University of Nairobi

Republic of Kenya

TRACER STUDY ON DESTINATION OF ENGINEERING GRADUATES FROM PUBLIC AND PRIVATE UNIVERSITIES IN KENYA

November-2021

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Foreword

The Ministry of Education through the State Department of University Education and Research commissioned the University of Nairobi to conduct a tracer study, targeting engineering graduates from both public and private universities in Kenya. The tracer study focuses on destination of engineering graduates, with the following goals: (a) to establish the employability of graduates, and (b) to provide feedback to inform the curriculum development and review process.

The tracer study is part of the Ministry of Education's concerted effort to improve the quality and relevance of engineering and applied science training in local universities. The overall goal is to produce high quality human resource to work in the productive sectors of the economy in line with Vision 2030 and the "Big Four" agenda. The Ministry of Education in collaboration with the Africa Development Bank Group (AfDB) is currently addressing the challenge of low number of qualified staff in the fields through training of existing staff at masters and doctorate levels to serve the institutions of higher learning and other research institutions.

For the training to be relevant to the needs of the labour market, there is need for feedback to the universities that will inform curriculum development and review process. One way of obtaining feedback on quality and relevance of training is to conduct a tracer study targeting past graduates of the training and their employers. Feedback from tracer studies would also help in improving on the delivery methods and ensure that graduates attain the skills and competencies required by the employers. The tracer study on destination of engineering graduates from public and private universities in Kenya was contracted by the Ministry of Education, State Department of University Education and Research to the University of Nairobi with financial support from the Africa Development Bank (AfDB).

The Ministry of Education through the Commission of University Education expects universities to carry out tracer studies periodically to inform policies regarding programs being offered. This study is expected to provide methodology for such good practice. In this regard, the consultant was asked to advise on database and data collection instruments that would enable universities to annually carryout tracer studies to monitor their graduates' occupational movements in the labour market.

Amb. Simon Nabukwesi
Principal Secretary –
State Department for University Education and Research
Ministry of Education

Acknowledgements

I wish to sincerely thank the Ministry of Education, State Department of University Education and Research (SDUER) and the Africa Development Bank Group (AfDB) that provided funding for the tracer study on destination of engineering graduates from public and private universities in Kenya. The tracer study covered all the 18 Kenyan universities offering engineering degree programs as of 2020. The Ministry through the Project Implementation Committee provided advice to the tracer study team during consultation meetings and facilitation through letters of introduction to stakeholders. I wish to express our gratitude to members of the Project Implementation Committee with special mention to Mr. James Kiburi (Chair, Project Implementation Committee) and Mr. Charles Obiero (Project Coordinator).

The study utilized database and contact information on engineering graduates for three cohorts 2009, 2014, and 2018 from various schools and departments of engineering from all the participating universities. I am grateful to deans of schools and heads of departments who labored to provide the required data. The cooperation of the deans and heads was critical and where such cooperation was lacking the universities were not adequately represented in the study. I am grateful to the vice chancellors of all the participating universities for their support.

I would also like to express my gratitude to the management of the University of Nairobi, in particular the DVC Research and Extension Services, who supported the research project by encouraging the team and providing space and time for the study. I deeply appreciate the contribution of the two secretaries, Ms Lydia Kamau and Ms Victoria Mbui who managed the communication and documentation for the study, Mr. Humprey Misigo, the head of ICT at the College of Architecture and Engineering who handled online questionnaires and outreach, and Dr. Rachael Sarguta, Department of Mathematics, who undertook data analysis for the study.

I am particularly grateful to members of the research team who individually and collectively showed great resilience and teamwork in undertaking the study during a difficult and trying period of Covid-19. Each member made unique contribution to the study.

Thank you.

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Acronyms and Abbreviations

AfDB	Africa Development Bank
CAE	College of Architecture and Engineering
CUE	Commission of University Education
EBK	Engineers Board of Kenya
HELB	Higher Education Loans Board
IGU	International Gas Union
IEK	The Institution of Engineers of Kenya
ISK	The Institution of Surveyors of Kenya
KAM	Kenya Association of Manufacturers
KENET	Kenya Education Network Trust
KII	Key Informant Interview
KITP	Kenya Industrial Transformation Programme
KUCCPS	Kenya Universities and Colleges Central Placement Service
LAPSSET	Lamu Port, South Sudan, Ethiopia Transport Corridor
LSB	Land Surveyors Board
MoTIH&UD	Ministry of Transport, Infrastructure, Housing and Urban Development
REREC	Rural Electrification and Renewable Energy Corporation
SAGAs	State and Governmental Agencies
SDUER	State Department of University Education and Research
SGR	Standard Gauge Railway
STEM	Science, Technology, Engineering & Mathematics
ToR	Terms of References
UNESCO	United Nations Educational, Scientific and Cultural Organization

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Executive Summary

Background

The overall goal of Vision 2030 is to transform Kenya into a middle income and industrialized country through the production of high-quality human resources, mainly science and engineering related fields to work in the productive sectors of the economy. The Ministry of Education, State Department of University Education and Research (SDUER) is therefore concerned with the significantly low number of qualified teaching staff in the engineering field, which is noted to adversely affect the capability of universities and technical institutions to fill in existing teaching vacancies in the engineering field. The Ministry is currently addressing this challenge through training of existing staff at masters and doctorate levels to serve the institutions of higher learning and other research institutions. However, the Ministry still feels that for the training to be relevant to the needs of the labor market, there is need for feedback to the universities that will inform curriculum development and review process, hence the need to conduct this tracer study which focuses on destination of engineering graduates, with two noble goals listed as follows:

a. Establishing employability of graduates, and

b. Providing feedback to inform the curriculum development and review process

The study was undertaken by a team of researchers based at the University of Nairobi, College of Architecture and Engineering (CAE), after a competitive bid put out in February 2019 by the Ministry of Education, State Department of University Education and Research to select a suitable university to undertake the study. The execution of the contract was delayed by one and half years following national lock down due to the Covid-19 pandemic conditions in 2020. The study focused on destination of engineering graduates from public and private universities in Kenya. This study is expected to build on a pilot study carried out by the Ministry on graduates of electrical engineering-based programmes in 2012.

Tracer Study Objectives

The main objective is to carry out a comprehensive tracer study in engineering programmes to establish the employability of graduates and provide feedback to inform the curriculum development and review process.

The specific objectives are listed as follows:

1. To establish the engineering and applied sciences graduates employment rates in terms of gender and geographic distribution.

2. To establish the destination of engineering and applied science graduates after training.

3. To establish length of time taken by graduates to secure employment that corresponds to their qualification.

4. To establish the challenges encountered by engineering and applied science graduates in securing employment including self-employment.

5. To establish areas that need improvement in engineering and applied science training from employers.

6. To carry out extensive literature review and recommend best practice.

7. Advise on database and data collection instruments that would enable Universities to bi-annually carry out tracer studies to monitor their graduates' occupational movements in the labour market.

8. Provide an objective picture of the assessment of engineering and applied science graduates by their employers in terms of scholarly abilities, application of theoretical knowledge to concrete problems, ability to generate and disseminate knowledge and their competitiveness.

9. Provide an in-depth assessment of how graduates assess themselves and the relevance of skills and competence acquired in university within the world of work.

10. Establish the level of employer satisfaction regarding graduate employee's knowledge, skills and level of performance.

Study Methodology

The study utilized mixed methodologies benchmarked with similar studies reviewed in literature. They include literature review, questionnaires, key informant interviews, focused group discussion and stakeholder workshops. Methodologically, the study focused on the three cohorts (2009,2014 and 2018) taking into consideration the engineering course training cycle, technological transformation trends, and changes in the Kenya constitution which was presumed to have an impact in both professional and academic spheres.

Engineering as a discipline in Kenya is broad and diverse. The Engineers Board of Kenya (EBK) recognizes 60 Engineering programmes whereas the Commission of University Education (CUE) recognizes 110 programmes being taught across 18 Universities in Kenya, with the absolute majority 16 of the Universities accounting for 88.9% being public universities and 2 noted to be private universities. The Research Team worked closely with all relevant ministries and organizations, including the Ministry of Transport, Infrastructure, Housing and Urban Development (MoTIH&UD), State and Governmental Agencies (SAGAs) e.g. Rural Electrification and Renewable Energy Corporation (REREC), the professional and regulatory bodies for engineering, employers, alumni, Kenya Universities and Colleges Central Placement Service (KUCCPs), Commission of University Education (CUE) and Kenya Education Network Trust (KENET).

The entire study was done in a collaborative manner. The Research Team held several consultative meetings with the MOE-SDUER team and key stakeholders. The team held 3 consultative meetings with MOE-SDUER team, with the first one taking place on 27th May 2019 and the last one on 5th of October 2021 to finalize the work and agree on the validation workshops. Two stakeholders' workshops were organized, with the first held on the 20th of November 2019 at the

Nairobi Safari Club, Lilian Towers whose scope was to share with the stakeholders the proposed methodology for inputs as the team continued to develop and update the engineering graduates address database from the target universities. Inputs from the workshop led to refinement of the survey instruments and building of a network of contacts with participants from universities and employers. Due to Covid-19 related delay, the second and the last workshop was held virtually on 10th of November 2021. This was a validation workshop where the Research Team shared with the stakeholders the outcome of the study for their inputs and validation and the participation raised useful inputs which were infused in this report.

The contacts for engineering graduates were sourced from the engineering schools in the respective universities. A few of the universities offering engineering programmes did not have engineering graduates for the cohorts selected because their programmes were established recently. For those which were constituent colleges, their students graduated through the parent university.

A total of 5787 engineers graduated from various universities within the three cohort groups. Contacts were established with 1391 being about 24% of the graduate engineers. A majority (64.7%) of the graduate engineers' respondents had graduated in 2018, while 20% graduated in 2014, and 15.3% graduated in 2009. Responses were fewer from graduates of earlier cohorts, 2009 and 2014, just as the contacts received from those cohorts were fewer. This is due to the currency of the contact addresses of the graduates.

The team applied snowball technique in tracing engineering graduates whereby known class leaders were able to share contacts of classmates through their socialnetworks (WhatsApp, Facebook, Instagram).

The process was slow, time consuming and required a lot of follow-ups by lead experts and research assistants. The research team undertook the design of an online questionnaire (survey monkey) for wider online outreach and interview guides based on the terms of reference of the tracer study. The draft questionnaires were presented, discussed, and refined during and after the first stakeholder workshop. Questionnaires were designed for Graduate Engineers, Deans of Schools of Engineering, and Employers for online administration. A total of 465 graduate engineering students responded to the online questionnaire while a total of 21 employers from various sectors (Construction, land surveying, food and agriculture, roads and education) responded to the employers' questionnaires. An online Focus Group Discussion (FGD) was conducted with stakeholders on 20th May 2021 to better understand the study issues and in a bid to triangulate the views and perceptions raised by the other respondents.

Findings

The number of universities offering engineering programmes increased rapidly from 5 in 2002 to 18 in the year 2018. Similarly, the universities offered an increasing diversity of undergraduate engineering programmes, from 5 in 1980 to 110 programmes approved by the Commission for University Education by the year 2020. It was observed that some universities have highly specialized undergraduate programmes. However, such programmes are likely to leave out core areas and fail to produce an all-round professional

engineering graduate.Majority of employers reported that they look for competent engineers who are not over-specialized.

Graduate Engineers Profiles

Number of graduates from engineering schools, both public and private, grew at 49% per annum from 2012 to 2016 (CUE, 2016)[1]. Majority of the engineering graduates (82.2%) were found to be male, however, the proportion of female engineering graduates has been increasing, though it remains low due to low uptake of STEM subjects by girls.

Employment rates of Engineering graduates

Across the cohorts, those who are employed constitute the highest percentages at 89%, 82% and 62% for 2009, 2014 and 2018 cohorts respectively while the average is 71.2%. About 8.6% were self-employed, 17.4% were unemployed, while about 2% were in postgraduate studies.

Cumulatively, 17.4% of the graduate engineers are unemployed, with most of them being recent graduates (2018 cohort). Overall, the findings of this study do not support the notion that there is high unemployment of engineering graduates. The employer's responses also indicate higher employment statistics of male engineers as compared to females with a ratio of 1:6 which means that for every (1) female engineer employed we have 6 male engineers employed.

Nature of First Employment

Overwhelming majority (75.4%) of the engineering graduates were employed in engineering related fields, while 24.6% were employed in non-engineering fields. Among the non-engineering fields that graduates get employed in include, auditing, accounting, banking, insurance, sales, and marketing/ customer service/ shop keeping, farming/ green grocers, research, investment analyst, business intelligence analyst, hospitality industry/ Software tester/ transcription/ data entry, teacher, data analyst, interior design, printing services, casual labor, and Kenya Youth Employment and Opportunities.

Employment Lead Time

At least 43.4% of the female and 44.8% of the male engineering graduates are employed within the first 0 -6 months after graduation.

Another 21.7% engineering graduates are employed within 7 – 12 months after graduation. Majority of engineering graduates were noted to look for employment prior to completion of their studies (42.2%) for females and 40.1% for males, while a sizable portion (33.7%) and 34.3% female and male, respectively, were found to seek employment after completion of their studies.

Employment Sector and terms of employment

The greatest percentage of the graduates is employed in the private sector at 52.9%, while those in public sector represents 35.8%. This means that the private sector is the largest employer of engineering graduates. The number of those in permanent employment have a slightly higher representation at 38.6%, compared to those who are on contract at 35.8%

Main responsibilities at work

1 Commission of University Education (CUE) (2016). State of University Education in Kenya. ISBN 978-9966-009-21-0

Majority of the graduate engineers, irrespective of the year of graduation, are involved in technical roles/responsibilities at 51%, followed by those at supervisory and managerial roles at 18% and 12%, respectively. The percentage of those who graduated in 2009 and in management level is higher (at 26.9%) compared to those who graduated in 2014 (21.2%) and in 2018 (at 5.2%).

Geographical destination of engineering graduates

Most graduate engineers from Kenyan Universities are employed in Kenya (78%). All the self- employed (8.6%) are based in Kenya. The remaining percentage work either within East Africa, the rest of Africa, Europe, and Australia. This means that the Universities are training mainly for the Kenyan labor-market.

Local destination analysis indicates that Nairobi (44%), Uasin Gishu (2.9%), Mombasa (2.3%), Nakuru (2.0) and Kisumu (2.0), in that order, are the areas of concentration of graduate engineers. The distribution of employment follows the urban corridor, and this reflects urban bias of engineering graduates' employment opportunities.

Challenges Encountered by Graduate Engineers and Self-Assessment

The challenges encountered by graduate engineers include lack of connection to the available employment opportunities (47.1%), non-transparent recruitment process (37.1%), lack of required experience (21.3%), and tribalism (20.1%).

Self -Assessment by Graduate Engineers

The graduates generally consider all skill and competence areas learnt at the university to be relatively important. However, fewer graduates consider mathematics to be very important relative to the other subjects. This could mean that the alignment of the subject content to engineering applications in their career needs to be re-evaluated.

Rating of Training environment

The conditions most rated by graduates as poor and very poor are; participation in research projects, equipment quality, and opportunity to contact with lecturers; while the conditions most rated good and very good are consulting with fellow students, the training on structures, and to some extent the teaching quality.

Assessment of Engineering Graduates by their Employers

The employers consider the engineering graduates to be moderately prepared (average of 5.7 along the scale of 1-10) for entry-level positions. However, they were deeply concerned with the interpersonal skills of the graduate engineer. The employers identified the following emerging skills which graduates need to learn in order to be effective in the market: ICT, soft skills, energy and project management, writing skills, presentation skills, business development and marketing skills, ability to adapt, and climate smart technologies.

Qualities that the Employers look for in engineering graduates

Among the qualities the employers look for in engineering graduates are academic performance, relevance of the training,

problem solving ability, communication and presentation skills, personality (attitude), and experience and achievement. Generally, the industry spends 2 to 3 years to further train the graduates to attain the required job-ready skills and competences. This was attributed to weak university-industry linkage.

How Employers rate different factors when recruiting engineering graduates

Personality, otherwise attitude are rated highly by the employers when recruiting the graduate engineers.The theme of projects that the graduates undertook are not considered to be very important. It means that the projects that the graduates did while at the university do not address the current engineering challenges that are of interest to the employers.

Performance of engineering graduates from different universities

It was noted that engineering graduates from different Universities tend to have unique skills which was attributed to exposure to various materials and facilities while learning which has an impact in terms of grounding the graduates. It is therefore normal to find some graduates e.g. Agricultural engineering from JKUAT being highly preferred than other graduates, or electrical engineering graduates from University of Nairobi being preferred than other Universities. It can be concluded that different universities have a comparative edge based on the teaching materials and supportive learning infrastructure such as the laboratory associated with that particular engineering course.

Areas of improvement by universities

1. Universities- Industry Linkage can be enhanced by introducing adjunct positions with industry and other collaborations between universities and industry.

2. Mentorship Programmes and Modern Technology Applications should be organized to address the challenge of inadequate career counselling.

3. Curricular Content and pedagogy- Some cross-cutting courses that should be included in the curricular include IT/ automation, Product Design that incorporates local components, Quality control, Renewable energy/ energy management, and Climate change, and High voltage DC.. Since a good number of graduates end up as senior managers, it is important to introduce soft skills and supportive courses that include basic financial management, Business/ entrepreneurship, Legal issues, Management, Sales, and knowledge on public private partnerships/ procurement, communication, facilitative skills such as computing

4. The Government should partner with various universities to come up with centres of excellence in particular areas of Engineering and therefore equipping them with modern, top of the range facilities befitting that particular sector

5. Government should facilitate the institutions to ensure they are up to date with emerging technologies and improvement of facilities

Advice on Database and Data Collection Instruments for Tracer Studies

Alumni databases are vital to every learning institution and education sector in general. The databases can be used as an address book, communicate to and with the graduates, and for carrying out tracer studies.

The success of any tracer study depends on the completeness and currency of the alumni database.

The alumni database should contain the following information:

i) Contact details, which can include current email address, telephone contact.

ii) Whether or not they are employed.

iii) How long it took the respondents to land in their first job.

vi) Current occupation/job.

v) Reasons why some respondents are not yet employed,

vi) Whether or not the graduates' first job is related to their program in college,

vii) Gross monthly earning in respondents' first job,

viii) Whether or not the curriculum in college is relevant in their first job, and

ix) The competencies learned in college that respondents find useful in their job.

x) Expectations of the alumni on the University

Conclusions and Recommendations

The number of universities offering engineering programmes has increased rapidly from 5 in 2008 to 18 in 2018. In 1970, only one university (Nairobi) offered Engineering programmes, by 2002, the number increased to 5 universities, and by 2018, the number stood at 18 universities. Similarly, the universities offered an increasing diversity of undergraduate engineering programmes, from 5 in 1980 to 110 programmes approved by the Commission for University Education.

A large share (75.4%) of the graduate engineers find employment in engineering related fields, and about 46% of the graduate engineers are employed within six months after graduation. Overall, 71.2% of the graduate engineers traced were employed, and about 8.6% were self-employed. About 17.4% were unemployed.

The study has established that most of the graduate engineers are male (82.4%) which is comparable to other studies in Kenya and other parts of Sub-Saharan Africa. The greater percentage (52.9%) of the graduate engineers are employed in the private sector, and 35.8% in the public sector. Majority (51 %) of the graduates are involved in technical responsibilities, followed by those in supervisory and managerial roles, 18% and 12%, respectively. The greatest percent (44%) of the graduate engineers are concentrated in Nairobi, followed by the other major urban areas, Kiambu, Mombasa, Eldoret, Kisumu, and Nakuru, Nairobi is therefore seen to maintain its primacy in with regards to employment opportunities despite the Country celebrating almost 10 years of devolution.

Employers generally rate graduate engineers to have satisfactory theoretical knowledge

but with inadequate skills, especially problem-solving skills, soft skills, and communication and presentation skills. A few also lack self-confidence. The employers attribute the current state to weak university- industry linkage and inadequate mentoring. There is a skills mismatch between the needs of the employers (industry), and the skills currently provided during training of engineering graduates in Kenya. This is partly attributed to the use of old equipment and technology for training of engineers in most of the institutions.

Policy Recommendations

University-Industry Linkage Institutionalization - Measures should be taken urgently to institutionalize strong University-industry linkage in the country.

Complementary Curriculum Accreditation and Programme Recognition Process- Government bodies for approving, accreditation and recognition of engineering programmes should work in a mutual and complementary way with the professional bodies in guiding the development of engineering curriculum.

Continuous Professional Development (CPD) Strengthening - There is a need for strengthening continuous professional development by developing clear seminar packages with progress content and making it a requirement for career progression, through required credit points.

Reliable Graduates data archiving system - The study faced a big challenge in obtaining a reliable **database of past graduates** for tracing. Such data was expected from the source departments and schools, from the university alumni association, and from EBK and from IEK. However, the status of the graduate engineer database from the above sources was found poor and unreliable.

There is therefore a need to coordinate management (system) of the graduate database from the department, school, university, alumni association, IEK and EBK.

The MoE - SDUER in partnerships with the CUE to institutionalize conduct of tracer study after every 4-5 years - This will help in informing the curricular review of all university programs and also improving the quality of graduates such as the engineering graduates.

Revival of Compilation of Annual State of the University Report by CUE - The study found the CUE annual report called **"State of the University Report"** quite usual in showing trends in undergraduate and graduate enrollment and graduation in the country. However, the report is no longer being compiled by CUE since 2018.

Partnering with Industry in Investment in Modern Teaching and Training Equipments - The study observed that graduate engineers under self-assessment of their training programmes cited **poor quality equipment** and low participation in research projects and limited opportunity to contact lecturers in the university.

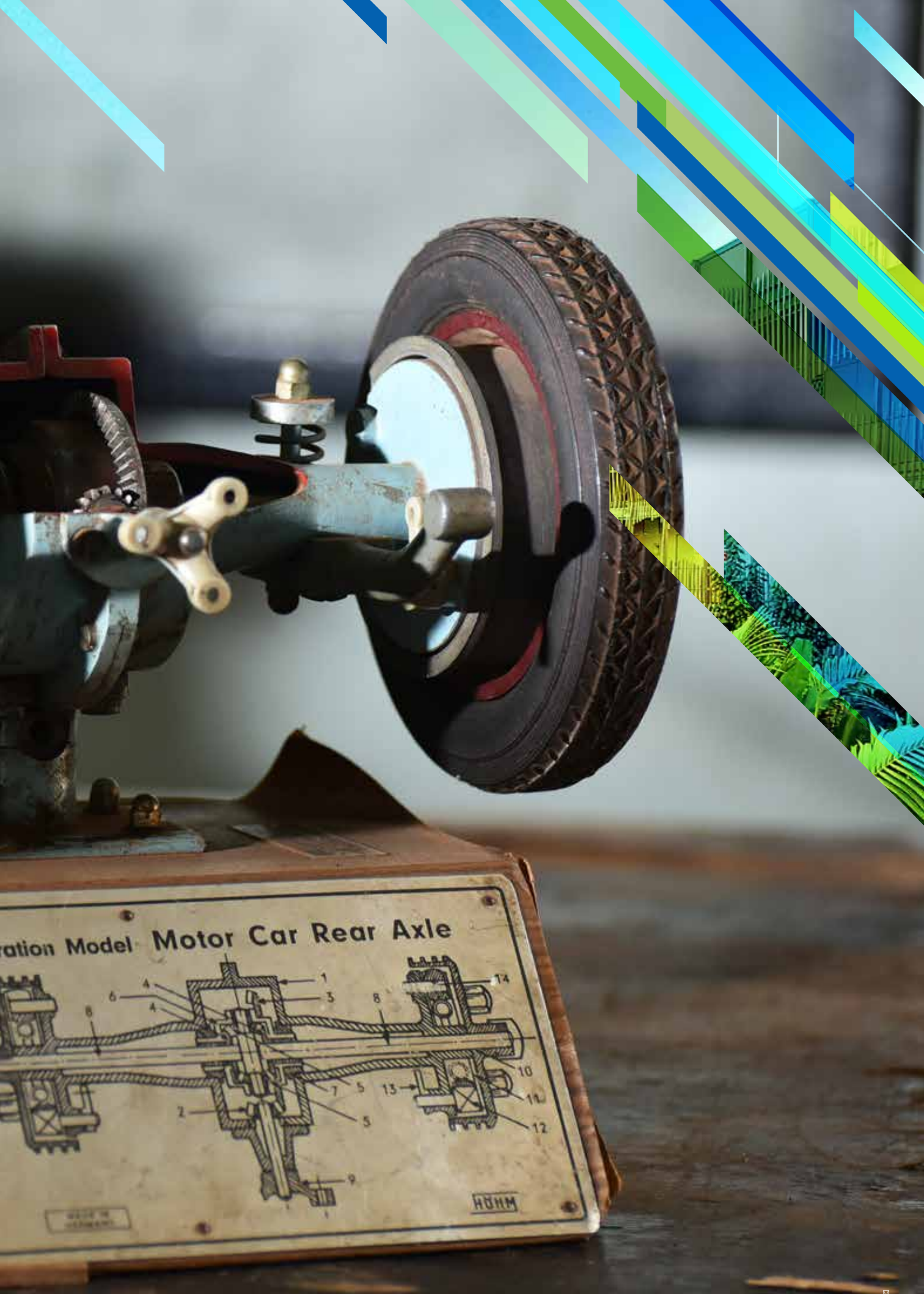
Develop a use and maintenance partnerships with the industry - The universities and industries to develop a system of equipment and laboratory use and maintenance in ensuring that the conditions of the equipment and laboratories are geared towards sustainable skills development and training.

Planning for Infusion of the Engineering Programmes with the new Competency Based Curriculum (CBC) - According to Amutabi (2019), Kenya needs to act fast to make sure that the current system in higher education is compatible to CBC expectations, especially on flexibility and focus on the learner.

CHAPTER

1

Introduction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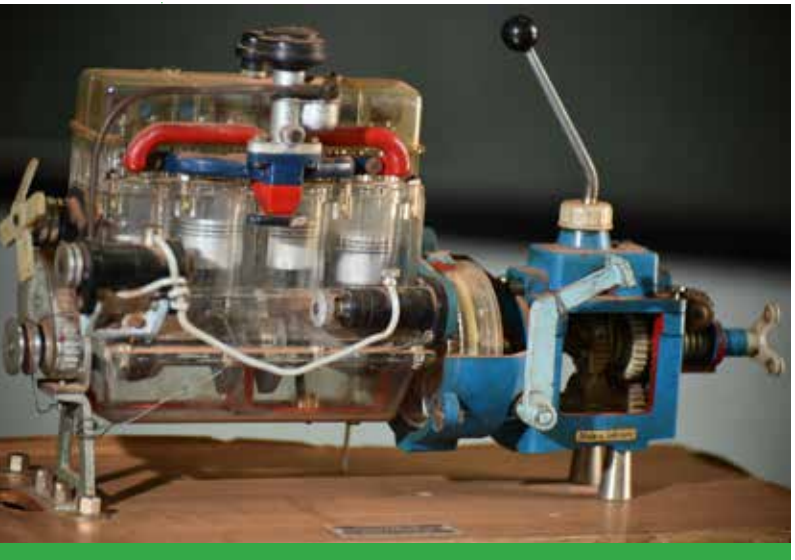
1.1 Background

The overall goal of Vision 2030 is to transform Kenya into a middle income and industrialized country. A key pillar in Vision 2030 is availability of high-quality human resource, mainly in science and engineering related fields, to work in the productive sectors of the economy. This calls for concerted efforts to improve the quality and relevance of engineering and applied science training in local universities to meet the labour market demands. The Ministry of Education, State Department of University Education and Research (SDUER) in collaboration with partners has launched several initiatives to improve the quality and relevance of engineering and applied science training in local universities.

The initiatives include support for training and deployment of qualified teaching staff in the engineering and science fields, curriculum review and improvement of the delivery methods. The purpose is to ensure that engineering graduates attain the skills and competencies required by employers. Further, the Ministry identified the need for a tracer study on the destination of engineering and applied science graduates from public and private universities in Kenya, to establish the employability of the graduates and provide feedback to inform the curriculum development and review process.



In February 2019, the Ministry of Education, State Department of University Education and Research put out a competitive bid to select a suitable public university to undertake a Tracer Study on Destination of Engineering and Applied Science Graduates from Public Universities in Kenya (Tender No. MOE/SDUER/001/2018-2019). The study was expected to build on a pilot study carried out by the Ministry on graduates of the electrical engineering-based programmes in 2012.

The University of Nairobi, through the College of Architecture and Engineering was awarded a contract on 4th June 2019 to undertake a tracer study on the destination of engineering graduates from public and private universities in Kenya. The execution of the contract was delayed by one and half years following a national lock down due to the Covid-19 pandemic.

Following partial reopening of the country in mid-November 2020, the consulting team commenced fieldwork and interviews for the study. This is the final report of the study. The report consists of six chapters: introduction, context of the study, methodology, findings, summary and conclusion, and policy recommendations. In addition, the report contains appendices, and references. It is envisaged that the report will shed light regarding the current nature and future direction in the training of engineers in the country. It is also expected that the findings from the study will help in identifying policy gaps to be filled for effective training of quality engineering graduates.

1.2 Scope of the Study

1.2.1 Objectives and Terms of Reference

The main objective as stated in the Terms of Reference (TOR) is to carry out a comprehensive tracer study in engineering programmes to establish the employability of graduates and provide feedback to inform the curriculum development and review process.

The **specific objectives** are:

1. To establish the engineering and applied sciences graduates employment rates in terms of gender and geographic distribution.

2. Establish the destination of engineering and applied science graduates after training.

3. To establish length of time taken by graduates to secure employment that corresponds to their qualification.

4. Establish the challenges encountered by engineering and applied science graduates in securing employment including self-employment.

5. Establish areas that need improvement in engineering and applied science training from employers.

6. To carry out extensive literature review and recommend best practice.

7. Advise on database and data collection instruments that would enable Universities to bi-annually carry out tracer studies to monitor their graduates' occupational movements in the labour market.

8. Provide an objective picture of the assessment of engineering and applied science graduates by their employers in terms of scholarly abilities, application of theoretical knowledge to concrete problems, ability to generate and disseminate knowledge and their competitiveness.

9. Provide an in-depth assessment of how graduates assess themselves and the relevance of skills and competence acquired in university within the world of work.

10. Establish the level of employer satisfaction with regard to graduate employee's knowledge, skills and level of performance.

1.2.2. Target Population

The tracer study focused on graduates from bachelor's degree engineering programmes from public and private universities in Kenya. It covered the last 10 years in three cohorts of 2009, 2014 and 2018. Currently, engineering education is offered in 18 universities (16 public and 2 private) in Kenya.

From the beginning it was agreed that the tracer study would focus on engineering graduates, excluding the broader category of applied science graduates. The former was considered clearly identifiable and manageable within the professional programmes recognized by CUE and Kenya Universities and Colleges Central Placement Service (KUCCPs).

Nevertheles, Engineering as a discipline in Kenya is broad and diverse. The Engineers Board of Kenya (EBK) recognizes 60

Engineering programmes whereas the Commission for University Education (CUE) lists a total of 110 Engineering programmes being offered in 18 Universities (Appendix 1). Different universities in Kenya have adopted different names for the programmes they offer. This study has utilized the CUE list of engineering programmes for purposes of sampling as shown in appendix 1. The tracer study is restricted to the bachelor's degree engineering graduates, from the three cohorts, namely 2009, 2014 and 2018. Only six of the 18 universities have graduated engineers over the three cohorts (2009,2014 and 2018), the rest having commenced engineering programmes after 2015.

The choice of the cohorts was informed by,

a. the engineering programmes cycle, where Engineering courses take 5 years, (b) the current role of the Commission for University Education (CUE) in regulating the courses offered in universities, while professional bodies regulate professionals in practice (University (Amendment) Act 2016, Section 5A), (c) the technological changes (second, third and fourth industrial revolutions) which have revolutionized engineering programmes as well as the operations in the industry over the last ten years. The cohorts were selected to enable the study to reveal how much engineering programmes offered in Kenya have kept the pace of technological change and also to accommodate samples from both the old and new universities offering engineering courses.

1.2.3 Key Stakeholders

The tracer study was done in collaboration with the Ministry of Education, State Department of University Education and Research and the target universities, in particular the schools and Departments of Engineering. The study worked closely with all relevant ministries and organizations, including the Ministry of Transport, Infrastructure, Housing and Urban Development (MoTIH&UD), State and Governmental Agencies (SAGAs) e.g. Rural Electrification and Renewable Energy Corporation (REREC) the professional and regulatory bodies for engineering, the employers, alumni, Kenya Universities and Colleges Central Placement Service (KUCCPs), Commission of University Education (CUE) and Kenya Education Network Trust (KENET).

The Ministry of Education (SDUER) greatly facilitated the study by providing introduction letters to stakeholders and the institutions included in the study; providing invitation letters to participants for the two workshops; and sharing with the consultant the policy documents from the ministry, relevant to the study.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CHAPTER

2

Context of the Tracer Study

2.1 Kenya: Social Economic Outlook

Under Kenya Vision 2030 and the Big Four Agenda, Kenya has made significant political, structural, and economic reforms aimed at driving sustainable economic growth, social development and political gains. Vision 2030 aims to transform Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment. Kenya's economic growth was on an upward trajectory until the onset of Covid-19 in March 2020. In the period 2015-2019 the GDP annual growth averaged 5.7 per cent. In 2020 the GDP contracted to 1.5 per cent due to the effects of Covid-19 pandemic; however, the World Bank predicts that Kenya's economy will expand by 6.9 per cent in 2021, the fastest growth rate in Africa. Development challenges include inadequate infrastructure, high income inequality, and high poverty, high unemployment and growing informal economic sector. Kenya's GDP growth is largely driven by tertiary services sector at 52% and the rest is equally distributed at 24% for primary and secondary sector[2].

The Jubilee Government in 2017 launched the "Big Four Agenda" to improve the living standards of Kenyans and grow the economy through affordable universal healthcare, affordable housing, food security and nutrition, and enhancing manufacturing. The 2030 Agenda for Sustainable Development recognizes blue economy as central in advancing sustainable development by calling on all stakeholders to conserve and sustainably use the oceans, seas, and marine resources for sustainable development[3]. The pace of global technological changes makes it necessary for Kenya to develop strategies which respond to these rapid changes. It is imperative to develop policy frameworks and strategies to revitalize the industrial sector for effective contribution to national growth, employment, and wealth creation. The role of the industrialization and manufacturing sector in Vision 2030 is to create employment and wealth. The sectors' overall goal is to increase its contribution to the GDP by at least 15% per annum as envisaged in the Big Four Agenda.

Kenya's flagship public investment projects include the Lamu Port, South Sudan, Ethiopia Transport Corridor (LAPSSET), the Standard Gauge Railway (SGR), Port of Mombasa, National Road network, and more recently the Port of Kisumu. High-quality human resource, especially in engineering and applied science, are key for the desired transformation of the Kenyan economy.

2.2 Human Capital and Labor Market Outlook

Vision 2030 is based on 3 main pillars, stressing the economic, social, and political components of its structure. Within the economic pillar, the objective is to transform Kenya into a newly industrialized middle-income economy. Within the social pillar, the main action is about developing the Human Capital of the country to meet the requirement of a growing industrialized economy. Under Kenya Vision 2030 the manufacturing sector has been identified as the key driver for economic growth and development.

2 World Bank (2020), Kenya Economic Update, November 2020: Navigating the Pandemic; GOK, Economic Survey, 2020

3 http://www.blueeconomyconference.go.ke/wp-content/uploads/2018/11/Nairobi-Statement-of-Intent-

Berths-complete-at-lamu-port-

Kenya has since a long time been an economy dominated by the service sector despite growing share of the agricultural sector and a slightly declining Industry/ Manufacturing sector. The active population is estimated to be 19.3 million people out of a total working age population of 29.5 million Kenyans. By 2030, Kenya will need to solve a difficult equation; a working-age population at approximately 60%; and high levels of informal jobs, unemployment,and underemployment.

At first Kenya unemployment seems to be quite low as it reaches 7.4% according to the Kenya National Bureau of Statistics latest Labour Force Basic report[4]. But the report also found that 20% of those who were employed (3.7 million) were underemployed. This means they were willing and available to work more hours than the threshold used by KNBS of 28 working hours a week. In 2016, the Youth population was more likely to be unemployed than the overall working age population (11.4% and 7.4% respectively). Urban working age population has more chances to be unemployed than the rural population. The gap between urban and rural unemployed female working age population is close to double. The youth unemployment varies from sources, for the KNBS, it was 11.40% in 2016 while for the World Bank/ILO it represented slightly more than 19% of the youth population.

The Kenya National Bureau of Statistics (KNBS, 2018) estimated that 840,000 jobs have been created in Kenya, and only 78,400 new jobs were created in the formal sector. Although formal jobs are in high-growth and high productivity sectors, the job- creating potential of these sectors is relatively low, so most job seekers end up in low-productivity, informal activities.

4 KNBS 2015/2016 Labour Force Basic Report

Kenya's modern service sectors, such as financial services and communications, but also the education sector, mining, and utilities, have been adding jobs and raising labour productivity at the same time. However, the job-creating potential of these sectors is still below the objectives set by Vision 2030. More than 900,000 youths enter the job market annually, with 88,773 University graduates according to the Commission for University Education[5].

2.3. Labor Market Demand Analysis

Agriculture sector represents 33% of GDP[20] and includes all economic activities related to farming, fishing, and forestry. The sector contributes to 70%[21] of the total Kenya exports, largest exporter of horticulture and the third largest tea exporter globally. Agriculture adds 27% to Kenyan GDP through linkages to other sectors such as manufacturing, distribution, and services. Indeed, agriculture is the main driver of the non-agricultural economy by providing inputs and markets for non-agricultural operations such as building/construction, transportation, tourism, education and other social services. The sector employs more than 40% of the total population and about 70% of the rural population[6].

Kenya's manufacturing sector's contribution to the economy has stagnated at about 10% of the GDP and was about 8.4% in 2017 (Kenya Manufacturing Association, 2018). There is a renewed interest in the manufacturing sector through Vision 2030, the Kenya Industrial Transformation Programme (KITP) and the Big 4 Agenda which seeks to increase the GDP contribution of the sector to 15% by 2022. The manufacturing sector real added value increased by 4.2 % in 2018 compared to a revised growth of 0.5% in 2017[7]. The volume output expanded by 5.1% in 2018, compared to 0.8 % in 2017. An estimated 18% of Kenyan manufactured goods are exported of which 6.1% exported to the EAC and 12% to the rest of the world but Kenyan exports have stagnated, while imports have grown to 40% of GDP, creating a trade imbalance. These gaps can only be closed by revitalizing the industrial sector and turning Kenya into a manufacturing industrial hub.

In 2018, the construction sector registered a slowed growth of 6.3% compared to a revised growth of 8.5% in 2017. Expenditure on construction of new roads is expected to grow by 22.5 % to KES 128.4 billion. During the same period, the constructions of public residential buildings were 430 units in 2018 compared to 1,164 units in 2017. The numbers of housing units under construction in 2018 were 2,028 at an estimated cost of KES 4,381.0 million. The sector is expected to grow at an average annual growth rate of 6.8% by 2020. Aside of the Big Four Agenda, with the objective of Affordable Housing for which the Government of Kenya has committed to KES 11.4 billion for 2019-20. The sector according to the latest KNBS Economic survey employs 1,630,000 people in the private sector and 86,000 in the public sector. The sector depends mainly on unskilled labourers who account for 42% of the employed labour force within the sector.

Kenya's mining industry is dominated by production of non-metallic minerals encompassing industrial minerals such as soda ash, fluorspar, kaolin and some gemstones. Mining and quarrying currently

5 Commission for University Education, 2019.
6 Ministry of Agriculture, Livestock, Fisheries andrrigation, Agricultural Sector Transformation and Growth Strategy 2019-2029
7 KNBS, Economic Survey 2019

contributes to 0.8% of the GDP and around 3% of export revenues according to the KNBS Economic Survey (2019). Formal employmentin the mining & quarrying sector for the moment represents 14,700 people, which is quite limited compared to the 29.5 million working age population. In the last decade, the Eastern Africa region has emerged as a major destination for oil and gas exploration. Currently in Kenya most operators are in the early stage of operations with most undertaking exploration activity[8].

2.4 Surveys on Job Market and Skill Areas

According to a Ministry of Labour and Social Protection report[9] On skill areas and levels required by employers, 34.6% require Basic General Programmes education, Business Administration at 13.9 % and Health at 9.3 %, out of the total jobs advertised. Engineering and Engineering trades (6.18%), Physical Sciences (0.54%) and Life Sciences (0.31%) represent a total of 7% of the total number of job advertisements in Kenya for 2017. This is obviously just for the formal labour market and when the recruiter publishes advertisements.

A Federation of Kenya Survey (FKE) in 2018 found that a lot of university graduates are applying to jobs which are below their competencies, contributing to the deflation of their degree (FKE, 2018). Furthermore, the majority of employers surveyed by FKE think that graduates aside from technical skills, do not have the necessary skills set to perform their first job experience properly such as interpersonal skills, the right life skills, soft skills and the right technical skills. According to the Kenya Labour Market Information System (KLMIS), main obstacles to hiring professional are the inadequacy between salary offer and wage expectation by the candidate, the lack of qualified candidate for the job advertised, followed by the work experience[10].

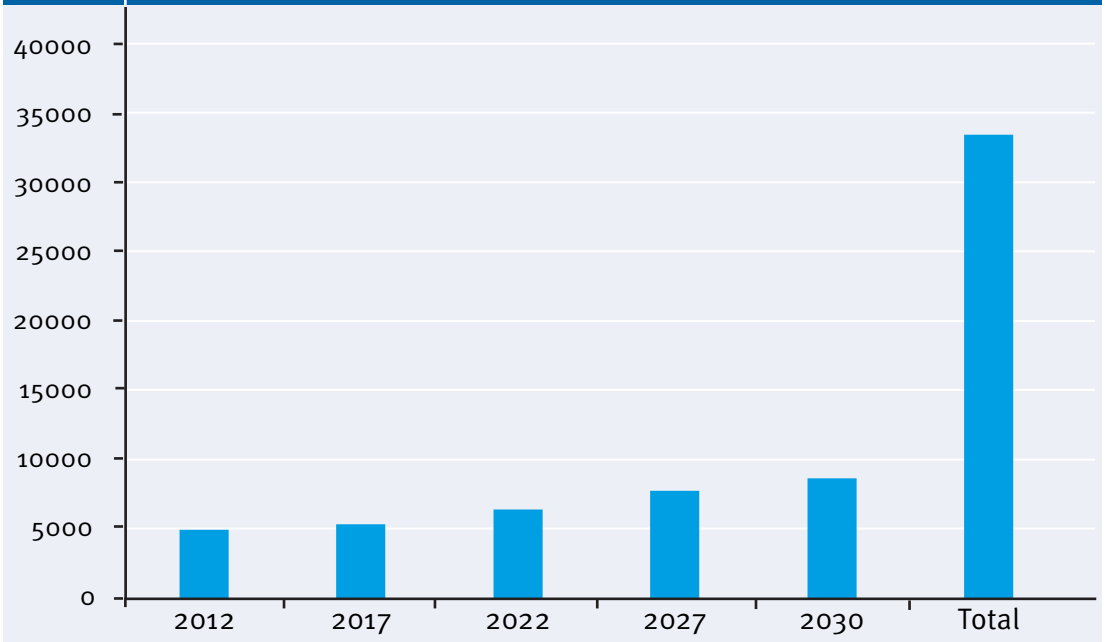
2.5 Demand for Engineering

The Engineers Board of Kenya (EBK), which has the overall mandate of developing and regulating engineering practice in Kenya, conducted a study[11] of engineering needs in Kenya in 2014 and the following projections on the number of Engineers needed are derived from that study. While there are many engineering graduates who are jobless in the country, industry is still in need of engineers and the demand will grow in the coming years (Fig. 2.1 and Fig. 2.2).

As we can see in the above graph the total number of Engineers needed by Kenya in 2030 is an estimate of 33,739. The actual number of Engineers registered by EBK is equivalent to 15,406; it means that the market will need to find 18,333 engineers by 2030 to fulfil the estimated market demand.

8 Kenyan Extractive Industry Development Program (KEIPD), Extractive Industry Early Gap Analysis 2015
9 Ministry of Labor and Social Protection, Kenya: Job opportunity analysis report, 2018
10 https://www.labourmarket.go.ke/
11 "Study on Engineering Manpower Needs Assessment in Kenya" , Ernst & Young Consulting, February 2015

Figure 2:1 Estimated Demand for Engineering in Kenya



	2012	2017	2022	2027	2030	Total
Series1	5046	5444	6546	7882	8821	33739

Source: Engineers Board of Kenya (EBK), 2014.

2.6 Universities Supply in Engineering

The East African Science and Technology Commission (EASTECO), the Inter University Council of East Africa and the East African Health Research Commission estimates that the current ratio of engineers to the total population across EAC was 1 for 5,500 inhabitants. EAC goal is to reach 1 for 3,000 inhabitants by 2030, and 1 for 1,500 by 2050[12]. It is estimated that for technological take-off, a country should be having at least 500 engineers and engineering technologists to 1 million people of the population[13] or 1 for 2000 inhabitants. According to EASTECO, the ratio of engineers to the total population is 1 for 5,500, but data available show that it could be much higher. Indeed, it is 1 for 5,930 in Tanzania, 1 for 6,300 in Kenya, and 1 for 10,000 in Uganda[14].

According to the Commission for University Education (CUE) "State of University Report" (2016), Humanities and Arts cluster had the highest proportion of programmes across the universities with 14%, followed by Business and Administration and teacher training with 11.1%, Life Science and Physical Science programmes as well as Agriculture, Forestry and Fisheries with 10.7% each. On the other hand, the least represented clusters were Manufacturing, Law, Architecture and Veterinary.

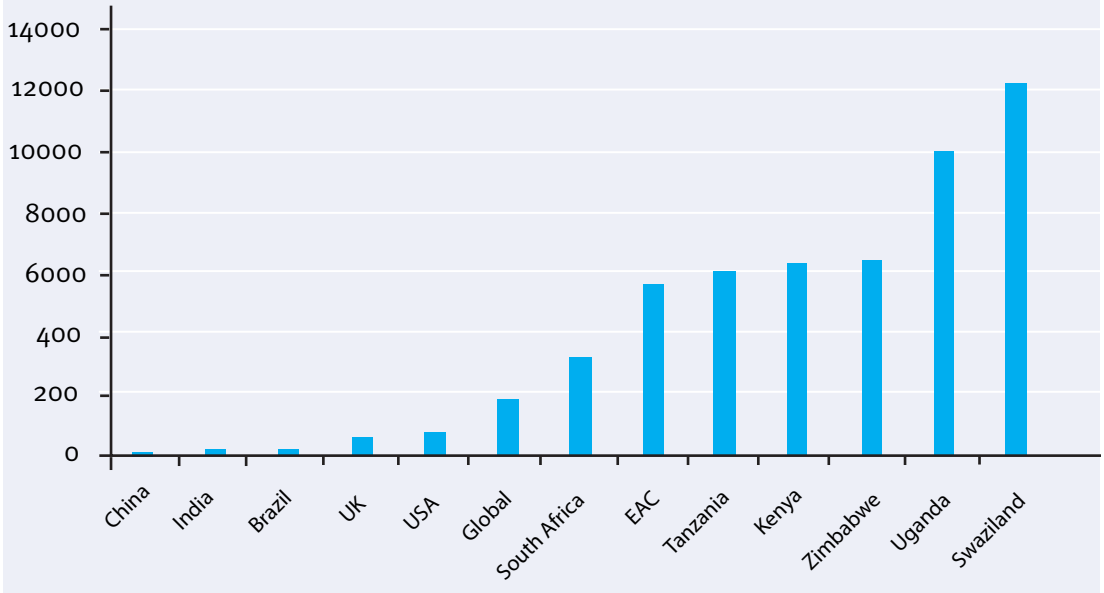
The extremely low offer and attractiveness in Engineering, Technology and Sciences

12 "East African Science And Technology Commission (EASTECO) Strategic Plan 2017/18 – 2021/22", EAC,2016

13 "Draft Technical And Vocational Education And Training Policy", Ministry of Education Science and Technology, March 2014

14 "Manpower Planning for Attainment of the Middle Income Status: Opportunities, Challenges and Prospects", Dr Isaac Mutenyo, November 2017

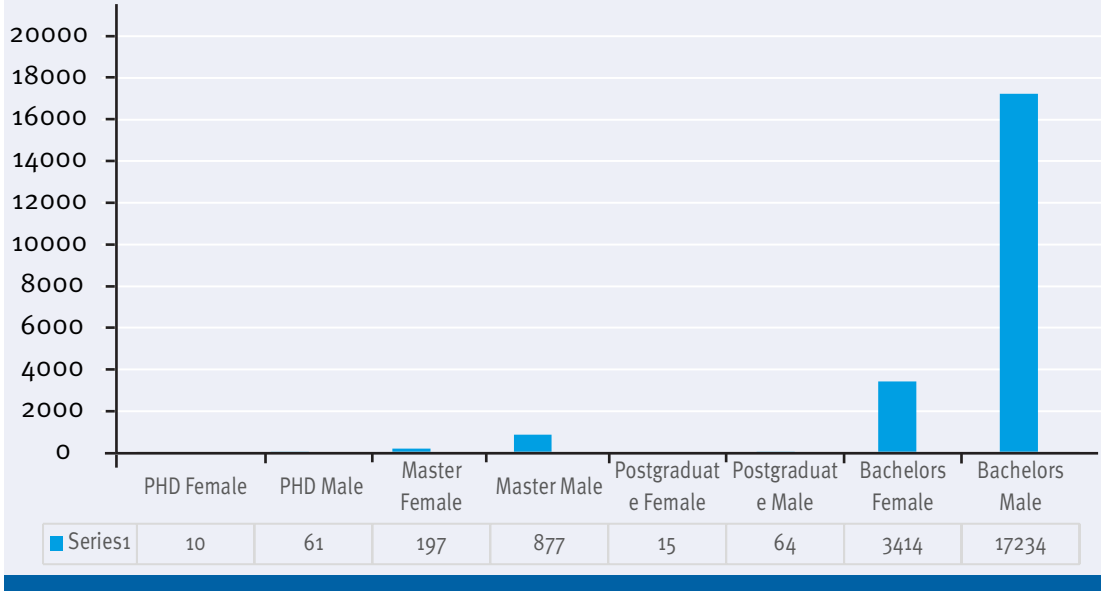
Figure 2:2 Comparative Ratio Number of Engineers to Population



Source: EASTECO, 2016

programmes[56] is a challenge for Kenya. Only 19% of the Universities students are in those clusters which is far less than needed by the market. Indeed, according to CUE the percentage of graduates in the category out of the total graduate in Kenya are very low compared to market needs: for Architecture: 0,6%; Computing: 5,3%; Engineering:3,5%; Health and Welfare: 6%; and Life and Physical Sciences (3,7%) Manufacturing and Veterinary clusters each had 0.1%.

Figure 2:3 Enrollment in Engineering in Public& Private Universities



Source: Commission of University Education, State of the University, 2016

The Engineering enrollment of students in Public and Private Universities was 21,872 in 2016, with a large majority of male students as illustrated in fig 2.3[15].

Fig.2.4 based on the Engineers Board of Kenya study from 2015 shows the gap between the Labor Market needs for Engineering graduates and the supply from the Universities across the country. Based on the estimated growth of the Kenyan economy and Vision 2030 strategic guidance, the country will need an estimate of 33,739 engineers while Universities will produce an expected number of 28,272. It is estimated it could represent a gap of 5,467 Engineers by 2030. Currently, the Kenyan universities graduate an average of 2,500 Engineers per year, and despite a growing number of students' enrolment in the field, the growth is slower than the potential demand.

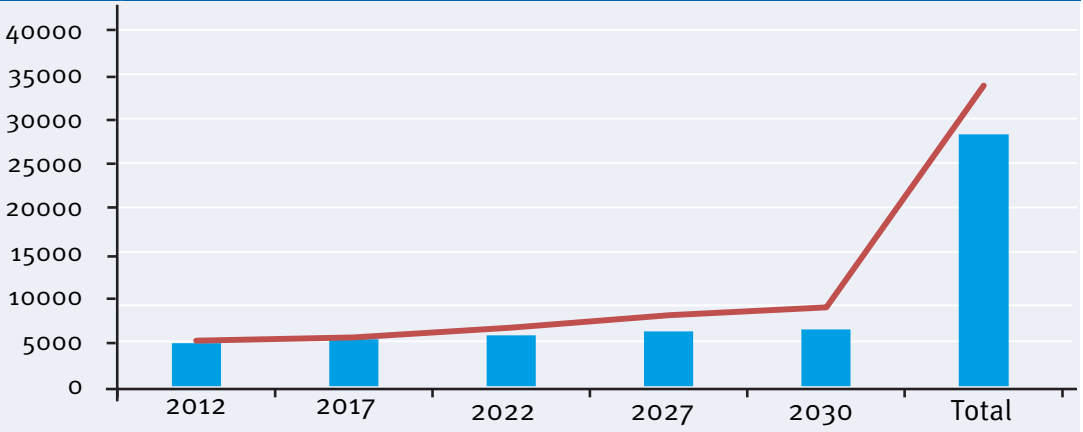
From the above analysis, there is great demand for engineers across board and in specific areas to serve the country's needs for industrial transformation. Concurrently, the University engineering courses must provide students with the range of knowledge and innovative problem-solving skills to work effectively in industry as well as motivating students to become engineers on graduation.

2.7 Justification for the Tracer Study

2.7.1 Tracer Studies- Historical Background

There is a long history on the use of tracer studies across developed and developingcountries. Tracer studies seek to trace, find or locate a group of individuals sometime after an event has taken place,

Figure 2:4 Engineering Graduates Supply& Demand 2012-2030



	2012	2017	2022	2027	2030	Total
Supply	4793	5289	5687	6114	6389	28272
Demand	5046	5444	6546	7882	8821	33739

Source: Extrapolated from EBK study, Vision 2030, and MoE Policy Studies.

15 "State of University Education" , Commission for University Education, 2016

and follow up on what has happened in their lives since then by monitoring changes in the former beneficiaries' lives in order to influence decision-making or policy formulation through the provision of feedback from the beneficiaries (ILO, 2011). Outside of Africa tracer studies have been carried out by The German Higher Education Information System (HIS) for its first-degree graduates commencing a year after graduation. In Switzerland regular higher education tracer studies are used for the purpose of evaluating higher education institutes, career counseling and benchmarking, In the Netherlands, tracer studies are used as a monitoring instrument covering the entire education system to acquire information on labor market outcomes and competencies (Schomburg 2016). Similar studies have been carried out in the former Yugoslav Republic of Macedonia since 2016 as a tool for providing feedback for improving vocational educational institutions (VET) and higher education institutions.

In Africa, tracer studies have been conducted in Morocco (Schomburg, 2016) and South Sudan (Sorkatii et al., 2016) to capture the paths of Technical, Vocational Educational Training (TVET) graduates targeting specific cohorts in order to help improve skills for vocational education and training. In Nigeria, a tracer study was conducted to investigate the adequacy of higher education to meet manpower development needs of manufacturing industries (Uguona and Omeje, 1998) by investigating links between higher education and industries in the areas of development and utilization of skilled labor.

In Kenya, tracer studies have been carried out to inform programming of future projects intended to eliminate the worst form of child labor through a Time Bound Project (TBP), implemented in ten districts and five urban areas. The intended purpose was to understand the longer-term changes (economic well-being, health, attitude and behavior) in the lives of former beneficiaries (ILO-IPEC. 2012).

Badiru and Wahome (2016) report that a pioneer tracer study was conducted by Moi University, Kenya (MUTRACE), 2010 to help improve the quality of academic programmes at universities in East Africa. While referring also to MUTRACE, Egesah et al. (2014) notes that goodwill from the university is an important factor determining the success of tracer studies and so universities need to embrace the value of Graduate Tracer surveys and incorporate them in all their policy documents e.g. mission, vision, core values and objectives.

2.7.2 Tracer study methods

As argued by (Egesah *et al.*, 2014, Flotcher, 2010, Herrmann *et al* 2010, Dillman *et al.* 2008) tracer studies have their unique rigorous methodologies. Graduate tracer methodology must be planned systematically, and it is quite iterative in strategy. Egesah *et al*. (2014) noted that if tracer studies are designed with rigor and inherent uniqueness, tracer study methodologies provide simple to utilize results that can be consumed appropriately at individual and institutional level. Tracer studies cannot happen without the involvement, support and goodwill of the target Universities administrative and management teams. This is because tracer studies investigate University structures and products and in return, they produce results that are of first concern to the University and also to the market.

One of the greatest challenges tracer studies face is methodological. Tracer

studies cannot be of any value without an accurate graduates' address data bank. It is therefore important that the consulting team with support from the client, establish a working rapport with the target universities in accessing engineering graduates address data banks. Tracer surveys provide manifold information for universities, sponsors, students and employers

2.7.3 Legal and Policy Framework guiding Engineering Discipline & Practice

According to University (Amendment) Act 2016, the Commission for University Education (CUE) has the overall mandate of approval, accreditation and recognition of academic programmes offered by universities in Kenya, while professional bodies are confined to regulating professional practice. The Engineers Board of Kenya (EBK) is a statutory body established under Section 3(1) of the Engineers Act 2011. The Board has the overall mandate of developing and regulating engineering practice in Kenya. Specifically, the Board's responsibility includes regulating standards in the engineering profession and building the capacity of individual engineers and engineering firms. The Board maintains a register of engineers and engineering firms and regulates their conduct. The Institution of Engineers of Kenya (IEK) is the learned society of the engineering profession and co-operates with national and other international institutions in developing and applying engineering to the benefit of Kenyans.

Engineering training in Kenya commences with a 4/5-year undergraduate program. This program provides class-based lectures and practical demonstrations and laboratory exercises. In addition, the programs provide for an 8week to 3-month industrial attachment that enables students to experience the workplace environment and apply the knowledge already gained. After graduation, engineering training takes place using short courses and/or postgraduate training. EBK also provides a "Continuous Professional Development" program (CPD) that enables engineers access technical training from specialists in selected fields.

2.7.4 Employment Status and Career Paths of Engineering Graduates

Engineering graduates find employment in industry, government departments, non-governmental organizations, international organizations, research institutions etc. The exact nature of the employment will depend on the engineering discipline pursued. The career paths will be determined by the engineering programme pursued by the engineering graduate.

2.7.5 Market and Skills Demand for Engineering Graduates

Engineering graduates require skills and competencies that include their ability to be creative and innovative in identifying, assessing, formulating and solving divergent and convergent engineering problems, demonstrate ability to apply knowledge of mathematics, basics sciences and engineering sciences to solving engineering problems, perform design and synthesis of components, systems, engineering works and products, design and conduct investigations, demonstrate competence to use appropriate engineering methods, skills and tools including those based on information. They are also expected to communicate orally and in writing. Engineers are also expected to demonstrate critical awareness of the impact of engineering activity on the social, industrial and physical environment. Engineers should be able to engage in independent learning and also demonstrate critical awareness of the need

to act professionally and ethically to exercise judgment and take responsibility within their own limits of competence.

Factors that influence employability of graduates on completion of their studies include the fact that the job market does not have immediate employment opportunities for all the trained engineers. A graduate may also have problems securing employment when the knowledge and skills acquired during training does not match those required in employment. Lack of employment could also be attributed to lack of information on availability of employment opportunities for the graduate. Some graduates are not able to be employed due to their lack of initiative and motivation to seek employment, lack soft skill or have graduated from programmes that are not accredited making the employers reluctant to absorb them.

2.7.6 Engineering Curriculum and Technological Trends

According to Gumbe (2010**),** engineering has been defined as the science and art of using nature's forces and materials for the benefit of humankind and that engineering is about the systematic application of basic sciences, i.e. Physics; Chemistry and Biology; Mathematics; Economics; and other Social Sciences to solve problems in society. To achieve the necessary competencies, the candidate must go through an appropriate engineering curriculum.

Curriculum

The B.Sc. programme is structured to be completed in five years: The students are initially upon admission exposed to training in basic sciences and general education. As the students' progress to the subsequent year they learn the relevant engineering sciences. The students then continue with the engineering sciences and commence study of the fundamental courses in their professional disciplines which then widen as the candidates proceed to the final year of study. In their final year, students may select options for specialization in their fields of their discipline.

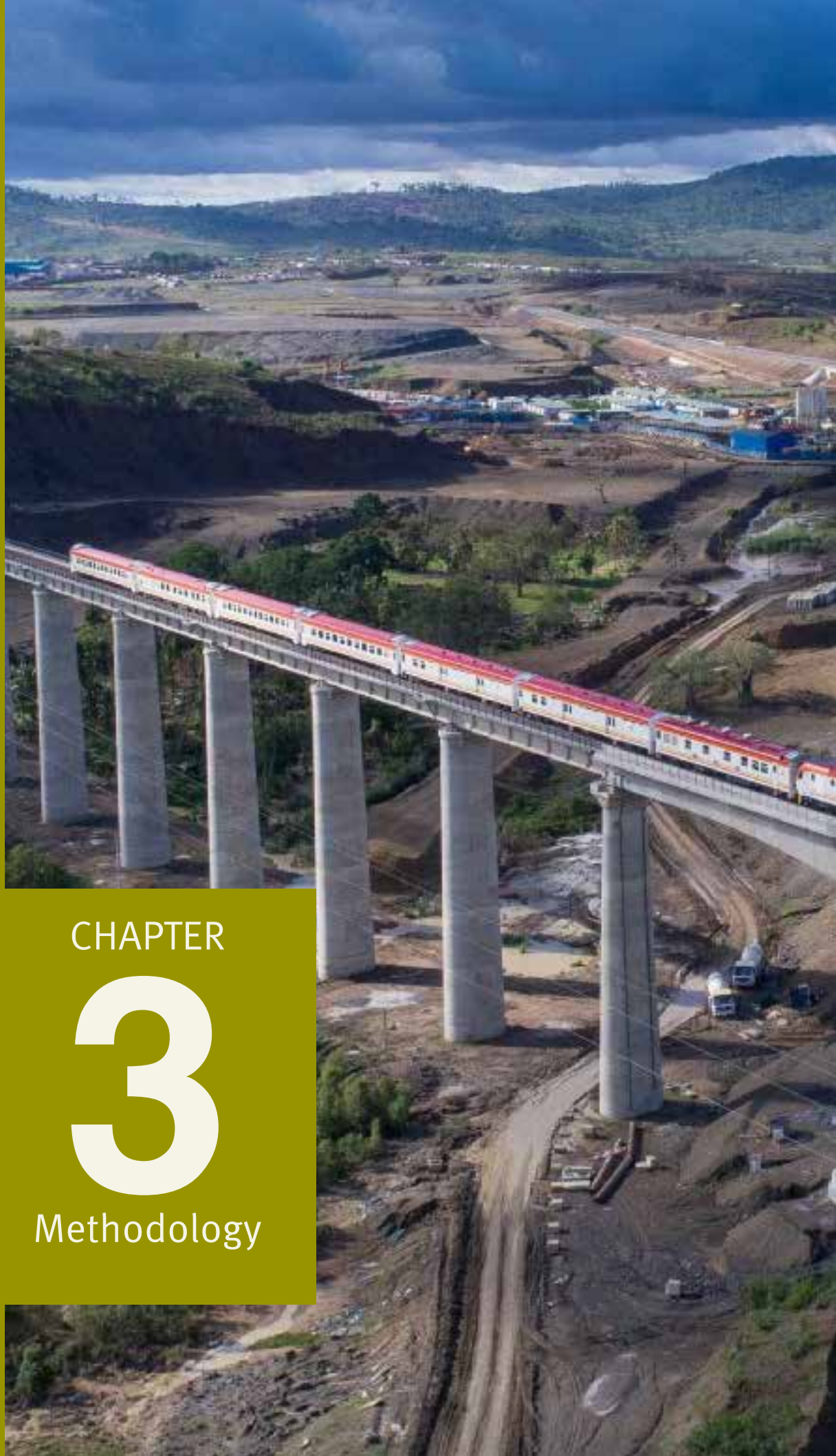
The teaching style in most academic institutions in the Sub-Saharan region was described as "chalk and talk" as opposed to problem-based learning (PBL) (Nyichomba& Sheikheldin, 2019).

Technology trends

The practice of engineering has significantly changed with the introduction of new technologies to perform certain engineering processes. Examples include the use of robotics in the manufacturing industry, artificial intelligence, machine learning, internet of things, big data, and cloud computing. Such changes in technology have placed demand on the need to change the methodologies used in training engineering students. Some engineering design contains both the hardware and software components.

Influence of technology on curriculum

In order for the existing engineering curricula to remain relevant for the job market, it has to constantly undergo review to keep pace with technological changes in industry or other sectors. This is to enable the student to acquire the relevant skills and competencies that meet potential employer expectations. Changing technologies also influence the delivery methods used by the trainers so that the engineering students are exposed early enough to emerging technologies.



CHAPTER

3

Methodology

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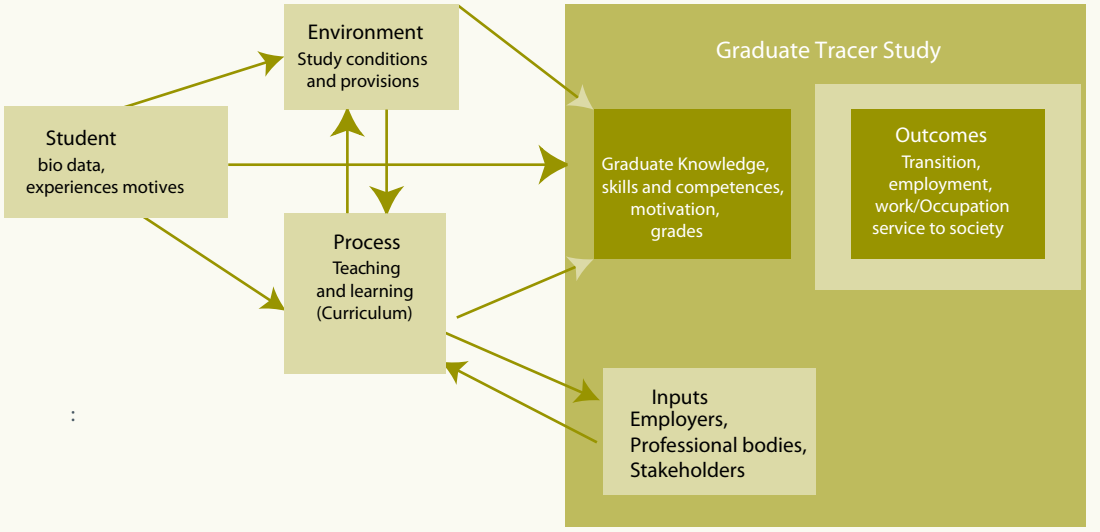
3.1 Conceptual Framework

The study utilized mixed methodologies benchmarked with similar studies reviewed in literature. They include literature review, questionnaires, key informant interviews, focused group discussion and stakeholder workshops. Figure 3.1 below presents a conceptual framework of the main tracer study methodology. The framework depicts a virtuous circle between students' learning, *input factors* (the teaching/curriculum delivery, the prevailing environment/external conditions, and feedback from employers and stakeholders), and *output factors* (the quality of graduates/ competencies, and employment outcomes). The study traces the graduate engineer to understand the consequences of the input factors on the output factors, with a view to apply lessons learnt to build on and reinforce engineering training, employment, and application in the country.

3.2 Steps in the Methodology

The execution of the research methodology entailed the following four steps (Fig. 4.2), survey design and inception, data collection, data analysis, interim report writing, and final report writing. Step one was accomplished in the second half of 2019, before the onset of Covid-19 pandemic. The study team had several consultative meetings with the MOE-STUDER Project Implementation Committee and key stakeholders with the first one taking place on 27th May 2019 and the last one on 5th of October

Figure 3.1: Conceptual framework for the graduate tracer study



Source: Modified from Schomburg, 2010

2021 to finalize the work and agree on the validation workshops. Two stakeholders' workshops were organized, with the first stakeholders workshop held on the 20th November 2019 at the Nairobi Safari Club, Lilian Towers whose scope was to share with the stakeholders the proposed methodology for inputs as the team continued to develop and update the address database of graduate engineers from target universities. Input from the workshop led to refinement of the survey instruments and building of network of contacts with participants from universities and employers. The second and the last workshop was held virtually on 10th of November 2021, this was a validation workshop where the research team shared with the stakeholders the outcome of the study for their inputs and validation and the participation raised useful inputs which were infused in this report.

Baseline data for engineering graduates is important to assess trends and composition of graduates from both public and private universities in the country. The Commission of University Education (CUE) published the *State of University Education in Kenya* Reports for 2015/16, 2016/17, and 2017/18 which provide data on academic programmes, enrolment, graduation, academic staff,and finances for both public and private universities in Kenya. In 2015 Kenya

Figure 3.2: : Steps in the Study Methodology

1. Survey Design & Inception

- Award/A kick off /inception meeting with client - 4th June 2019
- Preparation/submission of inception report - July 2019
- Desktop review of similar studies/ technical concept for carrying out the survey
- Survey design (selection of the cohorts of graduates to be included; and sampling)
- Formulation of questionnaires, training of research assistants and pre-testing of questionnaires.
- First stakeholders workshop/ Inception workshop - 20th November 2019

2. Data collection

- Developing and updating address database - university departments, graduates and employers
- Refinement and formatting of questionnaires
- Online distribution (survey monkey), and continuous data processing
- Preparation of Interim Progress report - 10th February 2021
- Focused Group Discussion with employers and senior engineers in the industry - 20th May 2021

3. Data analysis, interpretation and report writing

- Revised Interim Progress Report -
- Data analysis and interpretation
- Preparation of draft final report -10th November 2021

4. Making recommendations, validation and Final Report Preparation

- Second stakeholders workshop/ Validation-10th November 2021
- Final recommendations and report editing
- Final Report-30th November 2021

Education Network Trust (KENET) undertook a baseline survey of Engineering Departments in Kenya (KENET, 2015). The survey reported 12 universities offering engineering programmes. The study covered engineering enrollment, graduation, faculty, and funding for the Engineering Departments for years 2011-2014. The number of universities offering engineering has risen from five in 2002 to 18 in 2020.

Developing a contact database of engineering graduates proved harder than expected except for the University of Nairobi, largely because most engineering schools/ departments do not maintain such databases and do not keep track of their graduates. We were interested in such contact data as email and telephone, on graduate engineers from approved engineering schools and programs for the three cohorts: 2009, 2014, and 2018. However, many of the contacts received bounced as the graduates had already changed their email and telephone numbers. We opted for a snowball technique where known class leaders were able to share contacts of classmates in their social networks (WhatsApp, Facebook, Instagram). The process was slow, time consuming and required a lot of follow-ups by lead experts and research assistants.

The research team undertook the design of an online questionnaire (survey monkey) for wider online outreach and interview guides based on the terms of reference of the tracer study. The draft questionnaires were presented, discussed, and refined during and after the first stakeholder workshop. Questionnaires were designed for Graduate Engineers, Deans of Schools of Engineering, and Employers for online administration (Appendix 2). The team also prepared discussion points for focused group discussions with employers and senior engineers in the industry.

3.3 Number of Graduate Engineers Contacted and Responses by Cohort

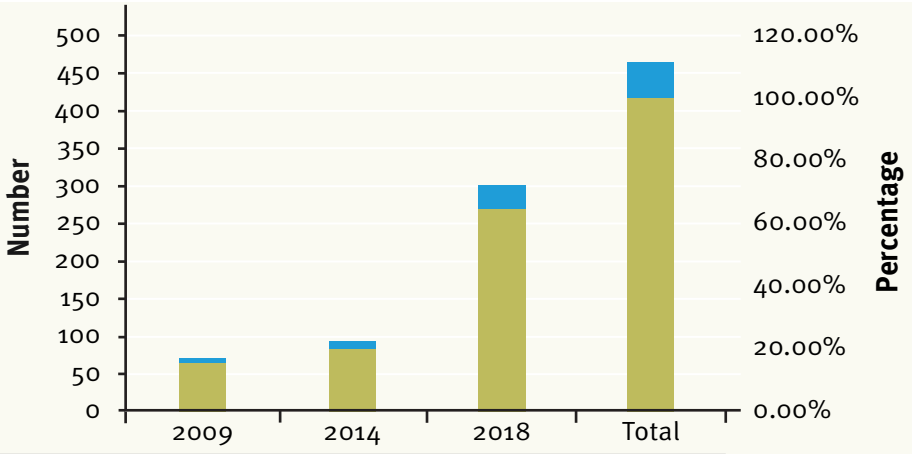
Table 3.1 shows the number of engineers who graduated from various universities for the cohorts selected for the tracer study and the number whose contacts were successfully obtained by the study team. The contacts were sourced from the engineering schools in the respective universities. Many of the universities did not have engineering graduates for the cohorts selected because their programmes were established recently. For those which were constituent colleges, their students graduated through the parent university. A total of 5787 engineers graduated from various universities within the three cohort groups. Contacts were established with 1391 being about 24% of the engineering graduates. Many of the contacts given by universities were unresponsive meaning that the graduates had since changed their contact addresses hence untraceable. The number of contacts also depended on how well each school kept contacts of their past graduates and cooperated with the research team.

Figure 3.3 shows the sampling distribution for the 3 cohorts, majority (64.7%) of the engineering graduate were noted to have graduated in 2018 and the least representation was 2009 at 15.3%. Responses were fewer from graduates of earlier cohorts, 2009 and 2014, just as the contacts received from those cohorts were fewer. This is due to the currency of the contact addresses of the graduates. Whereas the contacts for the recent graduates are relatively up to date, this may not be the

Table 1:	Number of Engineering Graduates by University and Cohort:									
	NAME OF UNIVERSITY	GRADUATES BY COHORT				CONTACTS BY COHORT				
		2009	2014	2018	Total	2009	2014	2018	Total	
1	UON	252	387	356	995	157	267	271	695	
2	MOI	224	319	171	714	4	7	19	30	
3	JKUAT	291	493	687	1471	3	0	2	5	
4	EGERTON	150	149	144	443	0	55	105	160	
5	MMUST								0	NC
2	KENYATTA	32	287	296	615	0	0	21	21	
7	TUK	0	300	300	600	0	29	264	293	
8	TUM								0	NC
9	DEDAN KIMATHI	0	287	347	634	0	4	14	18	
10	ELDORET	0	0	86		0	0	45	45	
11	MULTIMEDIA UNIVERSITY OF KENYA (MMU)								0	NG
12	MOUNT KENYA	0	0	9	9	0	0	8	8	
13	BARATON	33	36	16	85	9	3	3	15	
14	MACHAKOS	0	89	0	89	0	56	0	56	
15	TAITA TAVETA	0	0	46	46	0	0	46	46	
16	CHUKA	0	0	0	0	0	0	0	0	NG
17	MURANGA	0	0	0	0	0	0	0	0	NG
18	KISII	0	0	0	0	0	0	0	0	NG
		982	2347	2458	5787	173	421	798	1391	
		NC	No contacts		NG	No graduates				

case for those who graduated earlier. In this regard, it would be useful to ensure that the graduate database is maintained and contact the graduates earlier after graduation.

Figure 3.3 Distribution of Cohort Respondents



	2009	2014	2018	Total
Number	71	93	301	465
Percentage (%)	15.30%	20.00%	64.70%	100%

Number Percentage (%)

3.4 Number of Graduate Engineer Responses

Table 3.2 shows the responses received from various universities. A total of 465 (33%) responses were received[16]. The table shows the distribution of responses from graduate engineers by university and cohort.

16 There were 495 responses but after removing 33 duplicated cases, 465 responses remained and were used in the analysis. Universities in Kenya hold graduations at different times. A few respondents reported as graduates of 2019 and these were merged with the graduates of 2018 for the purpose analysis.

Table 3.2 Responses from Engineering Graduates by University and Cohort

	NAME OF UNIVERSITY	RESPONSES FROM E-GRADUATES			
		2009	2014	2018	Total
1	UON	65	49	91	202
2	MOI	3	7	19	29
3	JKUAT	2	1	2	5
4	EGERTON	1	12	21	34
5	MMUST	1	5	14	19
2	KU	0	0	21	21
7	TUK	0	15	86	101
8	TUM	0	0	5	5
9	DEDAN KIMATHI	0	3	15	18
10	ELDORET	0	1	17	18
11	MULTIMEDIA	0	0	1	1
12	MKU	0	0	2	2
13	BARATON	2	0	0	2
14	MKS	0	0	16	16
15	CHUKA	0	0	0	0
16	TAITA TAVETA	0	0	7	7
17	MURANGA	0	0	0	0
18	KISII	0	0	0	0
		71	93	301	465

CHAPTER

4

Findings

4.1 Engineering Programmes in Public and Private Universities

The number of universities offering engineering programmes increased rapidly from 5 in 2002 to 18 in the year 2018. In 1970, only one university (University of Nairobi) offered Engineering programmes, by 2002, the number increased to 5 universities, and by 2018, the number stood at 18 universities. Similarly, the universities offered an increasing diversity of undergraduate engineering programmes, from 5 in 1980 to current 110 programmes approved by the Commission for University Education[17a]. The Engineers Board of Kenya (EBK) recognizes 60 programmes (Appendix 1).In this study, it was observed that there are cases of engineering programmes with zero enrollment and graduation. It was reported that this occurs where universities have over specialized undergraduate programmes. Such programmes are likely to leave out core areas and fail to produce an all-round recognized professional engineering discipline. Majority of employers reported that they look for competent engineers who are not over-specialized. Similarly, students tend to avoid enrolling into such narrow area programmes, hence zero enrollment. The roles of CUE and Professional Registration Bodies should ensure well designed programmes and production of competent graduates in all engineering programmes[17].

17a The course areas have diversified from the traditional 5 distinct programmes (1980) to more than 30 currently.

17 The three-year -long court battle over the University (Amendment) Act, 2016 was ruled in favor of CUE to take full control of curriculum accreditation and supervision of academic programmes in higher learning institutions. However, the court ruled that CUE may, before approving any academic programme consult with any relevant body established by written law to regulate the profession.

4.2 Engineering Graduates from Public and Private Universities in Kenya

Table 4.1 shows trends and composition of engineering graduates from all public and private universities in Kenya from 2012 to 2016. Kenya Education Network (KENET) conducted a baseline survey of Engineering Departments in 2015 which covered 12 universities[18]. The study reported the number of graduates from Academic Year (AY) 2011/2012 to AY 2013/2014 as 1100, 1533, and 1625, respectively. According to the study, there was an increase of about 48% in the number of graduates between AY 2011/2012 and 2013/2014. The study covered graduates from public universities and three cluster areas: civil and structural engineering, electrical and electronic engineering, and mechanical and mechatronic engineering.

Table 4.1 shows that the number of graduates from engineering schools, both public and private, has grown at 49% per annum from 2012 to 2016. While the number of female graduate engineers has also increased it remains low due to low uptake of STEM subjects by girls.

4.3 Gender Analysis of Engineering Graduates

Majority of the engineering graduates (82.2%) were found to be male as shown in Figure 4.1. This confirms various studies e.g. Silbey (2016) who noted globally, the percentage of women pursuing degrees

18 KENET (2016) Baseline Survey of Engineering Departments, 2015.

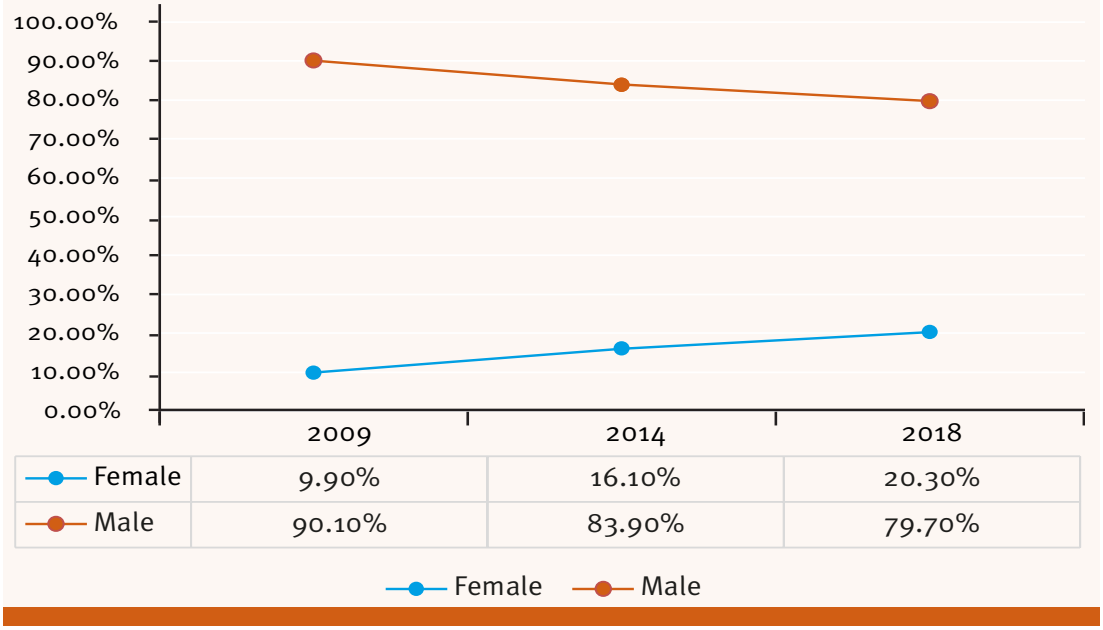
Table 4.1: Engineering Graduates 2012-2016 from Public and Private Universities

		2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
Public	**Male**	968	1106	2085	1568	2805
	Female	333	205	410	341	737
Private	**Male**	5	11	15	0	28
	Female	2	4	0	0	21
Total		**1308**	**1326**	**2510**	**1909**	**3591**

Source: KENET, 2015; CUE, Kenya State of University Report, various years.

in science, technology, engineering and mathematics (STEM) is small. Engineering is the most male-dominated field in (STEM). It may perhaps be the most male-dominated academic programme consult with any relevant body established by written law to regulate the profession.[19] Mugo (2012); Mbirianjau (2018)[20] with Silbey by stating that, in Africa, the numbers are even more dismal. The greatest imbalance is in engineering. Mbirianjau (2018) indicates that in 2010 only one in four engineering students was a woman which confirms Njau (2012) notion that there is a large disparity in the ratio of men to women studying STEM courses in public universities in Kenya generally. However, the proportion of female engineering graduates has been increasing, albeit slowly as shown in Fig. 4.1.

Figure 4.1: Distribution of Engineering Graduates by Gender and Cohort



19 Silbey, S. S. (2016). Why Do So Many Women Who Study Engineering Leave the Field? Accessed from 09th July, 2021 https://hbr.org/2016/08/why-do-so-many-women-who-study-engineering-leave-the-field

20 Mbirianjau, L. W. (2018). Why Fewer Kenyan Women are Choosing or Completing STEM Courses. The Conversation, September 19, 2018. Accessed from 12th July, 2021 https://theconversation.com/why-fewer-kenyan-women-are-choosing-or-completing-stem-courses-91706

4.4 Employment Rates of Engineering Graduates

The study sought to establish employment rates and destinations of engineering graduates from Kenyan universities. Destination is understood variously as, what the graduates do after they leave university and enter the labor market, in terms of nature of first employment, the time it takes to get employed, how many are unemployed, responsibility at work, how many engage in further studies, where they go to work in terms of geographical distribution, and in what sectors they work.

4.4.1 Employment Rates

Table 4.2 shows overall employment status by sex. The ratio of females to male engineering graduates (according to the response) is about 1:5 - which is also reflected in the employment status. Overall, about 71.2% of all graduate engineers were employed, 8.6% were self-employed, 17.2% were unemployed, while about 2% were in postgraduate studies. Comparing female and male graduate engineers, a higher percentage of female engineers than male engineers were employed, while more male engineers than female engineers were in self- employment. A World Bank's 2013 informal enterprise survey in Kenya found that "female owned firms are [significantly] less productive, less dynamic, and pay their workers less compared to male owned firms" (World Bank, 2016)[21]. The overall gender-current employment findings supports Timmis (2018)[22] who noted that Women have fewer employment opportunities than men. Since 1998, unemployment among Kenyan women has been consistently higher than unemployment among Kenyan men and has increased at a faster rate.

Table 4.3 shows the employment status by the three cohorts. Across the cohorts, those who are employed constitute the highest percentages at 90.1%, 85.0% and 62.5%, respectively, while the average is 71.2%. In 2009 and 2014, the second highest category are those who are self-employed, while in the 2018 cohort the second highest category are those who are unemployed.

Table 4.2: Employment Rates for Male and Female graduate Engineers

Employment Status	Female (%)	Male (%)	Total (%)
Internship	1.2	0.8	0.9
Self-employed	2.4	9.9	8.6
Employed	72.3	71.0	71.2
Unemployed	20.5	16.5	17.2
Studying (Postgraduate)	3.6	1.6	1.9

21 World Bank. (2016). Informal Enterprises in Kenya. Washington DC: World Bank. https://openknowledge.worldbank.org/ handle/10986/24973

22 Timmis, H. (2018). Jobs in Kenya: Opportunities and Challenges. https://assets.publishing.service.gov.uk/media/5afacd43ed915d0df4e8ce4d/Jobs_in_Kenya.pdf

Table 4.3:	Current Employment Rates by Cohorts of Engineering Graduates							
Employment Status	**2009**		**2014**		**2018***		**Total**	
Internship	0	0.0	1	1.1	3	1.0	4	0.9
Self-employed	6	8.4	9	9.7	25	8.3	40	8.6
Employed	64	90.1	79	85.0	188	62.5	331	71.2
Unemployed	1	1.4	3	3.2	77	25.6	81	17.4
Studying (Postgraduate)	0	0.0	1	1.1	8	2.6	9	1.9

* Includes a few responses of 2019.

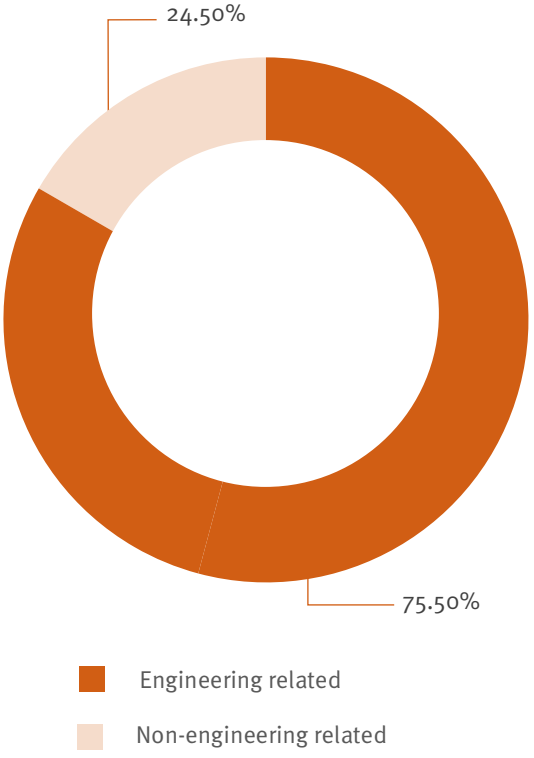
This analysis in table 4.3 shows that cumulatively 17.4% of the engineering graduates were unemployed, with most of them being recent graduates (2018). Therefore, the findings from the tracer study do not support the dismal picture painted by various social media on high levels of unemployment for engineering graduates[23]

4.4.2 Nature of employment

a) The nature of first employment

Figure 4.2 shows that about 75.5% of the engineering graduates were employed in engineering related fields, while 24.5% were employed in non-engineering fields. Among the non-engineering fields that graduates get employed in include, auditing, accounting, banking, insurance, sales, and marketing/ customer service/ shop keeping, farming/ green grocers, research, investment analyst, business intelligence analyst, hospitality industry/ Software tester/ transcription/ data entry, teacher, data analyst, interior design, printing services, causal labor, and Kenya Youth Employment and Opportunities. Although a good number of those in non-engineering employment indicated that they were employed, a good number equally indicated that they were self-employed. Only a small fraction considered themselves to be unemployed, even when engaged in some activity, which is not necessarily engineering related.

Figure 4.2: Graduates Destination based on Nature of First Employment



23 Accessed from 13th July, 2021 https://postamate.com/2020/06/helb-to-stop-funding-engineering-courses-in-kenya/

Table 4.4: Nature of first employment by cohort through the gender lens

Field	Gender	2009	2014	2018	Total
Engineering	Female	9.9%	11.8%	12.6%	12.0%
	Male	76.1%	72.0%	57.8%	63.4%
	Sub-total	86.0%	83.8%	70.4%	75.4%
Non-Engineering	Female	0.0%	4.3%	7.6%	5.8%
	Male	14.1%	11.8%	21.9%	18.7%
	Sub-total	14.1%	16.1%	29.5%	24.5%
Total	%	100.0%	100.0%	100.0%	100.0%
	Number	**71**	**93**	**301**	**465**

In Table 4.4, in 2009, 86% of the graduates were employed in engineering fields (the females were 9.9% and the males were 76.1%), while 14% (all male) were in non-engineering fields. Similarly, in 2014, 83.8% of the graduates were employed in engineering fields (the females were 11.8% and the males were 72.0%), while 16.1% were in non- engineering fields (the females were 4.3% and the males were 11.8%). Finally, in 2018, 70.4 % of the graduates were employed in engineering fields (the females were 12.6% and the males were 57.8%), while 29.5% were in non-engineering fields (the females were 7.6% and the males were 21.9%). It is observed that across the cohorts, the percentage of engineering graduates finding employment is increasing in non-engineering fields while it is decreasing in engineering fields. Over the study period however, the percentage of female finding employment in engineering and non-engineering fields is increasing. While this might indicate opening up of opportunities for engineers in non-engineering areas, the study appears to corroborate the study by FKE that graduates in professional are finding employment in areas lower than their qualification.

b) Nature of current employment

From table 4.5 analysis, males are proportionately more in the categories of self-employment while females are proportionately more in both categories of employed and unemployed. They are also slightly more on the category studying. This finding concurs with a UNESCO report on improving access to engineering careers for women in Africa and in the Arab States (2013) which notes that, while young women only represent 7 to 12 % of engineering students in Africa, the number of female engineering graduates who go on to work in engineering professions in the region is much lower. According to UNESCO/IGU (2013),[24] Educational constraints, cultural norms and prejudices influence opportunities and choices, severely reducing the number of women engineers who are employed in their field of expertise. This seems also to corroborate World Bank (2016) study on the declining number of women in both formal and informal employment sector.

24 UNESCO/IGU (2013). Workshop on Women in Engineering, (10th December 2013). Paris, France. Accessed from 14th July, 2021 http://www.unesco.org/new/en/natural-sciences/science-technology/engineering/women-in-engineering/workshop-on-women-in-engineering/

25 Daily Nation (02 July 2020). Too Many Graduates But Where are the Jobs? https://nation.africa/kenya/news/too-many-graduates-but-where-are-the-jobs--1032764?view=htmlamp

Table 4.5:	Current Employment Status by Gender					
Current employment status	**Female**		**Male**		**Total**	
Internship	1	1.2%	3	0.8%	4	0.9%
Self-employed	2	2.4%	38	9.9%	40	8.6%
Employed	60	72.3%	271	70.9%	331	71.2%
Unemployed	17	20.5%	64	16.7%	81	17.4%
Studying (PG)	3	3.6%	6	1.5%	9	1.9%
Total	**83**	**18%**	**382**	**82%**	**465**	**100.0%**

4.4.3 Employment lead time

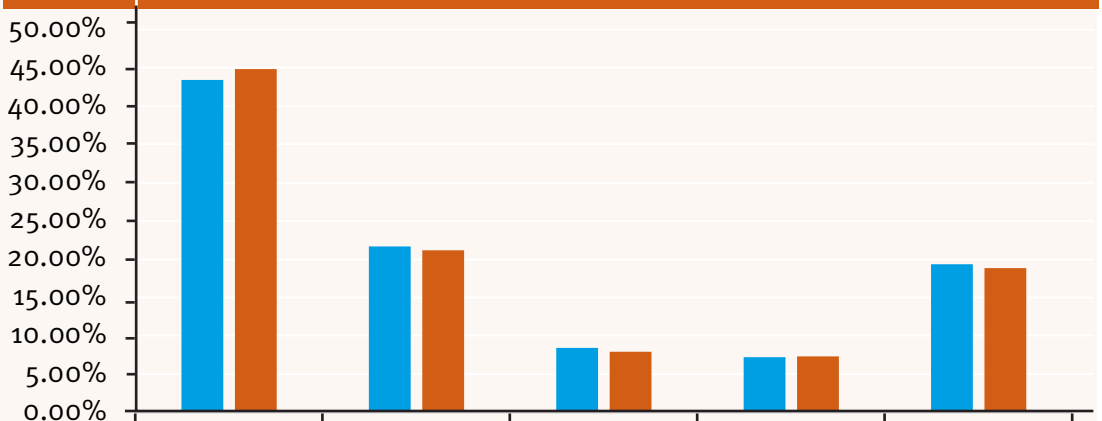
According to the responses shown in Fig. 4.3, most graduates (43.4%) for female and 44.8% for male are employed within 0 - 6 months after graduation. Another 21.7%, female and 21.2% male are employed within 7 – 12 months. Overall, 82% percent of the graduate engineers were employed within eighteen months[26].

Majority of engineering graduates were noted to look for employment prior to completion of their studies (42.2%) for female and 40.1% of male while a sizable portion (33.7%) and 34.3% of female and male, respectively, were found to seek employment after completion of their studies (Fig. 4.4). There was no major difference between male and female in terms of job-seeking period.

Males dominate both engineering employed (63.4%) and non-engineering employed (18.7%), compared to female in engineering (12%) and non-engineering (5.8%) as shown in Table 4.4. The employers' interviewed through FGD also reported higher employment statistics of male engineers as compared to female with a ratio of 1:6 which means that for every (1) female engineer employed we have 6 male engineers employed. This clearly validates arguments by Mugo (2012) and Silbey (2016) who noted that engineering is the most male-dominated profession.

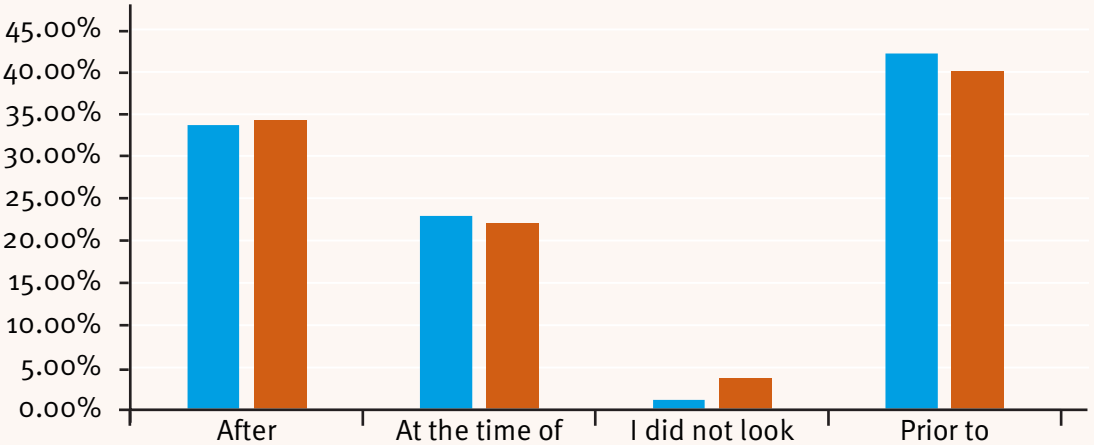
26 This is contrary to findings on general university graduates - Daily Nation, 2nd July 2020: Too many graduates but where are the Jobs? https://nation.africa/kenya/ news/too-many-graduates-but-where-are-the-jobs-- 1032764?view=htmlamp

Figure 4.3: Employment Lead Time



	0 - 6 (Months)	7 - 12 (Months)	13 - 18 (Months)	More than 18 Months	N?A (Not yet employed)
Female	43.40%	21.70%	8.40%	7.20%	19.30%
Male	44.80%	21.20%	7.90%	7.30%	18.80%

Figure 4.4: Period for looking for Gainful Employment



	After completion	At the time of completion	I did not look for	Prior to completion
Female	33.70%	22.90%	1.20%	42.20%
Male	34.30%	22%	3.70%	40.10%

Source: Ministry of Education Engineering Graduates Tracer Study (2019-2021)

4.4.4 Destination of Engineering Graduates

a) Employment sector

Table 4.6 shows that the greatest percentage of the graduate engineers is employed in the private sector at 52.9%, while those in public represent 35.8%. This means that the private sector is the largest employer of engineering graduates. In this regard, the government should continue providing a conducive environment for the private sector to continue flourishing but also with the curriculum review and accreditation of the programmes beyond Kenya, the graduates should be able to explore opportunities in other international agencies.

Table 4.6:	Employment across the Sectors

Employment sector	Freq	%	% Cum.
Civil Society	4	0.5	0.5
Development partner	2	0.3	0.8
Public University - in a foreign country.	1	0.2	1.0
Intergovernmental/UN	2	0.3	1.3
Private	238	52.9	53.2
Public	156	35.8	89.0
Research and Consultancy	2	0.3	89.3
Self-Employed/ Freelance	36	5.7	95.0
Student	11	2.7	97.8
Others	13	2.2	100.0
Total	**465**	**100.00**	**100.00**

b) Engineering Graduates by Employment Terms

In terms of the terms of employment,Table 4.7 shows the number of those in permanent employment have a slightly higher representation at 38.6% which is almost the same as those who are on contract - at 35.8%.

c) Main responsibilities at work

According to the responses, the graduate engineers are involved in different responsibilities ranging from casual, junior technical, supervisor up-to management. The cross tabulation in Table 4.8 shows the percentage of graduates involved in different responsibilities across the cohorts. Majority of the graduates irrespective of the year of graduation are involved in technical roles/ responsibilities at 51%, followed by those at supervisory and managerial roles at 18% and 12%, respectively. The percentage of those who graduated in 2009 and in management level is higher (at 26.9%) compared to those who graduated in 2014 (21.2%) and in 2018

Table 4.7:	Graduate Engineers by Employment terms

Employment terms	Freq	%
Casual	30	7.0
Consultancy	4	0.9
Contract	154	35.8
Self-employed/Freelance	5	1.2
Internship	30	7.0
Permanent	166	38.6
Temporary	34	7.9
Unemployed	26	7.4
Volunteer	7	1.6
Total	**465**	**100.0**

Table 4.8:	Work Responsibility by Cohort							
	Year of Graduation							
Responsibility at work	2009		2014		2018		Total	
Consultant	3	3.0%	5	6.1%	13	4.8%	21	4.70%
Managerial	19	26.9%	22	21.2%	14	5.2%	55	11.75%
Supervisory	15	20.9%	15	15.2%	51	17.2%	82	17.50%
Technical	31	46.3%	44	50.0%	157	52.4%	232	50.90%
Junior	0	0.0%	0	0.0%	6	1.6%	6	1.00%
Casual	0	0.0%	1	0.4%	3	1.2%	4	0.80%
Other	0	0.0%	2	1.5%	8	2.0%	10	1.60%
Teaching	1	1.5%	0	0.0%	1	0.4%	2	0.50%
N/A	1	1.5%	4	6.1%	38	15.2%	43	11.20%
Total	**67**	**100.0%**	**93**	**100.0%**	**291**	**100.0%**	**451**	**100.00 %**

NB: "Other" include responses such as: analyst, associate, classwork and research, operations, customer service, shopkeeper, advisor, order/project management, trainer

(at 5.2%).

d) Geographical destination of engineering graduates

I) Global Destination

Table 4.9 show that the majority of graduate engineers are employed in Kenya. Kenya is the main labor market for engineering graduates at 78% for those who are employed. All the self-employed are also based in Kenya. The remaining percentage work either within East Africa, the rest of Africa, Europe, and Australia. This means that the Universities are training mainly for the Kenyan labor-market. Only a few have either furthered their studies or and currently studying after undergraduate studies.

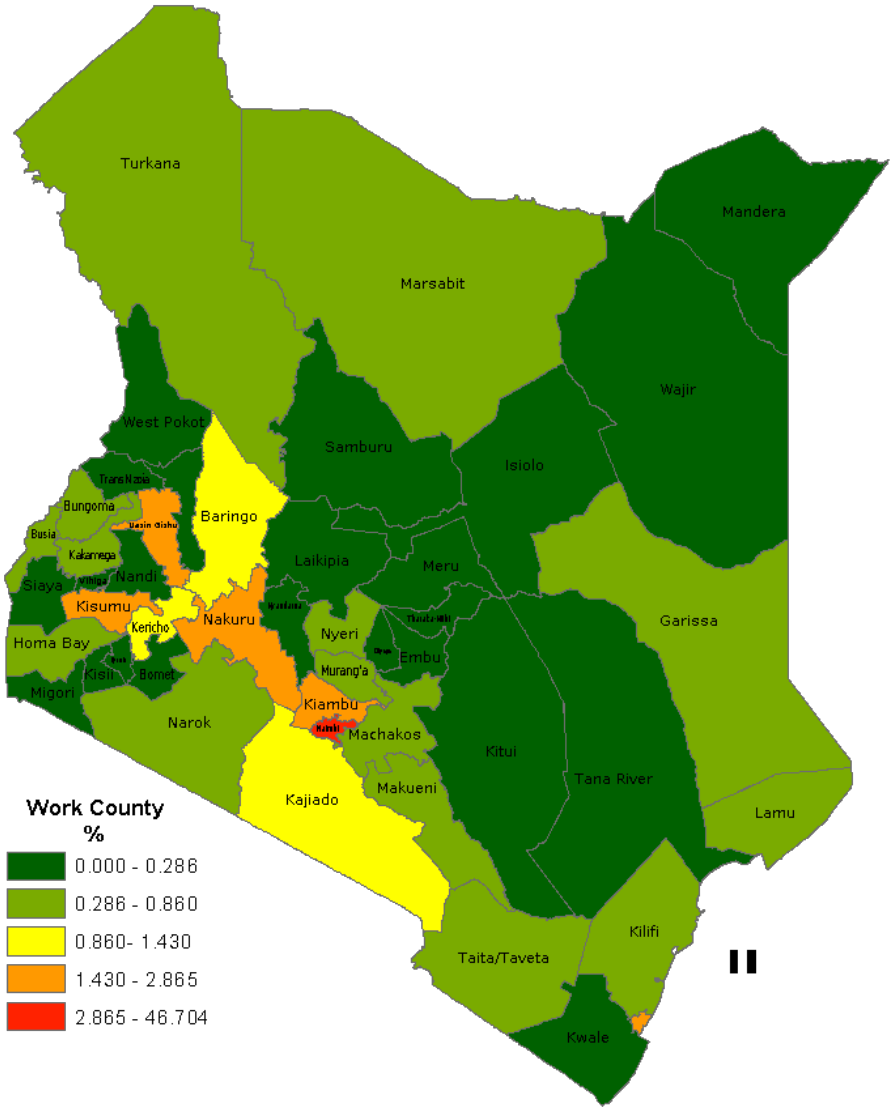
ii)Destination within Kenya

According to the responses, shown in Figure 4.5 Nairobi 44%), Uasin Gishu (2.9%), Mombasa (2.3%), Nakuru (2.0) and Kisumu (2.0), in that order, are the areas of concentration of graduate engineers. The distribution of employment follows the urban corridor, and this reflects a bias

Table 4.9:	Geographic Distribution in Employment for Engineering Graduates

Employment status	Kenya	East African (excluding Kenya)	Africa (excluding East Africa)	Asia	Europe	America	Australia	N/A	Total
Internship	1%	0%	0%	0%	0%	0%	0%	0%	1%
Self-employed	9%	0%	0%	0%	0%	0%	0%	0%	9%
Employed	66%	1%	1%	1%	1%	1%	0%	0%	70%
Unemployed	1%	0%	0%	0%	0%	0%	0%	16%	18%
Studying (Postgraduate)	1%	0%	0%	0%	1%	0%	0%	0%	2%
Total	**78%**	**1%**	**2%**	**1%**	**1%**	**1%**	**0%**	**16%**	**100**

Figure 4.5:	Work County of Engineering Graduates in Kenya



of engineering graduates' employment opportunities.

4.5 Challenges and Self-Assessment by Engineering Graduates

4.5.1 Challenges Encountered by Engineering Graduates in Securing Employment

Table 4.10 shows the challenges encountered by engineering graduates in securing employment. The challenges with high ratings include lack of connection to the available employment opportunities (47.1%), non-transparent recruitment process (37.1%), lack of required experience (21.3%), and tribalism (20.1%). However, Omolo (2013) argues many job seekers in Kenya have failed to secure the jobs they apply for since they only concentrate on academic papers while they forget to develop their professional networks.[27]

4.5.2 How Engineering Graduates Assess Themselves: Relevance of Skills and Competence Acquired in University

a. Self-Assessment by Engineering Graduates

The graduates were asked to assess themselves on various competencies/ attributes by the time they completed the degree programme. The competences include problem solving, application of engineering knowledge, engineering design, investigation, experiment, and analysis, using engineering methods, skills, and tools. Table 4.11 shows the percentage (%) responses. Generally, the

Table 4.10: Challenges in Securing Employment.

Measurement	Not at All	Limited Extent	Some Extent	Great Extent	Very Great Extent
Non- Transparent Recruitment	7.1	9.0	23.2	23.7	37.1
Not Connected	4.1	8.5	12.5	27.8	47.1
Lack Required Experience	9.0	12.3	30.8	26.7	21.3
Bribe Employer	50.1	18.9	19.8	5.3	5.9
Tribalism	28.9	17.6	21.5	11.9	20.1
Gender Discrimination	**41.4**	**20.0**	**20.3**	**10.8**	**7.5**

27 Omolo, J. (2013). Employment Challenges in Kenya. African Journal of Economic Review. Vol. 1 No.1 of 2013. Accessed from 12thJuly, 2021 https://www.ajol.info/index.php/ajer/article/view/116297

Table 4.11: Self-assessment on various attributes

	Problem solving	Application of engineering knowledge	Engineering Design	Investigation, Experiment and Analysis	Engineering methods skills and tools
Very High Extent	28.5	31.0	22.1	23.8	26.9
High Extent	48.9	43.0	38.7	36.4	39.3
Some Extent	19.5	19.2	28.1	29.5	25.2
Limited Extent	3.2	6.0	10.3	9.5	7.7
Not at all	0.0	0.9	0.9	0.9	0.9
	100.0	**100.0**	**100.0**	**100.0**	**100.0**

graduates are confident of the relevant skills required in engineering practice.

b. Relevance of skills and competencies acquired in university.

Graduate Engineers assessed themselves on the relevance of skills and competences acquired in the university (Table 4.11). The graduates generally consider all skill and competence area learnt at the university to be relatively important. However, from Table 4.12, fewer graduates consider mathematics to be very important relative to the other subjects. This could mean that the alignment of the subject content to engineering applications in their career needs to be re-evaluated.

c. Rating of Conditions in Training.

The graduates were asked to rate how they experienced the conditions in their undergraduate degree programmes – as a basis for identifying areas that need improvement in engineering and applied science training. The areas that the graduates were asked to rate included: assistance in preparing for examinations, opportunity for contact with the lecturer, academic advice, participating in research projects, teaching quality, structure of the program, grading system, quality of equipment, lecture rooms, consultation with fellow students and quality of buildings. From Table 4.13, the conditions most rated poor and very poor are participation in research projects, equipment quality, and opportunity to contact with lecturer; while the conditions most rated

Table 4.12: Relevance of skills and Competence acquired in University.

	Basic Sciences		Engineering and sciences		Maths and Sciences		Computing and IT		Complimentary studies	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Very Important	250	63.32	250	52.72	177	36.96	268	57.31	233	51.29
Fairly Important	121	20.92	121	26.93	120	25.79	119	26.65	103	20.92
Important	44	8.31	44	9.17	74	16.33	47	8.60	53	12.32
Slightly Important	20	4.01	24	5.16	53	11.17	19	4.01	30	6.02
Not at all Important	18	3.44	26	6.02	41	9.74	12	3.44	46	9.46
N/A	0		0	0	0	0	0	0	0	0
Total	**465**	**100.00**	**465**	**100.00**	**465**	**100.00**	**465**	**100.00**	**465**	**100.00**

Table 4.13: Rating the conditions of aspects during the training.

	Very Good	Good	Fair	Poor	Very Poor
Assistance with exam preparation	22.92	46.42	22.06	6.88	1.72
Opportunity for contact with lecturer	16.91	35.24	28.37	14.9	4.58
Academic advice	23.21	42.69	21.78	8.88	3.44
Participating in Research Project	13.47	34.38	25.21	17.77	9.17
Teaching Quality	28.37	45.56	22.06	2.87	1.15
Structures	33.52	46.42	14.33	4.01	1.72
Grading system	21.78	50.43	20.92	5.44	1.43
Equipment quality	19.77	32.95	26.07	14.61	6.59
Quality of Lecture rooms	18.05	42.41	26.36	9.74	3.44
Consulting with fellow students	47.85	42.41	7.74	1.72	0.29
Quality of buildings	**24.93**	**45.85**	**19.48**	**8.02**	**1.72**

good and very good are consulting with fellow students, the training on structures, and to some extent the teaching quality.

4.6 Assessment of Engineering Graduates by their Employers

4.6.1 How prepared Engineering Graduates are for entry-level positions

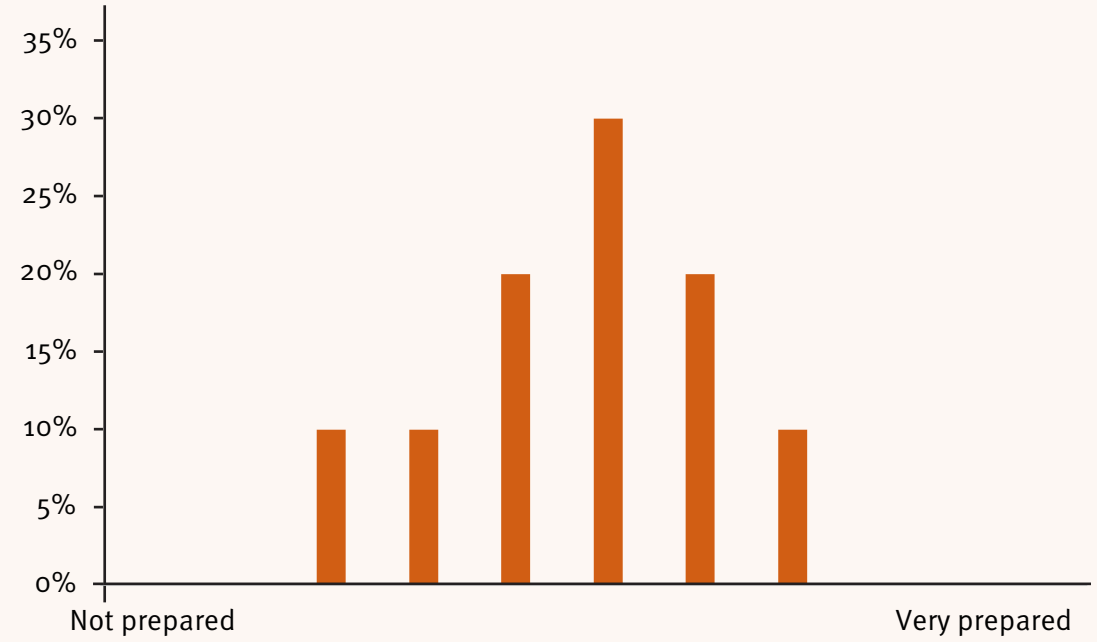
The study administered a questionnaire and also organized a focused group discussion with employers to gauge their assessment of Engineering graduates, the factors in recruitment of graduate engineers, and employer satisfaction regarding graduate employee's knowledge, skills, and level of performance, and recommendations on areas of improvement. Generally, the employers observed that Engineering graduates are generally intelligent young people who have satisfactory theoretical knowledge but have inadequate skills (hands-on experience). A few also lack self-confidence.

The employers were asked to rate how employment-ready the engineering graduates are for entry level positions on a scale of 1(not prepared) to 10 (very prepared). According to the responses shown in Figure 4.6 the employers consider the graduates to be moderately prepared (average of 5.7 along the scale) for entry-level positions.

4.6.2 Employer Satisfaction with regard to Engineering Graduates

The employers were asked to indicate the extent they agree that most graduates have the necessary skills to perform on their jobs without experience/training. According to the responses from the employers presented in table 4.14, the employers were generally ambiguous on all areas of skills in terms of agreeing, being neutral and disagreeing. They rated highly neutral regarding the assessment of the interpersonal skills of the graduate engineer.

Figure 4.6: How Prepared the Graduates are for entry-level Positions.



The employers were asked to indicate the emerging skills or competencies that engineering employees should have.

According to the responses the following skills were identified: ICT, soft skills, energy and project management, writing skills, presentation skills, business development and marketing skills, ability to adapt, climate smart technologies.

4.6.3 Qualities the Employers look for

Among the qualities the employers look for in graduate engineers are academic performance, relevance of the training, problem solving ability, communication and presentation skills, personality (attitude), and experience and achievement. Generally, the industry spends 2 to 3 years to further train the graduates to attain the required job-ready skills and competences. The employers attributed the current state to weak university-industry linkages. Where industries offer attachment and internship to students, the graduate numbers are overwhelming compared to the opportunities available. Better structured and well managed attachments and internships are needed. It also appeared there was not enough academic staff interacting with industry and student supervision.

Table 4.14: Do the Engineering Graduates possess the necessary skills to perform their jobs?

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The right technical skills	0%	50%	20%	30%	0%
Soft skills	0%	50%	20%	30%	0%
Right life skills	10%	30%	30%	30%	0%
Right interpersonal skills	**0%**	**20%**	**70%**	**10%**	**0%**

Table 4.15: How Employers rate different factors when recruiting engineering graduates.

	Very Important	Fairly Important	Important	Less Important	Not at all Important
Field of Study	70%	10%	10%	0%	10%
Main focus of subject area/ specialization	40%	20%	20%	10%	10%
Theme of thesis/projects if applicable	0%	10%	50%	20%	20%
Grades at the institution of higher education	20%	30%	30%	10%	10%
Reputation of the institution of higher education	40%	30%	10%	10%	10%
Previous work experience	50%	10%	30%	0%	10%
Personality	**60%**	**10%**	**20%**	**0%**	**0%**

4.6.4 How Employers rate different factors when recruiting engineering graduates

The employers were asked to rate a number of factors that they consider when recruiting graduates. Table 4.15 gives a summary of the employers' views of those aspects that include field of study, areas of specialization, grades obtained during the study, reputation of the university, previous work experience and personality (attitude). From the table, the field of study and personality, otherwise attitude are rated highly by the employers when recruiting the graduate engineers.

The theme of projects that the graduates undertook are not considered to be very important – this means that the projects that the graduates did while at the university do not address the current engineering challenges that are of interest to the employers.

4.6.5 Performance of engineering graduates from different universities

The employers were asked the extent to which they agree that the work performance of engineering graduates from different universities with similar qualifications differ. Majority of the employees agreed while a sizable 20% were neutral and the remainder 20% disagreed. Some of the reasons given to support the rating are listed below:

Table 4.16: Employers Perceptions on Graduates Preference

Rating	Reason
Agree	• Although the universities offer the same programs, these are however not standardized. • Regular students from public universities show more capabilities. • We prefer graduate engineers from Nairobi University and JKUAT • Exposure offered to the graduates by their faculties that impacts mostly on their soft and interpersonal skills. • Some institutions expose their students while others are very theoretical
Neutral	• The ones that have engaged from different institutions do perform well with guidance
Disagree	• The competence and attitudes towards work largely depend on the individual rather than the institution.

Table 4.17:	Which Universities competently trained their Engineering Graduates to perform Engineering tasks required in the Organization

University	% Mention
University of Nairobi	30%
Kenyatta University	11%
Moi University	15%
Technical University of Kenya	4%
Technical University of Mombasa	4%
Jomo Kenyatta University of Agriculture and Technology	22%
Egerton University	11%
Strathmore University	4%

The employers, all from the engineering sector, listed the universities they consider the graduates to be competently trained to perform engineering tasks required in their organization. From a list of 27 mentions, the University of Nairobi had the highest at 8 mentions (30%), followed by JKUAT (22%) and Moi University (15%) in that order. Table 4.17 gives a summary of the percentage mention of the universities that employers consider producing competently trained engineering graduates.

4.7 Areas of Improvement

4.7.1 Areas of improvement by universities

The following suggestions were made regarding what the tertiary institutions need to do to make engineering training in Kenya more relevant to the labour market.

a. Universities- Industry Linkage

i. Collaboration between universities and industry can be enhanced by introducing adjunct positions with industry experience in the universities and holding regular joint seminars/ workshops.

ii. Selection of relevant projects by students can be realized by collaborating with industry to ensure learners have relevant skills through attachments and research.

iii. Enough practical in the industries (more attachments - at least 3 in different organizations)

b. Curricular Content and pedagogy

i. Some cross-cutting courses that should be included in the curricular includeIT/ automation, Productive Design that incorporates local components, Quality control, Renewable energy/ energy management, and Climate change, and High voltage DC.

ii. More time to be allocated for attachment in industry / field work and focus on emerging technologies.

iii. Since a good number of graduates end up as senior managers, it is important to introduce soft skills and supportive courses that include Basic financial management, Business/ entrepreneurship, Legal issues, Management, Sales, and knowledge

on public private partnerships/ procurement, communication, facilitative skills such as computing

iv. The soft skills are essential and should be provided in later years of undergraduate study at the university. The learners are encouraged to have a positive attitude and to proactively undertake training in particular skills, and also not to depend on being employed but by considering self – employment/ job creation.

v. There should be more practical exposure in the respective fields. There should be a shift to hands-on graduates rather than office and supervision engineers. This will enable self-employment as the employment market gets saturated,

vi. Training to be geared towards solving our problems. Prepare students for self-employment. It was noted that it takes industry about 1-2 years to train graduate engineers on the job and some of the Engineering graduates are very successful in this area.

vii. Universities should reduce too much focus on written examinations and instead consider the use of practical/oral examination and curriculum review.

viii. Among the areas the employers think the universities offering engineering programmes need to improve on in response to the employment needs were identified as follows:

c. University- Industry linkage

i. Assessment of the industry needs when developing courses and also regular updates.

ii. More exposure to industrial operations.

iii. Introduce a course network coordinator in the faculty/department to be responsible for linking students with the industry through attachments and internships.

d. Curricular Content and Pedagogy

i. introduce more practical content and emerging technologies in the curriculum.

ii. Focus on hands-on/ practical skills rather than the theoretical part of engineering.

iii. Soft skills, life skills and interpersonal skills like communication, marketing.

e Mentoring Programmes and Modern Technology Application

i. More mentorship programmes should be organized to address the challenge of inadequate career counselling.

ii. Applicability of the technologies to solve our current challenges.

iii. On supporting engineering graduate employees intending to undertake further studies in engineering, 60% of the employer respondents, mainly from the public sector indicated the willingness, while 20%, mainly from the private sector did not show any willingness, while another 20% were non-committal. Those who indicated willingness to support the graduates for further studies prefer local institutions, noting that training locally is sufficient for our needs and that it is also budget friendly to support more employees.

4.7.2 Areas of improvement by learners

The employer made the following suggestions that will make the learners more relevant to the labor market.

i. Align with industry needs, demands and trends.

ii. Be ready to start their careers at any levels available in the market-attitude change on white collar jobs.

iii. Be up to date by undertaking Continuous Professional Development

iv. They need to be open minded and not rigid and be prepared to do jobs that may be different from their main line of training. For example, our manager in charge of our borehole division is an electrical engineering graduate. He is now an expert in sizing, quoting, installation and commissioning of borehole pumping systems.

v. embrace more hands-on learning of engineering.

vi. Focus on solving our problems other than office jobs.

4.7.3 Areas of improvement by Government

The employers made suggestions on what the government should do to that can make higher education more relevant to the labor market:

i. The employers observed that the challenge of outdated equipment in the universities can be addressed through a well-defined collaboration between the universities and the industry. The Ministry of Education Science and Technology should work with the Ministry of Industrialization in creating appropriate collaboration that ensure linkage between universities and the industry (market) through development of relevant policies

ii. Facilitate the institutions to ensure up to date with emerging technologies and improvement of facilities

iii. The Government should ensure that there is a forum through a national committee consisting of the Universities and the private sector so that there is a forum for discussing the relevant and emerging skills needed by Industry.

iv. The various universities could be organized as centres of excellence in particular areas of Engineering and therefore be equipped with modern top of the range facilities befitting that particular sector.

v. Do skills gap analysis in the infrastructural sector.

vi. The Government should, if possible, heavily subsidize the technical courses such as Engineering, Medicine, Agriculture etc. These courses should be supported as they offer the trigger for real development of the country.

vii. Provide more resources for equipped labs, equipment, research, and experience.

viii. Universities are encouraged to conduct more research and establish stronger donor collaborations.

4.8 Advice on Database and Data Collection Instruments for Tracer Studies

4.8.1 Tracer Study Database

Alumni databases are vital to every learning institution and education sector in general. The database can be used as an address book, communicate to and with the graduates, and for carrying out tracer studies. In tracer studies, the database can be used to validate the gap between the knowledge and skills possessed by the graduates and the required qualifications needed by the labor market. This serves as a tool to establish the effectiveness of training and achievement of its graduates.

The success of any tracer study depends on the completeness and currency of the alumni database. Finding and developing the graduate address database was challenging given universities hardly keep the databases of their past graduates and have no office responsible for coordinating graduate databases. One graduate was adamant to respond because he did not know how his address was obtained. This demonstrates the apprehension the graduates would have in responding to similar tracer studies. Instead, if the tracer studies are conducted from within the institution/institute/school/department, the response would be higher.

Moreover, when tracer studies are done many years have passed after graduation, the graduates tend to have lost the attachment with their *alma mater*. The solution in these circumstances would be to develop an alumni database at the department level.The alumni will usually be interested in maintaining relations with their institutions and also the need to communicate to the students regarding job opportunities and the students can share the department activities to the alumni, fund raising through a long- term relationship with individual alumni. In this regard, the greatest asset any institution can have is the Alumni system - through the alumni database – the alumni are informed of major events at the institution, locating the alumni is much easier.

The alumni/graduate database should contain relevant pieces of data elements/themes.[28]

i. Contact details, which can include current email address, telephone contact.

ii. Whether or not they are employed.

iii. How long it took the respondents to land in their first job.

iv. Current occupation/job.

v. Reasons why some respondents are not yet employed,

vi. Whether or not the graduates' first job is related to their program in college,

vii. Gross monthly earning in respondents' first job,

viii. Whether or not the curriculum in college is relevant in their first job, and

ix. The competencies learned in college that respondents find useful in their job?

x. Expectations of the alumni on the University

28 Albina A.C. and Sumagaysay L.P. (2020). Employability tracer study of Information Technology Education graduates from a state university in the Philippines, Social Sciences & Humanities Open, Volume 2, Issue 1.

4.8.2 Data Collection Instruments

The database for graduate tracer study can be grouped into main data themes/ questionnaire for graduates, employers and stakeholders[29]. Appendix 2 shows three sets of questionnaires that relate to the three elements/actors of tracer study namely Graduates engineers, employers, Deans/ Head of Department, and key informants.

The success of the system will largely depend on the fitness for use of the Graduate/Alumni database. The parameters to consider should include graduate profile and in addition the employment history. The observation made was that institutions do not have a structured way of collecting and maintaining data on the graduates. A proposed template of graduate/ alumni data collection is shown in table 4.18.

4.8.3 Tracer Study System Actors

A graduate tracer study system should have four main actors namely Graduates/Alumni, Graduates Employers, university officials and the system administrators as shown in figure4.7 .

Figure 4.8 : Tracer Study System Actors

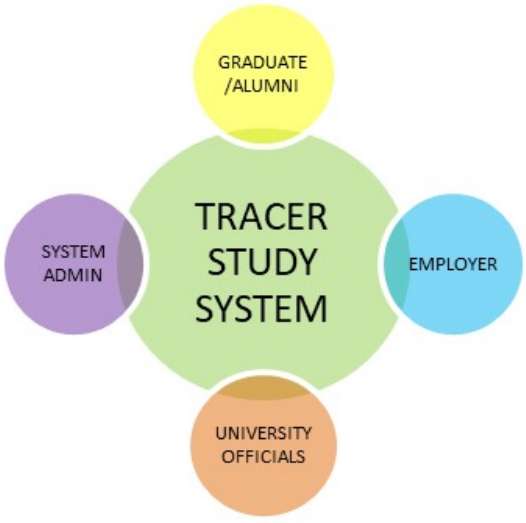


Table 4.18: Graduate/Alumni Data Collection Template

S/No	Graduate Profile						Employment History
S/No	Name	Registration Number	Degree Program	Year of Graduation	E-Mail Contact	Phone Contact	

29 https://www.ifs.org.uk/caytpubs/mapping_occupational_destinations.pdf, https://ifs.org.uk/publications/6897,https://www.cedefop.europa.eu/en/publications-and-resources/publications/2218, https://luminate.prospects.ac.uk/what-do-graduates-do

CHAPTER

5

Summary and Conclusions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The Ministry identified the need for a tracer study on the destination of engineering and applied science graduates from public and private universities in Kenya, to establish the employability of the graduates and provide feedback to inform the curriculum development and review process. The tracer study focused on graduates from bachelor's degree engineering programmes from public and private universities in Kenya. It covered the last 10 years with three cohorts for 2009, 2014, and 2018.

The number of universities offering engineering programmes has increased rapidly from 5 in 2008 to 18 in 2018. In 1970, only one university (Nairobi) offered Engineering programmes, by 2002, the number increased to 5 universities, and by 2018, the number stood at 18 universities. Similarly, the universities offered an increasing diversity of undergraduate engineering programmes, from 5 in 1980 to 110 programmes approved by the Commission for University Education. The number of graduates from the engineering schools, both public and private, has increased rapidly since 2012, increasing by about 20% per annum for both genders, though the population of female graduate engineers seems to range between 15-20%.

A large share (75.4%) of the graduate engineers find employment in engineering related fields, and about 44% of the graduate engineers are employed within six months after graduation, a total of 65% are employed within twelve months and 82% are employed within eighteen months. Overall, 71.2% of the graduate engineers traaced were employed and about 8.6% were self-employed. About 17.4% were unemployed. This finding is contrary to the widely held notion that there is lack of employment opportunities for graduate engineers in the country. The study has established that the greater percentage (52.9%) of the graduate engineers are employed in the private sector, and 35.8% in the public sector. Majority (51%)of the graduates are involved in technical responsibilities, followed by those in supervisory and managerial roles, 18% and 12%, respectively. The greatest percent (44%) of the graduate engineers are concentrated in Nairobi, followed by the other major urban areas, Kiambu, Mombasa, Eldoret, Kisumu, and Nakuru, Nairobi is therefore seen to maintain its primacy in with regards to employment opportunities despite the Country celebrating almost 10 years of devolution.

Majority of the graduate engineers are male (84%) which is comparable to other studies in Kenya and other parts of Sub-Saharan Africa. According to Fomunyam et al (2020)[30], despite the fact that fewer women enroll in engineering programmes, the representation of women in STEM-based careers can potentially increase when college and university administrators work on implementing mentoring programmes and work-life policies for women. Studies shows that these rates have a hard time increasing

30 Fomunyam, G.K., Matola, N.& Moyo, S. (2020). Gender& Gender Mainstreaming in Engineering Education in Africa. International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249-8958, Volume-10 Issue-1, October 2020. Accessed from 14thJuly, 2021. https:// www.ijeat.org/wp-content/uploads/papers/v10i1/ A18621010120.pdf

31 Morley L (2010). Gender mainstreaming: myths and measurement in higher education in Ghana and Tanzania, Compare. A Journal of Comparative and International Education; 40 (4): 533-550.

32 Egne RM (2014). Gender equality in public higher education institutions of Ethiopia: the case of Science, Technology, Engineering, and Mathematics. Discourse and Communication for Sustainable Education; 5: 3-21.

33 United States Agency for International Development (USAID), (2015). Gender Equality in Science,Technology, Engineering, Agricultural Sciences and Mathematics (STEAM) Academic Pipeline: Challenges Transferring Knowledge to Practice.United States Agency for International Development

34 United Nations, Convention on the Elimination of all Forms of Discrimination against Women (CEDAW). Accessed from 12th July, 2021 from https://www.un.org/womenwatch/ daw/ cedaw/text/convention.htm

since women are judged as less competent than men to perform supposedly male jobs this is also supported by (Morley, 2010[31]; Egne, 2014[32]; USAID, 2015[33]; UN, 2020[34]).

Employers generally rate graduate engineers to have satisfactory theoretical knowledge but with inadequate skills, especially problem-solving skills, soft skills, and communication and presentation skills. A few also lack self-confidence. The employers attribute the current state to weak university-industry linkage and inadequate mentoring. Generally, the industry spends 2-3 year to further train the graduate engineers to attain the required job-ready skills and competence. The employers also proposed the need to revise the engineering curriculum by inculcating a culture of innovation and problem solving and establish a well-defined collaboration between the Universities and the industry.

There seems to be a skills mismatch between the employers, especially the industry, and the skills provided during training of engineering graduates. This is partly attributed to the use of old equipment and technology for training of engineers in most of the institutions. The curriculum also does not adequately impart skills relevant for industry needs.

The proportions of graduates pursuing postgraduate studies after graduation has remained low. Furthermore, most of the students who pursue postgraduate studies do so in fields that are nor engineering related.

The findings of the study include the graduate self-assessment, and relevant skills and competence from the universities they are trained. The also provides suggestions on areas of improvement by universities, the learners, and by the government. The study makes suggestions for conduct of regular tracer studies to enable curriculum review and strategies for development of engineering competence in the country.

5.1. Recommendations from the Study

1. In order to enable achievement of quality engineering education, it is proposed that an advisory committee be set up to work with training institutions to address the challenges associated with the training of engineering graduates e.g. skills mismatch, effectiveness of attachments, integration of soft skills in the training of engineers etc.

2. An appropriate scheme be set up to facilitate acquisition of appropriate skills that are relevant for employment e.g. CDET for TVET and CBC for schools.

3. Universities should work in collaboration institutions that play critical roles in enhancing quality engineering education and employment of engineers e.g. NITA, Employment Authority, etc.

4. Linking of training to CBC

5. Professional bodies e.g. EBK to set up mechanisms by which new and emerging engineering programmes are recognized for registration as engineers. Current practice is to recognize the traditional engineering programmes. In addition, CUE and EBK should work in collaboration in accreditation of engineering programs. They should be a mutual and complementary relationship.

6. The content of mathematics courses being taught to engineering students be reviewed with a view to making them more relevant in the training of engineers.

7. Efforts made, through appropriate incentives, to encourage graduating engineering students to pursue further studies leading to higher degrees in order to increase qualified staff numbers with relevant qualifications to teach at the universities in order to reduce the student: lecturer ratio.

8. Development or revision of engineering curriculum in the universities to involve all stakeholders to ensure concurrence in the training of quality engineering graduates. An Apex body to be set up to oversee curriculum development for all engineering programmes and ensure all relevant processes are followed.

9. University industry linkages should be strengthened in order to enable university academics to engage in research that lead to innovations relevant to the needs of the industry.

10. Where possible, engineering students could be given the opportunity to travel overseas for exposure to state of the art technologies that can be replicated locally. This may be partly achieved through revival of student and staff exchange programmes.

11. There is a need to continue updating the state of the university report at predetermined periods.

12. A number of professional engineers exit the profession after practicing for a while. This may be attributed to limitations in further progressions beyond the highest possible level forcing them to leave the profession. Not much can be done about this as it is driven more by the need for self-actualization and exploring of other opportunities. However, attempts may be made to make the profession more lucrative by incentives.

CHAPTER

6

Policy Implications and Recommendations

From the findings of this study drawn from literature review, data analysis and discussions with stakeholders several policy recommendations are proffered:

1. **University-Industry Linkage Institutionalization** - Measures should be taken urgently to institutionalize strong University-industry linkage in the country. Universities will benefit from student and staff attachment and research links with the industry, while industry will benefit from research innovations and incubation from the universities.

2. Engineering schools should work in close collaboration with industry and stakeholders in the d**evelopment of curriculum**.

3. **Complementary Curriculum Accreditation and Programme Recognition Process** - Government bodies for approving, a**ccreditation and recognition of engineering programmes** should work in collaboration in a mutual and complementary way with the professional bodies in guiding and harmonizing engineering curriculum. The curriculum development and approval process should be mutual and complementarity. Accreditation should be extended to regional, continental and global bodies such as the World Federation of Engineering Organizations (WFEO) to make engineering graduates more mobile and marketable beyond Kenya's borders.

4. **Continuous Professional Development (CPD) Strengthening**- There is a need for strengthening continuous professional development by developing clear seminar packages with progress content and making it a requirement for career progression, through required credit points.

5. **Reliable Graduates data archiving system**- The study faced a big challenge in obtaining a reliable **database of past graduates** for tracing. Such data was expected from the source departments and schools, from the university alumni association, and from EBK and from IEK. However, the status of the graduate engineer database from the above sources was found poor and unreliable. There is therefore a need to coordinate management (system) of the graduate database from the department, school, university, alumni association, IEK and EBK[1].

6. **The MoE-SDUER in partnerships with the CUE to institutionalize conduct of tracer study after every 4-5 years-** This will help in informing the curricular review of all university programs and also improving the quality of graduates such as the engineering graduates

7. **Revival of Compilation of Annual State of the University Report by CUE**- The study found the CUE annual report called **"State of the University Report"** quite usual in showing trends in undergraduate and graduate enrollment and graduation in the country. However, CUE appears to have discontinued compilation of the report after the 2017/2018 period. It is recommended that CUE continue compilation of the report as no other institution has been doing it.

1 What is proposed is an integrated graduate database system, including a baseline.

8. **Partnering with Industry in Investment in Modern Teaching and Training Equipments**- The study observed that graduate engineers under self-assessment of their training programmes cited **poor quality equipment** and low participation in research projects and limited opportunity to contact lecturers in the university. Many of the engineering departments in the public universities have obsolete equipment in laboratories, and workshops which are in need of upgrade.

9. **Develop a use and maintenance partnerships with the industry**- The universities and industries to develop a system of equipment and laboratory use and maintenance in ensuring that the conditions of the equipment and laboratories are geared towards sustainable skills development and training.

10. **Planning for Infusion of the Engineering Programmes with the new Competency Based Curriculum (CBC)**- According to Amutabi (2019), Kenya needs to act fast to make sure that the current system in higher education is compatible to CBC expectations, especially on flexibility and focus on the learner. CBC at university level will promote institutions of higher learning to become true innovators and produce unique engineers, doctors and scientists in different fields and may not need to be regulated by traditional regulatory bodies that may not have expertise in the unique areas of innovation. It is only when institutions become autonomous that they are able to think outside the box. This will change greatly how engineering programmes are taught and the size of classes in engineering programmes.

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APPENDIXES

APPENDIX 1

Universities Offering Engineering Programmes in Kenya 2020

University Name	Public/Private
1. Chuka	Public
1. Bachelor of Engineering Physics	
2. Bachelor of Science in Instrumentation and Control Engineering/Bachelor of Science in Electrical Engineering	
2. Dedan Kimathi	Public
1. Bachelor of Science (Mechanical Engineering)	
2. Bachelor of Science (Mechatronic Engineering)	
3. Bachelor of Science in Civil Engineering	
4. Bachelor of Science in Electronics and Electrical Engineering	
5. Bachelor of Science in Geomatic Engineering and Geospatial Information System	
6. Bachelor of Science in Geospatial Information Science	
7. Bachelor of Science in Telecommunication and Information Engineerin	
3. Egerton University	Public
1. Bachelor of Science in Agricultural Engineering	
2. Bachelor of Science in Instrumentation and Control Engineering	
3. Bachelor of Science in Manufacturing Engineering and Technology	
4. Bachelor of Science in Software Engineering	
5. Bachelor of Science in Water and Environmental Engineering	
6. Bachelor of Technology in Civil Engineering	
4. Jomo Kenyatta University of Agriculture and Technology	Public
1. Bachelor of Science (Mechanical Engineering)	
2. Bachelor of Science in Aerospace Engineering	
3. Bachelor of science in Agricultural and Biosystems Engineering	
4. Bachelor of Science in Agricultural Engineering	
5. Bachelor of Science in Agricultural Engineering and Rural Entrepreneurship	
6. Bachelor of science in Biomechanical and Processing Engineering	
7. Bachelor of Science in Civil Engineering	
8. Bachelor of Science in Electrical and Electronic Engineering	
9. Bachelor of Science in Electronic and Computer Engineering	
10. Bachelor of Science in Financial Engineering	
11. Bachelor of science in Food Process Engineering	
12. Bachelor of Science in Geomatic Engineering	

	13. Bachelor of Science in Geospatial Information Science	
	14. Bachelor of Science in Marine Engineering	
	15. Bachelor of Science in Materials and Metallurgical Engineering	
	16. Bachelor of Science in Mechatronic Engineering	
	17. Bachelor of Science in Mining and Mineral Processing Engineering	
	18. Bachelor of Science in Soil Water and Environmental Engineering	
	19. Bachelor of Science in Telecommunication and Information Engineerin	
	20. Bachelor of science in Water and Environmental Engineering	
5.	Kenyatta University	Public
	1. Bachelor of Science (Electrical & Electronics Engineering)	
	2. Bachelor of Science (Energy Engineering)	
	3. Bachelor of Science (Manufacturing Engineering)	
	4. Bachelor of Science (Mechanical Engineering)	
	5. Bachelor of Science (Water Engineering)	
	6. Bachelor of Science in Biomedical Engineering	
	7. Bachelor of science in Computer Engineering	
	8. Bachelor of Science in Civil Engineering	
	9. Bachelor of Science in Petroleum Engineering	
	10. Bachelor of Science in Software Engineering	
	11. Bachelor of Science (Aerospace Engineering)	
6.	Kisii University	Public
	1. Bachelor of Software Engineering	
7.	Masinde Muliro University of Science and Technology	Public
	1. Bachelor of Science in Civil and Structural Engineering	
	2. Bachelor of Science in Electrical and Communications Engineering	
	3. Bachelor of Science in Mechanical and Industrial Engineering	
	4. Bachelor of Technology (Building Construction)	
8.	Moi University	Public
	1. Bachelor of Engineering (Chemical & Process Engineering)	
	2. Bachelor of Engineering (Civil & Structural Engineering)	
	3. Bachelor of Engineering (Electrical & Electronics Engineering)	
	4. Bachelor of Engineering (Electrical & Telecommunication Engineering)	
	5. Bachelor of Engineering (Manufacturing, Industrial & Textile Engineering)	
	6. Bachelor of Engineering (Mechanical & Production Engineering)	
9.	Mount Kenya University	Private
	1. Bachelor of Science in Electrical and Electronic Engineering	
10.	Multi Media University of Kenya	Public
	2. Bachelor of Science (Mechanical Engineering) being phased out	
	3. Bachelor of Science (Mechatronic Engineering) being phased out	
	4. Bachelor of Science (Telecommunication Engineering)	

	5. Bachelor of Science in Software Engineering	
11.	Technical University of Kenya	Public
	1. Bachelor of Technology (Electrical & Electronics Engineering)	
	2. Bachelor of Engineering (Aeronautical Engineering)	
	3. Bachelor of Engineering (Electrical & Electronic Engineering)	
	4. Bachelor of Engineering (Geospatial Engineering)	
	5. Bachelor of Engineering (Mechanical Engineering)	
	6. Bachelor of Engineering (Civil Engineering)	
	7. Bachelor of Philosophy in Technology (Civil Engineering Technology)	
	8. Bachelor of Philosophy in Technology (Electrical & Electronics Engineering Technology)	
	9. Bachelor of Philosophy in Technology (Geo-Informatics Engineering Technology)	
	10. Bachelor of Philosophy in Technology (Mechanical & Mechatronics Engineering Technology)	
	11. Bachelor of Technology (Building And Construction)	
	12. Bachelor of Technology (Chemical Engineering)	
	13. Bachelor of Technology (Civil Engineering Technology)	
	14. Bachelor of Technology (Electrical & Electronic Engineering Technology)	
	15. Bachelor of Technology (Geoinformation Technology)	
	16. Bachelor of Technology (Geoinformation Engineering Technology)	
	17. Bachelor of Technology (Geo-Information Technology)	
	18. Bachelor of Technology (Geospatial Engineering Technology)	
	19. Bachelor of Technology (Land Surveying Technology)	
	20. Bachelor of Technology (Mechanical Engineering Technology)	
	21. Bachelor of Technology (Electrical & Electronics Engineering)	
12.	University of Eastern Africa Baraton	Private
	1. Bachelor of Science in Software Engineering	
13.	University of Eldoret	Public
	1. Bachelor of Engineering in Civil and Structural Engineering	
	2. Bachelor of Engineering in Electrical Engineering	
	3. Bachelor of Engineering in Mechanical and Production Engineering	
	4. Bachelor of Engineering Agricultural and Bio-Systems Engineering	
14.	University of Nairobi	Public
	1. Bachelor of Science in Civil Engineering	
	2. Bachelor of Science in Electrical & Electronics Enjoining	
	3. Bachelor of Science (Agricultural Engineering)	
	4. Bachelor of Science (Bio systems Engineering	
	5. Bachelor of Science (Electrical Engineering)	
	6. Bachelor of Science in Environmental &Biosytems Engineering	
	7. Bachelor of Science in Geospatial Engineering	
	8. Bachelor of Science in Mechanical Engineering	

15.	Machakos University	Public
	1. Bachelor of Science in Electrical and Electronics Engineering	
	2. Bachelor of Science in Civil Engineering	
	3. Bachelor of Science in Mechanical Engineering	
16.	Murang'a University of Science and Technology	Public
	1. Bachelor of Science (Software Engineering)	
17.	Taita Taveta University	Public
	1. Bachelor of Science (Mining and Mineral Processing Engineering)	
	2. Bachelor of Science in Mining and Mineral Processing Engineering	
18.	Technical University of Mombasa	Public
	1. Bachelor of Engineering (Building & Civil Engineering)	
	2. Bachelor of Engineering (Electrical & Electronic)	
	3. Bachelor of Engineering (Mechanical Engineering	
	4. Bachelor of Science (Building & Civil Engineering	
	5. Bachelor of Science (Electrical & Electronic)	
	6. Bachelor of Science in Civil Engineering	
	7. Bachelor of Science in Industrial Engineering	
	8. Bachelor of Science in Mechanical Engineering	


WILD

APPENDIX 2: Tracer Study Questionnaires

TRACER STUDY ON DESTINATION OF ENGINEERING GRADUATES FROM PUBLIC AND PRIVATE UNIVERSITIES IN KENYA (GRADUATES / ENGINEERS QUESTIONNAIRE)

Purpose: This Graduate Tracer Study is carried out by the consultant on behalf of the Ministry of Education- State Department of University Education, with the main objective of establishing employability of engineering graduates and providing feedback to inform the Universities Curriculum Development and Review Process. The study is focusing on the three cohorts, i.e. 2009, 2014 and 2018 graduates in all the 18 Universities (both public and private universities) offering engineering courses.
All the responses given will be handled with utmost confidentiality and will only be used solely for the objectives of the study in improving engineering training in Kenyan universities.

* Required

1. Email *

2. Gender *

Mark only one oval.

- ◯ Male
- ◯ Female

3. State your home county *

Mark only one oval.

- Mombasa
- Kwale
- Kilifi
- Tana River
- Lamu
- Taita-Taveta
- Garissa
- Wajir
- Mandera
- Marsabit
- Isiolo
- Meru
- Tharaka-Nithi
- Embu
- Kitui
- Machakos
- Makueni
- Nyandarua
- Nyeri
- Kirinyaga
- Murang'a
- Kiambu
- Turkana
- West Pokot
- Samburu
- Trans Nzoia
- Uasin Gishu
- Elgeyo-Marakwet
- Nandi
- Baringo

- Laikipia
- Nakuru
- Narok
- Kajiado
- Kericho
- Bomet
- Kakamega
- Vihiga
- Bungoma
- Busia
- Siaya
- Kisumu
- Homa Bay
- Migori
- Kisii
- Nyamira
- Nairobi City

Skip to question 4

BSc. Engineering Details

4. Which University did you attend? *

Mark only one oval.

- Chuka University *Skip to question 7*
- Dedan Kimathi University of Technology *Skip to question 8*
- Egerton University *Skip to question 9*
- Jomo Kenyatta University of Agriculture and Technology *Skip to question 10*
- Kenyatta University *Skip to question 11*
- Kisii University *Skip to question 12*
- Masinde Muliro University of Science and Technology *Skip to question 13*
- Moi University *Skip to question 14*
- Mount Kenya University *Skip to question 15*
- Multimedia University of Kenya *Skip to question 16*
- Technical University of Kenya *Skip to question 17*
- University of Eastern Africa Baraton *Skip to question 18*
- University of Eldoret *Skip to question 19*
- University of Nairobi *Skip to question 20*
- Machakos University *Skip to question 21*
- Muranga Uiversity of Science and Technology *Skip to question 22*
- Taita Taveta University *Skip to question 23*
- Technical University of Mombasa *Skip to question 24*

5. Under which university did you graduate from? *

Mark only one oval.

- Chuka University
- Dedan Kimathi University of Technology
- Egerton University
- Jomo Kenyatta University of Agriculture and Technology
- Kenyatta University
- Kisii University
- Masinde Muliro University of Science and Technology
- Moi University
- Mount Kenya University
- Multimedia University of Kenya
- Technical University of Kenya
- University of Eastern Africa Baraton
- University of Eldoret
- University of Nairobi
- Machakos University
- Muranga Uiversity of Science and Technology
- Taita Taveta University
- Technical University of Mombasa

6. Which year did you graduate from the University with your BSc. Engineering? *

Mark only one oval.

- 2009
- 2014
- 2018
- 2019

Skip to question 25

Engineering program - Chuka

7. Which engineering programme did you pursue? *

The options given here cover the general themes of engineering programmes.

Mark only one oval.

- ◯ Bachelor of Engineering Physics
- ◯ Bachelor of Science in Instrumentation and Control Engineering/Bachelor of Science in Electrical Engineering

Skip to question 25

Engineering Program - Dedan Kimathi

8. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science (Mechanical Engineering)
- ◯ Bachelor of Science (Mechatronic Engineering)
- ◯ Bachelor of Science in Civil Engineering
- ◯ Bachelor of Science in Electronics and Electrical Engineering
- ◯ Bachelor of Science in Geomatic Engineering and Geospatial Information System
- ◯ Bachelor of Science in Geospatial Information Science
- ◯ Bachelor of Science in Telecommunication and Information Engineering

Skip to question 25

Engineering Program - Egerton

9. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science in Agricultural Engineering
- ◯ Bachelor of Science in Instrumentation and Control Engineering
- ◯ Bachelor of Science in Manufacturing Engineering and Technology
- ◯ Bachelor of Science in Software Engineering
- ◯ Bachelor of Science in Water and Environmental Engineering
- ◯ Bachelor of Technology in Civil Engineering

Skip to question 25

Engineering program - JKUAT

10. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science (Mechanical Engineering)
- ◯ Bachelor of Science in Aerospace Engineering
- ◯ Bachelor of science in Agricultural and Biosystems Engineering
- ◯ Bachelor of Science in Agricultural Engineering
- ◯ Bachelor of Science in Agricultural Engineering and Rural Entrepreneurship
- ◯ Bachelor of science in Biomechanical and Processing Engineering
- ◯ Bachelor of Science in Civil Engineering
- ◯ Bachelor of Science in Electrical and Electronic Engineering
- ◯ Bachelor of Science in Electronic and Computer Engineering
- ◯ Bachelor of Science in Financial Engineering
- ◯ Bachelor of science in Food Process Engineering
- ◯ Bachelor of Science in Geomatic Engineering
- ◯ Bachelor of Science in Geospatial Information Science
- ◯ Bachelor of Science in Marine Engineering
- ◯ Bachelor of Science in Materials and Metallurgical Engineering
- ◯ Bachelor of Science in Mechatronic Engineering
- ◯ Bachelor of Science in Mining and Mineral Processing Engineering
- ◯ Bachelor of Science in Soil Water and Environmental Engineering
- ◯ Bachelor of Science in Telecommunication and Information Engineering
- ◯ Bachelor of science in Water and Environmental Engineering

Skip to question 25

Engineering program - Kenyatta

11. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science (Electrical & Electronics Engineering)
- ◯ Bachelor of Science (Energy Engineering)
- ◯ Bachelor of Science (Manufacturing Engineering)
- ◯ Bachelor of Science (Mechanical Engineering)
- ◯ Bachelor of Science (Water Engineering)
- ◯ Bachelor of Science in Biomedical Engineering
- ◯ Bachelor of science in Computer Engineering
- ◯ Bachelor of Science in Civil Engineering
- ◯ Bachelor of Science in Petroleum Engineering
- ◯ Bachelor of Science in Software Engineering
- ◯ Bachelor of Science (Aerospace Engineering)

Skip to question 25

Engineering program - Kisii

12. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Software Engineering
- ◯ Other: _____

Skip to question 25

Engineering program - Masinde Muliro

13. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science in Civil and Structural Engineering
- ◯ Bachelor of Science in Electrical and Communications Engineering
- ◯ Bachelor of Science in Mechanical and Industrial Engineering
- ◯ Bachelor of Technology (Building Construction)

Skip to question 25

Engineering program - Moi

14. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Engineering (Chemical & Process Engineering)
- ◯ Bachelor of Engineering (Civil & Structural Engineering)
- ◯ Bachelor of Engineering (Electrical & Electronics Engineering)
- ◯ Bachelor of Engineering (Electrical & Telecommunication Engineering)
- ◯ Bachelor of Engineering (Manufacturing, Industrial & Textile Engineering)
- ◯ Bachelor of Engineering (Mechanical & Production Engineering)

Skip to question 25

Engineering program - Mt. Kenya

15. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science in Electrical and Electronic Engineering
- ◯ Other: _____

Skip to question 25

Engineering program - Multimedia

16. Which engineering program did you pursue?

Mark only one oval.

- Bachelor of Science (Mechanical Engineering)
- Bachelor of Science (Mechatronic Engineering)
- Bachelor of Science (Telecommunication Engineering)
- Bachelor of Science in Software Engineering

Skip to question 25

Engineering program - TUK

17. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Engineering (Aeronautical Engineering)
- ◯ Bachelor of Engineering (Electrical & Electronic Engineering)
- ◯ Bachelor of Engineering (Geospatial Engineering)
- ◯ Bachelor of Engineering (Mechanical Engineering)
- ◯ Bachelor of Engineering (Civil Engineering)
- ◯ Bachelor of Philosophy in Technology (Civil Engineering Technology)
- ◯ Bachelor of Philosophy in Technology (Electrical & Electronics Engineering Technology)
- ◯ Bachelor of Philosophy in Technology (Geo-Informatics Engineering Technology)
- ◯ Bachelor of Philosophy in Technology (Mechanical & Mechatronics Engineering Technology)
- ◯ Bachelor of Technology (Building And Construction)
- ◯ Bachelor of Technology (Chemical Engineering)
- ◯ Bachelor of Technology (Civil Engineering Technology)
- ◯ Bachelor of Technology (Electrical & Electronic Engineering Technology)
- ◯ Bachelor of Technology (Geoinformation Technology)
- ◯ Bachelor of Technology (Geoinformation Engineering Technology)
- ◯ Bachelor of Technology (Geo-Information Technology)
- ◯ Bachelor of Technology (Geospatial Engineering Technology)
- ◯ Bachelor of Technology (Land Surveying Technology)
- ◯ Bachelor of Technology (Mechanical Engineering Technology)
- ◯ Bachelor of Technology (Electrical & Electronics Engineering)

Skip to question 25

Engineering program - Baraton

18. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science in Software Engineering
- ◯ Other: _____

Skip to question 25

Engineering program - Eldoret

19. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Engineering in Civil and Structural Engineering
- ◯ Bachelor of Engineering in Electrical Engineering
- ◯ Bachelor of Engineering in Mechanical and Production Engineering
- ◯ Bachelor of Engineering Agricultural and Bio-Systems Engineering

Skip to question 25

Engineering program - UoN

20. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science in Civil Engineering
- ◯ Bachelor of Science in Electrical & Electronics Engineering
- ◯ Bachelor of Science (Agricultural Engineering)
- ◯ Bachelor of Science (Bio systems Engineering
- ◯ Bachelor of Science (Electrical Engineering)
- ◯ Bachelor of Science in Environmental & Biosytems Engineering
- ◯ Bachelor of Science in Geospatial Engineering
- ◯ Bachelor of Science in Mechanical Engineering

Skip to question 25

Engineering program - Machakos

21. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science in Electrical and Electronics Engineering
- ◯ Bachelor of Science in Civil Engineering
- ◯ Bachelor of Science in Mechanical Engineering

Skip to question 25

Engineering program - Murang'a

22. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science (Software Engineering)
- ◯ Other: _____

Skip to question 25

Engineering program - Taita Taveta

23. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Science (Mining and Mineral Processing Engineering)
- ◯ Bachelor of Science in Mining and Mineral Processing Engineering

Skip to question 25

Engineering program - TUM

24. Which engineering program did you pursue? *

Mark only one oval.

- ◯ Bachelor of Engineering (Building & Civil Engineering)
- ◯ Bachelor of Engineering (Electrical & Electronic)
- ◯ Bachelor of Engineering (Mechanical Engineering
- ◯ Bachelor of Science (Building & Civil Engineering
- ◯ Bachelor of Science (Electrical & Electronic)
- ◯ Bachelor of Science in Civil Engineering
- ◯ Bachelor of Science in Industrial Engineering
- ◯ Bachelor of Science in Mechanical Engineering

Skip to question 25

Undergraduate Degree Details and Competencies

25. What was the duration of your undergraduate programme? *

Mark only one oval.

- ◯ 4 Years
- ◯ 5 Years
- ◯ More than 5 Years
- ◯ Other: _____

26. Which degree classification did you obtain? *

Mark only one oval.

- ◯ First Class
- ◯ Second Class (Upper)
- ◯ Second Class (Lower)
- ◯ Pass

27. How do you rate the study provision and study conditions you experienced during your 1st degree program? Please rate each of the applicable options on a 5-point scale. *

Mark only one oval per row.

	Very Good	Good	Fair	Poor	Very Poor
Assistance/advice in preparation for your final exam	◯	◯	◯	◯	◯
Opportunity of out of class contacts with teaching staff	◯	◯	◯	◯	◯
Academic advice offered	◯	◯	◯	◯	◯
Opportunities to participate in research projects	◯	◯	◯	◯	◯
Teaching quality of lecturers	◯	◯	◯	◯	◯
Structure of degree program (e.g. what course unit is done when)	◯	◯	◯	◯	◯
Testing/grading system in examinations	◯	◯	◯	◯	◯
Quality of equipment of laboratories/workshops	◯	◯	◯	◯	◯
Quality of lecture rooms (space & furniture)	◯	◯	◯	◯	◯
Consultations with fellow students	◯	◯	◯	◯	◯
Quality of Buildings (lecture buildings and libraries)	◯	◯	◯	◯	◯

28. Please, state the extent to which you had the following attributes/competencies at the time of completion of your degree programme.

Mark only one oval per row.

	Very High Extent	High Extent	Some Extent	Limited Extent	Not at all
Problem solving	◯	◯	◯	◯	◯
Application of scientific and engineering knowledge	◯	◯	◯	◯	◯
Engineering design	◯	◯	◯	◯	◯
Investigations experiments and data analysis	◯	◯	◯	◯	◯
Engineering methods, Skills and tools, including InformationTechnology	◯	◯	◯	◯	◯

29. Did you have a part-time course besides your full-time engineering course during your undergraduate study? *

Mark only one oval.

◯ Yes *Skip to question 30*
◯ No *Skip to question 32*

Skip to question 30

Part-time Course

30. State the part-time course you studied during your undergraduate studies

_____

31. Why did you choose to do the part-time studies?

Search for first employment after completion

32. When did you start looking for gainful employment? (Exclude search for casual and vacation jobs) *

Mark only one oval.

- ◯ Prior to completion
- ◯ At the time of completion
- ◯ After completion
- ◯ I did not look for a job

33. How did you try to get your first gainful employment after completion?

Check all that apply.

- ☐ Public Service Recruitment
- ☐ Application to advertised vacant position
- ☐ Personal contacts through friends/relatives
- ☐ Contacting the employer without knowing about a vacancy
- ☐ Worked with same employer before graduating
- ☐ I set up my personal business
- ☐ Work experiences during my study (incl. internship/field attachments/industrial training)
- ☐ I got the job through a private employment agency
- ☐ I joined family business
- ☐ Employer offered me the job

Other: ☐ _____

34. How many months did it take you to get a first gainful employment after completion? *

Mark only one oval.

- ◯ 0-6 Months
- ◯ 7-12 Months
- ◯ 13-18 Months
- ◯ More than 18 Months
- ◯ Not Applicable (Not yet employed)

35. How many employers did you contact before you got your first job after completion? *

Mark only one oval.

- ◯ 0 (None)
- ◯ Only one employer
- ◯ 2 to 4 employers
- ◯ 5 to 10 employers
- ◯ 11 to 20 employers
- ◯ More than 20 employers

36. To what extent did you experience the following problems during the search for your first gainful employment after completion?

Mark only one oval per row.

	Very great extent	Great extent	Some extent	Limited extent	Not at all
Non Transparent Recruitment methods	◯	◯	◯	◯	◯
Not being well connected	◯	◯	◯	◯	◯
Lack of required experience	◯	◯	◯	◯	◯
Lack of jobs for graduates in my field of specialization	◯	◯	◯	◯	◯
Employers asking for bribes	◯	◯	◯	◯	◯
Tribalism	◯	◯	◯	◯	◯
Gender discrimination	◯	◯	◯	◯	◯

37. In your opinion, how important were the following factors for your being employed?

Mark only one oval per row.

	Very important	Important	Fairly important	Less important	Not at all important
Field of Study	◯	◯	◯	◯	◯
Main focus of subject area / specialization	◯	◯	◯	◯	◯
Theme of thesis/projects if applicable	◯	◯	◯	◯	◯
Grades at the institution of higher education	◯	◯	◯	◯	◯
Reputation of the institution of higher education	◯	◯	◯	◯	◯
Previous work experience	◯	◯	◯	◯	◯
Personality	◯	◯	◯	◯	◯

First Employment Details

38. What is/was the nature of your first employment? *

Mark only one oval.

◯ Engineering related *Skip to question 41*
◯ Non-engineering related *Skip to question 39*

Non-engineering related employment

39. State the non-engineering employment that you have or have had before

_____

40. If your first employment was non-engineering related, how long did it take you to get the first engineering related employment?

Mark only one oval.

- ◯ Less than 1 Year
- ◯ 1 - 2 Years
- ◯ 2 - 3 Years
- ◯ Not Applicable (Have never had an engineering related employment)

Graduate Employment Information

41. What is your current employment status? *

Mark only one oval.

- ◯ Employed *Skip to question 50*
- ◯ Self-employed *Skip to question 50*
- ◯ Unemployed *Skip to question 52*
- ◯ Studying now or have studied earlier (Postgraduate) *Skip to question 48*
- ◯ Employed and Studying (or have studied earlier) *Skip to question 48*
- ◯ Self - employed and Studying (or have studied earlier) *Skip to question 48*
- ◯ Unemployed and studying (or have studied earlier) *Skip to question 48*
- ◯ Other: _____

42. Based on the indicated employment position, which option below best describes your sector?

Mark only one oval.

- ◯ Public
- ◯ Private
- ◯ Self-Employed
- ◯ Civil Society
- ◯ Other: _____

43. What are the terms of employment in your current position *

Mark only one oval.

- ◯ Permanent
- ◯ Contract
- ◯ Temporary
- ◯ Internship
- ◯ Casual
- ◯ Volunteer
- ◯ Other: _____

44. What are your main responsibilities at work?

Mark only one oval.

- ◯ Managerial
- ◯ Supervisory
- ◯ Technical
- ◯ Consultant
- ◯ Other: _____

45. Taking all aspects into account, to what extent does your current work situation meet the expectations you had when you started your degree/diploma program?

Mark only one oval per row.

	To a very great extent	Great Extent	Some Extent	Limited Extent	Not at all	Not Applicable, didn't have any expectations
Income / Remuneration	⬭	⬭	⬭	⬭	⬭	⬭
Career growth	⬭	⬭	⬭	⬭	⬭	⬭
Current work role	⬭	⬭	⬭	⬭	⬭	⬭
Training opportunities and skill development	⬭	⬭	⬭	⬭	⬭	⬭
Work location	⬭	⬭	⬭	⬭	⬭	⬭
Promotions and upward mobility	⬭	⬭	⬭	⬭	⬭	⬭
Training support from employer	⬭	⬭	⬭	⬭	⬭	⬭

46. What is the level of importance of the following general sub-themes of the subjects learnt at the university in relation to your current work responsibilities? *
(The sub-themes here are the general subjects taught at university)

Mark only one oval per row.

	Very Important	Fairly Important	Important	Slightly Important	Not at all Important
Basic Sciences (Communications skills, Engineering economy, Management for engineers, Operations Research, Project , Entrepreneurship and Product Development, project planning and management.)	◯	◯	◯	◯	◯
Engineering Sciences	◯	◯	◯	◯	◯
Mathematical Sciences (Pure & Applied Mathematics and Statistics)	◯	◯	◯	◯	◯
Computing and IT	◯	◯	◯	◯	◯
Complimentary Studies (Structural design, Design project, Irrigation and drainage systems design, Computer Aided Design, Rural Water Supply and Sanitation.)	◯	◯	◯	◯	◯

47. What skill/knowledge challenges do you encounter in your work?

Post-Graduate Studies

48. If you are studying, which Postgraduate or Professional course are you undertaking?

Mark only one oval.

- ◯ Engineering course
- ◯ Science related course
- ◯ Business course
- ◯ Leadership course
- ◯ IT course
- ◯ Other: _____

49. If Undertaking a non-engineering course what is your main reason?

_____

_____

_____

_____

_____

Geographical Region

50. Which of the following Geographical region is your current workplace located? *

Mark only one oval.

- ◯ Kenya *Skip to question 51*
- ◯ East African Countries excluding Kenya *Skip to question 52*
- ◯ Africa excluding East Africa *Skip to question 52*
- ◯ Europe *Skip to question 52*
- ◯ Asia *Skip to question 52*
- ◯ South America *Skip to question 52*
- ◯ North America *Skip to question 52*
- ◯ Australia *Skip to question 52*

Work County

51. Which county is your workplace located?

Mark only one oval.

- Mombasa
- Kwale
- Kilifi
- Tana River
- Lamu
- Taita-Taveta
- Garissa
- Wajir
- Mandera
- Marsabit
- Isiolo
- Meru
- Tharaka-Nithi
- Embu
- Kitui
- Machakos
- Makueni
- Nyandarua
- Nyeri
- Kirinyaga
- Murang'a
- Kiambu
- Turkana
- West Pokot
- Samburu
- Trans Nzoia
- Uasin Gishu
- Elgeyo-Marakwet
- Nandi
- Baringo

- ◯ Laikipia
- ◯ Nakuru
- ◯ Narok
- ◯ Kajiado
- ◯ Kericho
- ◯ Bomet
- ◯ Kakamega
- ◯ Vihiga
- ◯ Bungoma
- ◯ Busia
- ◯ Siaya
- ◯ Kisumu
- ◯ Homa Bay
- ◯ Migori
- ◯ Kisii
- ◯ Nyamira
- ◯ Nairobi City

Conclusion

52. Would you refer more young people/students to the undergraduate course you studied?

Check all that apply.

- ☐ Certainly
- ☐ Possibly
- ☐ Doubtful
- ☐ Not at all

53. Please give reason(s) for the choice above

54. What suggestions do you have to improve training of your (first) profession in order to make it more relevant to the market?

TRACER STUDY ON DESTINATION OF ENGINEERING GRADUATES FROM PUBLIC AND PRIVATE UNIVERSITIES IN KENYA (EMPLOYER QUESTIONNAIRE)

Purpose: This Graduate Tracer Study is carried out by the Kenya Ministry of Education- State Department of University Education, with the main objective of establishing employ-ability of graduates and providing feedback to inform the Universities Curriculum Development and Review Process. The Ministry is focusing on the three cohorts, i.e. 2009, 2014 and 2018 graduates in all the 18 Universities (both public and private universities) offering engineering courses.
All the responses given will be handled with utmost confidentiality and will only be used solely for the objectives of the study in improving engineering training in Kenyan universities.

* Required

1. Email *

_____

2. Which category among the following does your organization belong to:

Check all that apply.

- [ ] Public
- [ ] Private
- Other: [ ] _____

3. Which sub-sector does your organization belong to:

Check all that apply.

- [ ] Roads and Transport
- [ ] Construction
- [ ] Food and Agriculture
- [ ] Electrical, Electronics and Computers
- [ ] Banking and Finance
- [ ] Logistics
- [ ] Geospatial and Land Resources
- [ ] Motor Vehicles and Machineries

Other: [ ] _____

4. How many people are presently employed in your organization?

Check all that apply.

- [ ] Less than 50
- [ ] 50 - 99
- [ ] 100 - 250
- [ ] More than 250

5. How many of these employees are Bsc degree engineering graduates? *

_____

6. Of the BSc engineering graduates stated, how many are females? *

_____

7. Of the BSc engineering graduates stated, how many are males? *

_____

8. In your opinion, how important were the following factors when recruiting engineering graduates?

Mark only one oval per row.

	Very Important	Fairly Important	Important	Less Important	Not at all Important
Field of Study	◯	◯	◯	◯	◯
Main focus of subject area/specialization	◯	◯	◯	◯	◯
Theme of thesis/projects if applicable	◯	◯	◯	◯	◯
Grades at the institution of higher education	◯	◯	◯	◯	◯
Reputation of the institution of higher education	◯	◯	◯	◯	◯
Previous work experience	◯	◯	◯	◯	◯
Personality	◯	◯	◯	◯	◯

9. On a scale of 1 - 10, how do university engineering graduates come prepared to take entry level positions in your organization? *

Mark only one oval.

	1	2	3	4	5	6	7	8	9	10	
Not prepared	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Very prepared

10. What is your level of agreement with the following attributes as seen in the university engineering graduates at entry level positions in your company? *

Mark only one oval per row.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Most graduates have the right technical skills to perform on their jobs without experience/training	◯	◯	◯	◯	◯
Most graduates have the soft skills to perform on their jobs without experience/training	◯	◯	◯	◯	◯
Most graduates have the right life skills to perform on their jobs without experience/training	◯	◯	◯	◯	◯
Most graduates have the right interpersonal skills to perform on their jobs without experience/training	◯	◯	◯	◯	◯

11. In your opinion what are the emerging skills or competencies which engineering employees should have?

12. Do you think the work performance of engineering graduates from different universities with similar qualifications differ?

Check all that apply.

- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neutral
- [ ] Agree
- [ ] Strongly agree

13. Elaborate your choice above

14. Which university graduates do you feel are competently trained to perform engineering tasks required in your organization?

Check all that apply.

- [ ] University of Nairobi
- [ ] Technical University of Kenya
- [ ] Kenyatta University
- [ ] Multi Media University
- [ ] Technical University of Mombasa
- [ ] Taita Taveta
- [ ] Machakos
- [ ] Jomo Kenyatta University of Agriculture and Technology
- [ ] Dedan Kimathi
- [ ] Mount Kenya
- [ ] Murang'a
- [ ] Moi
- [ ] Egerton
- [ ] Eldoret
- [ ] Baraton
- [ ] Masinde Muliro
- [ ] Kisii

Other: ☐ _____

15. If non- engineering firm (Banks, NGOs and other private sector) what is the main reason for hiring engineering graduates?

_____

_____

_____

_____

_____

16. What areas do you think our universities offering engineering programmes need to improve on in response to your employment needs?

17. Is your organisation willing to support employees intending to undertake further studies in engineering?

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Maybe

18. If yes (above), which institution would you refer?

Check all that apply.

- ☐ Local Institution
- ☐ International Institution
- Other: ☐ _____

19. If no (above), please can you provide reasons for this?

20. What suggestions do you have for the tertiary institutions that can make engineering higher education in Kenya more relevant to the labour market?

21. What suggestions do you have for the learners that can make them more relevant to the labour market?

22. What suggestions do you have for the government that can make higher education more relevant to the labour market?

TRACER STUDY ON DESTINATION OF ENGINEERING GRADUATES FROM PUBLIC AND PRIVATE UNIVERSITIES IN KENYA (DEANS OF ENGINEERING SCHOOLS).

Purpose: This Graduate Tracer Study is carried out by the Kenya Ministry of Education- State Department of University Education, with the main objective of establishing employability of graduates and providing feedback to inform the Universities Curriculum Development and Review Process. The Ministry is focusing on the three cohorts, i.e. 2009, 2014 and 2018 graduates in all the 18 Universities (both public and private universities) offering engineering courses.
All the responses given will be handled with utmost confidentiality and will only be used solely for the objectives of the study in improving engineering training in Kenyan universities.

1. Please give your name

_____

2. Your title

Mark only one oval.

- ◯ Professor
- ◯ Doctor (PhD)
- ◯ Mr.
- ◯ Ms

3. Your position

_____

4. How many departments are in your school or faculty?

5. How many degree programs are offered in your school / faculty?

Courses Profile

6. Which engineering course is considered most popular among students in your University?

7. What is making the course popular among undergraduate students?

8. How attractive is/are your postgraduate engineering program(s)?

Mark only one oval.

	1	2	3	4	5	
Least attractive	◯	◯	◯	◯	◯	Very attractive

9. Which program attracts most of your postgraduate students

10. What do you think should be done to make engineering postgraduate programs attractive?

Courses Delivery and Quality

11. What are your concern(s) with engineering course delivery in your University(Staffing, facilities)

12. What is your university doing in addressing this/these concern(s)?

13. Comment on the status of usage of modern technology in teaching of engineering students in your university?

14. Do you feel that the engineering curriculum used for training engineer is adequate in meeting the market needs?

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Maybe

15. Comment on the curriculum

16. What should be done to improve the quality of the engineering graduates trained in Kenya Universities?

17. Which institutions/actors should play a critical role in improving the quality of engineering graduates in Kenya?

18. Any other comment/concern with engineering training in Kenya?