contracts require the LS-contractor/consultant to be paid on issuance of fee notes as per the work that has already been executed. Under these circumstances, LS firms have failed to secure lucrative projects, perform well, grow and prosper. The CI projects have therefore suffered from these scenarios, while land surveyors have been hard hit as a result being denied of experiences of big and challenging projects to improve their performance.

5.0 CONCLUSIONS AND RECOMMENDATIONS

- The major problems facing Land Surveying (LS) education and training for Construction Industry (CI) relate to the abilities to attract larger number of student applicants in LS programmes. These problems negatively affect competitive selection, employment creation opportunities with lucrative remunerations to cater for harsh working conditions on site, promote LS among the society, research and development, compliance to the Laws and Regulations guiding professional practice, and the use of Kiswahili as a medium of instruction for training land surveyors
- The remedies for these challenges are dependent on social-economic developments of the nation. Improving the number of students' enrolment and lecturers employment, equipping laboratories, LS stores and libraries, expanding physical spaces and research activities greater depend on sponsorships. The government and private sectors sponsorships could be facilitating in resolving some of the problems
- The curriculum of LS at SGST and regulations of NCPS also need regular updating to improve shortfalls to match the current changes in social-economic and technological developments. Close association and strong ties between ARU, NCPS and IST need to be promoted for the purpose of exchange of ideas, and formulating strategies for improvement. Since, LS services lead at every new stage of a CI projects and they are needed even after a construction, PPA (2004) and PPR(2005) must invite LS firms to bid together with architectural and quantity firms in building works, and with engineering construction and consulting firms in civil works.
- The existing laws and regulations governing the activities of the construction industry are adequate. However, lack of effective implementation coupled with poor monitoring and enforcement have made the industry not to perform to the expectations of the stakeholders it is serving, including failure to guarantee value for money for constructed facilities

- Land surveying services are needed by the construction industry stakeholders at all stages of construction projects. It is of crucial importance to incorporate the utilisation of surveying firms in the entire process of tendering for the purpose of enhancing quality and safety of the built environment. The Public Procurement Act (PPA) No. 21 of 2004 and its Regulations 2005 should be amended to take into account the utilisation of land surveying services.
- The challenges which need to be addressed as a priority is the utilisation of Kiswahili as a medium of instruction at all levels of the education system. The utilisation of English as medium of instruction limits lecturers in conveying comprehensive messages to their students. Students in turn, cannot fully understand their lecturers. The English medium of instruction will continue to make intelligent Tanzanian students fail examinations, holders of degrees fail to communicate efficiently both in oral and written, students pass examination by memorising materials rather than understanding. The existing scenario contributes to the poor performance of the industry since it is run by incompetent professionals.

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