MAKERERE UNIVERSITY
College of Engineering,
Design, Art and Technology

United Nations
Educational, Scientific and
Cultural Organization

UNESCO-China
Funds-in trust

Graduate Tracer Study for School of Engineering, Makerere University (2012 - 2021)

SEPTEMBER
2022

Acknowledgement

This work was funded by UNESCO China Funds-in-Trust with a focus on Higher Technical Education in Africa for a Technical and Innovative Workforce (CFIT III). CFIT III aligns with Sustainable Development Goal 4 to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. In particular, this work targets ER 4 - Relevant skills for decent work.

The overall objective of the CFIT III project at Makerere University with a focus on the School of Engineering is to strengthen industry-academia partnerships in support of graduates with training that is better aligned to the labour market and industry needs thereby increasing the employability and engagement of engineering graduates from the College of Engineering, Design, Art and Technology (CEDAT). This will also contribute to Makerere University's focus on research and innovation through the application of engineering in addressing sustainable national and regional development.

MAKERERE UNIVERSITY
College of Engineering,
Design, Art and Technology

United Nations
Educational, Scientific and
Cultural Organization

UNESCO-China
Funds-in trust

Tracer Study for graduates of the School of Engineering for the period 2012 to 2021 on Engineering Programs of Makerere University

September 2022

LEAD AUTHORS:

Vincent A Ssembatya (PhD)
Robert K Ngobi (PhD)

TABLE OF contents

1.0	EXECUTIVE SUMMARY		2
2.0	GENERAL INTRODUCTION		5
	2.1	Tracing Engineering Graduates	5
	2.1	History of Engineering	8
	2.2	Rationale of the Graduate Tracer Studies	8
	2.3	Literature Review	8
	2.4	Objectives	10
3.0	Scope of the study		11
4.0	Conceptual Framework		11
5.0	Theoretical Framework		11
6.0	Expectations		12
	6.1	Employers of graduates	12
	6.2	Graduation from STEM disciplines have better chances to be Employed	12
	6.3	On average there are fewer Engineering students in the graduate programs	12
	6.4	Transferable Skills mitigate acquiring and retaining employment	12
	6.5	Internship is a critical part of engineering training	13
	6.6	Education of the Parents	13
	6.7	Student Experiences while studying for the qualifications	13
7.0	Materials and Methods		14
	7.1	Phases for conducting the Tracer Studies	14
	7.2	Survey Instruments	14
	7.3	Sample Size Selection	14
	7.4	Duration of the study	15
	7.5	Institutionalization	15
8.0	Provisional Results		16
9.1	General Characteristics of Respondents		16
	Class of Degree acquired.		17
	Type of A-level School		19
	Participation in Supervised Internship		19
	Intention to pursue further studies		20
Discussion			21
Employment Status			22
Salaries			23
Are they satisfied with their jobs?			23

Views about training obtained at Makerere University		26
	Self-assessment on chosen skills	26
Conclusion and Recommendations		29
	Education of the Parents	30
	Student Experiences while studying for the qualifications	30
	Institutionalization	30
	Type of A-level School	31
	Participation in Supervised Internship	31
	Intention to pursue further studies	31
	Recommendations	31
10	REFERENCES	33
APPENDIX I: SAMPLE QUESTIONNAIRE		34
Organisations that Employed Engineers who Responded to the Survey		37

1.0 Executive Summary

The School of Engineering at Makerere University has five training programs in engineering at Bachelors level, five Masters programs and a PhD program. The university has a program in Agricultural Engineering hosted in the College of Agricultural and Environmental Sciences (CAES) and a program in Biomedical Engineering hosted in the College of Health Science (CHS). The programs hosted outside the School of Engineering share part of their curriculum with some programs in the School of Engineering and students are taught together in this shared curriculum.

Three Thousand Four Hundred Fifty (3450) students graduated on engineering programs in the period 2012 to 2021 with 3338 graduating from the Bachelors programs and 112 from the Masters programs. A tracer study was carried out on these graduates of engineering programs at Makerere University. The tracer study reviewed among other things the typical career progression path of graduates, wage levels & labor force participation, on-the-job trainings & further education experiences, female engagement, self-employment situation, and unemployment situation. Inclusion of other programs in CEDAT held useful information related to the industry where the graduates of the core engineering programs were located. In the process of collecting data, graduates from Architecture, Quantity Surveying, Land Economics, Construction Management, Land Surveying and Geomatics were allowed to submit data on the same aspects of the survey.

The overall objective of the tracer study was to review among other things the typical career progression path of graduates, changes in wage levels & labor force participation, on-the-job trainings & further education experiences, job changes & promotions, female persistency in jobs, self-employment situation and unemployment situation.

The Tracer Study findings are to: Establish the locations of all graduates from the School of Engineering since 2012; Establish the graduate views on the relevance of training, skills and competences for the type of work they were doing; Assess the extent to which the graduates were fit for purpose; Determine gaps in skills and competences that needed to be filled in future engineering programmes; Inform the review of curricula for the engineering programmes, required upgrading of teaching equipment and/or tools, career guidance services for students and preparation of students (orientation) for transition from HEIs to the work environment

A combination of methods were applied to trace graduates of engineering programs at Makerere University. The graduates were traced based on the pathways approach and snowballing techniques. The questionnaire was the major research instrument used in conducting the tracer study. The snowball technique was used to establish the employability status of the graduates of the engineering programs.

More than 550 respondents were accessed, which number had adequate reach for the sample size with its attributes. A response rate of 20% had been anticipated at the start of the survey and where the actual responses fell short several follow ups and reminders were required.

A questionnaire was designed focusing on the following features: the notion of the different pathways from study to work, student & parental educational backgrounds, and desire for further studies. The questionnaire was chronological in nature and was designed to filter responses to situational questions. The questionnaire captured transition factors from university education to work such as levels of education of parents or guardians, participation in extra curricula activities and internships undertaken by students prior to graduation.

The Sampling Frame was composed of the graduates of the engineering programs in the ten year period of 2012-2021. The names of these students were obtained from the graduation records at the University and other databases from societies and groups of engineers. The total number of respondents that were accessed and successfully filled in the questionnaire were 630 of which 104 were female. The respondents derived over 200 companies and agencies that employed the majority of these. Some of the respondents were self-employed and others were unemployed. The number of respondents that were female was 69 (14%) from the core target group and 104

(17%) altogether. Biomedical Engineering had the largest percentage of female respondents.

The proportion of graduates that are employed (including self) is 87%. Those that indicated they were employed by the public and private sectors were a proportion of 76%. Those that were self-employed were 11% of all respondents; those that were not employed and looking for work comprised of 12% of the total respondents. The study has identified locations for over 400 graduates of the School of Engineering. For those that are employed, the survey has established more than 250 institutions and organizations where they are employed.

Views have been collected on the aspects connecting the training of the graduates and their experiences at work. With the generous responses, feedback including narratives concerning their experiences; Good feedback has been obtained and will support the improvement in the curriculum and training at the university.

A number of gaps have been identified mainly from self-assessment of the respondents. Complimentary information will be required from the side of the industry especially from the employers of these graduates.

Each curriculum offered in the School of Engineering is supposed to be reviewed after a cycle of five years according to the requirements of the National Council for Higher Education. There are three layers of programs in the school. The first layer consists of the traditional engineering programs of Civil, Mechanical and Electrical Engineering. These programs have shown strong signs of resilience (maintaining high numbers over time and good employment proportions). The second layer consists of programs that were derived from Electrical Engineering. These include Telecommunications Engineering and Computer Engineering. These are thriving in the times and the new industries in the fourth industrial revolution. However, these programs are also strongly related both in training and employing industries. The curriculum review process should strongly consider disambiguating these programs. The third layer of programs consists of Biomedical Engineering and Agricultural Engineering. These programs are seemingly less appreciated. The programs have each averaged less than 20 students per year for the last 10 years (even though Agricultural Engineering has been around for more than 20 years).

The respondents have decried the inadequacy of practicals during their training. A list of required equipment may be generated during the curriculum review exercise. The equipment should be derived from the requirements of the course units in the curriculum.

A great deal of the career guidance is located in the life of the student before they select programs to pursue at the university. The two weeks allocated to students during the window for the change of programs after admission could be the only opportunity for career guidance to alter the decisions of the students before serious training begins. For students at the university, any career guidance comes in too late as most of the engineering programs don't lavitate into options. The School of Engineering should consider coining missions to High Schools in conjuction with the Department of the Academic Registrar;

From the survey it became evident that the proportion of students who achieved first class degrees in these programs was 8% which is very high (considering the university average of 2%). Engineering students have generally performed very well over the years. Considering that most of the engineering programs have filled their admission quotas through the time of their existence one can easily conclude that the students largely feel comfortable making engineering their choice at the university.

A proportion of 27% of the respondents reported that they were earning more than 3 Million Uganda Shillings per month with the majority of the respondents (21%) earning between 1 Million Uganda Shillings and 2 Million Uganda Shillings per month. Of the total respondents, 46% earn at least 1 Million Uganda Shillings per month.

A proportion of 79% are satisfied with their current job; 50% very satisfied; 17% ecstatic. Key correlates include salary, level of challenge at the workplace and opportunities for upward mobility.

In all programs views emerged that ranged from complete satisfaction with the level of provision in the training to complete dissatisfaction. Key categories that emerged from the responses were eight: Curriculum, Institution, Lecturers, Practicals, Social Environment, Computer (Programming and Software), Career Guidance and Field Visits.

Predominantly (52% of the views) respondents felt good about Makerere University as an institution and the opportunity it provided them in advancing their careers. The positivity was around the institution being able to transform them into professionals. The negative comments (6.5%) were around institutional processes and bureaucracy that tended to complicate their lives while studying.

A number of comments (18%) were around the inadequacy of practicals in terms of time and equipment. Views on practicals were across all programs on offer. Some respondents recommended an increment in field visits during the training to support hands-on training. Respondents (10%) commented on the curriculum as urgently in need of updates to tune to the state of the art in the industry. Related to the curriculum was the need to integrate soft skills, computer programming and modern software in the processes of training. Examples given included Computer Aided Design (CAD), Civil 3D, Prota, Midas, and Finite Element Software for Civil Engineering, Prokon, Protastructure, Epanet, WaterCad. In addition to the need to introduce modern engineering sciences at the college i.e. optimization, Artificial Intelligence, Big data, the smart grid, GiBES and crypto technologies amongst others to encourage research into novel areas. Other skills suggested include: report writing skills and research skills.

Findings have pointed to the need for the College of Engineering to set up a Career Guidance Office whose purpose is to prepare students to the ever-changing work place; in addition to infusing Career Guidance into the different courses. In addition representatives from the industry should be periodically invited to campus to talk to the students.

Findings have pointed to the need to give students practical hands-on skills from the engineering industry that are required to navigate the work environment; to reduce the pressure and embarrassment to the graduates when they join the industry and get compared with graduates from technical institutes. A suggested solution by a respondent was having more practical laboratory sessions that expose students to real world electrical equipment to demystify some concepts and harmonize acquired knowledge. That the university should continue providing entrepreneurship trainings no matter the course of the student. An outcry is out for the School to put in place evening and weekend programs for masters studies. This will enable masters students to be able to attend school while balancing work. And more Ugandans will be able to enroll for these courses.

Institutionalization of the Tracer studies would involve key aspects like collection and maintenance of data on students during and after their training; maintaining a database of employers for engineering students; proposing budgeting for the tracer studies; proposing the designation of human resources to support the tracer studies on an annual basis. At exit graduates should be required to fill exit forms that among other things would include their intended permanent addresses including contacts of close family members for future tracing or information sharing.

2.0 General Introduction

The Education Act, 2008 provides the structure of education under which Section 10(1) indicated that there shall be four levels of education in Uganda, pre-primary education; primary education; post primary education and training; and tertiary and university education.

Universal Primary Education is a decentralized service with a Directorate at the Ministry of Education and Sports (MoES) and is coordinated by the District Education Department (DED) headed by the District Education Officer. The DED has a number of inspectors headed by the District Inspector of Schools. The District Council is the highest political authority that provides policy direction to primary education. The District Service Commission (DSC) is responsible for the recruitment of staff for the DED.

Secondary education provision in Uganda prepares the students for higher education and the world of work. The secondary education cycle in Uganda lasts six years of which four are at the lower secondary level or Ordinary Level and two for the Advanced level. Secondary education is centralized and Government built on the good work of founding religious bodies that owned a number of Government aided secondary schools. The requirements for admission to these engineering programs for those from the A-level system are mainly good grades from Physics and Mathematics. A three-tier systems of subjects (Essential, relevant and desirable) is specified for students that seek admission to university education. A typical student at A-level does three principal subjects and two subsidiary subjects. The principal subjects are the key knowledge areas required to assign a student to a university study program leading to a degree award. The subsidiary subjects are generally support knowledge areas and occupy smaller proportions in the curriculum at high school. The current list of subsidiary subjects includes General Paper, Subsidiary Computer Science as well as Subsidiary Mathematics. Student doing the principal Mathematics paper are not eligible for doing the subsidiary mathematics.

Higher Education (HE) provision is regulated by the National Council for Higher Education. The Professional bodies complement the NCHE since they provide input in curriculum development or revision, participate in joint institutional & program accreditation inspections and regulate the conduct of the different professionals. Despite the fact that at university sub-level, the private universities are more than the public universities, high education provision is largely public in terms of programs,

enrolments, graduate training and research outputs as well as doctoral graduations and staffing qualifications across levels.
The School of Engineering at Makerere University has five training programs in engineering at Bachelors level, five mater programs and a PhD program. The university has a program in Agricultural Engineering hosted in the College of Agricultural and Environmental Sciences (CAES) and a program in Biomedical Engineering hosted in the College of Health Science (CHS). The programs hosted outside the School of Engineering share part of their curriculum with some programs in the School of Engineering and students are taught together in this shared curriculum.

2.1 Tracing Engineering Graduates

Three Thousand Four Hundred Fifty (3450) students graduated on engineering programs in the period 2012 to 2021 with 3338 graduating from the bachelors programs and 112 from the masters programs. The highest percentage of female graduates was registered on the Biomedical Engineering program (33%) whereas the lowest was on Mechanical Engineering (12%). The undergraduate program in Civil Engineering was the most productive with 933 graduates in a period of 10 years. Electrical Engineering produced 787 graduates over the study period whereas Mechanical Engineering produced 535 graduates during the study period. Agricultural Engineering was closely related to Mechanical Engineering and produced 176 graduates over the study period. The program in Biomedical Engineering produced 165 graduates over the five-year period in which it has had graduates.

A tracer study was carried out on the graduates of engineering programs at Makerere University. Most of these programs are hosted in the School of Engineering in the College of Engineering, Design Art and Technology (CEDAT) with the exception of

the program of Biomedical Engineering and that of Agricultural Engineering which are hosted in the College of Health Science (CHS) and CAES, respectively. The tracer study reviewed among other things the typical career progression path of graduates, wage levels & labor force participation, on-the-job trainings & further education experiences, female engagement, self-employment situation, and unemployment situation. Consideration was taken to include the other programs in CEDAT that held useful information related to the industry where the graduates of the core engineering programs were located. In the process of collecting data, graduates from Architecture, Quantity Surveying, Land Economics, Construction Management, Land Surveying and Geomatics were allowed to submit data on the same aspects of the survey. Information from these noncore engineering programs held useful contrasts against the focus data. In addition, it was considered to be useful utilization of resources to collect data on programs whose graduates worked closely with those from the core engineering programs.

Table 1: Graduates in core engineering programs at Makerere University for the period 2012-2021.

	Number of Graduates in Core Engineering Programs 2012-2021										
Programs	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**
Bachelors	299	258	386	347	372	388	302	338	315	333	3338
Agricultural Engineering	22	19	29	19	25	23	17	12	5	22	193
Biomedical Engineering	0	0	0	0	16	47	33	26	15	28	165
Civil Engineering	79	72	107	105	113	94	90	95	97	81	933
Computer Engineering	0	0	0	0	0	43	26	48	28	21	166
Electrical Engineering	79	57	88	96	95	82	51	87	70	82	787
Mechanical Engineering	57	55	77	56	52	50	44	30	55	59	535
Telecom Engineering	62	55	85	71	71	49	41	40	45	40	559
Masters	10	16	16	12	5	6	7	15	22	3	112
Agricultural Engineering	0	2	4	3	1	0	0	0	0	0	10
Civil Engineering	6	14	8	5	4	6	6	10	7	1	67
Electrical Engineering	2	0	0	0	0	0	1	1	1	0	5
Mechanical Engineering	2	0	2	2	0	0	0	2	6	1	15
Power Systems Engineering	0	0	2	2	0	0	0	2	8	1	15
Total	**309**	**274**	**402**	**359**	**377**	**394**	**309**	**353**	**337**	**336**	**3450**

Table 2: Graduates in the core engineering programs of Makerere University for the period 2012-2021 disaggregated by gender.

Graduate of Engineering Programs for the period 2012-2021				
Programs	**Female**	**Male**	**Total**	**Percentage (Female)**
Bachelors	652	2686	3338	20%
Agricultural Engineering	30	163	193	16%
Biomedical Engineering	55	110	165	33%
Civil Engineering	162	771	933	17%
Computer Engineering	42	124	166	25%
Electrical Engineering	151	636	787	19%
Mechanical Engineering	63	472	535	12%
Telecom Engineering	149	410	559	27%
Masters	19	93	112	17%
Agricultural Engineering	3	7	10	30%
Civil Engineering	8	59	67	12%
Electrical Engineering	0	5	5	0%
Mechanical Engineering	2	13	15	13%
Power Systems Engineering	6	9	15	40%
Total	**671**	**2779**	**3450**	**19%**

Table 3: Graduates of the core Engineering Programs at Makerere University for the period 2012-2021

Graduates of Engineering Programs for the period 2012-2021				
	Female	**Male**	**Total**	**Percentage (F)**
Programs				
Bachelors	647	2674	3321	19%
Agricultural Engineering	25	151	176	14%
Biomedical Engineering	55	110	165	33%
Civil Engineering	162	771	933	17%
Computer Engineering	42	124	166	25%
Electrical Engineering	151	636	787	19%
Mechanical Engineering	63	472	535	12%
Telecom Engineering	149	410	559	27%
Masters	19	93	112	17%
Agricultural Engineering	3	7	10	30%
Civil Engineering	8	59	67	12%
Electrical Engineering	0	5	5	0%
Mechanical Engineering	2	13	15	13%
Power Systems Engineering	6	9	15	40%
Grand Total	**666**	**2767**	**3433**	**19%**

2.1 History of Engineering

Engineering education is traced from two different distinct roots. First is the trade apprenticeship education where the trainees of the local trade program studied to advance their practical and theoretical knowledge of their various trades. The second is through the college or university that recognizes natural science which serves as a key point for specialization to an application in engineering (Booth, 2004). Maillardet, (2004) labelled engineering as 'a three-legged stool' that relies on science, mathematics and techné. The word techné is described as the creative abilities that distinguish an engineer from a scientist; to design, to make, to conceive and to actually bring to fruition. It is important to recognize that engineering is more than simply understanding the rudiments of science; it is basically a vocational subject which depends on the sound understanding of scientific principles as well as appropriate mathematics facility, the modeling language and vital communication.

The future of any nation does not only depend on its enormous natural resources possessed but the specialized engineering skills, competence and the ability of its populace to harness and utilize the resources. Engineering is the bedrock to economic, social and technological development of any nation because of its connection to all aspect of human activity (Kofoworola, 2003). Most of the engineers are engaged in several re-training by the industries in order to build their skills for the fact that they are considered to be un-employed at the first intake level (Adegbuyi & Uhomoibhi, 2008).

2.2 Rationale of the Graduate Tracer Studies

A university is a composite open system with numerous stakeholders with divergent expectations. It is imperative that universities are aware of these expectations and strive to ensure that they are achievable (Brits & Steven, 2019). Tracer studies provide a platform for feedback for the different stakeholders in an educational setting and its attendant associates. Universities are key role players in improving the employability of their graduates, enhancing economic growth and reducing the global knowledge divide. Universities impart students with technical knowledge and skills required by the contemporary labour markets (Tran, 2016). The School of Engineering, Makerere University received funding from UNESCO China Funds in Trust (CFIT) Phase III: Higher Technical Education in Africa for Technical and Innovative Workforce to conduct a graduate tracer study as one of the project outputs.

Graduate Tracer studies provide information regarding not only the employability of graduates but also the type of employment they gain; a match or mismatch between educational qualifications and the required work skills (CRHEW, 2003). The success of an economy is closely hinged on the quality of its human resources and hence no economy is better than the quality of its higher education system in this knowledge-based growth era. Tracer studies involve identification and follow-up of graduates from higher education institutions and are spurred by the need to investigate how graduates view the experiences they underwent during their degree studies and their transition from university to the job market.

Tracer studies are useful since they are instrumental in improving the teaching & training of graduates and are an input to the program accreditation process by regulatory agencies (Schomburg, 2011). The information provided by graduate tracer studies may also inform the career decisions of prospective & current students. Parents, career counsellors, and school & university teaching staff could also make use of the findings from graduate tracer studies in their guidance & teaching of prospective and current students (Goldwyn-Simpkins 2015).

Graduate Tracer Studies help to identify supply and demand issues as well as skills mismatches. Tracer studies do help to: ascertain the quality of the higher education sector & its institutions based on their ability to meet labor market demands, consider curriculum redesigns and fine-tune the advice & support they offer to students. Employers can use GTS for recruitment purposes while prospective & current students make informed decisions when selecting an academic program & institution in consideration of future job options (Minsk, 2018).

2.3 Literature Review

Africa has significant shortage of engineering skills. For instance in 2013, UNESCO alluded to the fact that there was one qualified engineer for a population of 6000 people in Namibia, Zimbabwe and Tanzania compared to one engineer per 200 people in China (and one in 311 in UK; one in 227 in Brazil). In one sector (water and sanitation), it was estimated that 2.5 million new engineers and

technicians were required in sub-Saharan Africa (SSA) to meet the development goals on access to clean water and sanitation. Yet, paradoxically, many engineering graduates in Sub Saharan Africa, cannot find employment in engineering fields. It has been asserted that the demand for engineers and unemployment of engineers happen simultaneously, a valid explanation is not only about the number of engineers in the job market, but the number of engineers (and engineering practitioners in general) with matching skills for the jobs awaiting them (IMF, 2016).

Unexpectedly, South Africa also faces a deficiency of high level engineering skills and there is an ongoing need to transform the profession to ensure greater representivity. Currently qualifying students from the secondary school system into science, engineering and technology (SET) fields in higher education is constrained by the poor quality of lower secondary schooling and it is asserted that a number of students enrolled in engineering disciplines are either academically under-prepared and or financially disadvantaged. Less than a third of all engineering students in Bachelors programmes graduate within four years and under two thirds graduate within six years. For African students the graduation rates are even less satisfactory. Just under a third of African students graduate in five years, as opposed to 64% of white students (Fisher, 2011).

The bottleneck in the progression–from studying to graduation to professional career–is hinged to how and when new engineers are prepared for work with combined employability skills that are not all 'core' engineering skills. The 'employability skills' include reliable communication, task & time management, familiarity with local processes & industrial standards, administrative skills and incentive frameworks for engineering skills such as career satisfaction, financial incentives and work environments.

Analogously, a study conducted by the Royal Academy of Engineering (2012) asserted that the majority of engineering academic staff in higher education institutions in Sub Saharan Africa "had very little exposure to engineering practice [in industries and public works]" despite being well-qualified. The teaching style in some academic institutions in the region was described as "chalk and talk" as opposed to problem-based learning (PBL).

The current shortage in quantity and deficiency in engineering quality in Africa is attributed to gaps in policies and capacities which include but are not limited to the following: (i) dramatic decreases of national funding for higher learning institutions during the late 1980s and early 1990s, which resulted in crowded classes, weaker laboratories and abilities to provide effective education/ training, (ii) low focus on scientific training–in science, technology, engineering and mathematics (STEM) and (iii) brain drain weakens both productive capacities and purchasing powers in a country or region. It was projected that migrants [from Sub Saharan Africa] to OECD countries could increase from about 7 million in 2013 to about 34 million by 2050 while acknowledging that "the migration of young and educated workers takes a large toll on a region whose human capital is already scarce (IMF, 2016).

It is also important to note that debates on how to transform Africa's higher education have also in many ways highlighted the centrality of gender as a crucial entry point into making system-wide changes. Prominent critics of systemic gender inequities in Africa's higher education have consistently emphasized the historical disadvantages African women face, attributable to culture and capitalist expansion (Aina, 2010). Financial and social barriers maintain the under representation of females in African higher education institutions including gender stereotyping, childcare & family responsibilities, violence against women in universities as well as a lack of role models (Desmennu & Owoaje, 2018).

Despite the fact that participation in career guidance activities in school provides students with necessary awareness, knowledge and skills required in the world of work, it has received minimal attention at higher education institutions. Students need to be provided with occupational orientation to choose careers that match their interests & abilities (Herr, Cramer, & Niles, 2004), for better self- understanding (Hiebert, Collins, & Robinson 2001) and to be informed about the existing opportunities to which the learning can guide. Analogously, Holland's theory (1992) asserts that self- knowledge and career information are necessary for career decision making. It asserts that people are attracted to careers that have similar qualities to their peculiar personalities and other background variables.

Balba (2019) traced electronics engineering graduates of the Lyceum of the Philippines-Laguna for the 2016-2018 period. The electronic engineering graduates had monthly incomes that ranged from USD

314 to USD 391 in their first jobs. Majority of the graduates held regular or permanent status employment.

German, Buan, Carrcon and Ochanoa (2021) conducted a GTS for graduates of industrial engineering, engineering management and service engineering management programs focusing on employment history & profile and skills & competencies as well as career progression of graduates in the Philippines. Engineering graduates were imparted with skills and competencies needed for professional practice making them highly employable. The majority (85.6%) of the graduates were employed in 276 job titles while 6.21% were self-employed either in their own businesses or their family long-run companies. The employability tenure of the employed and self-employed ranged from one to four years which corresponded to their graduation time. Having excellent personal skills and abilities were necessary for acquiring first jobs and bringing value to the employer. The skills and competencies identified in the GTS included but were not limited to the following: effective communication, human relations, research, problem-solving, ability to work under pressure, time management, risk taking and decision making.

Abana, Lerenzo and Liamelo (2017) assessed the employability status of graduates of civil engineering, electoral engineering, electronics engineering and computer engineering, University of Saint Louis, Cagayan during the period, 2012-2016. Many of the graduates were employed in industries where their courses of study or competencies were directly aligned. Flexibility and work ethics skills were the soft skills or competencies that were useful to engineering graduates. The majority (45.8%) of the graduates were formerly employed self-employed. The unemployed were either pursuing post-graduate studies or were unemployed due to family concerns. The graduates found jobs six months after their graduation since they had to undergo board examination reviews and undertake licensure examinations before they could start searching for jobs.

The majority of graduates (94.4%) held technical positions and worked in Government institutions and the rest were employed in the private sector in their areas of study. In addition technical skills acquired during training, work ethnics, flexibility, decision-making and computer skills were useful in their work places. Abana et al (2017) and Singh (2008) asserted that communication, computer and problem- solving skills were important workplace skills.

2.4 Objectives

The overall objective of the tracer study was to review among other things the typical career progression path of graduates, changes in wage levels & labor force participation, on- the- job trainings & further education experiences, job changes & promotions, female persistency in jobs, self- employment situation and unemployment situation. The specific objectives of the tracer study were to:

1. Develop the tracer method and study instruments
2. Establish the locations of all graduates from the School of Engineering since 2012, and the sector & institutions/organizations in which they were employed and obtain their contact details.
3. Establish the graduate views on the relevance of training, skills and competences for the type of work they were doing.
4. Assess the extent to which the graduates were fit for purpose
5. Determine gaps in skills and competences that needed to be filled in future engineering programmes
6. Given results of the tracer study and with benchmarking against international exemplars, recommend the tracer study method that could best be used to inform:
    a. review of curricula for the engineering programmes offered by high education institutions
    b. required upgrading of teaching equipment and/or tools
    c. career guidance services for students
    d. preparation of students (orientation) for transition from HEIs to the work environment

3.0 Scope of the study

The technical scope of the study was limited to undergraduate and master's graduates since Doctorates were very few. It was limited to School of Engineering programs but it included Biomedical Engineering and Agricultural Engineering from 2012 to 2021. Care was taken to trace graduates across the country. The scope of the study was aligned to the following:

a. Conduct a graduate tracer study to generate information and intelligence for the curriculum review, assessment reforms and programme development;

b. Organize consultations with the private sector and relevant stakeholders to map out any existing skills gaps, and emerging demands for new skills based on tracer study insights;

c. Identify skills gaps and anticipate skills needs based on the tracer study, consultations, national development plans, etc., and explore the necessity of introducing new curriculum and programmes required from higher education institutions;

d. Develop recommendations in curriculum and programme development depending on skills needs identified in the tracer study results, upholding the principles of inclusiveness, relevance and gender-equality.

4.0 Conceptual Framework

Graduate unemployment results in a waste of resources spent on studies and reduces the quality of life & self- esteem of the graduates. Graduate unemployment has been attributed to either the mismatch of skills imparted to graduates by higher education institutions & those required by prospective employers and/or the small size of the country economies that do not provide enough beginner jobs to enable fresh graduates to launch their career paths and professional growth among others (Rosenburg, Heimler & Morote, 2012).

Graduate tracer studies are a useful feedback mechanism for higher education institutions to ascertain: the employability status of their graduates, employer expectations of their graduates, relevance of courses of studies and transition to higher academic levels. Universities must therefore be responsive to societal and professional needs of their graduates (Martin, Lang-ay & Guidangen, 2015). Schomburg (2003) notes that graduate tracer studies are a tangible feedback mechanism for "analysis of the relationship between higher education and work".

5.0 Theoretical Framework

The Undergraduate and Master's graduate destinations were hinged on the seven pathways theory. The first and second pathways were derived from an important distinction that was made between 'young graduates' who entered the labour market for the first-time after graduating and 'mature graduates' who already had experience of employment prior to studying for the qualification they attained during the study period. First-time entry into the labour market and securing the first full-time, formal sector job was considered the most important life-course transition for a young graduate from higher education into work. Failure to access the first job could condemn young people into permanent unemployment.

The third pathway was for graduates who opted for self-employment. The fourth pathway was graduate employment in the informal sector. The fifth pathway for graduates was unemployment/ the unemployed graduates. The sixth pathway for graduates was continuing with higher education i.e. transition to higher levels of education. The seventh pathway was for graduates who were not employed and declare themselves not to be looking for a job (CHEC, 2013).

The School of Engineering respondents of the GTS were classified within the seven pathways that do not form mutually exclusive categories.

6.0 Expectations

6.1 Employers of graduates

The Public Sector in Uganda was expected to be a major employer for graduates of Makerere University. The Government was engaged in major infrastructural transformation projects in various sectors, most of which required graduates from engineering programs. The private sector was as well expected to be a major employer of the engineering graduates since this sector is heavily engaged as a co-provider in several aspects of industrial development including telecommunication, banking and utilities.

6.2 Graduation from STEM disciplines have better chances to be Employed

'At international level, the most consistent research on tracer studies was attributed to Schomberg and Teicher (2006). The causal factors for graduate unemployment in Africa ranged from inappropriate institutional & subject choices, imperfect information flows including poor career guidance, poor academic grades to the shrinking civil service. "Arts and Social Sciences" discipline graduates were candidates for high unemployment rates signaling difficulties in finding first employment opportunities upon graduation. It was anticipated that the graduates from engineering programs had better chances of accessing employment than their counterparts from the humanities. Most of the arguments that linked higher education and economic development seemed to work in favor of Science Technology Engineering and Mathematics (STEM). Indeed, Makerere University was transforming its curriculum so that it could achieve enrolments of more than 40% in STEM.

6.3 On average there are fewer Engineering students in the graduate programs

Doctoral programs in the School of Engineering had graduated about 30 students in the period of interest. The university had graduated about 700 PhDs in the same period; in proportion less than 5% were from the School of Engineering. The majority of these PhDs were trained as part of capacity building for Makerere University and had since become staff members. The Tracer study did not target the PhD graduates. The Masters graduates were invited to respond to the survey through the same instrument as the first graduates.

In a doctoral tracer study carried out by Ssembatya and Ngobi, the focus was the doctoral graduates of the period, 2000-2012. It was revealed that Makerere University had more than doubled its annual doctoral production from 23 in 2000 to 61 in 2012. More than 300 doctorates were awarded during the 2000-2012 period. Most of the doctorates were from the science disciplines with emerging capacities from the College of Health Sciences. The majority (97%) of the doctoral graduates were employed in fields related to their training. There was, however, an impending challenge in retaining doctorates trained at Makerere University since 92% of the respondents indicated they would leave Uganda once an opportunity was availed. Low salaries and benefits were the major demotivating factors. Only 23% of the doctoral graduates were female, mirroring the low representation of females in leadership and seniority at decision making bodies at the university. The study recommended an increase in doctoral production in Uganda so as to meet the increased demand for doctorates attributed to the expanding: higher education sub-sector, research institutions and the emerging system of innovations.

Very few students had enrolled in graduate programs as the past has shown that the capacity of these programs is still low. In addition, the programs in engineering were considered to be professional with the majority of the graduates ready to be registered and start work in their respective areas of training. This phenomenon was reflected in the enrolment on graduate programs in the School of Engineering.

6.4 Transferable Skills mitigate acquiring and retaining employment

Soft skills (transferable skills) were generally considered good assets that could increase the chances of the graduate to acquire and retain jobs. Self-assessment for these skills supported the respondent to reflect on important aspects of their predisposition at work; in addition to giving useful feedback to the institution for improvement of training. In the past Tracer Studies candidates

rated themselves high on Communication Skills and low on initiative and technical knowledge. Responses from the self- assessment on transferable skills were averaged and put on Rickert diagram to provide further insights for improvement of training.

6.5 Internship is a critical part of engineering training

You would often hear insinuations that university graduates were unable to perform certain tasks expected of them, or inability to address components that given firms considered important. This could be a pointer towards challenges in application of technical knowledge. Whereas the university's internship programme was designed to close this gap, continued insinuations could also be a pointer towards a disconnect between expectations of employers and what academic institutions offered.

Makerere University, for instance, was bent towards training life-long learners. Therefore, the ability of graduates to learn continued even after university. So, the typical Makerere graduate was equipped with both technical and soft skills and is trainable on their application as the context would require. Universities do not necessarily train targeting a specific trade as is the case with technical institutions. There is need for this understanding to continuously sieve through. The world of work remains dynamic. Some of the jobs for which training is ongoing, may not exist in the coming 5- 10 years.

Universities are aware of this, thus the emphasis on training life-long learners, who could quickly learn, unlearn and relearn. A university trains someone to be able to touch bits of broad arrears, so that they are not disadvantaged with a one-dimension skill-set. This is indeed a delicate balance considering that some employers are yet to embrace this line of thought and may therefore not be patient with the graduates. The glimmer of hope is that these graduates are trained to learn faster and adjust quickly to the prevailing circumstances in the world of work.

Completion of supervised internship was a transitional factor that could mitigate access to employment. Knowledge from the respondents on whether they completed this training and if they submitted a report (and got a good grade from it) was relevant for the GTS. This information was very useful in improving the procedures related to the internship policy in the School of Engineering.

6.6 Education of the Parents

The relationship between the education of the parents and student achievement has received attention by scholars. The involvement of parents in the education of their children starts from early childhood. Key transformative factors included the choice of schools, support with homework, creating safe home environments & neighborhoods as well as playing inspirational roles in the lives of the children. In addition, dinner table conversations are likely to reflect benefits associated with acquiring university qualifications.

6.7 Student Experiences while studying for the qualifications

Makerere University gives opportunity to students to engage in a variety of intra and extra curricula activities to enrich the experiences of the students and to produce holistic graduates. While student Internships and Projects provide a linkage between the academic involvement in the classroom and the places of work, extracurricular activities like sports; cultural activities; religious engagements and students' leadership promote the general wellbeing of the students. Furthermore, these activities promote the creation of teams and networks that may become useful springboards to social cohesion and harmony in society. Some of the activities turn out to be future careers for the students. In addition career guidance is a useful mitigator for employment.

7.0 Materials and Methods

A combination of methods were applied to trace graduates of engineering programs at Makerere University. The graduates were traced based on the pathways approach and snowballing techniques. The questionnaire was the major research instrument used in conducting the tracer study. The snowball technique was used to establish the employability status of the graduates of the engineering programs. It was anticipated that the respondents would be in a similar proportion to the one in the sampling frame; with about 19% female and the majority being from the program of Civil Engineering. It was as well anticipated that the majority of the employed graduates would be employed in fields that were related to their training. There were cases in the past when graduates would keep themselves occupied in areas not so closely related to their training; this normally happens in situations of acute job shortages.

7.1 Phases for conducting the Tracer Studies

The tracer study for the School of Engineering, CEDAT since 2012 followed four sequential generic procedures: Compilation of sample framework, design of the questionnaire, administering the questionnaire and data capturing, cleaning & analysis. The data for the sample frame was obtained from the University Registry. All accessible graduates in the sample frame were surveyed; with access being a major complication since the university did not have updated databases on the location of its convocation.

More than 550 respondents were accessed, which number had adequate reach for the sample size with its attributes. A response rate of 20% had been anticipated at the start of the survey and where the actual responses fell short several follow ups and reminders were required. An extensive phase of data collection yielded a much fairer distribution among the programs and ensured the possibility of drilling down the data for 14 sizable subcategories (each bigger than 30) segregated by gender to allow for deeper insights.

7.2 Survey Instruments

The questionnaire was designed focusing on the following features: the notion of the different pathways from study to work, student & parental educational backgrounds, and desire for further studies. The questionnaire was chronological in nature and was designed to filter responses to situational questions. The questionnaire captured transition factors from university education to work such as levels of education of parents or guardians, participation in extra curricula activities and internships undertaken by students prior to graduation.

7.3 Sample Size Selection

The Sampling Frame was composed of the graduates of the engineering programs in the ten year period of 2012-2021. The names of these students were obtained from the graduation records at the University. Various strategies to access these graduates were utilized including:

1. Access through the registration board under the society of engineers.
2. Access through the registration board under the society of architects.
3. Practitioners' configurations and special interest groups;
4. Alumni associations under the college (CEDAT).
5. Engineers on various projects in the districts around the country.
6. Students who had registered for further studies at universities.
7. Engineers in Ministries, Departments and Agencies of Government (MDAs);
8. Engineers within social groups;
9. Engineers in the private sector;

A 2-stage stratified- proportional purposive sampling was adopted to select graduates for the tracer study. The graduation lists of the 2010 to 2021 period were used as the sampling frame.

The first stage involved stratifying the graduates 7 strata (courses) of Agricultural, Biomedical, Civil, Computer, Electrical, Mechanical, Power Systems and Telecom Engineering, from which a sample of graduates was selected from each strata.

The second stage involved randomly selecting proportionate samples based on the type of award (bachelors or Masters) from each strata (course), which was informed by the number of graduates. The sub-strata sample was purposely varied across all cohorts to have balanced or representative results across the years. The selection of graduates across the strata considered gender using proportions of 81 percent for males and 19 percent for females. The proportion selection was based on the graduation composition by gender over the different cohorts.

Considering that over the 10 graduations, there were 3450 graduates in the different courses; the Sample size was derived from the Taro Yamani formula given by:

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size (Total number of graduates that were to be traced) and e is the level of significance. A 5 percent level of significance was used in the formula to have a statistically acceptable sample size due to resource constraints. In total sample of 346 students were selected.

Table 3: Drawn Samples from diffent programs

	Population			Proportions			Sample		
Program	Bachelors	Masters	Total	Bachelors	Masters	Total	Bachelors	Masters	Total
Agricultural Engineering	176	10	186	0.10	0.10	0.05	18	1	19
Biomedical Engineering	165		165	0.10	0.00	0.04	17	-	17
Civil Engineering	933	67	1000	0.10	0.10	0.29	94	7	101
Computer Engineering	166		166	0.10	0.00	0.04	17	-	14
Electrical Engineering	787	5	792	0.10	0.00	0.23	79	0	84
Mechanical Engineering	535	15	550	0.10	0.13	0.16	54	2	59
Power Systems Engineering		15	15	0.00	0.07	0	-	1	1
Telecom Engineering	559		559	0.10	0.00	0.18	56	-	65
Grand Total	3321	112	3433	1	1	1	335	11	346
Proportion	99%	1%							

7.4 Duration of the study

The team accomplished the study within 44 working days, including travel days.

7.5 Institutionalization

Institutionalization of the Tracer studies would involve key aspects like collection and maintenance of data on students during and after their training; maintaining a database of employers for engineering students; proposing budgeting for the tracer studies; proposing the designation of human resources to support the tracer studies on an annual basis. At exit graduates should be required to fill exit forms that among other things would include their intended permanent addresses including contacts of close family members for future tracing or information sharing.

8.0 Provisional Results

The total number of respondents that were accessed and successfully filled in the question were 630 of which 104 were female. The respondent from the core interest group of engineering programs were 497 of whom 69 were female. Even though the target group included the years 2012 to 2021, the later years had more respondents. The sample was not powered for year specific conclusions to be drawn as this would have required a lot of financial and time resources to accomplish.

Table 4: Respondents by Year of Graduation

Program	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Grand
Bsc Agricultural Engineering	7	8	3		3	1	1	1	6	10	40
Bsc Biomedical Engineering					2	2	6	8	7	14	39
Bsc Civil Engineering		5	1	6	10	11	7	44	17	51	152
BSc Computer Engineering		1	2	2	2		1	4		10	22
BSc in Electrical Engineering		2	4	5	11	5	3	18	13	29	90
BSc in Mechanical Engineering	4	4	6	4	9	3	4	5	5	23	67
BSc Telecommunications Engineering		4			17	2	5	7	7	15	57
MEng (Civil)										2	2
Grand Total	**11**	**24**	**16**	**17**	**54**	**24**	**27**	**87**	**55**	**154**	**469**

9.0 General Characteristics of Respondents

The 630 successful respondents derived over 200 companies and agencies that employed the majority of these. Some of the respondents were self-employed and others were unemployed. The number of respondents that were female was 69 (14%) from the core target group and 104 (17%) altogether. Biomedical Engineering had the largest percentage of female respondents.

Table 5: Required Sample and achieved targets

Table 6: Samples taken in different programs

Required Samlpe - Achieved and Targets					
Program	**Female**	**Male**	**Total Respondents**	**Target**	**Difference**
Bsc Agricultural Engineering	10	30	40	18	22
Bsc Biomedical Engineering	10	29	39	17	22
Bsc Civil Engineering	17	135	152	94	58
BSc Computer Engineering	3	19	22	17	5
BSc in Electrical Engineering	10	80	90	79	11
BSc in Mechanical Engineering	9	58	67	54	13
BSc Telecommunications Engineering	8	49	57	56	1
Grand Total	**67**	**400**	**467**	**335**	**132**

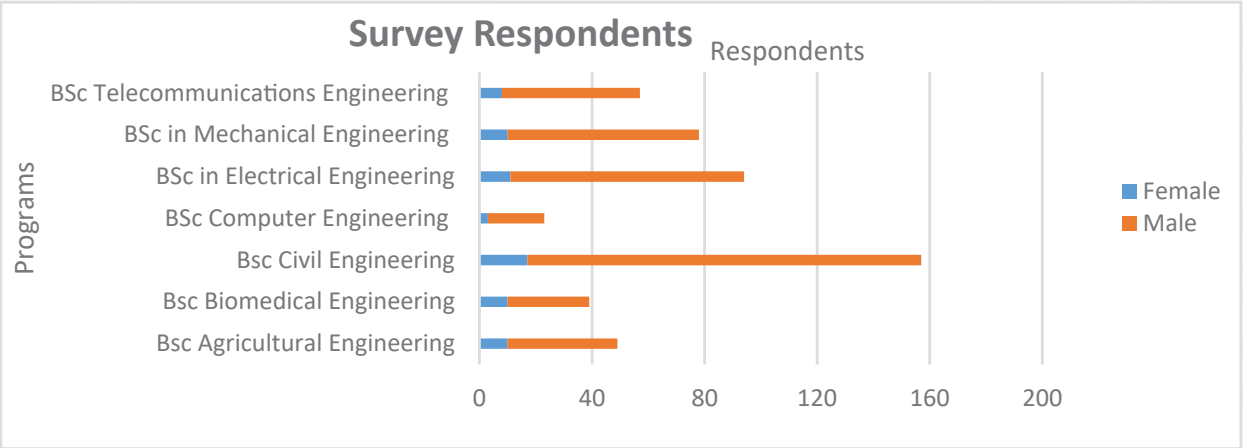


Figure 1: Samples from different programs

Table 7: Respondents from CEDAT Programs

Program	Female	Male	Total
Bsc Agricultural Engineering	10	30	40
Bsc Biomedical Engineering	10	29	39
Bsc Civil Engineering	17	135	152
BSc Computer Engineering	3	19	22
BSc in Electrical Engineering	10	80	90
BSc in Mechanical Engineering	9	58	67
BSc Telecommunications Engineering	8	49	57
MEng (Civil)		2	2
MTIID		1	1
Other Allied CEDAT Programs			
Bachelor of science in Architecture	4	8	12
Bachelor of Science in Land Surveying and Geomatics	2	17	19
Bachelor of urban and Regional planning		3	3
BSc (Land Economics)	7	8	15
Bsc Construction Management	10	20	30
Bsc Quantity Surveying	11	36	47
Grand Total	**101**	**495**	**596**

Class of Degree acquired.

A proportion of 7% reported first class as the class of degree awarded to them. Indeed, this is consistent with university records as the engineering degrees attract over 6% first class degrees on average over the years. The majority of graduates reported upper second-class degree qualifications.

Table 8: The Classes of Degree awarded to Engineering graduates of respondents.

Degree Class	Female	Male	Total	Percentage
First Class	5	25	30	6%
Second Class Upper Division	42	212	254	54%
Second Class Lower Division	19	157	176	38%
Pass	1	7	8	2%
Undeclared		1	1	0%
Grand Total	**67**	**402**	**469**	**100%**

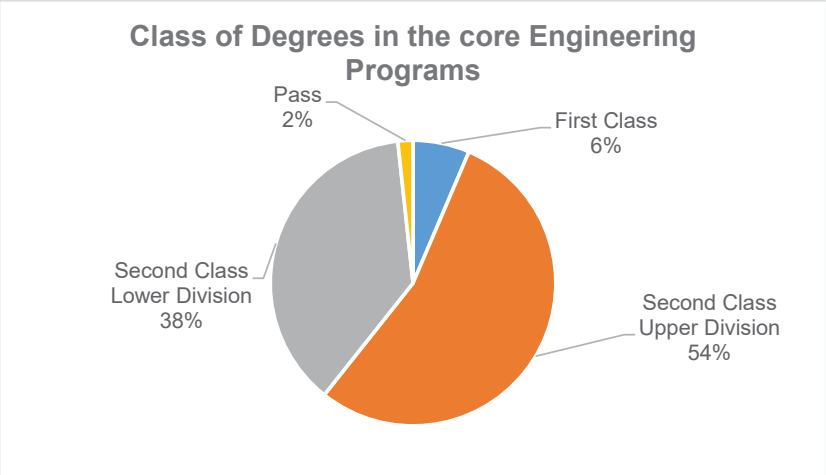


Figure 2: Proportion of respondents in the Degree classes.

Table 9: Distribution of Degree Classes among the Programs in Engineering

Program	1:1	2:1	2:2	Pass	UD	Total
Bsc Agricultural Engineering	2	26	12			40
Bsc Biomedical Engineering	1	23	14	1		39
Bsc Civil Engineering	13	77	58	3	1	152
BSc Computer Engineering	2	9	10	1		22
BSc in Electrical Engineering	3	55	31	1		90
BSc in Mechanical Engineering	7	37	23			67
BSc Telecommunications Engineering	1	26	28	2		57
MEng (Civil)	1	1				2
Grand Total	**30**	**254**	**176**	**8**	**1**	**469**

Table 10: Degree class by Mode of Access to the university

	Mode of Access to the University				
Class of Degree	**A Level or Equivalent**	**Diploma**	**Mature Age**	**Undeclared**	**Total**
First Class	28	1	1		30
Second Class Upper Division	239	10	4	1	254
Second Class Lower Division	144	25	7		176
Pass	6	2			8
Undeclared	1				1
Total	**418**	**38**	**12**	**1**	**469**

Type of A-level School

Students are equally being sponsored by the private sector. Government aided schools are no longer monopolizing access to engineering programs.

Table 11: Program by sponsorship

Program	Government Aided	Private	Undeclared	Total
Bsc Agricultural Engineering	27	13		40
Bsc Biomedical Engineering	12	25	2	39
Bsc Civil Engineering	77	71	4	152
BSc Computer Engineering	8	12	2	22
BSc in Electrical Engineering	48	34	8	90
BSc in Mechanical Engineering	28	35	4	67
BSc Telecommunications Engineering	21	25	11	57
MEng (Civil)	1	1		2
Grand Total	**222**	**216**	**31**	**469**

Participation in Supervised Internship

The proportion of respondents that reported to have participated in supervised internship was 95%. This proportion confirms that, at entry level, the internship program is effective. A few respondents made comments to the effect that the host environment varies from company to company pointing to a need to strengthen this internship link. Respondents have suggested that some companies are invited to the university during the time of training to talk to the students while still at the university.

Table 12: Participation in Supervised Internships

Program	No	Yes	Undeclared	Total	Percent (Yes)
Bsc Agricultural Engineering		40		40	100%
Bsc Biomedical Engineering		39		39	100%
Bsc Civil Engineering	2	149	1	152	98%
BSc Computer Engineering		22		22	100%
BSc in Electrical Engineering	7	83		90	92%
BSc in Mechanical Engineering	1	65	1	67	97%
BSc Telecommunications Engineering	7	47	3	57	82%
MEng (Civil)	1	1		2	50%
Grand Total	**18**	**446**	**5**	**469**	**95%**

Intention to pursue further studies

A proportion of 91% of the respondents indicated that they have intentions to pursue further studies, with 42% (200 respondents) having intentions to pursue further studies up to the level of PhD. Whereas some of the respondents have already enrolled for further academic pursuits, some even completed, a few the respondents indicated that they are still held up by several reasons. Most of the impediments are financial and failure to secure release from their jobs; in several cases, the reasons are a combination of factors as indicated in Table 15. Some respondents mentioned family commitments as current impediments to further studies. It should be noted that about 25% of the respondents reported that they were married.

Table 13: Respondents intentions to pursue further studies

Program	No	Yes	Undeclared	Grand Total
Bsc Agricultural Engineering	2	38		40
Bsc Biomedical Engineering	3	36		39
Bsc Civil Engineering	11	141		152
BSc Computer Engineering		22		22
BSc in Electrical Engineering	11	78	1	90
BSc in Mechanical Engineering	4	61	2	67
BSc Telecommunications Engineering	5	50	2	57
MEng (Civil)		2		2
Grand Total	**36**	**428**	**5**	**469**

Table 14: Furthest Academic pursuit

Furthest Academic Pursuit	Number
Doctorate (Ph.D)	200
Masters	230
No plans for further studies	23
Post Graduate Diploma	8
Undeclared	8
Grand Total	**469**

Table 15: Impediments to the Pursuit of further studies.

Current Status/Impedement for Further Qualifications	Respondents
Doctorate (Ph.D)	**200**
Already Enrolled	14
Class of Degree	1
Completed	1
Finances/Time off Commitments	155
Indifferent	29
Masters	**206**
Already Enrolled	6
Class of Degree	7
Finances/Time off Commitments	177
Indifferent	16
Post Graduate Diploma	**3**
Class of Degree	1
Finances/Time off Commitments	2
Grand Total	**409**

The program in Biomedical Engineering graduated its first 16 students in 2016, whereas the program in Computer Engineering graduated its maiden 43 students in 2017. Both programs are still in their infancy with none of them having reached 150 students.

Discussion

Experiences and Challenges:

1. Whereas we thought the questionnaire would be self-driving and respondents would quickly stream in to give us the data, it turned out the rate of the data flow was very slow and we ended up spending much more than expected; Data from some people could only be obtained after meetings and negotiations.
2. People from earlier years of graduation became very difficult to locate;
3. The required sample size was computed a specific number less than 400 respondents. Without ready access to the population (given sporadic unguided locations) one could only hope that the required number of respondents would be reached soon with adequate desirable characteristics;

Objectives

The tracer study reviewed among others things the typical career progression path of graduates, self- employment situation, and unemployment situation. The specific objectives of the tracer study were to:

Objective 1: Develop the tracer method and study instruments; This objective was achieved and the study instruments are included in the appendices. The methods are elaborated in the document and have supported the achievement of the objectives.

Objective 2: Establish the locations of all graduates from the School of Engineering since 2012, and the sector & institutions/organizations in which they are employed and obtain their contact details. The study has identified locations for over 400 graduates of the School of Engineering. For those that are employed, the survey has established the institutions and organisations where they are employed. A catalogue of over 250 such institutions can be developed from the list in the appendix.

Objective 3: Establish the graduate views on the relevance of training, skills and competences for the type of work they are doing. Views have been collected on the aspects connecting the training of the graduates and their experiences at work. The respondents have been very generous in providing feedback including narratives concerning their experiences. Good feedback has been obtained and will support the improvement in the curriculum and training at the university.

Objective 4: Assess the extent to which the graduates are fit for purpose. To a large extent the survey can only provide part of the answer. The views of the employers are important in supplementing the self-assessment obtained from the respondents in the survey. Partial solutions are obtained from the rate of employment (including self) which is close to 90%. This objective will require further interrogation in the industry and data from this survey will be useful in concluding the fit for purpose question.

Objective 5: Determine gaps in skills and competences that need to be filled in future engineering programmes. A number of gaps have been identified mainly from self-assessment of the respondents. Complimentary information will be required from the side of the industry especially from the employers of these graduates.

Objective 6: Given results of the tracer study and with benchmarking against international exemplars, recommend the tracer study method that could best be used to inform:

Review of curricula for the engineering programmes offered by high education institutions

Each curriculum offered in the School of Engineering is supposed to be reviewed after a cycle of five years according to the requirements of the National Council for Higher Education. There are three layers of programs in the school.

The first layer consists of the traditional engineering programs of Civil, Mechanical and Electrical Engineering. These programs have shown strong signs of resilience (maintaining high numbers over time and good employment proportions).

The second layer consists of programs that were derived from Electrical Engineering. These include Telecommunications Engineering and Computer

Engineering. These are thriving in the times and the new industries in the fourth industrial revolution. However, these programs are also strongly related both in training and employing industries. The curriculum review process should strongly consider disambiguating these programs.

The third layer of programs consists of Biomedical Engineering and Agricultural Engineering. These programs are seemingly less appreciated. The programs have each averaged less than 20 students per year for the last 10 years (even though Agricultural Engineering has been around for more than 20 years). For instance whereas Agricultural Engineering graduated 4 students in 2002, there was only one student graduating in 2005. A thorough review is required for this layer of programs whose training draws resources from across colleges.

a. required upgrading of teaching equipment and/or tools
The respondents have decried the inadequacy of practicals during their training. A list of required equipment may be generated during the curriculum review exercise. The equipment should be derived from the requirements of the course units in the curriculum.

b. career guidance services for students:
A great deal of the career guidance is located in the life of the student before they select programs to pursue at the university. The two weeks allocated to students during the window for the change of programs after admission could be the only opportunity for career guidance to alter the decisions of the students before serious training begins. As students at the university, any career guidance comes in too late as most of the engineering programs don't lavitate into options. In the current dispensation, there is barely any room for career guidance during the course of training. The School of Engineering should consider coining missions to High Schools in conjuction with the Department of the Academic Registrar; promoting the training through media targeting high school students with objectives encouraging them to target careers in engineering; opting for subjects that lead them to these careers as well as studying hard to achieve good grades.

From the survey it became evident that the proportion of students who achieved first class degrees in these programs was 8% which is very high (considering the university average of 2%). Engineering students have generally performed very well over the years. Considering that most of the engineering programs have filled their admission quotas through the time of their existence one can easily conclude that the students largely feel comfortable making engineering their choice at the university.

c. preparation of students (orientation) for transition from HEIs to the work environment
Participation in internship programs was adequately interrogated in the survey. Incites are being generated for inclusion in the report.

Employment Status

Those that indicated they were employed by the public and private sectors were a proportion of 76%. Those that were self-employed were 11% of all respondents; those that were not employed and looking for work comprised of 12% of the total respondents.

Table 16: Employment Status for the respondents in the core Engineering Programs

Pathway	Female	Male	Total
Enrolled for further studies, not looking for work	3	8	11
Self-employed	4	39	43
Un-employed and looking for work	8	55	63
Un-employed and not looking for work	1		1
Working in Private Sector at least 40 hours a week	33	170	203
Working in Private Sector less than 40 hours a week	4	24	28
Working in Public Sector at least 40 hours a week	10	94	104
Working in Public Sector less than 40 hours a week	4	11	15
Undeclared		1	1
Grand Total	**67**	**402**	**469**

Salaries

A proportion of 27% of the respondents reported that they were earning more than 3 Million Uganda Shillings per month with the majority of the respondents (21%) earning between 1 Million Uganda Shillings and 2 Million Uganda Shillings per month. Of the total respondents, 46% earn at least 1 Million Uganda Shillings per month.

Table 17: Monthly Salaries reported by the Respondents

Salary Level	Number	Percentage
Above UGX 3M	122	26%
UGX 2M - UGX 3M	78	17%
UGX 1M-UGX 2M	84	18%
UGX 0.5M-UGX 1M	69	15%
Less than UGX 0.5M	21	4%
Undeclared	95	20%
Grand Total	**469**	**100%**

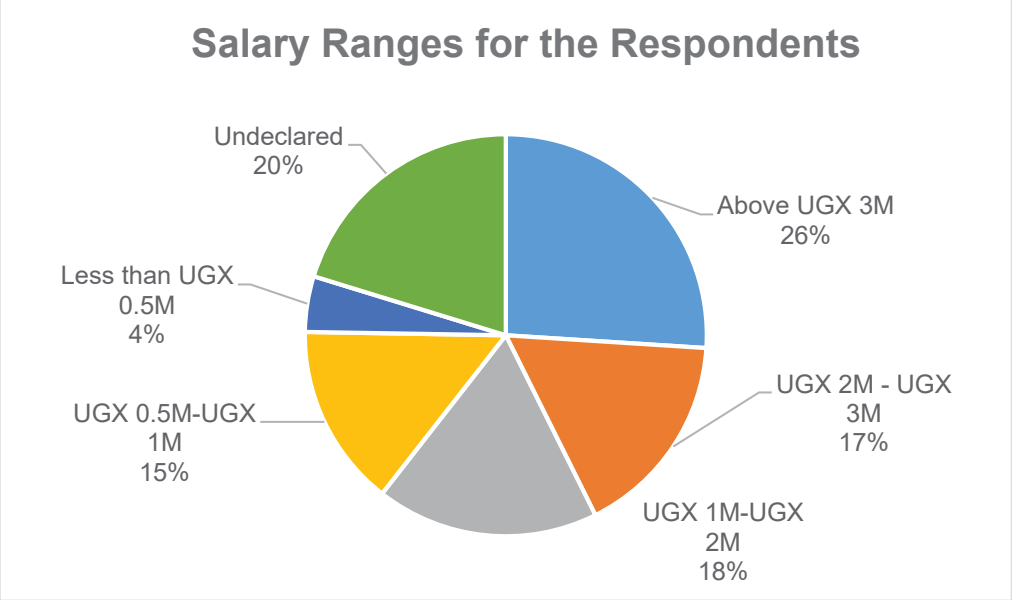


Figure 1: Proportion of respondents within several salary categories

Are they satisfied with their jobs?

A proportion of 79% are satisfied with their current job; 50% very satisfied; 17% ecstatic. The question is what makes them so happy. A key correlate is the salary. However whereas 80% of the higher income category was very satisfied, some respondents earning more than 3 Million Uganda Shillings said they were not satisfied at all. Some of the reasons cited for this phenomena are in the table below:

Table 18: Reported Levels of Satisfaction with the current jobs of the respondents.

Job Satisfaction	Number	Percentage
Very much	86	18%
Much	140	30%
A little	149	32%
Not at all	47	10%
(blank)	47	10%
Grand Total	**469**	**100%**

Table 19: Level of satisfaction reported by the respondents cross-tabulated with salary levels.

	Job Satisfaction					
Salary Level	**A little**	**Much**	**Not at all**	**Very much**	**Undeclared**	**Grand Total**
Above UGX 3M	14	56	5	32	2	109
Below UGX 0.5M	8	1	6	1	2	18
UGX 0.5M to 1M	35	9	16	5		65
UGX 1M to 2M	37	28	6	10	2	83
UGX 2M to 3M	22	21	4	9	1	57
Grand Total	**145**	**152**	**46**	**69**	**40**	**332**

Gross Salary scale is small; Limited opportunity for applying their knowledge; Need for new challenges; Need to improve on their set of skills to be competitive on a global scale (example in electric mobility systems). Other causes include short contracts; poor management and leadership at the companies they are employed with. Stagnation in career growth. Some of the respondents reported that they are in sections of the company where they are not supposed to be (say procurement). A respondent mentioned that the field was not their preference in the first place; they are just happy to be applying the knowledge out of their training. A respondent mentioned that there was so much repetition in what they do.

One self-employed respondent mentioned their involvement in setting up a startup and that most of the money goes into establishing the business.

Yet another respondent mentioned that they have been a graduate trainee for almost two years. A respondent said "I work 10-12 hrs a day, 7 days a week and far away from my family which is mentally disturbing. At the end of the month, I earn little money."

Poor working conditions were mentioned by respondents as a source of dissatisfaction; Overexploitation by the company where they work. Not being involved in decision making. A respondent said "I'm self- employed in running a construction equipment (at the moment I have a concrete mixer, jumping compactor and poker vibrator, hoping to purchase more equipment in future) hiring business. Being new in the business, I still got a lot to learn so as to maximize profits. Additionally, some clients don't pay on time, others require to be run after before they can pay".

Table 20: Respondents who reported they were not satisfied with the current job.

Disatisfaction Category	Number
Job not Challenging	41
Low Pay	44
Inadequate Capital	3
Poor Management and Working Conditions	8
Short Term Contracts	4
No Upward Mobility	14
Social and Family dislocation	4
Total	**118**

Generally speaking, the employed engineering are doing just fine. The companies that employ them need little to do in order to retain these engineers at work. Those who reported a level of dissatisfaction (21%) are a small proportion of those who are employed.

A small proportion (28%) of Engineers reported were married. This was fairly balanced across the gender. The graduates from Agricultural Engineering had the largest proportion (45%) of married respondents; whereas graduates of Computer Engineering had the smallest (14%) proportion of married respondents.

Table 21: Proportion of Respondents who were married.

Marital Status	Female	Male	Grand Total
Married	18	114	132
Single	49	284	333
Undeclared		4	4
Grand Total	67	402	469
Percent Married	**27%**	**28%**	**28%**

Table 22: Proportion of respondents from the various programs who were married

	Marital status				
Program	Married	Single	Undeclared	Total	Percent Married
Bsc Agricultural Engineering	18	21	1	40	45%
Bsc Biomedical Engineering	10	27	2	39	26%
Bsc Civil Engineering	39	113		152	26%
BSc Computer Engineering	3	19		22	14%
BSc in Electrical Engineering	23	66	1	90	26%
BSc in Mechanical Engineering	23	44		67	34%
BSc Telecommunications Engineering	15	42		57	26%
MEng (Civil)	1	1		2	50%
Grand Total	**132**	**333**	**4**	**469**	**28%**

Views about training obtained at Makerere University

Respondents were given an opportunity to give feedback on their training for the purpose of improving this training for future students. In all programs views emerged that ranged from complete satisfaction with the level of provision in the training to complete dissatisfaction. The views obtained from the respondents have further been coded to obtain quick snapshots as well including a few views for improving the training. The categories that emerged from the responses were eight: Curriculum, Institution, Lecturers, Practicals, Social Environment, Computer (Programming and Software), Career Guidance and Field Visits. Specific comments under these categories led to subcategories as indicated in Table 10.

Table 23: Views from respondents on improvement of training.

Category	Count
Curriculum	30
Needs update	21
Relevant	6
Requires update	1
Update	2
Institution	171
Good and Supportive	152
Challenging	19
Lecturers	17
Good	1
Uncooperative	14
Unprofessional	2
Practicals	54
Inadequate	54
Social Environment	3
Good	3
Computer, Programming and Software	8
Needs integrating	8
Career Guidance	1
Required	1
Field Visits	5
Required	5
Total	**289**

Self-assessment on chosen skills

Respondents were asked to assess themselves on the strengths of a spectrum of skills they believe they acquired and are supportive in their work environment. On average, the respondents assessed Team Playing and Group Dynamics followed by Technical Knowledge as the most powerful skill they have at work. All the skills in the list averaged about 3.0 (on a scale of 1-5 with 1 the worst and 5 the best). The lowest rating was on Entrepreneurial Skills; in the free comments respondents recommended that the curriculum should be upgraded to include more training in this area.

Table 24: Self-assessment of respondents on skills acquired during their training at the university.

Self Assessment on Skills Acquired from the University	
Transferable Skills	**Self Assessment Average**
Organization skills	3.86
Communication and Interpersonal skills	3.86
Initiative and Creative Thinking skills	3.95
Negotiation skills	3.50
Entrepreneurial skills	3.23
Problem Solving skills	4.06
Analytical skills	4.11
Leadership skills	3.52
Ability to work independently	3.98
Team player and group dynamics	4.20
time management skills	3.93
conflict resolution skills	3.58
Honesty	3.84
Computer skills	4.04
Technical Knowledge	4.18

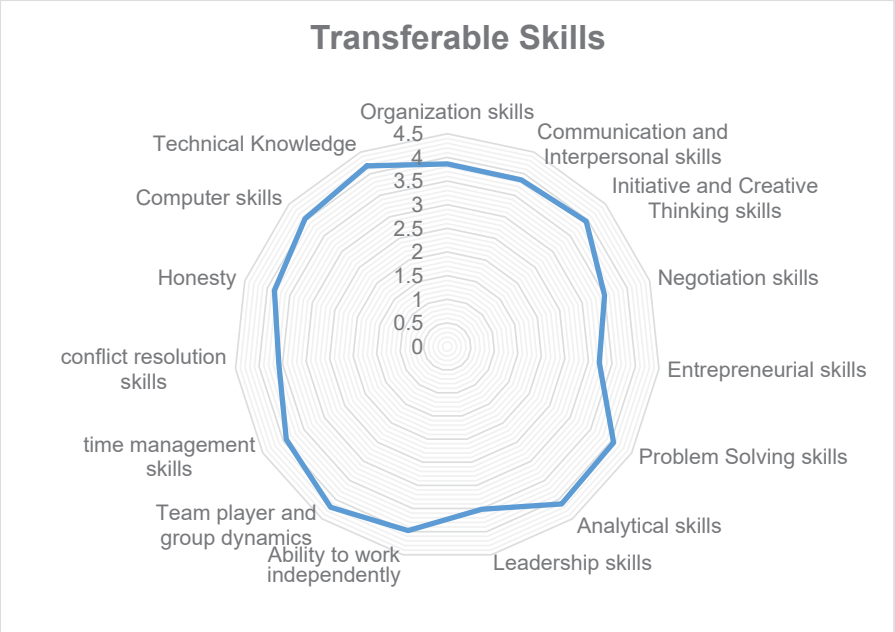


Figure 2: Radar Diagram showing the average self-assessment scores from the respondents on various skills

Predominantly (52% of the views) respondents felt good about Makerere University as an institution and the opportunity it provided them in advancing their careers. The positivity was around the institution being able to transform them into professionals. The negative comments (6.5%) were around institutional processes and bureaucracy that tended to complicate their lives while studying.

Some respondents commented (5%) on uncooperative lecturers who they had to overcome to obtain their qualifications. The lack of cooperation evidenced through poor supervision by final year project supervisors and lack of commitment during the lecturing processes. A respondent commented "Graduation on record time not assured despite the efforts given the lecturer entirely determines your fate. You need to closely follow up your research is supervised. Students are at the mercy of the lecturers. Systems are quite weak"; A respondent commented:

"It is critical that the faculty members and administrators know that students are their customers. Without students, their services would not be required. Secondly people who work for the university should treat students as adults. Whilst Makerere does fairly well in teaching and research, most support staff behave like demigods who are in their offices to be appeased rather than to serve".

A number of comments (18%) were around the inadequacy of practicals in terms of time and equipment. Views on practicals were across all programs on offer. Some respondents recommended an increment in field visits during the training to support hands-on training. Respondents (10%) commented on the curriculum as urgently in need of updates to tune to the state of the art in the industry. Related to the curriculum was the need to integrate computer programming and modern software in the processes of training. Examples given included Computer Aided Design (CAD), Civil 3D, Prota, Midas, and Finite Element Software for Civil Engineering, Prokon, Protastructure, Epanet, WaterCad. Some respondents commented on the need to integrate soft skills (leadership, communication, etc.) in the updated curriculum. Another respondent commented "There is need to introduce modern engineering sciences at CEDAT i.e optimization, Artificial Intelligence, Big data, the Smart Grid, GiBES and crypto tech amongst others to encourage research into novel areas".

A respondent suggested the inclusion of report writing skills in the curriculum pointing to a gap in the capacity to write a structural report as an example. In addition, that the students need to be equipped with critical engineering skills that are needed on the market. Another respondent commented "There is need to teach research methods at undergraduate level to encourage modern research and the publication of works

undertaken".

A respondent suggested that Degree classes discouraged learning and instead encouraged making lots of marks. The respondent proposed that degree classes be removed and instead encourage more of field learning and projects right from year one.

Few respondents commented on career guidance pointing to the need for the College of Engineering to set up a Career Guidance Office whose purpose is to prepare students to the ever-changing workplace environment. The respondent recommended that Career Guidance should be infused in the different courses as well as career workplace visits; in addition to inviting representatives from the industry to campus to talk to the students.

A respondent commented that practical hands-on skills in basic electrical repair, house wiring and machining are only touched mildly which means some graduates cannot do the basics that an electrical engineer is expected to do. This causes embarrassment to the graduates when they join the industry and get compared with graduates from technical institutes. A suggested solution by a respondent was having more practical laboratory sessions that expose students to real world electrical equipment to demystify some concepts and harmonize acquired knowledge. In addition, Guest Speakers from the industry can be invited to speak to students to share about industry experiences. A respondent commented that "The small engineering field in Uganda means that the University will play a big part in exposing a student";

Another respondent commented that "The mentorship program at the College of Engineering is broken. Hardly did any practitioner come around to talk to the collegiate. This in itself is a place of disadvantage";

In other comments respondents suggested:

That the university should support student projects that solve very argent problems in society. This could be through funding or linking them up to funders.

That the university should continue providing entrepreneurship trainings no matter the course of the student. A respondent commented "We leave the university to find no jobs and it's our responsibility to create the jobs. I thank our college for the entrepreneurship classes, they have been invaluable towards my success";

That CEDAT puts in place evening and weekend programs for masters studies. This will enable masters students to be able to attend school while balancing work. And more Ugandans will be able to enrol for these courses.

10. Conclusion and Recommendations

The training programs at the School of Engineering at Makerere University are providing a significant contribution to the economy of Uganda through training engineers in the key categories of Civil, Electrical,Mechanical,AgriculturalandBiomedical Engineering. The training in these programs is supported by has College of Agricultural and Environmental Sciences (CAES) and the College of Health Science (CHS). The programs hosted outside the School of Engineering share part of their curriculum with some programs in the School of Engineering and students are taught together in this shared curriculum. The graduates on these programs (3450) for the period (3450) 2012 to 2021 formed the focus of the graduate tracer study which reviewed among other things the typical career progression path of graduates, wage levels & labor force participation, on-the-job trainings & further education experiences, female engagement, self-employment situation, and unemployment situation. The Inclusion of other programs in CEDAT held useful information related to the industry where the graduates of the core engineering programs were located. In the process of collecting data, graduates from Architecture, Quantity Surveying, Land Economics, Construction Management, Land Surveying and Geomatics were allowed to submit data on the same aspects of the survey.

The Tracer Study findings established over 250 of the typical locations of all graduates. The study gathered views on the relevance of training, skills and competences for the type of work the respondents doing; Assessed the extent to which the graduates were fit for purpose; Determined gaps in skills and competences that needed to be filled in future engineering programmes; Is to inform the review of curricula for the engineering programmes; provides information on the required upgrading of teaching equipment and/or tools, career guidance services for students and preparation of students (orientation) for transition from HEIs to the work environment

An adequate number of respondents (630), of whom 104 (17%) were female, were accessed to support sound incites for the review of curriculum and training environment. Some of the respondents were self- employed and others were unemployed. The rate of employment (including self) which is close to 90%.

A proportion of 7% reported first class as the class of degree awarded to them. The majority of graduates reported upper second class degree qualifications.

A number of gaps have been identified mainly from self-assessment of the respondents. Complimentary information will be required from the side of the industry especially from the employers of these graduates.

The respondents have decried the inadequacy of practicals during their training. A list of required equipment may be generated during the curriculum review exercise. The equipment should be derived from the requirements of the course units in the curriculum.

A great deal of the career guidance is located in the life of the student before they select programs to pursue at the university. The two weeks allocated to students during the window for the change of programs after admission could be the only opportunity for career guidance to alter the decisions of the students before serious training begins. For students at the university, any career guidance comes in too late as most of the engineering programs don't lavitate into options. The School of Engineering should consider coining missions to High Schools in conjuction with the Department of the Academic Registrar;

Those that indicated they were employed by the public and private sectors were a proportion of 76%. Those that were self-employed were 11% of all respondents; those that were not employed and looking for work comprised of 12% of the total respondents.

A proportion of 27% of the respondents reported that they were earning more than 3 Million Uganda Shillings per month with the majority of the respondents (21%) earning between 1 Million Uganda Shillings and 2 Million Uganda Shillings per month. Of the total respondents, 46% earn at least 1 Million Uganda Shillings per month.

A proportion of 79% are satisfied with their current job; 50% very satisfied; 17% ecstatic. Key

correlates include salary, level of challenge at the workplace and opportunities for upward mobility. In all programs views emerged that ranged from complete satisfaction with the level of provision in the training to complete dissatisfaction. Key categories that emerged from the responses were eight: Curriculum, Institution, Lecturers, Practicals, Social Environment, Computer (Programming and Software), Career Guidance and Field Visits.

Predominantly (52% of the views) respondents felt good about Makerere University as an institution and the opportunity it provided them in advancing their careers. The positivity was around the institution being able to transform them into professionals. The negative comments (6.5%) were around institutional processes and bureaucracy that tended to complicate their lives while studying.

A number of comments (18%) were around the inadequacy of practicals in terms of time and equipment. Views on practicals were across all programs on offer. Some respondents recommended an increment in field visits during the training to support hands-on training. Respondents (10%) commented on the curriculum as urgently in need of updates to tune to the state of the art in the industry. Related to the curriculum was the need to integrate soft skills, computer programming and modern software in the processes of training. Examples given included Computer Aided Design (CAD), Civil 3D, Prota, Midas, and Finite Element Software for Civil Engineering, Prokon, Protastructure, Epanet, WaterCad. In addition to the need to introduce modern engineering sciences at the college i.e. optimization, Artificial Intelligence, Big data, the smart grid, GiBES and crypto technologies amongst others to encourage research into novel areas. Other skills suggested include: report writing skills and research skills.

Very few students had enrolled in graduate programs as the past has shown that the capacity of these programs is still low. In addition, the programs in engineering were considered to be professional with the majority of the graduates ready to be registered and start work in their respective areas of training. This phenomenon was reflected in the enrolment on graduate programs in the School of Engineering.

Responses from the self-assessment on transferable skills were averaged and put on Rickert diagram to provide further insights for improvement of training.

Completion of supervised internship was a transitional factor that could mitigate access to employment. Knowledge from the respondents on whether they completed this training and if they submitted a report (and got a good grade from it) was relevant for the GTS. This information was very useful in improving the procedures related to the internship policy in the School of Engineering.

Education of the Parents

The relationship between the education of the parents and student achievement has received attention by scholars. The involvement of parents in the education of their children starts from early childhood. Key transformative factors included the choice of schools, support with homework, creating safe home environments & neighborhoods as well as playing inspirational roles in the lives of the children. In addition, dinner table conversations are likely to reflect benefits associated with acquiring university qualifications.

Student Experiences while studying for the qualifications

Makerere University gives opportunity to students to engage in a variety of intra and extra curricula activities to enrich the experiences of the students and to produce holistic graduates. While student Internships and Projects provide a linkage between the academic involvement in the classroom and the places of work, extracurricular activities like sports; cultural activities; religious engagements and students' leadership promote the general wellbeing of the students. Furthermore, these activities promote the creation of teams and networks that may become useful springboards to social cohesion and harmony in society. Some of the activities turn out to be future careers for the students. In addition career guidance is a useful mitigator for employment.

Institutionalization

Institutionalization of the Tracer studies would involve key aspects like collection and maintenance of data on students during and after their training; maintaining a database of employers for engineering students; proposing budgeting for the tracer studies; proposing the designation of human resources to support

the tracer studies on an annual basis. At exit graduates should be required to fill exit forms that among other things would include their intended permanent addresses including contacts of close family members for future tracing or information sharing.

Type of A-level School

Students are equally being sponsored by the private sector. Government aided schools are no longer monopolizing access to engineering programs.

Participation in Supervised Internship

The proportion of respondents that reported to have participated in supervised internship was 95%. This proportion confirms that, at entry level, the internship program is effective. A few respondents made comments to the effect that the host environment varies from company to company pointing to a need to strengthen this internship link. Respondents have suggested that some companies are invited to the university during the time of training to talk to the students while still at the university.

Intention to pursue further studies

A proportion of 91% of the respondents indicated that they have intentions to pursue further studies, with 42% (200 respondents) having intentions to pursue further studies up to the level of PhD. Whereas some of the respondents have already enrolled for further academic pursuits, some even completed, a few the respondents indicated that they are still held up by several reasons. Most of the impediments are financial and failure to secure release from their jobs.

Recommendations

Each curriculum offered in the School of Engineering is supposed to be reviewed after a cycle of years determined by the duration of the study program according to the requirements of the National Council for Higher Education. These reviews should continue promptly with several points in the list below:There are three layers of programs in the school:

1. The first layer consists of the traditional engineering programs of Civil, Mechanical and Electrical Engineering. These programs have shown strong signs of resilience (maintaining high numbers over time and good employment proportions). These programs should be strengthened as the flagship programs in the school. In addition these are likely to provide the base required in research and graduate training;
2. The second layer consists of programs that were derived from Electrical Engineering. These include Telecommunications Engineering and Computer Engineering. These are thriving in the times and the new industries in the fourth industrial revolution. However, these programs are also strongly related both in training and employing industries. The curriculum review process should strongly consider disambiguating these programs;
3. The third layer of programs consists of Biomedical Engineering and Agricultural Engineering. These programs are seemingly less appreciated. The programs have each averaged less than 20 students per year for the last 10 years (even though Agricultural Engineering has been around for more than 20 years). For instance whereas Agricultural Engineering graduated 4 students in 2002, there was only one student graduating in 2005. A thorough review is required for this layer of programs whose training draws resources from across colleges;
4. The respondents have decried the inadequacy of practicals during their training. A list of required equipment may be generated during the curriculum review exercise. The equipment should be derived from the requirements of the course units in the curriculum; Inclusion of practical hands-on skills in basic electrical repair, house wiring and machining are only touched mildly which means some graduates cannot do the basics

that an electrical engineer is expected to do;

5. The proportion of students who achieved first class degrees in these programs was 8% which is very high (considering the university average of 2%). Engineering students have generally performed very well over the years. This is an opportunity draft more students into the proportion. Indeed admission quotas have always been filled for these programs. The School should leverage on this positivity scale the training to cover more areas of engineering. Considering that most of the engineering programs have filled their admission quotas through the time of their existence one can easily conclude that the students largely feel comfortable making engineering their choice at the university.

   The university should identify role models for the various engineering programs to sustain this trend; The College of Engineering to set up a Career Guidance Office whose purpose is to prepare students to the ever-changing workplace environment. Career Guidance should be infused in the different courses as well as career workplace visits; in addition to inviting representatives from the industry to campus to talk to the students; The School of Engineering should consider coining missions to High Schools in conjuction with the Department of the

   Academic Registrar; promoting the training through media targeting high school students with objectives of encouraging them to target careers in engineering; opting for subjects that lead them to these careers as well as studying hard to achieve good grades;

6. Participation in internship programs should be upheld; internships should be complimented by field visits to key industries;

7. Those that indicated they were employed by the public and private sectors were a proportion of 76%. Those that were self-employed were 11% of all respondents; those that were not employed and looking for work comprised of 12% of the total respondents. Clearly the country has a shortage of professional engineers. This notwithstanding some engineers are looking for employment. This points to a need to review curriculum in line with the National Development Plans while keeping in view the aspirations of the East African Community;

8. A proportion of 27% of the respondents reported that they were earning more than 3 Million Uganda Shillings per month with the majority of the respondents (21%) earning between 1 Million and 2 Million Uganda Shillings per month. Of the total respondents, 46% earned at least 1 Million Uganda Shillings per month. The earnings in the industry are mainly outside the control of the university. Working with agencies and societies the university can influence what the industry offers as wages. In addition some protection in terms of local content could go a long way in influencing the wages. Government could gazette some positions in skill sets that can be acquired from Uganda;

9. Generally speaking, the employed engineering are doing just fine. The companies that employ them need little to do in order to retain these engineers at work. Those who reported a level of dissatisfaction (21%) are a small proportion of those who are employed;

10. The mentorship program at the College of Engineering is broken. Practitioners should be invited to talk to the students. In addition, the university should support student projects that solve very argent problems in society. This could be through funding or linking the students to funders;

11. That college should consider putting in place flexible modes of offering its programs especially at the postgraduate level. This could be in form of evening and weekend programs. This will enable masters students to be able to attend school while balancing work. And more Ugandans will be able to enroll for these courses.

11. References

Rosenberg,S., Heimler, R., & Morote, S. (2012). Basic employability skills: A triangular design appr Education + Training. 54(1):7-20.

Schomburg, H. (2003). Handbook for Graduate Tracer Studies. Schomburg, H., & Teicher, U. (2 Higher education and graduate employment in Europe. Results from graduate surveys from tw countries. Higher Education Dynamics 15, Dorrecht, Springer.

Ssembatya, V.A & Ngobi.K.R. (2014). Mapping the Careers and Mobility of Makerere University Doc Graduates. A tracer study on PhD Graduates of Makerere University 2000-2012.

Goldwyn-Simpkins, H. (2015). What do graduates do?. Manchester: Prospects/AGCAS.
Minsk (2018), International experience in the implementation of graduate tracer studies in h education.

Azhar,M. , Nadeem, S, Naz, F, Perveen, F. , & Sameen.(2013). Impact of Parental education and Socio- economi status on academic achievements of University Students. International Journal of academic Research and Reflection:1(3):25-33.

CHE, (2013) Pathways from University to Work: A graduate destination survey of the 2010 cohort of graduates from the Western Cape University

Guthrie, H., Stanwick, J., Karmel, T. (2008). Pathways: Developing the skills of Australia's workforce. National Centre for Vocational Education Research.

ee, H . (2014). To marry or not to marry before graduation. USA Today College.
Schomburg, H . (2008). Handbook for graduate tracer studies, Centre for Research on Higher Education and work. university of Kassel.

Adegbuyi, P.A.O. and Uhomoibhi, J.O. (2008). Trends in the Development of Technology Engineering Education in Emerging Economies. Multicultural Education & Technology Jou
2 (3), pp. 132-139. Emerald Group Publishing Limited.

Booth, S. (2004). Engineering education and the pedagogy of awareness. In Brown, S Effective Learning and Teaching in Higher Education (PP 9-23). London: Taylor & Francis e-ibrary.

Maillardet, F. (2004). What outcome is engineering education trying to achieve? In Brown, S. Effective Learning and Teaching in Higher Education (PP 9-23). London: Taylor & Francis e-ibrary.

Signed:

Vincent A. Ssembatya, PhD.

Robert K. Ngobi, PhD.

Appendix I: Sample Questionnaire

MAKERERE UNIVERSITY

DIRECTORATE OF QUALITY ASSURANCE

Quality Assurance Directorate:
Room 203, Senate Building
Makerere University
P.O. Box 7062, Kampala, Uganda
Tel: +256 414 533009
Fax: +256 414 533640
Email: vas@qad.mak.ac.ug
http://qad.mak.ac.ug

MAKERERE UNIVERSITY
Graduate Tracer Study 2016

Dear Makerere University Graduate of 2014,
Makerere University is undertaking a study regarding your employment status, further study or other activity you are engaged in after completing your Makerere University award of 2014. The information will assist the university in improving the quality of teaching and learning. The information provided will be kept confidential and presented without disclosing personal information. We are very grateful for your acceptance to participate in this survey.

A. General

1. Last name: _____ First Name(s): _____ Maiden Names (if applicable): _____
2. Sex: Male ☐ Female: ☐
3. Age: ☐
4. Marital Status: Married ☐ Single ☐
5. Highest Education Qualification attained by parents:

	Primary	Secondary	Certificate	Diploma	Degree	Masters	Phd
i. Father							
ii. Mother							

B. Education

6. Title of degree awarded _____
   Year of award ☐ Year of enrolment ☐
7. Class of degree: 1st ☐ Upper Second ☐ Lower Second ☐ Pass ☐
8. Did you possess any other tertiary-level qualification before enrolling for the above award?
   Yes ☐ No ☐
   i. If yes, please indicate details in **Table 1** below

Title of Previous Award	Awarding Institution(s)	Year of Award

9. What was the mode of access to university education; A'Level or Equivalent ☐ Mature Age ☐
   Diploma ☐ Transfer from another University ☐
   What type of A-level school did you attend? Government Aided ☐ Private ☐
   District where the A-level School was located _____

C. Further study

10. Have you completed a higher qualification since you graduated in 2014? Yes ☐ No ☐
    If Yes please give details in **Table 2** below

Title of Award	Awarding Institution(s)	Year of Award

12. (a) Do you intend to pursue further studies? Yes ☐ No ☐
    (b) Up to what level do you plan to study? Postgraduate Diploma ☐ Masters ☐ PhD ☐
    Others; _____

(c) Would you consider enrolling at Makerere University for further studies; Yes ☐ No ☐

(d) Would you enroll in the same discipline you pursued your qualification awarded in 2014;
Yes ☐ No ☐

(e) What are your current impediment(s) to further studies; Financial ☐ Class of degree ☐
Time off current employment ☐ Family commitments ☐ other (specify)

D. Experience while Studying for the qualification earned in 2014;

13. (a) Did you receive any career guidance while studying for this qualification? Yes ☐ No ☐

(b) Did you participate in any supervised internship programme while studying for this qualification? Yes ☐ No ☐

(c) If Yes please state the duration of the internship: Months ☐ Days ☐

(d) Did your programme require completion of a project? Yes ☐ No ☐

(e) Did you participate in any extracurricular activities while studying for this qualification?
Academic Associations ☐ Sports ☐ Cultural Organizations ☐
Religious Organizations ☐ Student Leadership ☐

E. Employment

14. (a) Did you continue in the same area of employment after graduation?

(b) Which one of the following best describes your current activity with regard to paid work?

(i) Working full time (at least 40 hours a week) ☐ Start date; Title of job;
Public Sector (specify government entity)
Private Sector (specify company name)

(ii) Working part time (less than 40 hours a week) ☐ Start date:
Public Sector (specify government entity)
Private Sector (specify company name)

(iii) Were you employed prior to studying for qualification awarded in 2014; Yes ☐ No ☐

(iv) Did you continue in the same area of employment after graduation; Yes ☐ No ☐

(v) Self Employed: Yes ☐ No ☐ Specify Please give a reason for being self employed;

(vi) Unemployed and looking for work;Yes ☐ No ☐

(vii) Continuing with Higher Education Studies;Yes ☐ No ☐

(viii)Employed in the informal sector (Street vendors, kiosks, ...);Yes ☐ No ☐

(ix) Unemployed and not looking for work (Home makers, caregivers, ...);Yes ☐ No ☐

(x) What was the source of information for your current Job?
Advertising(News paper, employer's website e.t.c) ☐ Head hunted by employer ☐
Social network ☐ Directly Contacted employer ☐

15. How do you rate the contribution of your programme of study at Makerere University relating to:

	Very High	High	Medium	Low
Organisational Skills				
Problem Solving Skill				
Leadership Skills				
Ability to work independently				
Creativity/Creative thinking				
Negotiating Skills				
Team work/Team orientation				
Time Management				
Initiative/Risk Taking;				
Writing Skills;				
Communication Skills/Interpersonal skills;				

	Very High	High	Medium	Low
Computer Skills				
Technical Knowledge				
Decision-making				
Enterpreneurship skills				
Ability to work under pressure				
Analytical Skills				

16. Are you satisfied with your current job? Very much ☐ Much ☐ A little ☐
    Not at all ☐ If not why?
17. Do you intend to stay in the same job/profession; Yes ☐ No ☐
18. Any other comment concerning your study experience at Makerere University

Please return to;
Directorate of Quality Assurance,
Makerere University,
Senate Building Room 203
Lincoln Road.

Serial No. ☐

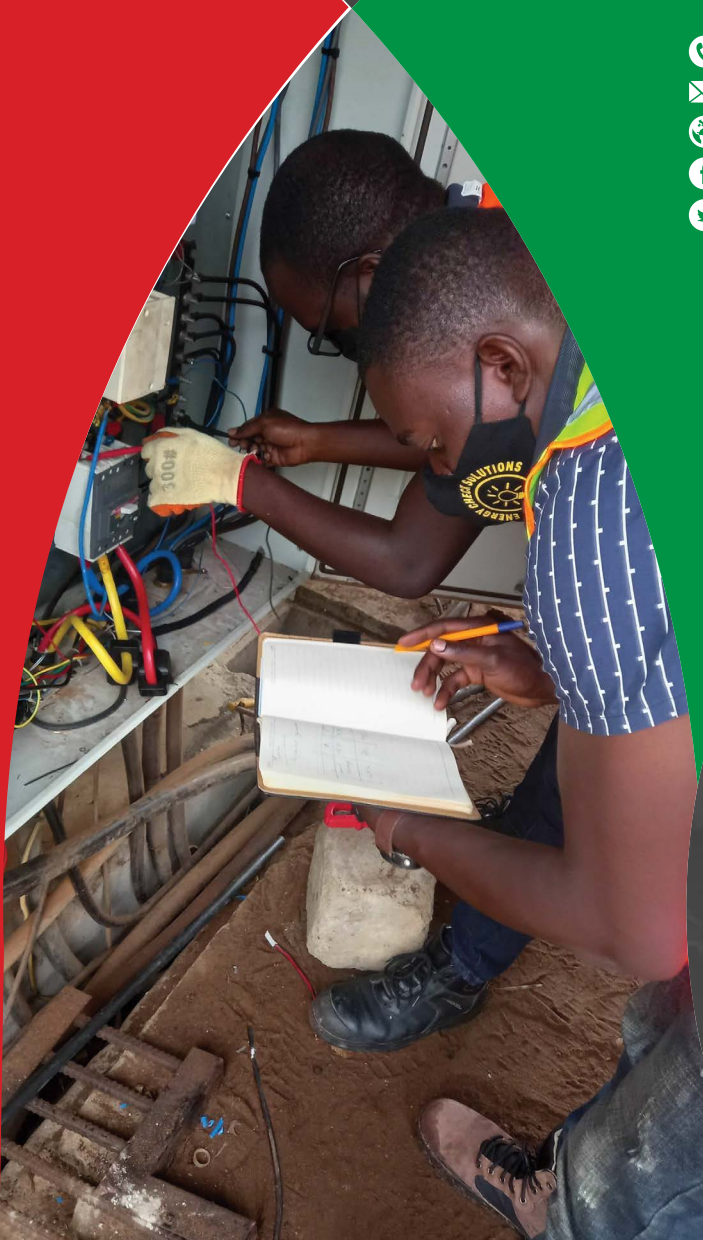
Organisations that Employed Engineers who Responded to the Survey

Table 25: Organisations that employ the respondents in the survey.

	Company	Number		Company	Number
1	A&S Electronics	1	140	MANTRAC UGANDA LTD	1
2	Abacus Medical appliances ltd	1	141	Mbarara District	1
3	Absa bank Uganda	1	142	Mbawo Timber works LTD	1
4	ACHELIS UGANDA LIMITED	1	143	Mcash	1
5	ACWA Power	1	144	McDermott International	1
6	AD Concepts Ltd	1	145	McLeod Russell Uganda limited Mwenge tea estate	1
7	Africell Angola	1	146	Medequip Uganda Limited	1
8	AIR WATER EARTH (AWE) LIMITED	1	147	Met Surveyors	1
9	Akvo International SMC Ltd	1	148	Metka-egn	1
10	All Across Africa	1	149	Microhaem Scientifics	1
11	Aloesha Organic Natural Health	1	150	Ministry of Agriculture, Animal Industry and Fisheries.	3
12	Amolatar District Local Government	1	151	Ministry of Defence	1
13	ANOMA GROUP PVT CO.LTD	1	152	Ministry of Education and Sports	2
14	Archtech Consults	1	153	Ministry of Energy and Mineral Development	2
15	ARPE Limited, Berkeley Energy Uganda	3	154	Ministry of Gender Labour and Social Development	1
16	ARRAY MEDICAL SUPPLIERS AND CONSULTS LIMITED	1	155	MINISTRY OF HEALTH- FORTPORTAL REGIONAL REFERRAL HOSPITAL	1
17	ASIGMA Capital Advisory Services Limited	3	156	Ministry of ICT and National Guidance	1
18	Associated Mapping Professionals	1	157	Ministry of lands housing and urban development	3
19	Aster Integral Private Limited	1	158	Ministry of Water and Environment	4
20	Atomic energy council	1	159	Mogas Uganda Ltd	1
21	AWAMO Gbh	1	160	Mott MacDonald	2
22	Badaye Technologies Ltd	1	161	Movit Products Limited	2
23	Badru Kasibante and Partners Limited	1	162	MTN Uganda	2
24	Bageine and Company	1	163	MUGA SERVICES LTD	1
25	Blades Unique Supplies E.A LTD	1	164	MultiChoice Uganda Limited	1
26	Budaka District Local Government	1	165	Multipex Ditaco VJ	1
27	Bujagali Energy	1	166	Muni University	1
28	Bukos Engineering Services Limited	1	167	MUWRP	1
29	Butaleja District Local Government	1	168	NAADS	1
30	Butambala District Local Government	1	169	Nabilatuk District Local Government	1
31	C&G Andijes Group Limited	2	170	Nakasero Hospital	1
32	Canaan Construction Company Ltd	1	171	National Animal Genetics Resources Center and Daya Bank	1
33	Celtick Construction Limited	1	172	National Revenue Authority - South Sudan	1
34	Centenary Bank	1	173	National Water and Sewerage Corporation	7
35	Centre For Infrastructure Consulting Ltd	1	174	NBRB	1
36	Ceremoi Engineering Company	1	175	NEC CONSTRUCTION WORKS & ENGINEERING LTD	3

37	CFAO Motors Uganda Limited	1	176	Newplan Limited	2
38	CHINA STATE	1	177	Newton Construction Ltd	1
39	China Wu Yi Co., Ltd	1	178	Ng'aali - Protosthetics	1
40	Chrisarc(U) Limited	1	179	Niem Establishment	1
41	Cipla Quality Chemical Industries Limited	1	180	Nile Breweries Limited	1
42	CITZ TECHNOLOGIES	1	181	NWSC	1
43	Coca-cola Beverages Uganda	1	182	Obed Construction Company	1
44	Code Academy Uganda	1	183	Octopus medical solutions limited	1
45	Complant Engineering & Technical Services Limited	2	184	Olam Uganda Limited	1
46	Concrete Construction Limited	1	185	Open Capital	1
47	Crane Aluminium and Construction Ltd	1	186	Open World Contractors	1
48	Crown Beverages Limited	1	187	OUBUNTU CONSULTING LTD	1
49	Csquared Limited	4	188	Oxylife 2020 (U) ltd	1
50	Cube Engineering and General Supplies Limited	1	189	Paroz Co. Ltd	1
51	Dawinci Impressions Ltd	1	190	Pearl Engineering limited	1
52	Dell Technologies	1	191	PEDREW ENGINEERING COMPANY LIMITED	1
53	Deloitte Australia	1	192	Pendocare	1
54	Deloitte Uganda Limited	3	193	Petroleum Authority of Uganda	1
55	Design station Architectural Firm	1	194	Plan International	1
56	DHL	3	195	PriceWater House Coopers- PwC	5
57	Dimension Data Uganda Limited	1	196	Proess Consulting Engineers	1
58	Directorate for ICT Support Makerere	1	197	PROHELI INTERNATIONAL SERVICES LTD, Nakasongala AirForce Base	3
59	Directorate of Industrial Training	1	198	Proman Consult Ltd	1
60	DOTT Services Limited	2	199	Raising the Village	1
61	Dynaco Limited	2	200	Reliefline Ug Ltd	1
62	East African Playgrounds	1	201	Research and Education Network for Uganda	1
63	East African Roofing Systems	1	202	Rhema hospital	1
64	Egiss Engineering Contractors	1	203	RIMA(E.A) LTD	1
65	Elsmed East Africa	1	204	Riverine Investment Company	1
66	ENABEL	1	205	ROKO	1
67	Endeleza Clarity SMC	1	206	Roofings Rolling Mills Ltd	4
68	Engineering Ministries International	1	207	Roughton international consultants	1
69	Engineers Brigade, UPDF	1	208	Rubirizi District Local Government	1
70	Engineers Without Borders-USA	1	209	Rural Electrification Agency	1
71	EPM Engineering Consults	2	210	SAED Technical Services Limited	1
72	EPSILON UGANDA LTD	1	211	Sartorius Uganda Limited	1
73	Equatorial Power	1	212	Schlumberger	1
74	Ernest and Young	2	213	SECO MARINE	1
75	Eskom Uganda Limited	1	214	SELEMANI CONSTRUCTION	1
76	Ever Well Cable and Engineering Co Ltd	1	215	Shamostech solutions	1
77	EWB-USA	1	216	SICPA UGANDA LIMITED	1
78	EXCEL CONSTRUCTION LIMITED	3	217	Sigma Immobili Ltd	1
79	Exon Biotechnology	2	218	SinoHydro corporation Limited	2
80	Exper Medical Netwoek	1	219	SMS CONSTRUCTION LTD	1

81	Eye-Grain APS	1	220	Sogea satom	1
82	Favour Africa Ministries International	1	221	Soliton Telmec UG ltd	4
83	FBW Uganda Ltd	1	222	Southern Nevada Water Authority	1
84	Foundation Rural Energy Services Uganda Limited	1	223	Specialised Technical Services	1
85	G-TECH LIMITED MUKONO	2	224	Spidd Africa Ltd	1
86	Galbern Construction Works Limited	1	225	Stanbic Bank	1
87	GIZ	1	226	Star Times Uganda	1
88	Global Solutions and Resources Consortium Limited	1	227	Staunch Consultancy and Engineering Services LTD	1
89	GMT Consults	1	228	Steward Consultancy Limited	1
90	Gozemu Technical Consultants	1	231	STOCK CONTROLLERS	1
91	Great Lakes Contractors Limited	1	232	STRECO (K) LTD	1
92	Greenlight Planet (U) Limited	1	233	Survey Uganda Limited	1
93	Growwell U Ltd	1	234	Symbion Uganda	1
94	Gulu Regional Referral Hospital	1	235	Tactical Infinity	1
95	Human Diagnostics Uganda Ltd	1	236	Taifa Partners Limited	1
96	I-engineering	1	237	Tata Uganda Limited	1
97	ICS Engineering and Environment	4	238	Technology Consults	1
98	Ingeniosite Engineering Consults	1	239	Terrain Services Ltd	1
99	Innok Engineering Ltd.	1	240	Thrive property solutions	1
100	Innovix Uganda Limited	1	241	Tororo district local government	1
101	Inspecta Africa Limited	1	242	Total Energies	6
102	Insurance company	1	243	Toyota Uganda Limited	1
103	International Atomic Energy Agency	1	244	Tugende Limited	2
104	IPL	1	245	UB Consulting Engineers Ltd	13
105	Japotech Solutions	1	246	UCAA	1
106	JESA FARM DAIRY LTD	1	247	Uganda Airforce	1
107	Joint Medical Stores	2	248	UGANDA AIRLINES	1
108	Junhui Company Limited	1	249	UGANDA CHRISTAIN	1
109	Kabale municipal Council	1	250	Uganda coffee (UGACOF)	1
110	Kagga and Partners	1	251	Uganda Coffee Development Authority	1
111	Kajjansi Brick and Tile Works Ltd	1	252	Uganda Electricity Distribution Company Limited	2
112	Kalungu District Local Government	1	253	Uganda Electricity Generation Company Limited	2
113	KAMPALA CAPITAL CITY AUTHORITY	5	254	Uganda Electricity Transmission Company Limited	3
114	Kampala Electric Mart	1	255	Uganda Marytrs Housing & Construction Company Limited	1
115	Kayunga District Local Government	1	256	Uganda National Association of Building and Civil Engineering Contractors (UNABCEC)	1
116	Kazo District Local Government	1	257	Uganda National Roads Authority	15
117	Kiira Motors Corporation	5	258	Uganda Police Force	1
118	Kikagati Power Company Limited	1	259	Uganda Prisons Service	1
119	King Albert Construction Company Ltd	1	260	Uganda Railways Cooperation	2
120	Kiryandongo District local government	1	261	Uganda Revenue Authority	2
121	Kitgum Municipal Council	1	262	Umbrella of water and sanitation	1



Makerere University College of Engineering, Design, Art and Technology (CEDAT)

P. O. Box 7062, Kampala, Uganda
Tel: +256 414 545129
Email: cedat.soe@mak.ac.ug
Website: www.cedat.mak.ac.ug
Facebook: MakerereCEDAT
Twitter: MakerereCEDAT - soe@x