Engineering in KENYA

ISSUE 004

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Engineering Education, Research and Practice

REPUBLIC OF KENYA

ENGINEERS BOARD OF KENYA
Enhancing Professionalism

ENGINEERS BOARD OF KENYA

NOTICE ON PROFESSIONAL EXAMINATIONS

01. PROFESSIONAL EXAMINATIONS FOR ENGINEERS

YEAR 2021 APPLICANTS

Applicants are invited for the above examinations from eligible Graduate Engineers who will have attain edaminimum of 36 months approved experience as at **30th June, 2021.**

Application forms may be downloaded from the Engineers Board of Kenya (EBK) website **www.ebk.go.ke.**

The duly completed application forms to be returned to the Registrar accompanied by all requirements.

All referees for the candidates must be Professional Engineers or Consulting Engineers.

PROFESSIONAL EXAMINATION CALENDAR

Below is the Professional Examination Calendar for the FY2021/22:-

Quarters	Activities	Date
Q2: Oct – Dec 2021	Pre-submission Conference	11th –15th October 2021
	Professional Examinations	1st–30th November 2021
Q3: Jan – Mar 2022	Pre-submission Conference	7th –11th Feb 2022
	Professional Examinations	1st – 31st March 2022
Q4: Apr – June 2022	Pre-submission Conference	9th – 13th May 2022
	Professional Examinations	1st to 30th June 2022

FINANCIAL YEAR 2021/22 APPLICANTS

Prospective applicants for the FY2021/22 Professional Examinations should:-

- Attend a pre-submission conference before applying to sit for the professional examinations (to sit for the Q3 examinations, an applicant needs to have attended the Q2 pre-submission conference to ensure documents are prepared in line with the EBK requirements)
- Applyintheprescribedformat
- SubmitPartI&PartIIreportswiththeapplicationform

02. NOTICE TO REGISTERED PERSONS SUPERVISING CANDIDATES SUPERVISION

All registered Engineers who are supervising applicants are to be of good standing and are reminded to observe and adhere to Engineers Act 2011 and Engineers Rules 2019 and other guidelines of the Board and Laws of Kenya.

MANUALS FOR ENGINEERS

All registered persons, candidates and the general public are notified that the Policy on ProfessionalExamination and the Notes & Rules for Professional Interviews **(discipline specific)** are available in the website, **www.ebk.go.ke.**

All registered persons are required to have a respective copy of the Policy and the Notes and Rules.Both candidate and the mentor must each have respective guidelines.

03. PUBLIC NOTICE

LIST OF LICENSED ENGINEERS IN KENYA

The general public are advised of the need to seek professional services from Professional Engineers in good standing with this Board (EBK).

This is therefore to notify the general public that the list of Professional Engineers, Consulting Engineers, Engineering Consulting Firms and Temporary Engineers in good standing is available on the Board's website **www.ebk.go.ke.**

The general public is encouraged to seek professional engineering services from persons duly registered with the Board.

REGISTRAR / CEO
Fortis Suites, 9th Floor, Hospital Rd,
P.O. BOX 30324-00100 NAIROBI, KENYA TEL: +254-20-2719974 CELL: +254-735-330744, +254-722-509972
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In this **Issue**

Cover photo: Dedan Kimathi University of Technology students assemble machinery for a continental engineering competition recently.

Engineering in KENYA

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Call for Papers

Engineering in Kenya Magazine - October / November 2021 Issue

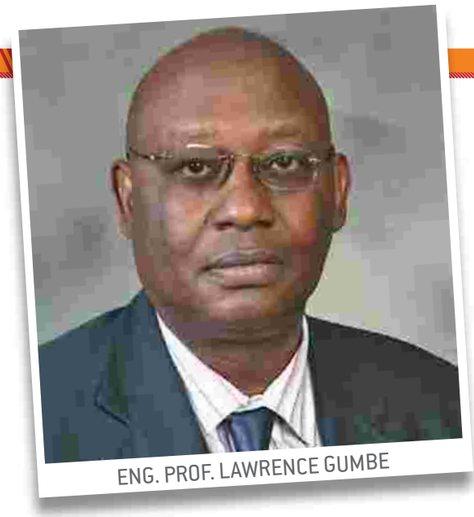
The Institution of Engineers of Kenya (IEK) publishes Engineering in Kenya magazine, whose target audience includes engineering professionals, practitioners, policymakers, researchers, educators and other stakeholders in engineering and related fields. The publication is distributed to its target readers free of charge through hard and soft copies.

IEK hereby invites you to contribute articles for the next and future editions. The articles should reach the Editor not later than 10th of October 2021 for our next issue whose theme shall be "Engineering In Agriculture And The Environment" and related sub-themes across all engineering disciplines. An Article can range from engineering projects to processes, machinery, management, innovation, news and academic research.

The articles must be well researched and written to appeal to our high-end audiences and to be informative to the public in Kenya and beyond. The magazine reserves the right to edit and publish the article in line with its editorial policy. The articles should be "500-1000" words, font type "Times New Roman" and font size "12".

Send your article today and get a chance to feature in the magazine!

Send your article to:
iek@iekenya.org and cc:
ceo@iekenya.org;
editor@iekenya.org and
engineeringinkenya@michi-media.com.


ENG. PROF. LAWRENCE GUMBE

Engineering Education, Research and Practice

Necessity Births Discovery and Innovation

THE modern world has been largely an engineering project. The structures, machines, processes and organization which have led to increased affluence, life expectancy, comfort and enlightenment are all largely due to the engineering profession.

Engineering educators, researchers and practitioners respond to needs in history and geography to develop systems which advance human civilisation.

As civilizations developed, people began reshaping their environment with farms, villages, ships, roads, and eventually great cities. With each advance came new challenges that required more complex and creative solutions. One early example of an activity that we now call engineering was the construction and improvement of the aqueduct system that transported water in and around Rome starting in the fourth century BC. A project of that scope today would be largely the responsibility of engineers.

Recently, the Covid-19 pandemic has made it necessary and urgent to review engineering education, research and practice worldwide.

The pedagogy at universities had to change to cope with the facts that physical in-person lectures and laboratory practical work were not suspended but education had to continue. For lectures, many universities opted for virtual presentation. This method had the challenges of unreliable and expensive internet systems.

For practical lessons some universities became more innovative. The ***Mechanical Engineering*** magazine recounts how the Columbia University's Fu Foundation School of Engineering and Applied Science addressed the problem. The engineering school sent out sets of soldering irons, 3D printers, electronic components, even fans to vent away noxious fumes. The intention was that if students couldn't make it into the lab to design and build the mechanism or product that would serve as their graduation project, the kits would enable them to perform that work from home.

The university soon learnt that its temporary measure to address practicals was something of a god send and should be made permanent. Prof Jeffrey Kysar, Chair of Mechanical Engineering Department observed that, "We found that having 3D printers at home really unleashed their creativity because they could print multiple things and experiment with multiple designs."

Engineering researchers have also responded to Covid-19 by expeditiously producing innovative products to combat the pandemic such a oxygen plants, rapidly constructed modular field hospitals, virtual meeting systems, rapid vaccine production factories, effective face mask and disease surveillance systems.

Engineering for Transformation

Kenya's Vision 2030 aims to transform Kenya into a newly industrialized, middle income country, providing a high quality of life to all its citizens by the year 2030. This vision is very largely an engineering one.

Vision 2030 is about economic development. Generally, economic development results from investment in the generation of new ideas through innovation and the creation of new goods and services, the transfer of knowledge and the development of viable infrastructure.

Examples of economic development include the creation of infrastructure, not just roads and bridges, but also digital and communications infrastructure, and the creation of knowledge through education and training, which can be utilised by businesses to create new goods and services. Investment in research and development and support for entrepreneurship and innovation make a significant contribution to economic development, as they identify new opportunities and then bring them to market to realise value, which will in turn lead to increased productivity within an economy.

By investing in infrastructure, such as transport, bridges, dams, communication, waste management, water supply and sanitation as well as energy and digital

infrastructure, countries can raise their productivity and enhance other economic variables. Manufacturing in industry and agriculture is also important to economic development.

By having a well-developed transport and communications infrastructure for example, countries are better able to get goods and services to market and move workers to work places. A strong communications network allows a rapid and free flow of information, helping to ensure businesses can communicate and make timely decisions.

Value addition through extraction of raw materials, such as minerals, and production of the same in agriculture as well as manufacture, processing, storage, transport and distribution of products are is also crucial to economic development. All the above activities of developing infrastructure, manufacture, operation, maintenance and distribution require engineers.

Educating Engineers

Vision 2030 recognizes that we need to greatly increase the number of engineers in Kenya if we are to implement the projects which will make us realize the vision. At the same time, we have recently been reading in the press that some Universities have had to close because of students' unrest due to polemics between the universities and the Engineers Board of Kenya.

Parliament amended the **Universities Act in** 2016 to effectively give the role of approval and accreditation of programmes to the Commission for University education. The sections of the **Engineers Act** which gave the **Engineers Board,** EBK powers to accredit programmes was not expressly repealed. EBK and others professional bodies moved to the High Court to challenge the constitutionality of the amendment to the Universities Act.

Specifically, the Court of Appeal judgment of 11 June 2020 on petition No. 35 of 2017 consolidated into Petition 106 of 207 reaffirmed the constitutionality of the 2016 amendment to the Universities Act which introduced Section 5A which states that:

> *5A. Conflicts with other Acts in approval of programmes: If there is a conflict between the provisions of this Act and the provisions of any other Act in matters relating approval or accreditation of academic programmes offered by universities, the provisions of this Act shall prevail.*

The effect of Section 5A of the Universities Act is to repeal Section 7(1) of the Engineers Act, which states that:

> *Engineering professionals of the future, starting today, must be team workers with requisite problems solving skills, good communicators, creative and innovative. Universities and colleges should modernise and orient their curricula to produce such professionals.*

To realize Vision 2030, we need more engineers. We need more innovation. We need more innovative engineers. What, therefore, is the problem? Why were the Universities, and the Engineers Board of Kenya not agreeing?

Academic freedom for universities is an accepted norm in Kenya and the world. Academic freedom refers to the right of a university to determine its educational mission free from governmental intervention. Academic freedom has an institutional and individual component. Specifically, the university has the right to what to teach, who is taught, how it is taught, to whom it is taught and who qualifies to be awarded a university degree. This is institutional academic freedom. Academic freedom also refers to the right of an individual professor to teach her or his curriculum without undue interference from university officials This is individual academic freedom.

The **Commission for University Education,** CUE, is a regulator and has the role of approving and accrediting university programmes. Where does it sit with the above academic freedom principle? Is the CUE a super university senate?

The above Court of Appeal judgment was explicit on the need for consultations between CUE and EBK in the approval and accreditation of universities exercise.

CUE, EBK and public universities are public institutions. The Constitution of Kenya requires that they conduct their mutual relations on the basis of consultation and cooperation. Chapter 6 of the Constitution requires state officers to: Exercise public trust in a manner that: is consistent with the purposes and objects of the Constitution; demonstrate respect for the people; bring honour to the nation and dignity to the office; and promote public confidence in the integrity of the office; and vest in the state officer the responsibility to serve the people, rather than the power to rule them.

Engineering work is effected by engineers, technologists and technicians. IEK has membership of all the above categories. The Engineers Registration Board, the predecessor to the EBK, used to register technicians and technologists. However, this ceased to be the case with the enactment of the Engineers Act in 2011.

The **Engineering Technology Act, 2016,** was enacted after a protracted campaign by technologists and technicians. The Act of Parliament makes provision for the regulation, practice and standards of engineering technologists and technicians, and for connected purposes. The act has created the **Kenya Engineering Technology Board, KETRB,** with powers quite similar to the EBK. We are very glad to note that CUE, EBK and universities are in dialogue to enunciate how they will work together in approval and accreditation of university programmes. As a number of universities also produce technologists and technicians, this dialogue may be broadened to include KETRB. The agreement on the way forward must be within the letter and spirit of the law. Otherwise, you all know how litigious Kenya has become!

Engineering Research

Section 32 of the **Science Technology and Innovation Act (STI) 2013** establishes the **National Research Fund, NRF.** The act states that the amount contributed by the government to the fund as a **sum of money amounting to two per of the country's gross domestic product, provided by the Treasury every financial year.** The funds which should have been released this year would be about KES 215 billion this year. To-date, only a small fraction of this prescribed amount has been released for research since 2013.

Engineering research is effected at universities and agencies such as the Kenya Industrial and Development Institute, KIRDI. Traditionally, the government of Kenya and international donors have traditionally prioritized funding social science, health and agricultural research.

It is crucial that the government of Kenya should move fast to implement funding of the research at the level of the STI. The government should thereafter give priority to engineering research funding. This is the only way to drive forward our industrialisation quest.

Engineering Practice

We are entering **Industry 4.0,** the *Fourth Industrial Revolution,* which encompasses the automation of conventional engineering work. It uses modern smart technology. Large-scale Machine to Machine Communication (M2M) and the Internet of Things (IoT) are used together to increase automation, improve communication and self-monitoring, and the production of smart machines that can analyse and diagnose issues without the need for human intervention. This is the environment of engineering practice in the future.

Kenyan engineers must be prepared for work in Industry 4.0. Regulators like the EBK and learned societies like IEK must adapt to this reality. Settled branches of engineering will be disrupted by new sub-branches and totally new branches. A few years ago country comparison of the number of persons served by an engineer were, in part, as follows: Kenya, 6,300; South Africa, 3,166; Korea, 285; UK; 311; Brazil, 227; and China, 130. We see from the figures that the level of industrialisation, economic development and affluence have a direct relationship to the quantity of engineers in a country. Hence Kenya must strive to expeditiously increase its quantity and quality engineers.

We, as indicated above, are pleased to note that CUE, EBK, universities and IEK in in dialogue to enunciate an all inclusive and effective accreditation processes of university programmes. Here, we can borrow from other jurisdictions such as USA. We must also note that the **Institution of Engineering Technologists and Technicians, IET,** has been in existence since 2011. Therefore, it may be desirable to include IET in the dialogue.

The number of graduates of engineering programmes has increased. As discussed above, the number should actually increase rapidly in the near future. The process of licensing, registration, of engineers should also be modernised and streamlined so that the pending and future candidates are processed efficiently and effectively. Again, we may learn from other countries such as the USA.

The Future

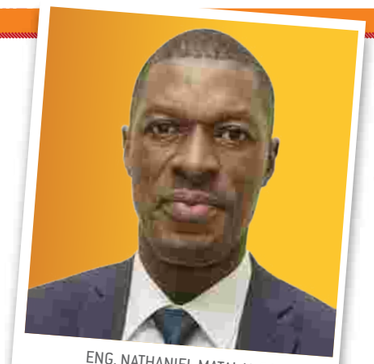
As we have observed above, the modern world has been largely an engineering project. The structures, machines, processes and organization which have led to increased affluence, life expectancy, comfort and enlightenment are all largely due to the engineering profession.

Engineering professionals of the future, starting today, must be team workers with requisite problems solving skills, good communicators, creative and innovative. Universities and colleges should modernise and orient their curricula to produce such professionals.

The government should lead the way in providing adequate research funding in line with the Science Technology and Innovation Act. The private sectors should also be interested in funding engineering research.

Regulatory and licensing entities such as EBK and KETRB should review their procedures and process so as to adopt modern efficient and effective methods of licensing and regulation of the profession.

Above all, all stakeholders in the engineering profession such as Engineers Board of Kenya, Commission for University Education, Institution of Engineers of Kenya, Kenya Engineering Technology Board and Institution of Engineering Technologists and Technicians should be in constant dialogue so as to always enunciate the best way forward for the profession. Petty competition and squabbling cannot be helpful to anyone. To paraphrase the Constitution of Kenya: We must conduct our mutual relations on the basis of consultations and cooperation.


ENG. NATHANIEL MATALANGA

We call upon varsities to show-case their work in this magazine

THE fourth issue of the Engineering in Kenya magazine focuses on Engineering Education, Research and Practice. In preparation for this issue, the editorial board has taken time to take the magazine to all universities offering Engineering courses. I am happy to report that the editorial board managed to visit and held discussions with 12 vice chancellors. All the vice chancellors expressed support and appreciation for the opportunity that the magazine had created for the universities to share their experiences and show-case their work.

During the visit to the Vice Chancellor of Masinde Muliro University, the editorial board also paid a courtesy call to the Governor of Kakamega, His Execllency, Dr Wycliffe Oparanya. At the meeting, IEK urged the Governor to ensure the county government Engineering dockets are headed by professional engineers registered by the Engineers Board of Kenya (EBK).

The Institution of Engineers of Kenya (IEK) has repeatedly called upon developers, contractors, corporate entities and government agencies to employ only qualified professionals. During the recent IEK President's dinner, former Infrastructure Permanent Secretary, Eng Cyrus Njiru, reiterated this clarion call, making it clear that hiring quacks has led to an influx of counterfeit products in the Kenyan economy, leading to a lot of losses.

The Governor noted that Kakamega County has employed qualified engineers who are playing a key role in the county's infrastructure development agenda. He promised to collaborate with IEK to ensure the code of ethics for engineers is adhered to. He also promised to continue the provision of internship opportunites to graduate engineers.

The practice of Engineering in Kenya is regulated by EBK for engineers and Kenya Engineering Technology Registration Board (KETRB) for technicians and technologists. Although this is the existing situation, it is not proper to have people working in the same profession regulated under different regulatory bodies. There is a need to amend the Engineers Act 2011 to have one regulatory body for all people working in engineering. This will avoid the existing confusion and clearly spell out the duties and responsibilities of each category of registration.

Engineering Education too is regulated. Until the High Court judgement by Justice James Aaron Makau of June 11, 2020 that singled out Commission for University Education (CUE) as the sole accreditation body for university programmes, professional bodies, including EBK, were accrediting university programmes in their professions.

Professional bodies provide a crucial link between studies and practice. They have a wide knowledge of what type of professionals the industry needs and help create a conducive environment for practice by professionals after they leave the university. Leaving them out of accreditation of university programmes would be a big mistake this country cannot afford to make.

Due to the court ruling, professional bodies now have to develop a memorandum of understanding (MoU) with the CUE for joint accreditation. The EBK is in the final stages of signing the MoU with the CUE and the process of accreditation of Engineering programmes is set to resume. All the vice chancellors that the editorial board had meetings with are eagerly waiting for the resumption of accreditation by EBK and also looking forward to guidance on how to address the gaps, if any, for students who may have undertaken programmes before accreditation. At the moment, the list of accredited programmes for each university is availllable on the EBK website and this list is set to grow once the accreditation process is resumed.

It is important that the EBK is able to ensure all the engineering programmes being offered in Kenya meet international standards. This makes the Board's journey towards acceptance to sign up for the Washington Accord easier. Being a member of the International Engineering Alliance is important for Kenya as this will create mobility for our graduates to work in other countries and also open up our universities for foreign students. We should all come together as a country and support the EBK in this journey towards the Washington Accord.

In addition, for the country to achieve Vision 2030 and the Big 4 agenda, there is a need to increase the budget for Engineering education, training and research. In particular, we need to grow the opportunities availllable for intership programmes for graduate engineers

The need for engineering in the growth of any economy cannot be over-emphasised. Countries like China who have achieved rapid development have an engineer as their president and have embraced engineers. Engineers are indispensable drivers of socio-economic development. IEK calls upon the government to embrace professionalism for an accelerated development.


ENG. MARGARET OGAI

Message from IEK Honorary Secretary

GREETINGS from IEK.

IEK has continued to engage members through a number of activities aimed at informing, exchanging ideas and networking.

On July 23, 2021, IEK held the President's dinner in partnership with the Kenya National Highways Authority (KeNHA) at the Four Points Sheraton Hotel in Nairobi. The theme of the dinner was 'Consolidating the Gains in Engineering'. The chief guest was Eng. Peter Mundinia, KeNHA Director General, who was represented by Eng. Samwel Omwer. The hybrid event, which was held in strict adherence to COVID-19 protocols was attended both physically and virtually.

During the event, Engineers were urged to enhance inter-agency cooperation and engagement with professional Engineers in the pursuit of development in Kenya.

IEK launched a new branch on August 13, 2021, at Double Tree Hotel. The Capital Branch was formed by the Outreach Committee as part of the Institution's goal to enhance IEK's visibility in 'Mashinani' and bring on board those engineers who are not members of IEK. It also provides industry linkages for the members. The IEK Capital Branch will be stationed in Nairobi and will cover the counties of Nairobi, Kiambu, Kajiado, Machakos, Makueni and Kitui.

The institution is planning the 28th IEK Annual Conference that shall be held both physical and virtually from November 8-12, 2021, at Pride Inn Beach Paradise Hotel in Mombasa. Below are the details for the conference:

Women Engineers Summit (WEC Summit)
Monday 8th November, 2021
Theme: Power of Diversity

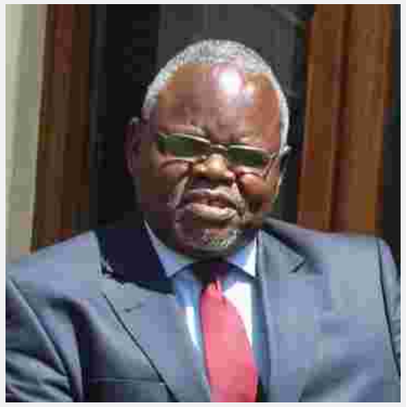
Main Conference
Tuesday 9th – Friday 12th November, 2021
Theme: Engineers Accelerating Sustainable Economy.

The upcoming conference is billed to be the biggest; we aim to have at least 3,000 policymakers, industry captains in infrastructure, engineers and associated professionals. We thank all members for their overwhelming response to our call for papers. As a result, this the conference has been extended by one day.

Members are invited to register early for the conference, which promises to inform, educate and entertain.

The Council is urging members to continue upgrading their membership status at the IEK and help bring on board Graduate Engineers who are not registered with the Institution.


Participants at the IEK President's dinner at the Four Points Sheraton Hotel in Nairobi on July 23.



A Discussion on the Discipline and Profession of Engineering

Prof. Dr.-Ing. Francis W. O. Aduol

Introductory

LOOKED at critically, there are three environments within which humans operate; the natural environment, the social environment, and the human-made environment. The natural environment comprises of nature as made up of all phenomena that occur naturally, whether living or non-living. The human-made environment is the environment that has been created by human beings. This environment consists of objects and structures made by human beings to improve the quality of living. The totality of such objects and structures is technology and the process of realising such technology consists in engineering and technology. The practice of engineering, as in most professional disciplines, typically takes two routes; academia and industry.

Engineering education is today almost exclusively realised through formal education at a college or university. At university level, engineering education is supported by research as carried out by the academic staff with assistance of senior students. The principal objective of engineering education is to make life more comfortable through the use of technology as developed by engineering. Engineering has been identified as critical to the realisation of sustainable development and hence there is an important need to pay attention to issues of sustainability in the practice of engineering. Science and arts are important to the study and practice of engineering.

The arts is important to the discipline of engineering because virtually all products of engineering get carried out for a client, and must therefore compete in the marketplace. In the marketplace, much more weight is usually placed on the beauty and aesthetics of the product than engineers typically realise.

Science is considered to be organised into three main branches; natural sciences, social sciences, and formal sciences.[1]

Natural science is a branch of science concerned with the description, prediction, and understanding of natural phenomena, based on empirical evidence from observation and experimentation.[2]. Natural science is organised into three main branches; physical sciences, life sciences, and earth sciences.

Social science is a branch of science concerned with the study of human societies and the relationships among individuals within those societies.[3] Social sciences encompass the following areas of study: anthropology, archaeology, economics, geography (human), linguistics, management sciences, business studies, media studies, political science, psychology, and sociology. Basically social sciences explain how societies work and how human beings relate to each other, both as communities and as individuals.

Formal science is a branch of science that uses abstract concepts and formal systems to generate knowledge. It is concerned with formal language disciplines mainly around logic and mathematics. The major branches of formal science are: mathematics, statistics, systems science, and computer science. Formal science, because it is based on abstract and logical reasoning, does not rely on empirical evidence to proffer any proofs of existence. Formal sciences are based on sets of axioms and definitions from which theorems and further statements may be derived. From the fact then that their statements are derived from such axioms, their formal statements hold under all circumstances without fear of being contradicted by new theories and concepts. To this extent then formal sciences find application in all domains.

Science is important to engineering in that it provides the foundation upon which the theoretical principles of engineering are built. Engineering might have started off as a craft, but modern engineering is based on quite complex scientific principles that underpin the applied and practical nature of the discipline.

Engineering and Technology

Engineering and Technology are so intertwined with each other that in practical terms they come out simply as a continuum of the same spectrum, where one simply fades into the other. In very simple terms it may be considered that the engineer is more of a thinker, philosopher, and innovator while the technologist is a doer, whose principal objective is to produce practical results based on the concepts devised by the engineer.

A functional definition of engineering is:

> *The creative application of scientific principles and mathematical methods to design and develop structures, machines, materials, devices, apparatus, systems, processes and organizations, under economic and safety constraints for the protection and improvement of lives.*

A working definition of technology is:

> *The branch of knowledge that deals with; (i) the application of knowledge in the production of devices and systems for the improvement of human life, (ii) the accumulation of procedures and processes for the production of such devices and, (iii) the totality of the products so produced.*

Academic and Professional Engineering

The discipline of engineering, like all disciplines gets practised in three main dimensions; academic learning, research and innovation, and practice in industry. Academic engineering is about the teaching of the discipline and research about the discipline.

The universities are in the forefront of academic work in engineering, but also the technical and vocational colleges play an important role of training technicians and artisans.

The practice of engineering on the other hand is basically the domain of industry where practical production in engineering is found. While academic learning and research have immensely contributed to the numerous innovations in engineering, the beginning of engineering practice was not so much driven by engineering science and theory. Engineering practice in fact was in the beginning driven simply by heuristic, practical, approaches devoid of much theoretical understanding of the underlying principles of such practical works.

Academic Engineering

Engineering remains one of the most prestigious and challenging academic disciplines. Traditionally engineering has attracted some of the most talented students. This situation continues to be maintained in developing countries and engineering continues to attract some of the brightest students.

The situation however is not always replicated in the developed world where it is increasingly becoming apparent that engineering is no longer consistently attracting the best students. Chang-Lin Tien [1995][4] considers that engineering is losing its best talents to other fields in five ways: (i) loss of interest by students in mathematics and science at high school, (ii) students are being lost to social sciences, humanities, and other professional fields, (iii) there is very low representation of women in engineering, (iv) a large number of graduates in engineering are taking up business, law, medicine, and other fields at postgraduate level, and (v) academic engineering is losing talents even at the level of those who have qualified at the postgraduate level, who in many cases are shunning joining the engineering faculty for careers in industry, business, and finance.

Professional Practice of Engineering

The professional practice of engineering is a highly regulated function. As with many professions, the practice of engineering is regulated to ensure that high standards in professional work and conduct are maintained. It is important in engineering that the highest standards of practice are observed at all times to shield the public from sub-standard work that could be costly and even put lives in danger. It becomes immensely important that those who practise engineering are vetted and licensed by a recognised professional body. Besides the maintenance of standards, professional societies have many other responsibilities, including; the further education of members, member discipline, member professional development, professional education standards, advice to the public, and setting of professional fees.

In Kenya, the professional bodies typically require a university graduate with an accredited degree to apply for admission as a graduate engineer (respectively graduate engineering technologist). Having been admitted as a graduate engineer/engineering-technologist, one is expected to take at least three years of work experience under the tutelage of a professional engineer/engineering-technologist before one can apply for consideration for the professional status. If the Board is satisfied about the experience of the candidate, then the candidate would be invited to take certain examinations. On passing the professional examinations, the candidate may then be registered as a professional.

In the United States of America, university graduates seeking to be registered as professional engineers start by taking the Fundamental Engineering/Surveying (FE/FS) examinations of the National Council of Examiners for Engineering and Surveying (NCEES). On passing the fundamental examination, the graduate is granted the status of Engineer-in-Training (EIT) (respectively Land-Surveyor-in-Training (LSIT)). Once qualified as EIT/LSIT, one is expected to accumulate experience in engineering/surveying work under the supervision of a professional

1 Wikipedia

2 Wikipedia

3 Wikipedia

4 **Tien,** Chang-Lin. 1995. Reengineering the academic engineering enterprise. *Forces Shaping the U.S. Academic Engineering Research Enterprise.* National Academy of Engineering. Washington DC. The National Academies Press. 145 pp; pp 37-46.

engineer/surveyor for at least four years after which they may take the second examination known as Principles and Practice of Engineering/Surveying (PE/PS). Those who pass the PE/PS examination may apply for registration as Professional Engineer/Land-Surveyor and is allowed to use the post-nominals PE/PLS.

In the United Kingdom, the practice of engineering is regulated by the Engineering Council. The Council grants four types of qualifications; Chartered Engineer (CEng), Incorporated Engineer (IEng), Engineering Technician (EngTech), and Information and Communications Technology Technician (ICTTech). The direct route to admission as a Chartered Engineer requires that one has a Master of Engineering (MEng) (undergraduate integrated) degree and then to acquire the necessary experience in engineering practice under the supervision of a Chartered Engineer. Experience gained during industrial attachment as a student may be taken into consideration for professional registration. Where one has a Bachelor's degree in engineering, one would normally be required to take relevant postgraduate study before presenting the necessary professional experience. Application to become an Incorporated Engineer requires a Bachelor's degree with professional experience. The basic qualification for the Engineering Technician is a Diploma with experience.

The Engineering Council has defined the various categories of qualification as follows:[5]

- ***Chartered Engineers*** develop solutions to engineering problems using new or existing technologies through innovation, creativity and change and/or they may have technical accountability for complex systems with significant levels of risk.
- ***Incorporated Engineers*** maintain and manage applications of current and developing technology, and may undertake engineering design, development, manufacture, construction, and operation.
- ***Engineering Technicians*** apply proven techniques and procedures to the solution of practical engineering problems.

We notice from this that these definitions correspond to the engineering professional, engineering technologist, and engineering technician as already considered above, and in our system in Kenya.

Practice and Organisation of Engineering

The practice and organisation of the discipline and profession of engineering revolves largely around the various levels of engineering practice as also represented by the various cadres of personnel who practice engineering, and the professional bodies that organise and control the profession. The various engineering cadres represent the structure of the profession in the vertical dimension while the breadth of the profession in terms of specialisms represent the profession in the horizontal dimension. For a holistic view of the discipline and profession of engineering, it is important that both these dimensions are considered in an integrative manner.

The Engineering Team

In the practice of engineering, each of these cadres have a specific role to play, as follows:

(i) ***Engineering Scientist:*** Interfaces with the pure scientist to seek to discover new ways of how to solve engineering problems and to advance technology; this is the most theoretical member of the team and normally would have to possess advanced knowledge in engineering and technology, usually at the doctorate degree level;

(ii) ***Engineering Professional:*** Uses the scientific knowledge to conceptualise how something practical could be produced from such knowledge and to design the respective artefact, device, process, system, or organisation, as well as supervise the production thereof; engineering professionals may practice as 'general' practitioners, at which level they may only need an undergraduate degree in engineering with professional registration, or as consulting engineers, at which level they would normally require a postgraduate qualification in engineering and in addition be registered as consulting engineers;

(iii) ***Engineering Technologist:*** An applied engineer concerned with the development and implementation of existing technology within a field of engineering and is focused on the construction, manufacturing, testing, measuring, improvement of engineering devices and systems, as well as the integration of engineering systems; the engineering technologist normally holds a bachelor's degree in engineering with focus on engineering technology and would qualify for registration as a professional engineering technologist;

(iv) ***Engineering Technician:*** Contributes to the practical realisation of a project through the use of the engineer's design to produce that which has been designed under the supervision of the engineering professional or engineering technologist, and further to implement, repair and make improvements on such technical equipment, device, or system; the engineering technician typically holds a Diploma or an associate degree and requires to be registered as an engineering technician professional;

(v) ***Vocational Technician:*** This is an artisan or a craft-person who is concerned with the operation and routine maintenance of the engineering artefacts, devices, and systems; the vocational technician is typically qualified with a certificate attained after two years of study at a technical college.

All these cadres of personnel are normally required for any engineering system to function effectively. Du Toit and Roodt (2010)[6] indicate that for developed countries the ratios of Engineers to Technologists to Technicians to Artisans in the engineering industry is 1:2:4:16. It is considered here, however, that for a developing country that an engineer will require three technologists; a technologist will require four technicians while a technician needs five artisans to work with. Thus the ratios for a developing country can be placed at 1:3:12:60. The reason the span of ratios should be wider for a developing country is because of the relatively lower level of technological sophistication that in effect requires fewer higher levels of professionals and more of the lower cadre of technical staff.

Engineering Organisations

The first professional engineering society is normally regarded to be the Society of Civil Engineers established under the leadership of John Smeaton (1724 - 1792) in London, in 1771.

What is considered to be the very first form of modern definition of engineer was provided by the Institution of Civil Engineers, and ran as follows:

An engineer is a mediator between the philosopher and the working mechanic; and like an interpreter between two foreigners must understand the language of both. The philosopher searches into nature and discovers her laws, and promulgates the principles and adapts them to our circumstances. The working mechanic, governed by the superintendence of the engineer, brings his ideas into reality. Hence the absolute necessity of possessing both practical and theoretical knowledge.[7]

Later on, on their application for Charter, the Institution of Civil Engineers (ICE) crafted, what probably is the most famous definition of engineering, as follows:

The art of directing the great sources of power in nature for the use and convenience of man.

The formation of ICE was quickly followed by the formation of other professional bodies in engineering as follows: Institution of Civil Engineers of Ireland (1835), the Swiss Society of Engineers and Architects (1837), the British Institution of Mechanical Engineers (1847), and the Royal Institution of Engineers in the Netherland (1847). Subsequently many more professional societies for engineering got formed. However, the discipline of engineering expanded in scope, particularly fuelled on by the Industrial Revolution. The discipline quickly expanded into several areas of specialisation led by mechanical, electrical, chemical, and mining engineering. Each of the areas of specialisation subsequently formed their own professional bodies. The first of the specialist professional bodies to be formed was the Institution of Mechanical Engineers (IMechE), which was formed in London in 1847 with George Stephenson (1781-1848) as its first Chairman. The Institution of Electrical Engineers (IEE) was founded in 1871 as the Society of Telegraph Engineers before eventually becoming the Institution of Electrical Engineers in 1889; in 2006, IEE joined up with the Institution of Incorporated Engineers (founded in 1884) to form the Institution of Engineering and Technology (IET).

Today, the discipline of engineering is represented by numerous professional organisations worldwide with virtually every country having at least one professional engineering body. Beyond national borders, there are a number of organisations that represent the interest of the discipline at the international level.

Engineering in Kenya

The direction the engineering profession has taken in Kenya has largely been determined by three main factors; the origins of engineering in the country, the organisation of the profession, and engineering education. The origins of engineering in Kenya may be said to have started with the building of the Uganda Railway in the period 1895 to 1901. The railway line brought with it the technologies of surveying and mapping, engineering construction, mechanical works, and telegraphy. This already represented the four broad areas that would represent engineering practice in the country as civil engineering, mechanical engineering, electrical engineering, and surveying and mapping. Further, with the shift of the railway headquarters from Mombasa to Nairobi in 1899, modern buildings and water supply systems as well as public health systems and structures had to be put up. Further, with the shifting of the headquarters of the British East Africa Protectorate from Mombasa to Nairobi in 1901, the Department of Public Works and other engineering facilities were established formally in Nairobi. Thus began the profession engineering in the country in earnest.

Engineering Practice

Engineering practice in Kenya is today under the direction of the Institution of Engineers of Kenya as the professional association and the Engineers Board of Kenya as the professional registration body. The development of the engineering profession in Kenya was considerably influenced by the practices of the engineering profession in the United Kingdom, for obvious reasons related to colonialism.

One of the challenges facing the practice of engineering in Kenya today is that there is a very distinct segregation between the place of the professional engineer and that of the other cadres covering technologists, technicians, and artisans in the practice of the profession.

This is so, such that there are now two professional registration bodies, one catering for the professional engineer as the Engineers Board of Kenya (EBK) and the other catering for technologists and technicians as the Kenya Engineering Technology Board (KETB). The trend worldwide however is to have the entire profession regulated under one body since it is recognised that the practice of the profession by the various cadres usually merge into each other seamlessly, that trying to draw a distinct line between any two cadres becomes an

5 https://www.engc.org.uk

6 Toit, du R, and Roodt, J. 2010. Engineers in a Developing Country – The Profession and Education of Engineering Professionals in South Africa. HSRC Press, Cape Town. 166 pp.

7 Wikipedia – Institution of Civil Engineers: en.wikipedia.org/wiki/Institution_of_Civil_Engineers

exercise in futility; and one that can only contribute in the frustration of the development of the entire profession. It is felt therefore that the Kenya engineering fraternity should seriously consider a professional structure that will allow for the close working relationships among the various cadres. Such will no doubt enhance and integrated growth of the profession in the country.

Engineering Education

Engineering education at the University level began at the Royal Technical College of East Africa (RTCEA) in 1956. RTCEA became the University of Nairobi in 1970. The education and training in engineering at the University of Nairobi was modelled along the lines of that of the University of London, largely because of the fact that when the institution started to offer degrees, it was a college under a special relationship with the University of London. The education and training in engineering at UoN was built around the concept of engineering science where considerable emphasis was put on producing graduates who were well schooled in the science of engineering, but, unfortunately, often at the expense of practical training. In the early years of engineering education in the country, this situation might have not presented much problems because the graduates were urgently needed in the market to support public service in organisations such as the Kenya Railways, the postal and telecommunication services, the Kenya Power and Lighting Company, the Public Works Department, as well as the Lands Department. These organisations were always in the position to provide relatively well organized internships for the graduates and so the lack of practical training at university was mitigated for in this way.

Over the years, as the number of universities in Kenya increased, a number of new Universities also started offering programmes in engineering. The new universities were Moi University, followed by Egerton University, the Jomo Kenyatta University of Agriculture and Technology, and Masinde Muliro University of Science and Technology. Today various aspects of engineering are offered in at least fourteen universities in Kenya. Most of the engineering programmes have adopted the engineering science model as inspired by the University of Nairobi.

Another reason that has inspired this is the fact that the engineering professional registration body in Kenya, the Engineers Board of Kenya (EBK), traditionally has only accredited programmes that have followed in the engineering science model. Many of the programmes however continue to face challenges of accreditation with EBK and that in a way has also compromised the full acceptability of a number of the programmes. Most of the universities offering the new engineering programmes are those that were previously polytechnics or institutes of technology. Among the universities offering the new engineering programmes is the Technical University of Kenya (TU-K), Technical University of Mombasa (TUM), and Dedan Kimathi University of Technology (DeKUT).

At TU-K, in the main, engineering is offered at four levels, namely; Diploma, TVET Bachelor Degree, Academic Bachelor Degree, and at Postgraduate level. The Diploma programme is a continuation from the programmes initially offered at the Kenya Polytechnic at this level. The institution was conceptualised to cover the characters of both a university of technology and a polytechnic, and to this extent it was important that the Diploma programmes be retained in the upgraded institution.

The TVET degree programme is a new concept in Kenya and has basically been introduced to train engineering technologists at the degree level. The TVET degree is offered as a Bachelor of Technology (BTech) degree and may be completed in four years of study. The TVET degree programme admits students from both high school and those who have already qualified as technicians with the Diploma. Students who are joining the BTech directly from high school start on the programme from first year while those who join with the Diploma receive credits and generally join the programme in the third year of study. The professional engineering programme is offered as the Bachelor of Engineering (BEng) degree and is a five-year course.

Conclusion

The twenty-first century will present completely new challenges to the discipline and profession of engineering. The profession will be challenged to respond to these in ways that will require that the engineering professional is trained to have a broad understanding of issues that are urgent to mankind. The main challanges that mankind will have to grapple with in the twenty-first century will be driven in the first instance by three main factors; the accelerated population increase, the fight against poverty, disease and ignorance and issues around climate change and the environmental sustainability. While the first two challenges will continue to be focused on the developing world, the question of climate change and environmental sustainability will impact all the world regions virtually in equal measure.

United Nations predicts that the World population will be 11.2 billion by the year 2100 against the current figure of 7.9 billion[8]. Most of the increase in population will be witnessed in Africa, where the population is expected to have increased from the current level of 1.4 billion to 3.4 billion by 2100. Of the top ten countries with the highest populations, five will be in Africa, namely; Nigeria (794m), Congo DRC (379m), Tanzania (304m), Ethiopia (250m), and Uganda (214m). If this is extended further, Africa will have eleven countries in the top twenty, which will further include Egypt (199m), Niger (192m), Angola (173m), Kenya (142m), and Sudan (139m). Engineering in Africa will be particularly called upon to respond to this situation, not only through practice, but perhaps more importantly, through education and research. African Universities and colleges will be expected to come up with relevant curricula and research programmes that will be in a position to address the myriad challenges of development that will come in, in the wake of this population explosion.

With the anticipated huge population increase, it can be expected that the challenges relating to poverty, disease and education, will continued to be visited upon African peoples. Coupled with all this will be pressures on the environment including issues of energy. The engineering fraternity needs to begin to plan seriously for all this. This effort will eventually have to begin with the engineering curricula that are offered in the African universities and colleges. For a long time, the engineering curricula in African universities mimicked considerably the models of engineering education in the West, perhaps due to the colonial heritage of education systems in Africa. This needs to change. African universities must begin to interrogate the curricula they offer to make them relevant for the African situation, especially in the face of the challenges that the continent is staring at in the twenty-first century and beyond. The African graduate in engineering will need to be versatile even as they are taken to the most rigorous levels of engineering learning. Engineering education in Africa will seek to offer more in practical education even as it seeks to keep abreast with the best in terms of academic rigour.

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8 United Nations, 2017. World population prospects – The 2017 Revision, New York. 46 pp.

KENYA RURAL ROADS AUTHORITY

VISION
Easy Access to Resources and Services

MISSION
To Develop, Manage and Maintain the National Secondary Trunk Road Network

ABOUT THE AUTHORITY

KeRRA's primary mandate is to develop, construct and maintain the National Rural Road Network in the country as per the Kenya Roads Act, 2007. The scope of the National Rural Road Network was revised via the Kenya Gazette Legislative Supplement No. 4 (Special Edition) of 22nd January 2016. It comprises the following core functions and duties.

- Constructing, upgrading, rehabilitating and maintaining National Rural Roads.
- Controlling reserves for National Rural Roads and access to roadside developments.
- Implementing road policies in relation to National Rural Roads.
- Planning the development and maintenance of National Rural Roads in liaison with the Cabinet Secretary and concerned Government Agencies.

FLAGSHIP AND ONGOING PROGRAMMES

The Government has pledged 10,000Kms of roads to; improve the National road network, decongest major towns, and promote domestic and regional connectivity. Consequently, all road agencies including the Kenya Rural Roads Authority (KeRRA) embarked on a programme on the development of roads using the Low Volume Seal technology. This programme is known as the 10,000km Low Volume Seal Roads Programme (LVSR). LVSR is aimed at achieving a substantial leap in delivery of the Government's development goal for the roads sub-sector in a cost-effective way.

The Authority also has several on-going projects under the Roads 2000 Programme, Conventional construction methods Rehabilitation and Maintenance projects on-going countrywide. In addition, the Authority is implementing road projects in 14 select Counties under the Equalization Fund. The Equalization Fund was established under the Constitution of Kenya 2010 for the purpose of providing basic services including water, roads, health services and electricity to marginalized areas to the extent necessary to systemically bring the quality of those services to the level generally enjoyed by the rest of the nation over time. The fund represents one half percent of all the revenue collected by the national government each year.

Road Construction Presently: Why the Low Volume Seal Approach?

The Government pledged 10,000Kms of roads to open up rural areas, decongest major towns, and promote domestic and regional connectivity. Consequently, all road agencies including the Kenya Rural Roads Authority (KeRRA) embarked on a programme on the development of roads using the Low Volume Seal technology. This programme is known as the 10,000km Low Volume Seal Roads Programme (LVSR). LVSR is aimed at achieving a substantial leap in delivery of the Government's development goal for the roads sub-sector in a cost-effective way. The LVSR Programme is guided by guidelines developed by the Materials Testing and Research Division based on Road Design Manual Part III: Materials and Pavement Design for New Roads, 1987. This is meant to prevent overdesign.

Conventional methods of road construction in many instances ensured high design speed roads with the resultant requirement for horizontal and vertical realignment leading to high cost of construction and in many cases the need to acquire land, relocation of services and resettlement of people. Subsequently, through the LVSR technology, the cost of road construction in rural areas has been reduced by more than 60 per cent since in many cases the cost of earthworks is reduced while there is no need for land acquisition and reduced relocation of services as the road follows the existing alignment.

The Road Design Manual Part III has successfully been used over time but has limitations regarding provisions for pavement structures for traffic loading below 250,000 Cumulative Equivalent Standard Axles (CESA). Further, the pavement structures provided for traffic loading between 250,000 and 1,000,000 CESA are mostly overdesigned, being based on the upper limit. Roads with traffic below 250,000 CESA could therefore not be designed to paved standards using the manual and have had to be designed for improvement to gravel standards. However, construction of gravel roads is becoming increasingly expensive and unreliable because of depletion of the existing gravel sources and high rates of gravel loss due to traffic attrition and environmental factors. This method is therefore not sustainable and as such calls for a different approach to construction and maintenance of our roads.

It was therefore imperative to adopt a design that enables upgrading of low volume roads to sealed/paved standard to increase the pavement life to at least 15 years thus lower whole life costs. The guidelines developed provides for upgrading of low volume roads to paved standards while optimising the use of locally occurring materials.

LVSR R10,000 Programme: Progress to Date

In using the Low Volume Sealed Roads technology, the Authority has two programmes namely the R2000 LVSR strategy (Labour Based) and the R10000 Programme (Machine Based). Under the R10,000 Programme (Machine Based), the Authority has 4,009Kms of on-going contracted works at a cost of Ksh180 billion and approximately 5,485Kms being at various stages of procurement.

The R10000 Programme is milestone-based consisting of two components namely: road construction and performance-based maintenance contracts. The effect of this is that after construction and expiry of the twelve (12) months Defects Liability Period, each road contract contains a maintenance provision that will ensure the road is maintained for a period of thirty six (36) months by the contractor unlike previously where the Authority would be responsible for the maintenance of the road. Currently approximately 128Km of roads have been upgraded to bitumen standard under the LVSR programme.

LVSR R10,000 Programme: The future

The LVSR programme is projected upon completion to inject a total of 10,000km of new roads upgraded to bitumen standard. It has been established in previous economic studies that with proper investment, a vibrant roads infrastructure can generate up to 5% of the Gross Domestic Product (GDP). As articulated in the Road Sector Investment Plan (RSIP, 2011), for every shilling invested in roads; the country stands to gain two shillings and fifty cents in benefits.

It is therefore apparent that the successful implementation of the programme will enable KeRRA to achieve its vision of providing an adequate, safe and efficient rural road network and continue to contribute towards achievement of the strategic vision of the Government of Kenya for the roads sub-sector as captured under key policy documents including the Road Sector Investment Plan and the Kenya Vision 2030.

	Contract No.	Project Name	Contractor Details (Name, Contact)	County	Road Length	Contract Cost (Ksh.)	Status	Km of Black-Top	Remarks / Impacts from Other MDAs that might affect planned completion
1	RWC 96	Mariakani - Bamba (D549)and Kili-fi-Kiwandani Primary School Roads	China Wu Yi Co. Ltd	Kilifi	53.0	2,531,587,992.08	100.0%	53.00	Substantially Complete
2	RWC 100	Roliondo - Kagaa - Captain	Jipsy Constrction	Nyandarua	10.0	397,775,834.90	100.0%	9.20	Substantially Complete
3	RWC 102	Kutus – Kianyaga – Kiamutugu – Githure Roads (D458)	Jipsy Constrction	Kirinyaga	29.0	1,569,766,451.25	100.0%	29.00	Substantially Complete
4	RWC 104	Kamatira - Cheptongei	Sino Hydro Tianjin Eng, Co, Ltd	West Pokot	80.0	3,369,347,767.19	100.0%	80.00	Substantially Complete
5	RWC 110	Brooke Bond - Maili - Nne - Kpkelion - Londiani/ Maili Nne - Chepseon	China Wu Yi	Kericho	56.2	1,679,392,937.21	100.0%	56.20	Substantially Complete
6	RWC 111	Daraja Sita- Dikirr- Chebole-Labotiet (D233 & D234)	Shengli Eng. Construction Ltd	Bomet	65.0	2,010,497,148.00	100.0%	65.00	Substantially Complete
7	RWC 126	Ruaka-Banana-Limuru (D407) - Ngecha (E423)&Thogoto-Gikam-bura-Mutarakwa (Phase 111)-(D411)	Shengli Eng. Co. Ltd	Kiambu	65.0	3,210,130,000.34	100.0%	65.00	Substantially Complete
8	RWC 129	Kisima - Kibirichia - Kima - Ruiri	China Nat. Aero-Tech	Meru	38.7	1,856,369,954.60	100.0%	38.70	Substantially Complete
9	RWC 135	Jnc A104 - Drys - Jnc C53 - Kapchorwa - Plateau -Naiberi	Third Eng. Bureau Of China City	Uasin Gishu	53.3	3,196,269,829.96	100.0%	53.30	Substantially Complete
10	RWC 136	Mauche – Bombo – Olenguruone – Kiptagich – Silibwet	China Wu Yi	Nakuru	120.0	3,365,427,365.17	100.0%	120.00	Substantially Complete
11	RWC 148	Junction B8 - Masalani	Warsan Construction	Tana River	15.0	761,615,900.90	100.0%	15.00	Substantially Complete
12	RWC 154	Sultan Hamud Kasikeu-Wautu-Kyam-beke-Kikoko(D515)	Kabuito Contractors	Makueni	30.0	1,448,187,891.50	100.0%	30.00	Substantially Complete
13	RWC 163A	Karima A2 - Kianjege - Mukangu - Ndi-maini - Karatina & Kiburu - Kabonge	Stecol Corporation	Nyeri / Kirinyaga	34.0	1,370,191,560.36	100.0%	34.00	Substantially Complete
14	RWC 163B	Njegas-Mutito-Gatwe-Kangaita/ Kiaga-Kianjege-Mukinduri Roads	Stecol Corporation	Kirinyaga	35.0	1,323,101,627.88	100.0%	35.00	Substantially Complete
15	RWC 164	Embu Hsp - Kathangariri - Kiajokoma - Runyenjes - Mugui - Mbui Njeru - Kanja - Sikago	S. S. Mehta &Son Ltd	Embu	63.1	3,355,958,230.32	100.0%	63.10	Partial Substantial completion for 43.13km Works still ongoing 1. Delayed payments causing slowdown in progress.
16	RWC 174A	Isiolo Town Roads Lot 1	Shibli Enterprises Ltd	Isiolo	5.7	402,409,448.72	100.0%	5.70	Substantially Complete
17	RWC 193	Butere-Sidindi &Butere(Bukolwe)-Musanda-Bungasi-Sigomere-Ugunja Roads	Stecol Corporation	Kakamega/ Siaya	57.0	2,217,618,965.57	100.0%	57.00	Substantially Complete
18	RWC 205	Ndere - Boro	Nam Rajope	Siaya	4.4	253,287,520.73	100.0%	4.42	Substantially Complete
19	RWC 233	Malindi – Kakoneni –Sala Gate Road(C103) And Sabaki Marikebuni Road(D553)	S. S. Mehta & Sons Ltd	Kilifi	113.4	4,530,765,586.70	100.0%	113.40	Substantially Complete
20	RWC 251	Athi-Kimongoro-Nkinja-Ugoti-Katith-ine, Auki Athii-Gaiti, Kijiji-Thii-Gaiti Roads And Access To Meru University	Jiangxi Water H. Co Ltd	Meru	33.0	1,558,151,625.05	100.0%	33.00	Ongoing - Delayed payments causing slowdown in progress
21	RWC 259	Rumuruti - Sipili - Ndindika	China Nat. Aero-Tech	Laikipia	42.0	2,118,168,845.60	100.0%	42.00	Substantially Complete
22	RWC 263	Lwakakha - Korosiondet – Tulienge-Sirisia -Namwela—Chwele	China N. A. T. I E Corporation	Bungoma	30.0	1,610,173,686.81	100.0%	30.00	Substantially Complete
23	RWC 265	Malaba - Angurai - Malakisi & Angurai-Moding- Kakamer	China Nat. Aero-Tech	Busia	35.0	1,680,250,895.58	100.0%	35.00	Substantially Complete
24	RWC 275	Imaroro-Mashru-Isara	Stecol Corporation	Kajiado	70.0	3,037,646,796.91	100.0%	70.00	Substantially Complete

	Contract No.	Project Name	Contractor Details (Name, Contact)	County	Road Length	Contract Cost (Ksh.)	Status	Km of Black-Top	Remarks / Impacts from Other MDAs that might affect planned completion
25	RWC 282	Indian Bazaar-Ndumberi-Ting'Ang'A-Riabai/Kist-Njathaini& Access To Starehe Girls Road	Samar Construction	Kiambu	15.0	717,730,206.05	100.0%	15.70	Substantially Complete
26	RWC 298	Kwa Vonza-Kenyatta University-Mikuy-uni Primary-South Eastern Kenya University Road	Briidgeways Construction	Kitui	20.0	980,964,679.25	100.0%	20.00	Substantially Complete
27	RWC 306	Kimutwa - Makaveti - Kwa Mutisya	Lilaaf Constructon Co Ltd	Machakos	12.0	624,792,878.00	100.0%	12.00	Substantially Complete
28	RWC 334	Gati-Iguru – Ithanga – Mithini – Kirimiri – Gakungu / Gakungu – Mak-uyu – Kamahuha – Mbombo Roads	Stecol Corporation	Murang`a	61.0	3,377,950,155.49	100.0%	61.00	Substantially Complete
29	RWC 335	Muranga Town (Huhi Town Stn) - Karii Railway Stn - Muthingiriri - Marewa - Gakindu Bridge - Wandaka - Gikuu-Kayuyu - Mirira	Mutech Motors Eng	Murang`a	20.0	1,076,435,490.80	100.0%	20.00	Substantially Complete
30	RWC 336	Gatanga - Kionyo - Nyaga - Mukurwe - Githiri - Mariaini Road & Jnct Muthandi-Mbugiti-Kagarie Loop	F.M & Sons Co.C.	Murang`a	23.0	942,713,522.94	100.0%	23.00	Substantially Complete
31	RWC 337	Jnc C71 Karugia - Ngurweini - Gath-imaini - Turuturu - Githima Jnc C70 Mathareini Roads	Mutech Motors Eng	Murang`a	26.7	1,271,775,590.30	100.0%	26.74	Substantially Complete
32	RWC 363	Soy-Kipsangui- Kabenes & Eldoret - Kiplombe- Soy	China Henan Chico	Uasin Gishu	46.8	2,109,794,892.00	100.0%	46.77	Substantially Complete
33	RWC 374	Marekebuni-Majengo-Marafa-Sosoni Road (D553)	A. A. Bayasuff & Sons Ltd	Kilifi	36.0	1,541,057,440.28	100.0%	36.00	Original Contracted works (36km) complete. Works on Variation order No. 3 (4km) ongoing.
34	RWC 382	Jnct B5 Subukia – Maseno – Lower Solai – Maji Matamu- Kamukunji – Solai – Jnct B5 Maili Kumi	China Henan Chico	Nakuru	65.0	2,490,846,750.63	100.0%	65.00	Substantially Complete
35	RWC 413	Kirima – Ndinda – Kirima -- Engineer & Access To North Kinangop Hospital	Jiangxi Youse Construction Co Ltd	Nyandarua	30.0	1,765,510,772.78	100.0%	30.00	Substantially Complete
36	RWC 421	Kiawara-Gatarakwa-Mugunda-Nairutia Road	Cmec Africa Dev Ltd	Nyeri	26.3	1,232,076,028.00	99.9%	26.30	Ongoing 1. Delayed payments causing slowdown in progress. 2. Low capacity of local contractor.
37	RWC 430	Taita Girls - Liloch & Mutaragon - Fortenan	Intex Const.Co. Ltd	Kericho	36.0	2,301,580,939.42	100.0%	36.00	Substantially Complete
38	RWC 433	Samburu- Kinango	Jiangxiyouse Constr. Co.	Kwale	52.2	2,025,210,662.18	100.0%	52.20	Substantially Complete
39	RWC 437	Teganda - Ndaraweta - Isaik -Sigorwet - Leldaret Road	China Wu Yu Co. Ltd	Bomet	28.1	1,276,115,043.00	100.0%	28.10	Substantially Complete
40	RWC 438	Soimet - Kapletundo- Mogogosiek & Kapletundo -Kapngoken-Kilgoris-Olo-sosayiet Roads	China Wu Yu Co. Ltd	Bomet	35.3	1,673,947,358.09	100.0%	35.30	Substantially Complete
41	RWC 444	Bugar - Chebiemit / Jnct D329 (Kaplolo) - Kaplamai - Jnct C50 Kruger Farm	Stecol Corporation	Uasin Gishu	32.0	1,685,705,562.50	100.0%	32.00	Substantially Complete
42	RWC 489	Olchobezi - Kabolecho - Mgondo/ Mogondo - Changina - Emurrua Dikirr	Parbat Siyani Ltd & Elite Earthmovers Ltd Jv	Narok	27.5	832,910,211.00	100.0%	27.50	Substantially Complete
43	RWC 527	Kapsigilai-Tenden/Access To Schools	Stecol Corporation	Trans Nzoia	36.0	1,711,175,163.39	100.0%	36.00	Substantially Complete
44	RWC 552	Isebania- Ikerege - Kehancha - Nti-maru - Gwitembe-Ang'ata-Lolgorian	Sino Hydro Tianjin Eng, Co, Ltd	Migori/ Narok	75.0	3,011,773,957.00		75.00	Substantially Complete
TOTAL					**1841.7**	**81,504,161,166.43**		**1,841.63**	

KENYA RURAL ROADS AUTHORITY

THE ROADS 10,000, LOW VOLUME SEALED ROADS PROGRAMME SUPPORTING PRIMARY GROWTH SECTORS: AGRICUTURAL, TOURISM & TRADE

Introduction

Roads play a very critical role in the socio-economic development of the Country. It is estimated that the total length of road network in Kenya is approximately 136,794km. Currently there are only 20,000km out of the entire road network that has been improved to bitumen standard and motorable in all weather conditions. A remarkable proportion of rural roads network totaling to approximately 132, 000 Kms is either in earth or gravel standard. Most of these roads are not motorable especially during the rainy seasons due to their poor conditions and low service levels. In most cases and especially during the wet seasons, transport in some areas is completely cut off thus making the existing roads unreliable. The foregoing increases travel time and total cost of travel and transportation of goods and services. Poor roads reduce the accessibility of socio amenities such as markets, schools, and hospitals. The foregoing has led to endless increase in demand for improved access and mobility for rural communities to support primary growth sectors of the economy such as the agriculture, tourism and trade. The same would go hand in hand in improving their social economic conditions. While roads are necessary for economic development, they can be very expensive especially if the pavement structure is not properly designed. This calls for suitable design methods to be used while carefully and strategically selecting materials so suit the wide range of road classes and the varied conditions they exist.

Low Volume Seal Roads (LVSR) Concept

The Jubilee Government of Kenya pledged to construct a total of 10,000Kms of road in the year 2013 for purposes of opening and spurring economic growth in the rural areas, decongesting major towns and promoting domestic and regional connectivity. To achieve the foregoing, the government's pledge, the Ministry of Trasport, Infrastructure, Housing and Urban Development (MOTIHUD) was tasked with the role of exploring the best models for road construction that would assist the government in realizing this goal and at a reduced cos of construction per kilometer. The Annuity concept was therefore conceived as an alternative model over the conventional methods where tenders were floated for selected roads country wide. After these tenders were evaluated based on the Annuity Criteria, the construction cost per kilometer was established to be between KShs. 200,000.00-Kshs 500,000.00 per kilometer thus proving to be capital intensive. Consequently, the Ministry of Trasport, Infrastructure, Housing and Urban Development, was again asked to come up with a model that would ensure reduced cost of construction and specifically with the utilization of the locally available construction materials.

Due to the experience that KeRRA had with Donor funded Low Volume Sealed Roads (LVSR) projects, under Roads 2000, programme, the concept was enhanced to include the mechanization of the same with the main focus being on the use of the locally available resources. The programme was called 10000Km Low Volume Seal Roads Programme (LVSR) and was aimed at achieving a substantial quantum leap in delivery of the governments' development goal for the roads sub-sector in a cost-effective way. The concept was to provide the basic access to the existing centres and stimulate growth of industries, generate traffic to the already improved roads and attracting potential investors. The foregoing would lead to the future improvement of the road network based on the data collected and gathered detailing the level of growth of the areas in terms of investments and generated traffic. A very good example is the improvement of Mariakani-Bamba Road, where it was noted that after the improvement of the road, investor established factories and warehouses along the first 7km thus leading to the need of improving that section of the road to high standards. This would ensure that the already constructed road was protected from damage by the overloaded trucks and provide the strong pavement structure.

Achievements of Low Volume Seal Roads (LVSR)

The Authority through the Directorate of Development has implemented the R10, 000 Low Volume Seal Roads (LVSR) across all the 47 Counties. The Authority has to date awarded a total of 200 projects under the programme totaling to approximately 8,201.50 km at a cost of Kshs. 371.033 billion. Out of

this, the Authority has upgraded to bitumen standards a total of 4200 km in total and having successful completed a total of 44 projects. In the F/Y 2020/21 the Authority targets to upgrade to bitumen a total of 1,313.1 km under the programme. The programme has covered all the Counties in the Country apart from Lamu, Nairobi and Mombasa Counties.

Table 1: Summary of the Completed and Ongoing Projects (Country Wide)

NATIONAL SUMMARY					
S/No	**STATUS**	**PROJECTS**	**SCOPE (KM)**	**COST (KSHS)**	**MILESTONES ACHIEVED (KM)**
1	Competed Projects	44	1,841.73	81,504,161,166.43	1,841.63
2	Ongoing Projects	156	6,359.77	289,529,065,655.51	2,390.95
	Totals on Completed and Ongoing Projects	**200**	**8,201.50**	**371,033,226,821.94**	**4,232.58**

Table 2: Projects Awarded Per Financial Year

FINANCIAL YEAR	NO. OF PROJECTS	SCOPE (KM)	PROJECT COST (KSHS.)
2015/2016	17	889.2	38,518,905,917.67
2016/2017	65	2,636.40	122,610,281,442.27
2017/2018	43	1,777.83	84,760,304,335.45
2018/2019	14	643	28,362,197,866.18
2019/2020	15	669	25,433,174,538.96
2020/2021	9	193	9,108,331,851.91
TOTALS	**162**	**6,808.43**	**308,793,195,952.44**

Socio-Economic Benefits

The provision of all-weather rural roads through the LVSR programmes has increased the mobility level of people, goods, and services. The roads have also resulted in increased levels of access to educational and healthy centres and establishment of factories and other social amenities along the project roads. The production of agricultural products has also increased as the same can be delivered to the markets without major hinderances. The vehicle maintenance costs and other related wear and tear cost, has significantly reduced and the savings realized be utilized for other economic benefits. The values of the land other property adjacent to the road project have significantly increased which is also increased the level of economic growth for the areas covered by the road project. Potential investors have commenced the process of setting up industries and companies along the completed road project, thus creating jobs to the locals and other neighboring counties.

The future of low volume seal roads (concept)

It is projected that upon completion of this programme, a total of 10,000Kms to bitumen standard will be added to the existing road network. It has been established in previous economic studies that with proper investment, a vibrant roads infrastructure can generate up to 5% of the gross domestic product (GDP). As articulated in the Road Sector Investment Plan RSIP, 2011 for every shilling invested in roads, the country stands to gain two shillings and fifty cents in benefits. It is therefore apparent that the successful implementation of this programme will enable Kenya Rural Roads Authority (KeRRA) to achieve its vision of providing an adequate, safe, efficient and reliable rural road network and continue to contribute towards achievement of the strategic vision of the government of Kenya for the roads Sub Sector as captured under key policy documents including the Road Sector Investment Plan and Kenya vision 2030.

There ahs been notable challenges which include funding, understaffing lack of adequate and suitable construction materials among others. However, the GOK has been supporting the initiative by providing of exchequer release through the MOTIHUD and also the treasury Bills. In regard to other challenges related to understaffing, and inadequate construction materials, The authority has continued to utilize the services of the inhouse staff and also supplementing them with non-permanent personnel who are hired through the projects. Contractors are also encouraged to source locally available materials which can be used for the construction of the road through this programme.

OUR PHYSICAL LOCATION:

Kenya Rural Roads Authority,
Barabara Plaza Block B, Airport South Road,
P.O Box 48151 – 00100 NAIROBI, Kenya

OUR CONTACTS:

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Telephone: 020-7807600/01-05 | 0711 851103
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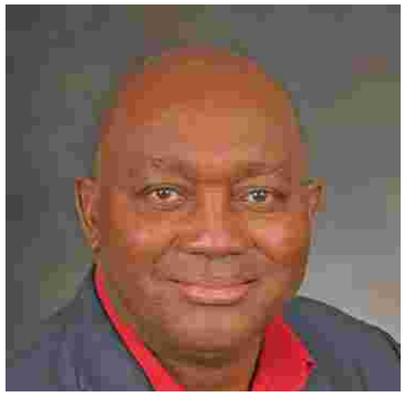
Visit www.kerra.go.ke to locate our 47 Regional Offices



Education for Industrialising Kenya

Dave Anyona KANUNDU

THE Kenya 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. Additionally the Constitution of Kenya 2010 Article 43 guarantees that:

(1) Every person has the right--

- **(a)** to the highest attainable standard of health, which includes the right to health care services, including reproductive health care;
- **(b)** to accessible and adequate housing, and to reasonable standards of sanitation;
- **(c)** to be free from hunger, and to have adequate food of acceptable quality;
- **(d)** to clean and safe water in adequate quantities;
- **(e)** to social security; and
- **(f)** to education.

These are responses to the longstanding yearnings of our people for a better life in line with the post-independence promise of liberation and prosperity.

Even after fifty eight years of independence we have been unsuccessful in transforming the underdeveloped and lopsided economy we inherited from Colonialism.

Our economy continues to be heavily dependent on foreigners. We largely consume what we don't produce and produce what we don't consume. The industrial sector is primarily for consumer goods and rely heavily on imported (and sometimes obsolete) technology as there is little domestic research, innovation and development. We lack a producer goods sector and most of our industries do not enjoy significant backward and forward linkages with other sectors in the economy. Our agriculture is largely dependent on imported machinery, equipment, technology and inputs. The majority of our farmers are engaged in small scale agriculture with low capital inputs and low productivity therefore low and declining incomes.

Our rural areas are largely ignored as sprawling slums continue to expand unabated in our urban areas. Many workers in urban areas eke out a living in the informal jua kali sector.

Poverty and disease persist and access to quality and relevant education continues to be a challenge for many of our people in spite of the independence promises of our founding fathers.

To deliver the Social and Economic Rights promised in Article 43 of the CoK 2010 we have to effectively tackle these challenges and transform Kenya into a modern industrialised, prosperous, inclusive and equitable society we must invest in a quality education that promotes lifelong learning opportunities for all.

THE PURPOSE OF EDUCATION

The purpose and uses of education in society depends largely on the person organising and providing it. It can be used to liberate and empower individuals and society or to control and dominate. One can distinguish what is should be used for and what it is actually used for.

Even though some view investment in education as wasteful spending on social welfare in fact it is perhaps the most important sector of the economy. Not only does it determine the quality of manpower in the economy it also creates a large number of quality jobs. Through research and innovation the sector also generates new knowledge giving rise to new products and processes in the economy. Probably with the exception of politics education is the most important driver of development, progress and prosperity. Above all else education is responsible for citizenship training and the transformation and sustainability of society.

A good quality education fosters rationality and nurtures the critical and creative abilities of the learners to power a dynamic and innovative economy and society. It must equip learners with capabilities that will liberate them from degrading and backbreaking material conditions and enable them to cope with the needs of today as well as the emerging and yet to be known challenges of tomorrow.

The best way to destroy a people or society is to give them substandard education. Education is therefore a contested domain within and between societies and nations. It can be a tool of liberation and empowerment or one deployed to control, dominate and exploit others in societies divided by caste, ethnicity, race and class.

Under those circumstances different segments of society are provided with different types of education such that some learners get a superior kind of curriculum while a majority get an inferior curriculum designed to turn out a pliable workforce suited for serving the master obediently. Where such discrimination is practiced the primary purpose of education is indoctrination. Invariably that is resisted by the victims.

Such was the case in colonial Kenya. Africans resisted this colonial education and set up independent schools and churches to provide an alternative that they deemed suitable for their needs.

They yearned for an education system that would bring academic parity among different racial groups.

As early as 1930s, some Africans wanted to build schools similar to those provided for white children.

For example one Amos Waweru is reported to have said: "Not until our children get degrees are we going to stop agitating for education".

EDUCATION IN COLONIAL KENYA: The Making of Education Policy for Subordination and Underdevelopment

The entry of colonialism and Christian missionaries heralded far-reaching changes in education in Kenya.

They introduced schooling and western mainly Christian education and changed what was taught, how it was taught, who taught, who taught, who was taught, where teaching took place and why such teaching was necessary. This also raised the question of how education was to be funded,i.e. who would pay for education.

The first mission school was introduced in Kenya at Rabai in Mombasa in 1846.

Early missionary education was focused on the conversion of Africans from traditional religion to christianity.

However, once the British took control and colonialism began to take root, especially after the railway line from Mombasa reached Kisumu, missionaries began to move into the interior and tentatively began to offer a rudimentary form of education,

whose primary purpose and goal was to teach basic literacy numeracy and the gospel to some converts who would be deployed in the mission of further evangelisation of the natives.

In due course (1908) the colonial state engaged the missionaries concerning the nature and type of education they considered acceptable for Africans. The settlers being mainly concerned with the availability of cheap labour were hostile to any education that would enlighten Africans. Ultimately they settled for minimal literacy, numeracy and practical vocational skills.

The colonial education system was thus racially segregated, hierarchical and discriminatory.

It provided separate and unequal education for the races.

Education for white children was much better resourced than that of African and Indian children.

White children were provided with better teachers and teaching and learning facilities, as well as much better boarding and catering facilities and services modelled on some of the best schools in Britain. They also enjoyed a better curriculum that would prepare them for positions at the top of the colonial pecking order in all sectors of the society.

Nevertheless with a rapidly changing international climate and the surging wind of change for decolonisation the colonial government hesitantly that began to prepare a few Africans to work with. Some of these would ultimately take over the reins of power as independence beckoned.

POST-INDEPENDENCE KENYA: Education and The Challenges of Nationhood and Modernisation

With decolonisation and the coming of independence there were great expectations that the colonial state and it's legacy of deprivation and destitution for Africans would be dismantled and a transformed political economy be built in its place.

Keenly aware of this challenge the government set up the Ominde Commission of 1964 to formulate new education policies, goals and strategies suitable for nation building in an independent and modernising nation. This commision recommend the establishment of an integrated non-racial national education curriculum for nation building and the production of manpower needed for national development.

Its objective was to introduce a single educational system to promote national unity and inculcate learners' desire to serve their Nation. The Commission supported the government's initiative to abolish racial segregation in schools and urged them to offer bursaries to African children so that they could join schools dominated by Europeans and Asians.

These period also witnessed the rapid expansion of self help Harambee schools and the creeping abandonment by government of provision of facilities and infrastructure in public schools to communities and parents. This entrenched the disparities inherited from the racist colonial model. Learners in these Harambee schools had to make do with whatever their poor parents could cobble together. This together with the availability of "A" Level schools in only a few advantaged parts of the country cemented the exclusion and disadvantages of the historically marginalised.

By the early 1970s there were more people graduating from the school system that could be accommodated in formal employment. This economic crisis was instead treated as an education policy failure. Thus began the push to review the curriculum and the structure of the education

system.

THE 8:4:4 CURRICULUM

The next major change was introduced by the Moi government in 1985 and was based on the recommendations of the Mackay Commission. It abolished the 7:4:2:3 system of education replacing it with the 8:4:4. Most significantly it abolished the A-Level education. Henceforth learners would go to university after form 4. This was to have a very significant impact on equity in the transition to university. For the first time secondary schools in all parts of the country could send students to university.

Additionally the 8:4:4 offered a broad based curriculum that also reintroduced practical and vocational craft subjects for every learner from early childhood. The was justified with the argument that those learners who were bound to drop out at the end of the primary and secondary cycles would be self-employed. This was apparently a remedy to the growing unemployment problem in the country.

This remedy were did not treat the malady.

The 8:4:4 lasted for 32 years and was the subject of a lot of criticisms and reviews so that mid-stream most of the practical subjects had been dropped.

Many critics worried about the cavalier manner in which it was introduced without the preparatory work and public consultations normally expected of such a significant change in public policy. Some argued that President Moi yearned for a return to the colonial education that fostered him while others saw it as a desire for a ruler from among those hitherto educationally marginalised seeking to redress the long standing historical wrongs.

Secondly it was introduced at a time of declining funding to the education sector precipitated by the austerity measures required by structural adjustment programmes (SAPs) imposed by the World Bank and IMF on Kenya. Consequently it could not get the required resources to fully realise it's goals.

As quality in government schools inevitably plummeted due inadequate staffing and resourcing the proliferation of private primary schools became a critical future of the primary school segment for parents and communities who could afford. This led to the domination of the few well equipped public high schools by students from private schools resulting in the restoration of the dominance of learners from advantaged backgrounds reoccupyng the bulk of the slots for university admissions.

Thirdly it looked more like a restoration of the racist colonial education philosophy that sought to pigeonhole Africans into menial tasks in the economy. Additionally it's vocational content veered towards imparting skills for disappearing lifestyles and occupations. In schools where technical subjects had been offered the power tools previously in use were replaced with hand tools. This was a curious innovation in an industrialising world. Probably this was the fulfillment of the 1972 ILO Report in the education sector that curiously recommended the mainstreaming of the jua kali sector as a model of development.

The Kibaki era saw the declaration of free primary education in 2003 and free day secondary education in 2008.

These were great initiatives that have been confronted with challenges of inability to provide a truly free and compulsory education as promised.

THE COMPETENCY BASED CURRICULUM: PROMISE AND PERILS

In response to the criticisms of the 8:4:4 system and in search of an answer to the development challenges facing the country in the face of a changing global environment the Competency Based Curriculum (CBC) was introduced in 2018. This new curriculum has put forth lofty ideals and proposes to rejig the way learners are taught, how they are assessed and the expected outcomes.

It promises to shift the focus from rote learning and accumulation of facts and knowledge to reproduce in tests and examinations to the development of learner competencies necessary for survival in a rapidly changing global environment.

It seeks to identify the learners abilities early to facilitate streaming so that each learners focuses on honing competencies that align better to their talents.

The mandatory basic education part of the curriculum starts at the pre-primary level when children are aged about 4 years and ends at grade 12 when he/she is about 18 years old.

CHALLENGES OF CBC

The new curriculum is facing many criticisms and challenges. Some of the challenges are concerned with how it was introduced and the process of implementation while others are concerned more with the theoretical and philosophical underpinings of the CBC.

It has been pointed out that like it's predecessor, the 8:4:4, the new curriculum was introduced without sufficient public participation and consultations with key stakeholders. The Kenya National Union of Teachers (KNUT), for example, were very critical of both the content and the process. In fact it took the deployment of force by the government to compel teachers to attend induction training programmes and to break the resistance.

It has also been pointed out that there is inadequate teacher preparation and re-skilling and that they don't understand the curriculum. Moreover it appears that teaching and learning resources are also a challenge especially in public schools.

Many parents have also complained about the cost and level of involvement expected of them in the out of class preparation of the learners. This is likely to lead to uneven outcomes between learners from poor families and those from well endowed families with.

More fundamentally the idea of streaming learners from early childhood is fraught with grave perils especially in the prevailing context of severe inequality in resource endowment among schools. Some critics have argued that far from delivering the promise the new curriculum may in fact marginalise learners from disadvantaged backgrounds.

The implicit suggestion that learners have innate abilities that can be identified in early childhood is of dubious validity. There are genuine fears that this curriculum may eternally condemn children from poor backgrounds to menial and backbreaking occupations at the bottom of the ladder further entrenching social disparities and growing inequality. This looks more like a return to the colonial philosophy of education which postulated that Africans are unteachable and should therefore be consigned to the hewing of wood and drawing of water.

THE QUEST FOR FREE COMPULSORY BASIC EDUCATION

The government introduced Free Day Secondary Education (FDSE) in 2008 and the CoK 2010 article 53(b) grants every child in Kenya the right to free and compulsory basic education (upto form four) and the Basic Education Act 2013 makes it mandatory for parents to take them to school.

Consequently enrolment rose from 2.0 million in 2013 to 2.7 million in 2017. The secondary gross enrollment ratio (GER)increased from 54.3% in 2013 to 69.0% in 2017 while the net enrollment ratio (NER)increased from 38.5% to 51.1% in the same period. The transition rate from primary to secondary also increased from 76% in 2013 to 86% in 2018. The total number of secondary schools increased from 8,034 in 2013 to 10,655 in 2017.

The struggle to achieve this goal is ongoing and it's achievement is constrained by widespread poverty and skewed regional availability of education infrastructure, teachers and teaching and learning resources.

UNIVERSITY EDUCATION IN KENYA

In 1947, the colonial government came up with a plan seeking to establish a technical and commercial institute in Nairobi.

At the same time, the Asian Community in Kenya was also planning to build a college as a memorial to Mahatma Gandhi. To avoid duplication the Asians agreed with the government to merge the Gandhi Memorial Academy with the Royal Technical College, Nairobi.

In 1949, the plan was expanded to Uganda and Tanzaniawith the aim of providing higher technical education in courses leading to the higher national certificate offered in Britain and to prepare the students for university degrees in engineering, and commercial courses not available in Makerere in Uganda. It admitted the first batch of students in april 1956 to become the first kenyan higher educational institution.

In 1958 the Royal Technical College was transformed into the second university college of East Africa, renamed the Royal College of Nairobi.

Following kenya's attainment ofindependence in 1963, the Royal College was elevated to the University College of Nairobi on 20 May 1964, following the establishment of the University of East Africa withMakerere, Dar-es-salaam and Nairobi as constituent colleges. This constituted the first step towards the introduction and development of university education in Kenya.

In 1970, the University of East Africa was dissolved and the University College of Nairobi was transformed into the University of Nairobi.

In this early period university education was for a small elite meant to fill the shoes of the departing colonial bureaucrats and expatriates in the parastals and private firms mainly subsidiaries of multinational corporations. By the beginning of the second decade of independence those opportunities were dwindling and would soon run out as the ruling elite failed to transform the economy and create new employment opportunities. At the same time the 1975 oil and financial crisis precipitated by OPEC began to bite causing an economic meltdown that brought the World Bank and IMF knocking with their austerity measures by the early 1980s.

These challenges were to see serious cuts in funding to public universities and severe decline in quality of facilities and staff remuneration and morale. The World Bank pontificated that governments should minimise funding to university education as it has higher private than social returns.

Moi University was established in 1984 by an Act of Parliament (Moi University Act, 1984) as the second public university in Kenya.

Since then Kenya has witnessed massification of university education has expanded greatly.

Just like was the case with secondary education the thirst for university education has seen the demand far outstripping the supply of vacancies funded by the government in spite of the rapid expansion of government investment in public universities.

Consequently families have pumped in private funding to give their children a university education. This massification saved the universities.

The expansion over the last three decades has been phenomenal. At present the sector comprises 74 institutions.The country has 31 chartered public universities, six public constituent colleges, 19 chartered private universities, five private university constituent

colleges and 13 universities with Letters of Interim Authority. Besides, there are four institutions approved for collaboration with universities in offering degree programmes.

The total population of students in the university currently stands at 510,000. It is projected that in the year 2029, when the first graduates of the CBC will enter the university, the number enrolling will have increased up to a total capacity of about 1.2 million.

This is a good trend that should be encouraged. However it is a good time to review the funding template to take into account the unit costs of producing a graduate different courses and provide adequate financing to agreed upon national manpower priorities. This would to address the financing, staffing and resourcing challenges that continue to bedevil our public universities which are the bedrock of our higher education industry. There is also need to review the curriculum and any pedagogical concerns in line with emerging trends to assure continuously improving quality and relevance. Even though some have argued that the future of industrialisation in Kenya lies in the establishment of technical and vocational education and training (TVET) the shortages of manpower at that level is not more severe than that at the engineering cadres level. It is easy to overlook the fact that the manpower required, as well as the knowledge and skills to be imparted at that level is generated in universities. Moreover literally all the infrastructure, equipment, tools and implements as well as products and processes that these cadres will work with,produce, operate and maintain are the products of the work of manpower prepared by universities. A modern society is inconceivable without universities unless we aspire to eternal dependence on foreign brains as we provide the brawn.

Universities are the primary drivers in the economics of knowledge, and are therefore expected to play a vital role in innovation and technology development especially in the emerging era of the fourth industrial revolution 4IR.

ENGINEERING EDUCATION FOR RE-ENGINNERING OUR INDUSTRIES

Engineering and technology education is critical for national development in the modern world. Everything that we use in the modern world has an engineering and technology input. The students of today will become the men and women who will be designing, producing, improving, and building our modern and fast-changing world. If we are to survive and thrive as a nation we must therefore invest heavily in quality and relevant engineering and technology education. This manpower will shape and reshape our society.

It is important that they are properly equipped to tackle today's challenges as well as envision and innovate for the future.

Because of the recognition of the great potential backward and forward linkages with other sectors of the economy Vision 2030 identifies manufacturing as a key economic pillar in the realisation of the Vision. Manufacturing also has the potential to create millions of new high quality jobs as well as increase high value exports not only the region but the rest of the world. The Vision purposes to invest in the development of basic manufacturing areas such as iron and steel, machine tools and spares, agro-machinery, automative and motor parts as well as farm inputs industries. Additionally it has prioritised textile and clothing, leather and leather products, paper and paper products and packing.

For us to achieve the dream we need to produce a large pool of high quality engineers and technologists that will not only provide the necessary manpower but also spearhead research and innovation that will underpin the innovations for industrialisation of all aspects of society. Our universities must be at the heart of this R&D and Innovation.

Regrettably in spite of the considerable investment we have made in higher education our investment in engineering education and training and is woefully inadequate resulting in very low output of engineering professionals. This is demonstrated by some 2011 data that compares the number of people per engineer for a selection of countries around the world. While Kenya had 6300 people per engineer, and South Africa 3166, China had 130, India 157, Brazil 227, Korea 285, UK 311, USA 389 and Malaysia 543. The conclusion that the huge investment in such a large pool of engineers is part of the explanation for the rapid industrial transformation and prosperity of countries such as China, India, Korea and Malaysia is inescapable.

It is instructive to note that in 1965 the Gross Domestic Product (GDP) per capita of South Korea was US$ 108 and Kenya's was US$ 104, while in 2020, the GDP per capita of South Korea had risen to US$ 31,489 as against Kenya's to US$ 1,838 only! Because Korea has twenty two times as many engineers as Kenya she has experienced incredible economic transformation to become a high-tech industrialized and prosperous economy driving modern technologies while the majority of Kenyans are engaged in low-tech agricultural and the informal jua kali sectors.

Clearly with the inadequate supply of engineers shown above our Vision 2030 will remain but a dream.To catch up with and surpass our contemporaries such as Korea we must rapidly raise our investment in science, technical,engineering and mathematics education and training in our universities

CHALLENGES FACING EDUCATION IN KENYA

As can be seen from the discussion above even though we have witnessed commendable expansion of education at all levels since independence we still face numerous challenges that we must surmount to ensure that education will drive industrialisation and deliver economic transformation and prosperity for all. We must therefore tackle the nagging challenges of access to all, transition, retention, equity as well as quality and relevance.

Even though the government has promised to ensure 100% transition to secondary there is little indication that it has committed sufficient resources to remove the bottlenecks that threatens the achievement of the goal. It is necessary to provide adequate staffing, physical facilities and teaching and learning resources for the increased numbers that are expected.

The university sector has also perennially grappled with similar challenges which are bound to get worse as the first CBC graduates enter university in 2029. There is little evidence to suggest that any serious planning is going on to provide for anticipated tripling of the students population in the next few years. If we do not adequately address the financing issue which is at the root of these challenges we shall continue to suffer shortages and congestion and risk declining quality of graduates. This is bound to have a worse impact in areas such as sciences, technology and engineering where laboratories workshops as well as individual and personal attention is necessary.

According to Commision for University Education 59 per cent male students were enrolled for Bachelor's degree programmes compared to 41 percent female students. Evidence also shows that majority of students enrolled in universities originated from Nairobi County (9.56 per cent) followed by Kisii (5.20 per cent) and Kiambu (4.68 per cent) counties. Others with notable representation were Uasin Gishu (4.51 per cent), Nyeri (2.62 per cent) and Murang'a (2.39 per cent). The counties that had the least representation of students were Mandera (0.13 per cent) followed by Wajir (0.14 per cent), Tana River (0.15 per cent), Lamu (0.15 per cent), Isiolo (0.20 per cent) and Marsabit (0.24 per cent).

The government must take deliberate steps to redress these inequities by removing all barriers to equitable access.

Of even greater significance to our industrialisation agenda is the inadequate funding for research, innovation and development. The government of Kenya has failed to fulfill it's commitment to mobilise at least 2% of the GDP annually to the National Research and Innovation Fund. Regrettably, as Professor Laban Ayiro recently observed in his Inaugural Lecture, Kenya presently spends only 0.1% of its GDP on research compared to South Africa at 0.76% and a global average of 1.77% of the GDP on research funding.

We urgently need to avail these funds to our universities and research institutions to enable them carry out the basic and applied research that will produce the knowledge and manpower required for innovation and industrialisation.
It is also necessary to formulate a comprehensive national research agenda and priorities to guide the venture.

We should also increase and expand technical universities to anchor the TIVET sector in the rapid escalation of manpower for industrialising Kenya.

CONCLUSION

We owe it to our children to give all of them, irrespective of their backgrounds, access to the highest quality education that will give them real choices in life and enable them to contribute to our development. They deserve an education that will liberate and empower them by bringing out the best in them and equipping them to be adaptable in a rapidly changing world. The prosperity of our economy, health of our democracy and future of the country depends on the education we offer them.

Such a system should be broad based and holistic and hone analytic, critical and problem solving abilities and skills. Our search for practical and technical skills should not temp us to assign some such roles and occupations to early. Let us not box them too early in a straight jacket that may condemn many of them to predetermined pathways that they may regret later on in life.

It is necessary to have a more open and robust conversation on the implications of the CBC to the future prospects of learners from disadvantaged backgrounds. Let us not unwittingly restore the colonial education framework in new guises.

As much as education is a crucial ingredient for development it is not the only determinant. Education policy is not a substitute for good political leadership and economic management. It is not responsible for a failed economy without jobs. The economy will definitely benefit from quality and relevant education but we must figure out how to grow an economy that delivers prosperity and decent jobs and other income earning opportunities.

Our education sector must contribute to that endeavour by producing many engineers to re-engineer our industrialisation pathway.

The maxim that "eternal vigilance is the price of liberty" is perhaps more relevant in Kenya today than wherever it was first said. For us to nurture our nascent democracy we require a well informed and educated citizenry that will robustly participate in public policy discussions and ensure that meaningful choices and decisions are made and carried out by government at all levels.

Finally let us take a keen interest in those we put in charge of our public policy and the public purse. I think that principled, ethical and visionary engineers can make a great contribution to re-enginnering our politics, public policy and the prudent application of our public purse. We deserve better.

Mr Kanundu is a former high school principal and county secretary

KENYATTA UNIVERSITY

Transforming Higher Education...Enhancing Lives

SCHOOL OF ENGINEERING AND TECHNOLOGY

HISTORICAL BACKGROUND OF THE SCHOOL OF ENGINEERING AND TECHNOLOGY

The School of Engineering & Technology had a humble beginning as a Department of Appropriate Technology Centre which was mandated to demonstrate the application of physics in solving day-to-day problems in the rural and urban areas of Kenya using locally available resources. Later it was upgraded to Department of Appropriate Technology (DAT) between 1985-2002 which finally graduated to become the current School of Engineering and Technology in 2008.

We started by offering degree programs in the areas of Civil Engineering, Energy Technology, Computing and Information Technology, Mechanical Engineering and Electrical & Electronics Engineering.

The school has grown to the current seven Departments with the addition of Gas and Petroleum and Agricultural & Biosystems Engineering Departments.

Three programs are already partially recognized and accredited by the Engineering Board of Kenya (EBK). The other four undergraduate programs have already been submitted for considerations will be accredited soon.

Notable achievement of the school includes graduating a large number of engineers in the various degree programs, establishment of new programs, participation in several conferences, workshops and seminars, competitions in different fields, partnering with other schools, universities, government agencies, private agencies, industry partnerships and even international organizations in the area of education, research and innovations. These initiatives have seen the school attracting funding for several school projects, scholarships and establishment of post graduate programs which are already at advanced stages and have already attracted several Masters and PhD students. The school has grown to become a centre of excellence that it is today, impacting positively both locally, regionally and internationally.

The School has received great support accorded to it the by the university management and other cooperating schools and departments.

The greatest strength is in the commitment and determination of our staff and students.

We produce graduates who are knowledgeable and skilled in their disciplines.

Some of the challenges we have faced as we developed the school include limitation of resources, both human and infrastructural.

PARTNERSHIPS, COLLABORATIONS AND SCHOLARSHIPS

The School played host in May to GIZ and FH Aachen University of Applied Sciences who visited for preparations on implementation of MoU on Biomedical Engineering. They are supplying laboratory equipment and giving support to Biomedical Engineering programme worthy over 40 million shillings.

GIZ, which is supporting the programme in a number of African countries, has strongly supported the programme development in Kenyatta University and has signed a memorandum of understanding with the University.

Kenyatta University recently signed an MOU with Kenya Electricity Transmission Company (KETRACO) and presented a cheque for Kshs 1m being full scholarship for two lady students to study engineering at KU.

Kenyatta University held the 3rd Deep Learning Indaba from 25th to 30th August 2019. During the INDABA, participants were taught, learned and debated the state-of-the-art in Artificial Intelligence and machine learning.

The mission for the INDABA was to strengthen Artificial Intelligence in Africa. The Nairobi Indaba attracted approximately 1000 guests from across the world. The holding of the INDABA in KU was a great opportunity for the University to gain world recognition as a leading University in the region.

Kenyatta University reaped immensely from increased international research visibility, financial inflows from the Indaba revenue, solidifying her position as a regional leader in technology innovation.

KENYATTA UNIVERSITY

Transforming Higher Education...Enhancing Lives

SCHOOL OF ENGINEERING AND TECHNOLOGY

Iowa State University (ISU) has collaboration with Kenyatta University that has taken three (3) students to pursue PhD degrees in Material Science and Civil Engineering.

Arizona State University (ASU) visited Kenyatta University in May 2018 and entered general collaboration agreement. During the April 2019 visit, a colloquium was organized where we made presentations on topics of Kenyan interest. Our presentation was on *"Mobile Network Coverage with rapidly Expanding Suburbs"*.

Staff and students in the Department of Gas and Petroleum have developed a project that allows for remote monitoring and control of wellheads from which a prototype has been developed. The project incorporates the latest technology such as machine learning for data analysis, embedded systems for data gathering and block chain technology for secure data transmission to the cloud. With this project, Kenya is leading in the current digital transformation in the oil and gas industry.

Staff in the department of Civil Engineering are collaborating with staff from Tartu University, Estonia, in implementing a project entitled "A carbon negative construction material – potential implementation in Africa" under the EU-Africa climate cooperation research grant.

Member of staff of the School from the Department of Gas and Petroleum Engineering was awarded scholarship for PhD programme under the World Bank African Center of Excellence in Oilfields Chemical Research (ACE-CEFOR) at Port Harcourt University.

Also a member of staff from the Department of Energy Technology in collaboration with one from Physics Department won a four-year collaborative Research Grant worth 12 Million Danish Kroner on Widespread use of Geothermal Energy in East Africa. This includes training of 2 Ph.D students in the Department.

The School of Engineering and Technology is reviewing its curricula for engineering programmes in collaboration with other universities and liaising with the industry players. We are also working on postgraduate Masters and PhD programmes where we recently held a stakeholders workshop to address concerns from different players in the engineering industry, academia as well as Government Institutions. The programmes will then be taken to the Senate for ratification and Commission for University Education (CUE) for approval

INNOVATIONS

1. TIBA Vent, a mechanical ventilator and a direct innovation of the School of Engineering and Technology, was recently approved by the Pharmacy and Poisons Board which makes it recognized nationally and internationally. The next step will be clinical trial after which mass production will begin. TIBA-VENT ventilator which has put Kenyatta University on a global map, has a team of 15 who have been honored by His Excellency, The President of Republic of Kenya with Head of State Commendation (HSC) medal. The team has also been recognized by United Nation as "UN Persons of the Year 2020" for the same invention and by IEEE KU Students Branch where they were awarded the IEEE Chapter of the Year Award.
2. Smart Detector Access Systems used for access control where it detects whether one has won a face mask and has the recommended temperature before being allowed entry into a building.
3. Ugali Maker for which the team won Kshs. 300,000/= from the Vice-Chancellor's Research Grant.
4. Solar Drier System under incubation at Chandaria.
5. KU CUBESat Project sponsored by Kenya Space Agency (KSA) for which the project won 1,000,000/=.
6. Smart Watch Project for detection of oxygen levels and temperate to combat COVID 19
7. Commenced a start up called AFEX which is an organization using engineering & technology to solve societal problems.
8. Hand wash machine which has helped immensely during the COVID 19 pandemic

CONFERENCES

1. We recently participated in KIPPRA conference held at the Bomas of Kenya to showcase our innovations.
2. IEEE power Africa Conference 2021 23rd to 27th August, 2021 sponsored by IEEE.
3. Kenya Space Agency capacity building workshop.
4. IEEE Globecom conference 2019 in Hawaii
5. IEEE ASYP (Africa students and yung professionals Congress) 2019
6. IEEE Power Africa Conference 2020
7. IEEE Engineering Festival 2020
8. IEEE Engineering Festival 2021
9. IEEE Global Deans Conference 2020

SCHOOL OF ENGINEERING & TECHNOLOGY PROGRAMMES

S/No	DEPARTMENT	PROGRAMME
1.	Mechanical Engineering	BSc(Mechanical Engineering)
		BSc(Aerospace Engineering)
2.	Civil Engineering	BSc(Civil Engineering)
3.	Agricultural Biosystems	BSc(Agricultural Biosystems)
4.	Electrical& Electronic Engineering	BSc(Electrical& Electronic Engineering)
		BSc(Biomedical Engineering)
5.	Gas& Petroleum	BSc(Gas& Petroleum)
6.	Energy Technology	BSc (Energy Technology)
		Msc(Renewable Energy Technology)
		PHD (Renewable Energy Technology)
7.	Computing Information Technology	BSc(Computing Science)
		Diploma in Information Technology
		Bachelor of Information Technology
		Bsc (Applied Computer Science)
		MSc (Computer Science)
		PHD (Computer Science)

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Let the Kenyan Varsities Revamp how they Teach Engineering

By Dr. Eng. Victor M Mwongera

THE Engineering profession has always been something to aspire to; a course that takes only the crème de la crème of students. Only the highest performing students in Kenya get a chance to train for five years to graduate as engineers.

In this training, there is a crucial aspect that we must continue to examine; the teaching of our young engineers within the universities. An engineering student studies for five years in whatever field they choose: the first two of these years are spent on units that tend to cross cut almost all engineering disciplines. This is a practice that was once popular across many institutions globally. However, engineering disciplines have continued to evolve, grow and specialise.

Take for example mechanical engineering. Over the last 100 years, the mechanical engineer's career prospects have grown to include the design of cars, airplanes, ships, industrial machines, building works, robotics, ventilation and refrigeration systems, farm equipment and many more areas of design that are too numerous to list here.

In fact, mechanical engineering has become so broad that many universities have moved to make this a school of its own, with many departments each of which has many programmes within it. The same can be said for most of the traditional engineering fields such as civil, electrical, agricultural and computer engineering.

> For us at icolo.io, this new data centre is a true landmark project," says Ranjith Cherickel, co-founder and CEO at icolo.io. "Not only is it the very first carrier neutral co-location site in Kenya, it also acts as the main gateway to Africa from a connectivity perspective.

Dedan Kimathi University of Technology engineering students prepare for an international competition in August 2021. The institution has been keen on hands-on training to deliver quality professional engineers.

In Kenya, however, we still hold on to these degrees as the standard for engineering programmes; so much so that a university is unlikely to be accredited as an engineering institute without them. And with the industry continuously evolving, the result is engineering graduates with general training in multiple engineering disciplines who are not able to work in the specialised industries that wait for them.

As a fraternity, we need to examine this and find a way to review and recommend a modified method of training students, a recommendation that needs input from all stakeholders, not just academics. We need to look at how our counterparts in other institutions are training their students, especially those that have a high employment rate in the industry.

We need to determine the practices that make our programmes strong, and those that we find outdated. We need to accept that the world keeps changing, and that we need to change with it. And we need to accept that continuous reform of our programme structures is not a vice, but a virtue.

Dr. Eng. Victor M Mwongera is Chairman, Department of Mechanical Engineering, School of Engineering & Technology, Kenyatta University

Members of IEK Editorial Board, led by Chairman, Eng. Prof. Lawrence Gumbe (second right) after a meeting with University of Eldoret DVC, Planning, Research and Extension, Prof Phillip Raburu (third right) and Dean School of Engineering, Dr. Clement Kiptum (right), at the institution in August 2021.

University Education and Research Principal Secretary, Amb. Simon Nabukwesi, and University of Eldoret Vice Chancellor, Prof. Teresa Akenga, during the 9th Graduation Ceremony on August 26, 2021.

University of Eldoret Reviews Academic Programmes

THE University of Eldoret has harmonised its programmes from 53 to 32 to meet the guidelines set by the Commission for University Education (CUE) and the Ministry of Education.

According to Deputy Vice-Chancellor (Planning, Research and Extension), Prof Phillip Raburu, the harmonisation of programmes has been crucial in positioning the university as a premier institution offering training in Science, Agriculture, Aquaculture and Innovation.

The streamlining of the programmes, which is currently ongoing in all universities across the country, also affected University of Eldoret's School of Engineering, which was only established in 2011. The school has three departments namely; Agricultural and Biosystems Engineering; Civil and Structural Engineering; and Mechanical Production Engineering.

"Currently, the school has a total student population of around 500 in both undergraduate and graduate programmes, with over 50 members of staff, giving a student ratio of 1:10, which is what is stipulated in the Universities Standards and Guidelines PROG/STD/17," said Prof Raburu.

He was speaking when the Institution of Engineers of Kenya (IEK) Editorial Board, led by Chairman Eng Prof Lawrence Gumbe, paid a courtesy call at the University of Eldoret Vice-Chancellor's office on August 11, 2021. Prof Raburu represented Vice Chancellor Prof Teressa Akenga in the meeting.

"Our members of staff are all registered by Engineers Board of Kenya (EBK) and IEK as graduate members and above. The Dean-SENG (Eng. Dr. Clement Kiprotich) is the treasurer of IEK-western Branch and this shows our commitment to collaborating with IEK," said Prof Raburu.

He said the university's engineering lecturers participate in IEK activities and the institution pays annual membership subscription fees, adding that the university has sponsored Faculty members to attend conferences organised by IEK.

The university's Engineering programmes are accredited by both EBK and CUE, with the latest programmes to be accredited being Bachelors in Mechanical and Production Engineering and Bachelors in Civil and Structural Engineering on February 14, 2020. The Bachelors in Agricultural and Biosystems Engineering was accredited on March 29, 2018.

"This clearly highlights our compliance to EBK and CUE guidelines when it comes to the programmes we offer. This has ensured that our declared capacity in these programmes are fully taken up by students pursuing engineering courses. Our graduates since 2012 have been registering by both EBK and IEK as graduate members and hopefully in one or two years we expect them to be corporate members in IEK and professional engineers with EBK," said the DVC.

The university has constructed a modern Engineering workshop and bought state-of-the-art equipment for its students, which has kept them abreast with happenings within the Engineering field, and also improved their hands-on experience.

"Irrespective of the strides we have gained, it is still clear that our school is young when compared to other already established schools such as the one in the University of Nairobi. Thus, this calls for mentorship and cooperation in terms of research, consultancy and innovation," said Prof Raburu.

"More so, we would like the IEK fraternity to assist the school get attachment places and internship opportunities for our students and graduates in various organisations."

He is confident that a close collaboration with the engineering fraternity is likely to open doors to mutually beneficial opportunities for students, industry and academic staff. He said collaboration with various organisations such as Kenya National Highways Authority (KeNHA) for equipment donation, resources and financial assistance will help improve the status of the School of Engineering.

"This University Management has the interest of engineers at heart, and we call upon IEK to also reciprocate so that we can have a cordial relation, as we strive to strengthen the level of Engineering in the country and the region at large," said Prof Raburu.

4TH IEK WOMEN ENGINEERS SUMMIT

Monday 8th November 2021

'POWER OF DIVERSITY'

For further information on the conference please visit our website: **www.iekenya.org** and/ or contact our Secretariat on email **iek@iekenya.org** OR **+254 20 2729326, +254 721 729 363**

Payment Mode

1. Direct Deposit to Standard Chartered Bank, Kenyatta Avenue Branch- Institution of Engineers Account No. **0102024134900**.
   Email the payment slip to the IEK Secretariat: iek@iekenya.org
2. Deliver the cheque to IEK Secretariat Offices at Top Plaza; Cheque addressed to **The Institution of Engineers of Kenya**
3. MPesa **Paybill No 976295**, Account - your name e.g. **An Other**

Registration Link: visit; *www.iekenya.org*

Eng. Rosemary Oduor, Kenya Power acting Managing Director

IEK Congratulates Eng Oduor for Appointment as Kenya Power Boss

By EiK Correspondent

THE Institution of Engineers of Kenya (IEK) has congratulated Eng Rosemary Oduor following her appointment as Kenya Power acting managing director.

The Board of Directors of the Kenya Power and Lighting Company (KPLC) appointed Eng Oduor to steer the parastatal with effect from August 3, 2021, following the resignation of Mr Bernard Ngugi.

"Congratulations to Eng. Rosemary Oduor on her appointment as the Ag. Managing Director & CEO of Kenya Power & Lighting Company. As the Institution of Engineers of Kenya, we have great confidence in her capability to steer the company to greater heights. Hongera!" IEK said in its message.

Eng Oduor replaces Mr. Ngugi, who has been the MD since 2019. Ngugi has worked in the company for over 32 years.

"On behalf of the Board of Directors, I take this opportunity to thank Mr. Bernard Ngugi for his dedicated service to the Company, and wish him all the best in his future endeavours," said Vivienne Yeda, Board of Directors Chairman.

Eng Oduor holds a Bachelor of Technology degree in Electrical and Communications Engineering from Moi University and Master of Business Administration from the University of Nairobi. She is a registered professional engineer with the Engineers Board of Kenya (EBK).

She has a wide experience in power engineering and management, having joined Kenya Power in 1991 and served in various senior positions. Prior to her appointment, she was the company's general manager in charge of commercial services and sales.

"The Board of Directors would like to assure all Kenya Power's stakeholders that our priority remains the successful implementation of the growth strategy in order to place the Company firmly on the path towards sustainable profitability," said Eng Oduor.

She takes over at a time Kenya Power has rolled out a smart metering project that will benefit 55,000 customers in the Small and Medium Enterprise sector across the country.

The Ksh1.25 billion World Bank-funded project is part of the Kenya Electricity Modernisation Project and is slated to be completed by June 30 next year.

The smart meters are part of an advanced metering infrastructure that facilitates a two-way communication between the company and the customer.

In case of any outage, the smart meters are able to communicate directly with the company's national contact centre, which facilitates immediate resolution and enhances efficiency as the Kenya Power teams are alerted promptly. Additionally, the smart meter also sends a notification to the customer via SMS.

UoN Opens Arms to Collaboration with the IEK

By EiK Correspondent

THE University of Nairobi (UoN) has welcomed collaboration with the Institution of Engineers of Kenya (IEK) in industrial mentorship for engineering students, workshops, webinars and knowledge exchange.

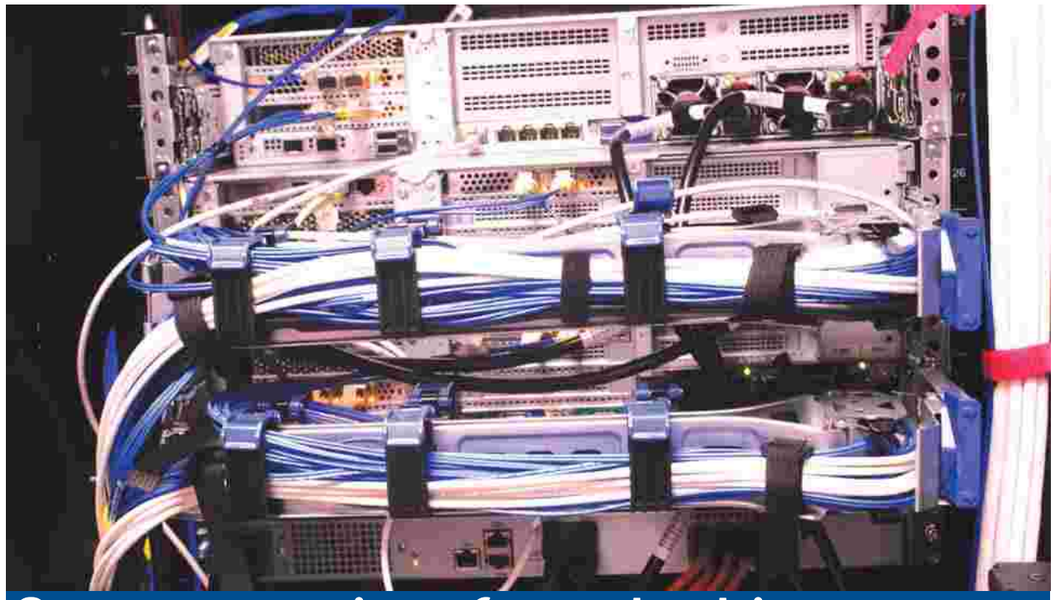
Speaking during a meeting with IEK President Eng Nathaniel Matalanga, UoN Deputy Vice Chancellor in charge of Academic Affairs, Prof Julius Ogeng'o, lauded efforts by the IEK in promoting professional development and welfare of engineers in the country.

"The University of Nairobi boasts the bulk of senior engineering fraternity professionals currently serving in Kenya and we are proud that our alumni are making significant contribution to economic development in Kenya," said the DVC, who was standing in for Vice Chancellor Prof Stephen Kiama.

This year, the IEK leadership graced a mentorship event at the invite of University of Nairobi Engineering Students Association (ESA). The event was attended by Eng Matalanga and IEK Honorary Secretary Eng. Margaret Ogai.

The ESA forum was used to discuss engineering students' mentorship and capacity building, and it allowed the engineer trainees in attendance to draw practical experience.

Members of IEK Editorial Board, led by President, Eng. Nathaniel Matalanga (right), at a meeting with University of Nairobi Deputy Vice Chancellor, Academics, Prof. Julius A Ogeng'o (below, right) in August 2021.



State agencies, fees the biggest obstacle to broadband connectivity

THE importance of broadband technologies in society is well known and the benefits widely proven and accepted both in Kenya and across the world. These technologies are essential as they help facilitate every facet of economic and social life through enhanced connectivity.

Deployment of fiber optic networks is a key ingredient to actualise access to the high-speed broadband services that society needs to function efficiently. Governments and policymakers all over the world have attempted to contribute to the construction of fiber optic networks in order to help accelerate the penetration of broadband technologies. The Government of Kenya, for example, has invested enormously in the construction of major routes connecting all county headquarters. Early stages of a co-build strategy to build inter-city fiber optic networks with the Kenya National Highways Authority (KeNHA), where fiber optic duct network infrastructure is laid by the authority, is already showing promising results.

State-owned enterprises such as Kenya Electricity Transmission Company (Ketraco) have also made significant contributions to the fiber kilometres available in the country, especially in the backbone inter-city networks. This is in addition to early deployments of backbone networks by private sector players.

However, the massive efforts made and the expenditures incurred over the past 15 years have not yielded corresponding results. Fixed broadband connections stand at a paltry 609,611. Mobile broadband usage is quite impressive at an average of 2 GB per mobile broadband subscription per month in 2020 – although this figure is far below the impression many have of Kenya being a mobile technology powerhouse (Finland is at 31 GB).

Moreover, broadband usage is increasing at a phenomenal rate – now at 3.5 times they were five years ago. It is expected to increase further, with more demand and much more devices getting connected. I have pointed out below three items that are hindering our progress towards ubiquitous broadband. But first let me explain an important concept – right of way is always touted as a major challenge.

Rights of way is an easement granted by a property owner, such as a public roads authority or a county government, to service providers to make reasonable use of the property as long as this use is not inconsistent with the primary function of the property. Road networks serve the primary purpose of facilitating safe and convenient travel. The road corridor also carries utilities that are essential for the functioning of modern societies. Typically, a local authority would grant service providers a wayleave or a right of way to build infrastructure on the road corridor. This infrastructure does not affect the primary objective of the road in any way.

Service providers face three major obstacles in the deployment of fiber optic networks – the backbone of the broadband technologies. These are, regulations and right of way and their associated costs; destruction of infrastructure by public authorities; and incompetence in the deployment, operation and maintenance.

Providers wanting to lay fiber must deal with at least two public authorities for permits and approvals: county governments and at least one roads authority – KeNHA, Kenya Urban Roads Authority (KURA) or Kenya Rural Roads Authority (KeRRA). In addition, they might have to face Kenya Railways and/or Kenya Pipeline Company. Each one of them demands fees and the approval takes time – at least weeks or even months.

The fees are typically not related to any cost of providing a service and sometimes can be ridiculously high. I have been asked to pay Ksh900 million as wayleave fees for an infrastructure whose total estimated costs of deployment would be less than Ksh600 million. The defunct City Council of Nairobi and the former Ministry of Roads and Public works had developed reasonable costs for rights of way based on costs associated with cutting of roads and pavements. In addition to this, they assumed certain obligations in terms of protecting the infrastructure and managing the safe use of the rights of way by multiple service providers.

With the advent of the new Constitution, the Nairobi County government inherited the fee structure of Nairobi City Council and only increased the pricing while abdicating any responsibility of managing the wayleave. Some other counties copied the Nairobi structure and merely changed the fees payable. These fees are arbitrary and not reflective of any service provided or costs related to contractor activities. For example, these days, contractors do not cut roads. They use drilling techniques both for crossing roads and even parallel bores along the highways – techniques that require little or no reinstatements. KeNHA still charges deposits to be refunded "upon satisfactory … reinstatements".

Such cut-and-paste approach to rule making means there is no anticipation of new technologies and new methods of construction. While other countries are exploring technologies such as micro-trenching, KeNHA directs that service providers lay their infrastructure at "the extreme end of the road reserve" with no glimmer of hope that new lower cost methods may be considered now or in the future.

Interestingly, while tough rules have been imposed with their attendant long approval processes, there is very weak enforcement. The intersection of tough regulations and weak enforcement leads naturally to all kinds of monkey business, which happens routinely. This brings me to my third point: incompetence in deployment, operations and maintenance.

If you live in Nairobi, there is a real possibility that you might trip over a fiber optic cable. Fiber is everywhere – in gaping manholes, hanging from poles, trees and strewn all over the roadsides without any regard to any deployment standards.

Yet, building optical fiber networks is a serious engineering undertaking that requires detailed planning and design, considered deployment techniques and with a keen consideration of operations and maintenance over the lifetime of the network. It is similar to the electricity transmission and distribution networks – the only difference being that fiber cables do not carry dangerous voltages. In Kenya, however, if you can raise enough money to purchase a mattock and a high visibility jacket, you are welcome to build fiber networks. The result has been total chaos.

Countries all over the world are working towards ubiquitous broadband for their populations. Kenya is no exception. Yet, to achieve widespread and cost effective connectivity for the entire population is not an easy task.

THE TECHNICAL UNIVERSITY OF KENYA

MODULE II PROGRAMMES
UNDERGRADUATE AND DIPLOMA

STARTING OCTOBER 2021

THE Technical University of Kenya (TU-K) is the leading university in technological education and training in Kenya. The University was awarded a Charter in 2013, making it a fully-fledged public university. The University specialises in training at the Postgraduate, Undergraduate and Diploma levels, while at the same time engaging in research. It has a clear student upward movement policy, which makes it easy for students to move from one level of training to the next, and recognise prior training by awarding students credit transfers. The University has developed and implemented a digitised and completely paperless student applications process; from application to registration. Students are therefore, advised to make their applications on-line for the programmes in the following academic units:

COURSE TITLE
Faculty of Engineering and The Built Environment
School of Architecture and Spatial Planning
Bachelor of Architectural Studies/Bachelor of Architecture
Diploma in Technology (Architecture)
School of Aerospace and Vehicle Engineering
Bachelor of Engineering (Aeronautical Engineering)
Diploma in Technology (Aeronautical Engineering Technology)
Diploma in Technology (Mechanical Engineering Technology): Automotive and Autotronic Engineering option
School of Chemical and Biological System Engineering
Bachelor of Engineering (Chemical Engineering)
Bachelor of Engineering Technology (Chemical Engineering Technology)
Diploma in Technology (Chemical Engineering Technology)

COURSE TITLE
School of Construction and Property Studies
Bachelor of Built Environment (Construction Management)
Bachelor of Quantity Surveying
Bachelor of Technology (Building Construction)
Bachelor of Technology (Building Construction)
Bachelor of Real Estate
Diploma in Technology (Real Estate)
Diploma in Technology (Quantity Surveying)
Diploma in Technology (Construction Management)
Diploma in Technology (Building Construction)
School of Civil and Resource Engineering
Bachelor of Engineering (Civil Engineering)
Bachelor of Engineering Technology (Civil Engineering)
Diploma in Technology (Civil Engineering)
School of Electrical and Electronic Engineering
Bachelor of Engineering Technology (Electrical and Electronic Engineering Technology)

COURSE TITLE
Diploma in Technology (Electrical and Electronic Engineering)
School of Mechanical and Manufacturing Engineering
Bachelor of Engineering (Mechanical Engineering)
Bachelor of Engineering Technology (Mechanical Engineering Technology)
Diploma in Technology (Mechanical Engineering Technology): • *Manufacturing Engineering • Industrial Plant and Energy Engineering • Structural Fabrication and Metallurgical Engineering • Refrigeration and Air Conditioning Engineering • Mechatronic Engineering*
School of Surveying and Geospatial Sciences
Bachelor of Engineering (Geospatial Engineering)
Bachelor of Applied Science (Geospatial Information and Communication)
Bachelor of Technology • *Surveying Technology • Geo-information Technology*

COURSE TITLE
Bachelor of Science (Land Administration)
Diploma in Technology in: • Geo-iformation Technology • Surveying Technology
Faculty of Applied Sciences and Technology
School of Biological and Life Sciences
Bachelor of Technology (Applied Biology)
Bachelor of Technology (Biotechnology)
Bachelor of Technology (Food Science and Technology)
Bachelor of Science (Biochemistry)
Bachelor of Technology (Science Laboratory Technology)
Diploma in Technology (Science Laboratory Technology)
Diploma in Technology (Industrial and Applied Biology)
Diploma in Technology (Biotechnology)
Diploma in Technology (Biochemistry)
Diploma in Technology (Ecology and Conservation Biology)
Diploma in Technology (Food Science and Technology)
School of Computing and Information Technology
Bachelor of Technology (Information Technology)
Bachelor of Technology (Computer Technology)
Bachelor of Technology (Communication and Computer Networks)
Bachelor of Technology in: • *Computer Technology • Information Technology* • *Communication and Computer Networks.*
Diploma in Technology (Information Technology)
Diploma in Technology in: - • *Computer Technology • Communication and Computer Networks*
School of Chemistry and Material Science
Bachelor of Technology (Industrial and Applied Chemistry)
Diploma in Technology (Analytical Chemistry)
Diploma in Technology (Industrial Chemistry)
School of Health and Biomedical Sciences
Bachelor of Technology (Community Health and Wellness)
Diploma in Community and Public Health
Diploma in Technology (Health Records & Information Technology)
Bachelor of Science (Nutrition and Dietetics)
Bachelor of Technology (Nutrition and Dietetics)

COURSE TITLE
Diploma in Nutrition and Dietetics
Diploma in Pharmaceutical Technology
School of Mathematics and Actuarial Science
Bachelor of Technology (Applied Statistics)
Bachelor of Science (Mathematics)
Diploma in Technology in: - • *Applied Statistics • Actuarial Science*
School of Physics and Earth Sciences
Bachelor of Technology (Technical and Applied Physics)
Bachelor of Technology (Environmental Science)
Diploma in Technology (Environmental Resource Management)
Diploma in Technology (Technical and Applied Physics)
Faculty of Social Sciences and Technology
School of Business and Management Studies
Bachelor of Science (Accountancy)
Bachelor of Commerce: • *Accounting • Business Administration • Finance • Human Resource Management • Insurance • Logistics and Supply Chain Management • Marketing*
Bachelor of Business Studies: • *Business Administration • Human Resource Management • Logistics and Supply Chain Management • Sales and Marketing Management*
Bachelor of Economics
Bachelor of Technology (Business Information Technology)
Bachelor of Technology (Office Administration and Technology)
Diploma in Business Information Technology
Diploma in Entrepreneurship
Diploma in Business Studies: • *Business Administration • Human Resource Management* • *Sales and Marketing Management* • *Procurement and Supply Chain Management*
Diploma in Accountancy
Diploma in Office Administration: • *Legal Secretarial • Medical Secretarial • Business Secretarial • Foreign Language Secretarial*
School of Creative Arts and Media
Bachelor of Technology (Design)
Diploma in Technology in Design
Bachelor of Technology (Journalism and Mass Communication)
Diploma in Technology (Journalism and Mass Communication)
Bachelor of Music

COURSE TITLE
Diploma in Music
Bachelor of Technology (Printing Technology)
Bachelor of Philosophy in Technology (Printing)
Diploma in Technology (Printing)
School of Hospitality and Human Ecology
Bachelor of Science in Tourism and Travel Management
Bachelor of Technology in Tourism and Travel Management
Bachelor of Science in Hospitality Management
Bachelor of Technology in Hotel and Restaurant Management
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Engineering Education – Integration and Interdisciplinarity

SOUND and wholesome engineering education is an important criterion for entry into the engineering profession, and also affects the economic and industrial growth of a country. This means that there is a demand for engineering education to produce graduates who have a wide range of skills, attributes and knowledge that would allow them to meet the minimum standard of skills, attributes and knowledge of an entry level expectation of a prospective employer.

Originally signed in 1989, the Washington Accord, is a multi-lateral agreement between bodies responsible for accreditation or recognition of tertiary-level engineering qualifications within their jurisdictions who have chosen to work collectively to assist the mobility of professional engineers. The Washington Accord is specifically focused on academic programmes which deal with the practice of engineering at the professional level. The Accord acknowledges that accreditation of engineering academic programmes is a key foundation for the practice of engineering at the professional level in each of the countries or territories covered by the Accord.

The Engineers Board of Kenya is being mentored towards acceding to the Washington Accord and one of the critical functions that the Board has to align its processes to global best practice is on accreditation. Based on the standards set for engineering education by the Washington Accord, at the point of graduation, a graduate engineer from an accredited engineering course must possess the following graduate attribute profile: -

a) Engineering Knowledge: application of knowledge of mathematics, natural science, engineering fundamentals and engineering specialization to solve engineering problems;

b) Problem Analysis: identification, formulation, research and analysis of engineering problems to reach substantiated conclusions using principles of mathematics, natural sciences and engineering sciences;

c) Design/Development of Solutions: designing solutions for engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations;

d) Investigation: conducting investigations of problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;

e) Modern Tool Usage: creation, selection and application of appropriate techniques, resources and modern engineering and IT tools, including prediction and modelling, to engineering problems, with an understanding of the limitations;

f) The Engineer and Society: application of reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to engineering problems;

g) Environment and Sustainability: understanding and evaluation of the sustainability and impact of professional engineering work in the solution of engineering problems in societal and environmental contexts;

h) Ethics: application of ethical principles and commitment to professional ethics and responsibilities and norms of engineering practice;

i) Individual and Team Work: functioning effectively as an individual, and as a member or a leader in diverse teams and in multi-disciplinary settings;

j) Communication: Communicating effectively on engineering activities with the engineering community and with society at large,such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions;

k) Project Management and Finance: Demonstration of knowledge and understanding of engineering management principles and economic decision-making and apply to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments; and

l) Lifelong Learning: recognition of the need for, and have the preparation and ability to engage in independent and life long learning in the broadest context of technological change.

For an engineering programme to graduate a student with the above defined profile, there is need to have an integrated engineering curriculum whereby a full range of skills and knowledge and the ability to put it into practice is contained together. The integrated engineering curriculum encourages students to bring together multiple ideas and concepts to develop a solution to a problem or gain an understanding of a problem that goes beyond a single perspective. This would require heavy involvement of industry in the development of engineering curriculum. More often than not, solving engineering problems requires insights of two or more academic disciplines. Introduction of interdisciplinarity into engineering education would require the crossing of 'traditional boundaries' between academic disciplines to address new and emerging issues.

To achieve the above, engineering education needs to lean towards outcomes based education (OBE) whose learning benefits include enhanced problem-solving skills, increased creativity and criticality, independent learning, development of team and communication skills, and alignment to industry and professional demands. OBE is generally characterised as an active learning technique which requires critical linkages between academia and industry to be created which will give the student the opportunity to put into practice their technical and theoretical knowledge while at the same time enhancing a wide range of professional skills and also broadening their understanding of the societal context in which their solutions will operate.

Section 7(1)(l) of the Engineers Act 2011 mandates the Board to 'approve and accredit engineering programs in public and private universities and other tertiary level educational institutions offering education in engineering', in conjunction with other key stakeholders in the development and delivery of engineering education in Kenya. Following the mentorship the Board is undergoing to accede to the Washington Accord, one of the requirements is to accredit engineering programmes based on an outcome based engineering education framework which will equip engineering graduates with not only theoretical principles of their discipline but the necessary problem-solving and communication skills to enable them to work in multi-disciplinary teams, understand the context of the problems they address and appreciate the ethical, societal, and financial connotations of their design decisions.

Key players in engineering education must come together to ensure that delivery of engineering education that aligns to industry's and the profession's requirements for the supply of 21st century graduate engineers with the expected global graduate engineer attributes. There is need for more involvement of critical stakeholders in engineering education programme design, programme curriculum content, faculty staff establishment, institution's training facilities and infarastructure and quality assurance that would deliver wholesome engineering education that has elements of integration and interdisciplinarity.

Isuzu EA Managing Director Rita Kavashe with EBK Chairman, Eng. Erastus Mwongera, during a visit to Isuzu Assembly Plant.

Participants at the recently concluded NACOSTI STI Conference in Naivasha.

Conference calls for increased funding for research, innovation

By EiK Correspondent

SCHOLARS and speakers at the recent multi-sectoral conference on Science, Technology and Innovation (STI) have called for increased funding for STI research activities in Kenya, saying this will bring positively impact the GDP.

The August 2021 STI conference was the first of its kind convened by the National Commission for Science, Technology and Innovation (NACOSTI) and National Research Fund (NRF).

The NRF acting CEO, Dr Jemimah Onsare, said increased research funding is key to achieving national economic goals. Research funding currently constitutes 0.8 per cent of Kenya's Gross Domestic Product (GDP).

Education Cabinet Secretary, Prof George Magoha, commended the first national multi-sectoral STI conference.

"Grade 4 and 5 children are already being introduced to robotics in the new curriculum. NACOSTI, universities and research institutions are encouraged to work in synergy to come up with scientific solutions to Covid-19," said Prof Magoha.

Higher Education and Research Principal Secretary Simon Nabukwesi said the Ministry of Education is actively looking into the issue and will engage political stakeholders and policymakers towards ensuring the two per cent threshold is achieved.

"We preach a lot about achieving 2% of GDP being allocated towards funding scientific research, technology and innovation but there has been very little action forthcoming. This is why we are now actively engaging with the political leadership and policymakers to realise this," said Amb Nabukwesi.

NACOSTI Director General, Prof. Walter Oyawa, affirmed the institution's mandate to oversee higher education scientific research, saying Kenya's Constitution is clear on the role of the agency as the scientific research and innovation regulator.

> All players in the ST&I ecosystem are urged to come together to provide solutions for the current problems facing the country as discussions are ongoing to improve ST&I funding," he said.

"As per the Science, Technology and Innovation Act Section 12, NACOSTI is mandated to approve all scientific research in Kenya and the Legal Notice No. 108 provides mechanisms for licensing research," said Prof Oyawa.

He delivered a keynote presentation on 'The Regulatory and Institutional Framework Governing the Science, Technology and Innovation Sector in Kenya'.

"All players in the ST&I ecosystem are urged to come together to provide solutions for the current problems facing the country as discussions are ongoing to improve ST&I funding," he said.

NRF Data showing funding of Research by the Exchequer.

According to University of Eldoret lecturer, Prof. David Some, the country stands to gain more returns on investment if significant strategic funding is pumped into STI research.

"For every 1% investment of funding in research, you get a return of seven times in research output/ impact. There should be an increase in research funding to 2% of GDP and a possible merger of the funding bodies to ease the research funding process," said Prof Some.

NACOSTI Director General, Prof. Walter Oyawa

University Education PS, Amb. Simon Nabukwesi

23 Institutions Registered to do Research as NACOSTI Calls for More

ByEiK Correspondent

A TOTAL of 23 institutions have been registered to conduct Science, Technology and Innovation (STI) research in Kenya, the National Commission for Science, Technology and Innovation (NACOSTI) has revealed.

NACOSTI Director General, Prof Walter Oyawa, said of the 23 institutions, 11 are registered to undertake research in agricultural and natural resources in line with President Uhuru Kenyatta's food security pillar of the Big 4 Agenda. Research in earth and space science however still holds a huge potential with no institution registered yet.

Prof Oyawa said Kenya still has immense potential to grow and expand in STI research, and opportunities exist for optimum investment in research and development.

"As NACOSTI and the science community in Kenya, in the era of the Covid-19 pandemic, the country is looking up to us to promote technology, innovations, tools and systems to save lives and maintain a socio-economic fabric amid a great disruption. The country is looking up to us to prevent further spread of the disease, facilitate the functioning of businesses, jobs and education," he said.

Prof Oyawa said while the pandemic is tragic, with so many lives having been lost, on the other hand, it has presented scientists with many opportunities to prospect and for the country and institutions to increase investments in science, technology and innovation.

"During this pandemic, it has been well captured that those countries that have always strategically and judiciously invested in scientific research have now gained some leverage in dealing with the pandemic," he said.

> The CBC currently introduces the learners to science at all prerequisite levels and this will improve uptake of STEM and guarantees Kenya's development with proper implementation.

Revealing that Kenya is ripe for STI research investment, the NACOSTI DG said the agency has developed STI indicators benchmarked globally and also finalised a National Priorities Framework 2018-2022.

"The scientific community is urged to join the Science, Technology and Innovation Network (STIRN) to advance apt strategy and profound networking in education, training, research, commercialisation and outreach Science, Technology & Innovation," said Prof Oyawa.

Prof Fatuma Chege, Principal Secretary for the Implementation of Curriculum Reforms in the Ministry of Education, said, "The CBC currently introduces the learners to science at all prerequisite levels and this will improve uptake of STEM and guarantees Kenya's development with proper implementation."

Gaps in Engineering Training in Kenya and Options in Filling them

By Eng. Horward Mm'ayi

KENYA'S economy is not driven by extractives as it happens in some developed nations. We have no oil, diamonds, gold and other extractives in quantities sufficient to drive our economy. Ours is largely a human resource driven affair, with the major sectors being agriculture and tourism, among others.

Manufacturing is one part of the value chain that is expected to absorb huge volumes of human capital. Governments all over the world have taken advantage of this to create jobs for the masses.

A robust manufacturing sector must be supported by a robust supply of raw materials on one hand and markets on the other; all requiring human capital. To serve the manufacturing and infrastructure development skills demand, the numbers and quality of Engineering professionals cannot be over-emphasised.

The quality of African Engineers has been brought to question by none other than UNESCO. Key areas pointed out are the Engineering training and the numbers per capita, which are the lowest world over. This is against the backdrop of Africa being a virgin land as far as infrastructure development is concerned, meaning that the opportunities for Engineers should be overwhelmingly high for a prolonged period.

The sentiments were captured in the UNESCO second report published on March 4, 2021 on the World Engineering Day focused on Engineering for sustainable development. Three areas that need attention to change the tide are pedagogical delivery at universities; structured on-job training and removal of regulatory barriers.

University of Eldoret Engineering students conduct experiments in one of the laboratories in the institution.

Pedagogy

The pedagogical gap in institutions of higher learning can best be illustrated by comparing elementary school teachers and university lecturers. The elementary school teachers are rich in delivery methods and shallow in content, while the university dons are deep with content and more often than not, poor in delivery of the content.

Experiences shared by learners in universities tell of lecturers who dish out piles of handouts; to those who read directly from books; to those who are a no show; to those who give all hard concepts as assignment so as to avoid the trouble of breaking it down to the learners; including cases of speaking to oneself or silently scribbling on the whiteboard for students to decide on their own what and how to learn. Engineering has not been spared in these troubles. This directly affects the quality of graduates and the level of confidence built in the learners.

I observed that architects have designed a mode of delivery, which has proven very helpful in equipping learners on the practice of building sciences. Architectural studios create a rigorously interactive tool for deeper learning and confidence building in the learners. Concepts are explained, actual problems requiring design, analysis, synthesis and judgement are given to students to solve independently. The student's work is critiqued by a spectrum of professionals (Architect, Engineer, Quantity Surveyor and such like) who form the training team. This is done all through the curriculum and the learning progresses from simple concepts to complex situations requiring intense judgement. The rigors of the studios allow students to make 'bad decisions' early in their learning under guidance of experienced professionals who then must guide the students through the challenges of their assignment to enable them understand why things

need to be done the way they are done. This is just one among many other tools that can be applied for better content delivery.

The bottom-line is that Engineering trainers can make a significant difference in the quality of their products by being deliberate in strengthening content delivery for better clarity, deeper understanding and confidence building.

On-the-job training

Having missed the chance to build confidence in campus classes, Engineering graduates have on-the-job training as the next stop gap measure for confidence building and sharpening of skills. This can be delivered as either attachment, internship or apprenticeship.

Considering the nature of Engineering projects where tendering processes can take as long as three months, mobilisation as long as six months and some activities ranging between a month and a year plus, the eight-week duration for attachment leaves many learners with minimal understanding of what is happening around them.

That leaves the bulk of on-the-job training to be done under internships and apprenticeships. The problem is that the two are not well structured for standard application in the industry. Even with a bustling infrastructure industry with many mega projects, we still don't have a system that can guarantee every Engineering trainee from campus to horn their skills in a work-place context and build confidence enough to make progress to the next professional level.

In the new Constitution, and under the framework created by the Engineer's Act 2011, the Engineers Board of Kenya (EBK) with expanded mandate of training has an important task to find a formula for structured on-the-job training for at least three years. This is the one thing that can guarantee steady growth of not only numbers of Engineers but also the quality of the practice.

Removal of regulatory barriers

There have existed several regulatory barriers historically. The barriers multiplied and became more intense during the transition from Engineers Registration Act Cap 530 to Engineers Act 2011 in conformity to the Kenyan Constitution 2010. Some of the pronounced barriers included training gaps as mentioned above, rendering graduates inadequate to transition; accreditation of engineering programmes; and general lethargy and entrenched perceptions.

The mother of all clashes between academia and the regulator in the history of Engineering in Kenya is the question of accreditation of university programmes.

Enforcement of Engineers Act 2011 on academic qualifications created an unprecedented regulatory barrier for students from both local and foreign universities, causing hue and cry. This precipitated a court battle that went through all stages of appeal, finally getting settled by the Supreme Court after almost a decade of untold suffering and friction between parents, graduates, universities and the regulator. Careers were threatened, lives derailed, hopes dashed.

But so much has changed now, with the Supreme Court judgement bringing down the barrier and opening doors for registration of the affected graduates.

Enactment of the Universities Act 2011 sought to settle the question of accreditation of university programmes, easing the tensions, albeit with protests from professional regulatory bodies. The State organs had however to seek ways of working together for the common good of their customers to avoid walking back into another standoff.

There remain a few unresolved barriers, for instance inadequacies identified in curricula from foreign universities. Students on government scholarships have found themselves stuck with degree qualifications not being able to get registered/ recognised as practitioners locally by the regulator.

The regulator, in response to the above, has initiated a process to join international accords like the Washington Accord and the Sydney Accord. It is expected that this will make it easy to standardise curricular and make it easy to domesticate qualifications from foreign institutions in member states.

Conclusion

Kenya and Africa are a virgin land for infrastructure and technological development. Professionals per capita is still acutely low. We must think growth in numbers and quality. We must build the critical mass. We must break the barriers.

We must embrace the necessary collaborations in view of the bigger picture and the bigger dream.

Eng. Howard AM is a Civil Engineer and Deputy Director, KeNHA

How IEK Runs Vibrant and Efficient Mashinani Networks

IEK President, Eng. Nathaniel Matalanga, members of Council, Editorial Board and Western Branch meet Kakamega Governor Wycliffe Oparanya in his office recently.

By GE Abdifattah Jama

ENGINEERING is a science of solving people's problems. No matter the nature of a problem faced by the community, there is always a solution to it. Engineers are strategically placed in the community to handle such problems. Whenever an incident occurs, you often hear the statement, "Our technical team is working on the issue to return the service as soon as possible".

If you were to explore the works behind such a statement, that is when you realise that an engineer is a critical component to all operations. In order for the technical team to address emerging issues, there is a network of team members who direct such a team to identify, troubleshoot and solve the problem.

Similarly, in the engineering

fraternity, the Institution of Engineers of Kenya (IEK), with its headquarters in the capital city, works in collaboration with branches (Western, South Rift, Coast, Central Kenya, Capital, North Eastern and North Rift branches) to achieve its strategic plan and to offer service to its members in the local areas. Therefore, presented here is a strategy to show how the branches can run efficiently and consequently result in the success of the IEK. First, the branch is headed by a chairperson, assisted by two vice chairpersons, honorary secretary and honorary treasurer. These comprise the top tier branch executive leadership. Further down in the hierarchy are six ordinary members; three of whom are professional engineers and the rest graduate members.

The counties covered by the branch also exercise their democratic right by electing their own county leadership and are represented by their county chairperson at the branch committee. The county is led by a chairperson, vice chairperson, secretary, treasurer and undersecretary. For effective running of the branch leadership, the branch executes its mandate through both functional sub-committee and county sub-committee that are mainly tasked with delegated responsibilities

that vary from strategic planning to welfare.

Looking at the functional sub-committee in detail:

Strategic Planning, Policy & Finance Sub-committee

This is formed in the branch to cater for raising of revenue for the branch, planning the branch activities as per our main strategic plan and policies established by the branch leadership that govern strategic planning, the prioritisation of branch activities and giving the general direction that the branch should take to entrench a culture of bringing service to the members at the grassroots level. In this sub-committee, the finance aspect is critical as it goes hand in hand with the strategic leadership in the branch. The membership of the sub-committee is all the county treasurers, and one ordinary sub-committee member from each county.

Membership, Mentorship & Training Sub-committee

This is formed by the branch to handle recruitment of members to join the branch and once they are on board, the sub-committee then coordinates their mentorship. The mentorship connects the graduates with professional engineers nearest to them. The mentorship aspect involves a close supervision of a graduate engineer working under a professional engineer. Subsequently, the training needs of members are addressed through the leadership of this sub-committee. The membership of this sub-committee comprises all county chairpersons and one ordinary sub-committee member from each county.

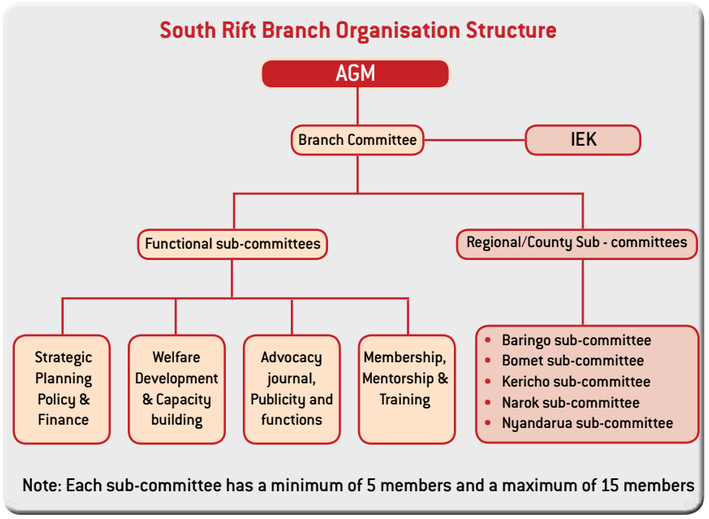
Advocacy, Journal, Publicity and Functions Sub-committee

To maximise the branch's visibility, this sub-committee is formed to propel the branch to the galleries for the works of the engineer to be noticed by the general society. This sub-committee drives the social, print and audio-visual media channels to showcase what the engineer is capable of delivering to society. This visibility also includes planning for road shows, conferences or publicity events within the jurisdiction of the branch. The membership of this sub-committee comprises all the secretaries and the under secretaries of all the counties under the branch.

Welfare Development & Capacity Building Sub-committee

To accomplish all these tasks by the branch, the engineer needs care and a balance in their daily life. To cater for these needs, the Welfare Development & Capacity Building Sub-committee is conveniently constituted to ensure the welfare of the engineer is catered for through sports, team building activities and emotional intelligence seminars to keep the engineer at the cutting edge of soft skills. It also pushes for better remunerations by ring-fencing the profession and setting engineering standards at the grassroots level. A healthy engineer delivers better service to society and stimulates innovative ways to solve emerging problems. To crown it all, the voice of the members in the branch is safeguarded through a transparent democratic process of electing their leaders. After the completion of their respective engineering degrees, members are old enough to make decisions, and are therefore free to participate in the election of their leaders according to the laid down procedure. The membership of the branch includes corporate, graduate and consulting engineers who all have an equal chance to elect their leaders at the branch. To ensure a free and fair election process, the branch requests members to nominate candidates for leadership positions. A team of scrutineers then supervise the conducting of the election and the results of the elections declared.

Ultimately, to ensure this branch model works, it is the commitment of the individual members to ensure their voice and input are heard and felt at the branch level. A vibrant branch is one that evolves from just having leaders holding office posts to serving its members through addressing their relevant training needs, identifying opportunities that can create jobs for fresh graduates and granting relevant experience to members through connection to internships, including industrial attachment. The branch also ensures members' welfare is catered for to ensure engineers work cohesively. It is time for engineers to network at the grassroots level and every member of the IEK should be affiliated to a branch. The ball is in your court, what would you like your branch to do for you as an engineer and how active are you as a member?



GE Abdifattah Jama is a member, IEK South Rift Branch.

Inside iconic UoN School of Engineering

UoN Faculty of Engineering Executive Dean Prof. Ayub Gitau, receives copies of the EiK magazine from Eng. Paul Ochola.

Question: 1

Share with us a brief history of the University Of Nairobi Faculty of Engineering?

THE Faculty of Engineering, formerly School of Engineering (SOE), is one of the three schools and one institute that constituted the College of Architecture and Engineering (CAE), University of Nairobi.

The Faculty is constituted by the five departments, which offer five-year BSc, two-year MSc and three-year PhD programmes.

The Department of Mechanical and Manufacturing Engineering is among the first departments set up in this university in 1956 in the then Royal Technical College, then came the Department of Civil and Construction Engineering in 1970.

The Department of Electrical and Information Engineering started in 1964 with 17 students in first year, 20 in second year and seven in third year. The original name of the Department was Electrical and Electronic Engineering which later changed to Electrical and Information Engineering.

Other departments include Geospatial and Space Technology, can be traced back to 1956; Biosystems Engineering (1965); Agricultural Engineering established in 1975 originally as the Department of Agricultural Mechanisation and Farm Planning. The name was then changed in 1976 to Department of Agricultural Engineering. In 2003, the University of Nairobi senate ratified the change of name of the department and the degree program to Environmental and Biosystems Engineering to reflect the content and intent of the Department's academic, research and consultancy services. The Faculty, being the oldest engineering training institution in the East African region, has developed a long tradition of excellence in engineering education and research.

Eng. Prof. Ayub N. Gitau

Question: 2

Many professional Engineers in Kenya today trace their humble beginnings to training at University of Nairobi. What distinguishes University of Nairobi Engineering training from the rest?

The University of Nairobi is "A world class University committed to scholarly excellence". It is committed to training high calibre professionals and innovative researchers. The Faculty of Engineering vision is to be a world class centre of engineering training, research, consultancy and extension. Its mission is to train top notch professionals in the disciplines of engineering and technology through teaching, research, consultancy and extension.

The Faculty has distinguished and well qualified lecturers and technicians. It offers engineering programmes that are accredited by the Engineers Board of Kenya (EBK). In addition, the Faculty has a high tech and well-equipped engineering training facilities and innovation hubs such as Makerspace and FabLab.

Question: 3

How does the Faculty of Engineering promote innovation, side by side with theoretical teaching?

In 2016, then Vice Chancellor, Prof Peter Mbithi, launched the Maker Space Innovation Hub. The hub focuses on engineering innovations as they impact service delivery in the health sector. Engineering students in collaboration with lectures have developed prototype machines, some of which include phototherapy unit, which helps new born children deal with jaundice problems by breaking down excess red blood cells; suction machine, which is used in sucking secretions during surgery procedure; and vinyl cutters used in calibrations.

In addition, the Faculty of engineering has FabLab (University of Nairobi Science and Technology Park). The FabLab hosted at the Engineering Building, is a science park for rapid start-ups, prototyping and business incubation centre. The FabLab couples as a fabrication lab as well as an incubation centre for SMEs. The University of Nairobi Annual Research Week also offers a forum for engineers to present their engineering innovations. This year's Research Week is scheduled for October 25 - 29.

There is also the Gearbox, an innovation hub led by Dr Kamau Gachigi. The Hub operates an equipment training academy, a mentoring programme and a contracting business for innovators who need to make a prototype. It provides a unique window into Industry 4.0 capabilities to innovators in Kenya, and it offers incubation/acceleration services.

Question: 4

How has training of modern-day engineers helped solve pertinent problems facing society today?

Engineering is a profoundly creative activity. Engineers are creative both as initiators and implementers of new ideas as well as solvers of the pertinent problems facing society.

The modern world is a product of human endeavour, our species' ability to envisage, design and construct. Engineers have always been at the forefront of this process, and today, more than any other time in history, we are living in a world of outstanding engineer innovators.

Today, in a smart world, universities have a hands-on approach that provides students with an opportunity for blended learning of real-world industry scenarios in their classroom. For much of the history of the engineering profession, the evolution of engineering education has mirrored changes in technology and society. Engineering disciplines have been added and curricula modified to yield a workforce capable of meeting the needs of society and remain relevant.

In these regards, one of the Faculty's strategic objectives is: To contribute to the development of society through creation, storage, application and dissemination of knowledge.

Question: 5

What can be done within the technical economy in Kenya to expand jobs for Graduate Engineers?

Of the 21,302 currently registered engineers, 819 are consulting engineers, 2,245 are professional engineers while 18,238 are graduate engineers. This shows a big gap between the professional and graduate engineers. To bridge this gap, the government, professional institutions and other stakeholders should set out and implement policies on graduate engineers' mentorship/internship programmes. An example is the Graduate Engineers Internship Programme (GEIP) by the EBK. A structured internship programme as offered through EBK by the government should be expanded to accommodate more graduates.

Question: 6

Some experts say there exists a great potential in self-employment for graduate engineers. Some Graduate Engineers however contend that with degrees they are fit for bigger jobs with better pay. What is your take?

One of the Faculty's strategic objectives is: To produce quality and holistic graduates in engineering.

For a bigger job and better pay in the engineering industry there is a need for on-the-job training. Lack of on-the-job training for graduate engineers makes them less fit for a big job with a better pay, thus the need for structured attachment and internship opportunities.

In this regard, Kenya's Micro, Small and Medium Enterprises (MSMEs) contribute approximately 40 per cent of the GDP, with the majority falling under the informal sector. Therefore, MSMEs offer numerous training opportunities for graduate engineers due to the higher needs for skilled manpower. In addition, there is greater potential in self-employment for graduate engineers who have the advantage of the technical and profession know-how.

Question: 7

How does the Faculty you lead promote collaboration with the professional Industry such as EBK and IEK? One of the Faculty's strategic objectives is: To enhance value-adding partnerships and collaborations.

Professional engineering institutions like the IEK and EBK offer a linkage between universities and the industry. They develop and implement mentorship programmes to improve competence in the engineering fraternity.

Notably, in April this year, IEK and EBK successfully organised the IEK Career Week 2021 for engineering students – a collaboration between engineering learning institutions and the professional bodies. The aim was to foster continued students' interest in the engineering career, expose the students to various career opportunities available to them after graduation, as well as empower them to feel part and parcel of the greater engineering community.

The IEK as well offers student membership for our engineering students. In addition, the IEK Young Engineers Chapter promotes continued professional training of young engineers as well as fostering all-round growth and development of the young engineer.

Therefore, the Faculty is committed to enhancing value-addition partnership and collaboration with all the engineering professional industry.

Question: 8

The Government of Kenya is currently undertaking Recognition of Prior Learning Policy Framework (RPL) that will recognise Jua Kali artisans as professional mechanics and engineers. Do you think this threatens professional engineering training in the long run?

A 2017 Economic Survey by the Kenya National Bureau of Statistics showed that the informal sector, generated 747,300 jobs, about 90 per cent of all jobs created, while the remainder, 85,600, were created by the formal sector. This shows the importance of the informal sector to the Kenyan economy.

Recognition of Prior Learning Policy Framework, which seeks to recognise Kenyans in the informal 'Jua Kali' sector who have acquired hands-on skills without formal training such as masons, plumbers, electricians, mechanics, among many others, is a game changer as it will enhance economic opportunities for the artisan and craft persons as well as societal recognition of their effort in the economy. The implementation of the framework therefore does not threaten the professional engineering training, rather it provides extra opportunities for collaboration in the professional engineering training and innovation.

Question: 9

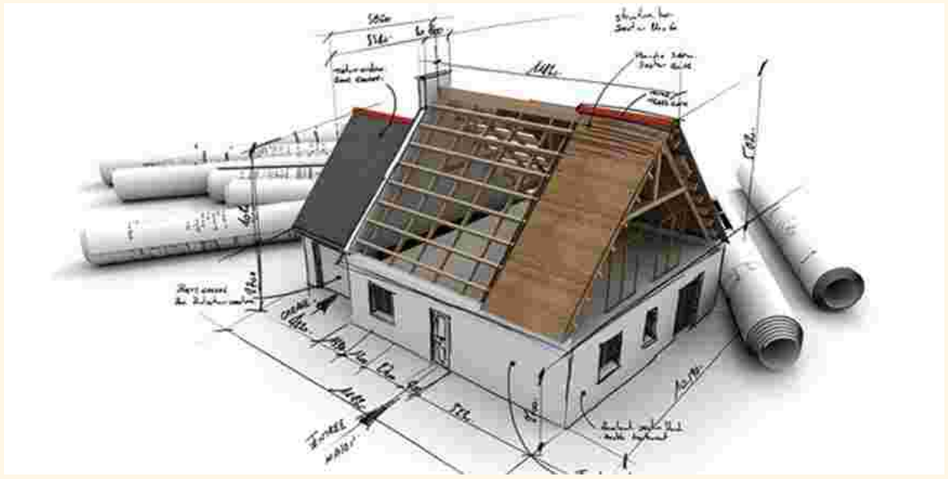
There is a notion among some employers that hands-on engineering skills lie with lower-cadre technicians and diploma holders in the engineering fraternity. Can you demystify this from the perspective of an experienced trainer of engineers?

"Tell me, and I forget. Teach me, and I may remember. Involve me, and I learn." A quote by the famous lighting rod, bifocals and franklin stove inventor Benjamin Franklin depicts the importance of hands-on skills for engineering students.

The Faculty offers theoretical and practical training though engineering design courses. In the fourth year of training, our students are attached for practicum industrial attachment in their professional fields where they are trained on hands-on skills. In addition, the Faculty offers practical training in the fourth term in the second and third year of study. In the fifth year, students undertake an engineering design project, where they attain engineering design skills as well. As earlier mentioned, our innovation hubs as well equip our students with hands-on engineering skills.

Finally, the Faculty strikes a good balance between the scientific/theoretical and practical training of our engineering students. Therefore, our engineering students attain immeasurable hands-on engineering skills suitable for the job market.

Prof Gitau is Executive Dean, Faculty of Engineering, Univeristy of Nairobi.



Ex-Infrastructure PS Eng. Dr. Cyrus Njiru makes an address during the IEK President's Dinner 2021.

Employ Professional Engineers to Guard against Counterfeits, State Urged

By EiK Correspondent

GOVERNMENT and private sector agencies have been urged to strictly engage and retain services of qualified professional engineers in middle and lower-level departments to work in quality control and stem the runaway influx of counterfeit products into the economy.

According to former Infrastructure Permanent Secretary Eng. Cyrus Njiru, the trade in illegal counterfeits is negatively impacting local Kenyan economy and costing jobs. "A lot of counterfeits still find their way in through our porous borders, due to illegal collusion or lack of due diligence as a result of the absence of qualified engineers at lower-level inspection and quality control areas."

"For example, Local jobs and investors in the cable industry in this country have greatly suffered at the expense of illegal counterfeit cables finding their way into the local market due to absence of qualified and accredited engineers at middle and lower-level department with compromise of critical quality and standards control agencies, to the detriment of the economy," said the former PS.

He was addressing thousands of members of the Institution of Kenya Engineers (IEK) during IEK Presidents' Dinner this past Friday at the Four Point by Sheraton Hotel. The former PS urged Engineers in Kenya to unite proactively in championing the agenda of professional quality engineering so as to fight economic evils such as counterfeits that are dragging the economy behind.

He added that engineers have become an authoritative voice in development projects being undertaken by government and the private sector in Kenya.

According to former PS, Engineers in Kenya need to be actively involved in forefront project policy decisions to optimize the value of development projects in the country.

Institution of Engineers of Kenya President Eng. Nathaniel Matalanga called for closer national and county government collaboration with professional engineering bodies EBK and IEK to benefit the economy and protect the interests of registered professional engineers in the country and to save development projects from poor workmanship and counterfeits.

"Training an engineer is very expensive and the government spends a lot of money training engineers in various public universities. An enhanced scheme of service both at national and county governments will maximize returns on this investment by retaining engineers in public service. Engineers who are lecturers should be paid non practice allowance to enable the universities attract the best talent to train future engineers," said the IEK President.

Former PS Njiru also urged enhanced inter-agency cooperation and engagement with professional Engineers "I thank the Engineering Board of Kenya (EBK), the IEK President Eng. Matalanga and current IEK Council for making great strides in the pursuit of professional interests of engineers in development projects happening around the country," he said.

The event was held in partnership with The Kenya National Highways' Authority (KeNHA) showcasing the race to complete the Nairobi Expressway.

On the expressway, KeNHA was asked to invoke the contractual clauses on the provision of safe passage to road users to enable the contractor to obey these clauses. This would stop the huge economic losses that are being caused due to the long traffic jams that the road construction is causing. The corporation had involved top-notch practicing and eminent professional Engineers in Kenya and globally, including student and graduate Engineers in Kenya, who shared various experiences in their areas of work.

Guest speakers at the President's dinner included EBK Chairman Eng. Erastus Mwongera, CEO of EBK Eng. Margaret Ogai, as well as former Regional Development Permanent Secretary Eng. Carrey Orege. A minute of silence was observed in honour of departed members of the Engineering fraternity in Kenya and their loved ones, with the event held in strict observation of Covid-19 protocols. Only a handful were in physical attendance while thousands of Engineers followed the event live virtually from around the globe.

Mainstreaming Women in Manufacturing

By EiK Correspondent

THE Fourth Industrial Revolution has redefined work and skills, especially within the context of manufacturing, with a good number of the most promising future jobs depicted to rely heavily on Science, Technology, Engineering and Mathematics (STEM) skills.

However, STEM graduates are still few and far between, and furthermore, women continue to be greatly disadvantaged in this field. Consequently, there is low transition of the graduates to jobs in industry.

A report on Kenya's Women in Manufacturing revealed that only 11 per cent of women complete STEM higher education courses compared to men (21 per cent). Additionally, women's attainment of training in areas such as engineering, manufacturing and construction is extremely low at two per cent compared to that of men (six per cent)

According to Kenya Association of Manufacturers (KAM), securing the future for manufacturing sector, and the economy at large, starts with today's students and workforce.

"The Association acknowledges the need to stay ahead of the curve on emerging technologies and the ever-changing market demands to bridge the current and upcoming skills gap and to enable the sector utilise new tools and technologies for advanced manufacturing processes," says KAM Chief Executive, Ms Phyllis Wakiaga.

"This is why we continue to champion the uptake of technical skills through our Technical and Vocational Education and Training (TVET) programme, especially by young girls. The focus on technical training stems from the large number of technicians that industry takes in, based on the shop floor needs. For instance, for every university graduate engineer hired, industry requires two or more technicians to run various parts of manufacturing systems."

"Through this programme, we have seen youth take up internships in various industries, with some being employed permanently. We have also seen young graduates gain hands-on experience, where they have acquired relevant competencies through our work readiness trainings that equip them with both work and life skills. This is critical, especially because the world is moving fast towards Industry 4.0 to increase the manufacturing sector's output," she says.

Ms Wakiaga elaborates that the programme has encouraged more young women to take up STEM courses and venture into manufacturing-related jobs, inspired by seasoned professionals in the sector. Previously, the number of young women venturing into this sector was small, compared to their male counterparts.

KAM is also driving this conversation through its Women in Manufacturing (WIM) programme, which supports young girls and women to venture into the manufacturing sector, and for women industrialists to scale up and venture into new markets – locally and regionally.

"The Association works towards reducing the gender gap by increasing the number of women in the sector through access to industry for internships and jobs. Female graduates also receive mentorship from KAM members on personal branding, networking, productivity improvement, among other areas," says Ms Wakiaga.

"We also advocate for increased enrolment and retention of young women in STEM-related subjects at technical training institutions. This is aimed at increasing the number of young women taking up technical apprenticeships, internships and transitioned to jobs in the sector," she adds. Development partners, TVET institutions, business member organisations and industrial companies are working together to change the status quo towards reinvigorating Kenya's manufacturing sector and job creation agenda for the youth.

Specifically, the Association provides opportunities for technical graduates to transition into blue collar and self-employment through internships and direct job matching in electrical (installation), electronics (instrumentation and simple automation) and mechanical technology and maintenance, heavy and light machine operations, welding, lathe machine operations, carpentry, plumbing and pipefitting, construction (masonry, concrete works), industrial paint brushing and scaffolding.

A young engineer during training are on a road project. There is a need to encourage active participation of women in engineering to bridge the gender gap.

Entrepreneur Mr. Anthony Muthungu (second right) with some of his workers inside the factory in Kirinyaga County.

By EiK Correspondent

INNOVATION
Youthful Manufacturer Blazes the Trail with Phone Charger Cables

FOR his youthfulness, Anthony Muthungu is an outlier. He dropped out of college four times, each time trying his luck – albeit without success – in employment and in various business start-ups in Nairobi. When he eventually settled on his passion, success came calling.

One day, Muthungu was searching for a charging cable for his phone whose battery had run low. He realised all six cables available in his house at the time were broken, damaged or spoilt.

This experience marked the origin of his company, Totosci Holdings Ltd, whose modest factory in Kiangwaci, Kirinyaga County, now employs at least 30 Kenyans.

At 28, Muthungu is now CEO of the fledgling start-up manufacturing high quality USB cables and chargers. At his factory located at the SME Industrial Park along Kaggio-Kirinyaga road, he speaks of his plans to start production of earphones and mobile phones in the near future.

His phone charging cables with Made in Kenya insignia are for both android and iPhone devices.

He was recently celebrated by the Central Kenya Economic Bloc as one of the visionaries actualising the bloc's "One Village One Factory" aspirations during the celebrations of the International Youth Day 2021.

The first time Muthungu dropped out of university while in second year, the packaging materials venture he started in Nairobi collapsed after the government banned use of plastic bags. He quit to resume college, only to drop out again – not once but three times more. Each time, he ran to the capital Nairobi to try out his luck in new business ventures around technology.

Engineering in Kenya tracked him down to his modest factory.

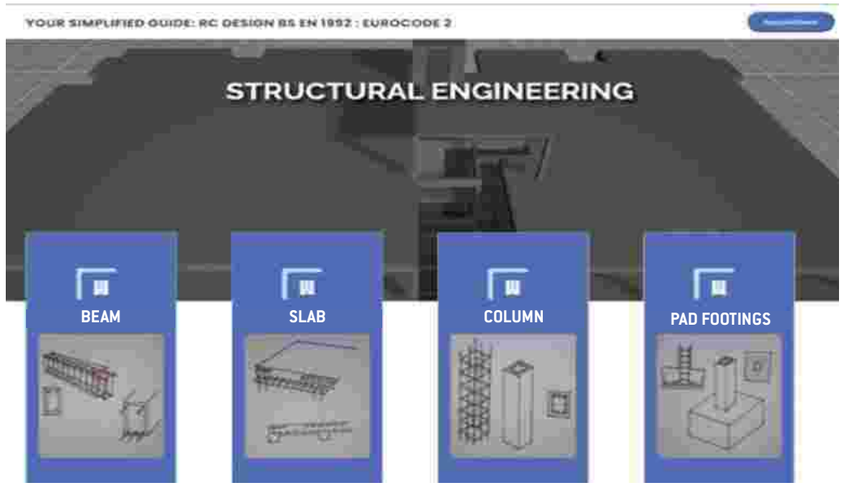
"I eventually completed my BSc Physics degree from Mt Kenya University and enrolled for a diploma in Computer Science at Zetech University," he says.

"I picked up vital lessons from my failed business ventures earlier in life. I always detested employment and loved technological ideas."

In spite of the financial challenges, Muthungu reveals that Totosci Limited has now manufactured over 7,000 USB cable units since he started production in April 2020, and his company now sells more than 800 phone charging cables weekly.

He is now appealing for funding support.

"We will appreciate any form of funding since we are currently low on resources to expand the manufacturing operations. We need close to Sh10 million to scale up the manufacturing. This will go towards equipment and infrastructural expansion," he says, adding that lack of substantial collateral is a big hindrance to loans access for his start-up. His small factory has created employment for 15 youth and given a livelihood to their dependents since April 2021, helping them navigate the raging Covid-19 pandemic.



Computer Programme for Analysis, Design and Costing of Reinforced Concrete Structural Elements

Introduction

AKEEN and proper design for any structure ranging from the most basic to the more complex ones cannot be over-shadowed. Structural analysis and design is the most initial and most important task for a structural engineer and a keen and intellectual mind is paramount to enable one conceptualize, model, analysis and design a structure that will perform throughout its design life. The design task is often involving and has no room for any errors. Software available for this purpose are most often not open source; they are costly and choice of any requires a critical investment decision. They have some learning curves and those using them must be well conversant with them.

All these challenges have had us develop our own computer program that can be used for analysis, design and costing of reinforced concrete structural elements. The software is convenient as is it based on the Eurocodes and can run on any smartphone as well. The software has been achieved by outlining the design procedures and equations from manuals, developing algorithms and flowcharts of the same and programming using an appropriate language to realize the end product.

Methodology

The general procedure of developing an application software is as follows

1. Understand the problem you are trying to solve
2. Design a solution
3. Draw a flowchart(s)
4. Write pseudo-code
5. Write code
6. Test, validate and debug
7. Test with real-world users
8. Iterate the steps

The problem in question is to ease the most often long and iterative structural analysis, design and costing of reinforced concrete structural elements.

Design of the solution involved obtaining the procedures provided in the design manuals, developing algorithms and flowcharts, choosing an appropriate programming language and compiling the codes.

Initially, the programs front end was designed (GUI). A front end manages everything that users visually see in their browser or application. In this front-end page, users can input their data before executing commands.

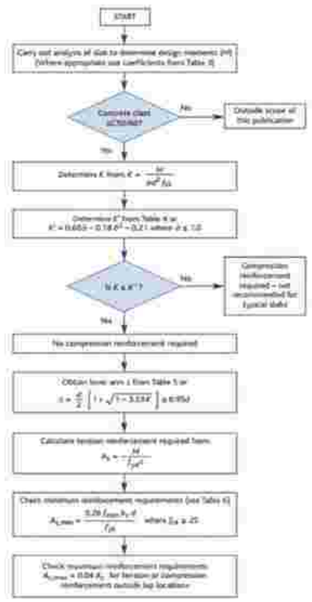
The back end processes the user instructions and the outputs of the commands are displayed in the output page.

The most appropriate approach inhere was to code a program in a web way so that it could be convenient to run on computer as well as on smartphones. The following 3 languages suited this approach and were used.

1. HTML
2. Cascading Style Sheets
3. Bootstrap

Each of the structural elements viz slabs, beams, columns and pad footings were done and their approach is detailed below.

Results and Discussion



The design of slabs involves determining loads, determining the slab depth, checking whether the slab is one way or two-way spanning, checking the type of panel to obtain the bending moments and shear forces and following the design procedures in codes to obtain the steel areas required to carry the applied stresses.

The solution to this in our program is to have a simplified font end user interface where the user will input their slab panel geometry (lx, ly and H), the cover to reinforcement and the variable and permanent actions. The user will click on the design button and commands will run in the back end and outputs displayed in the output page areas of steel required, minimum and maximum steel area, cost of steel and cost of concrete for the designed slab panel.

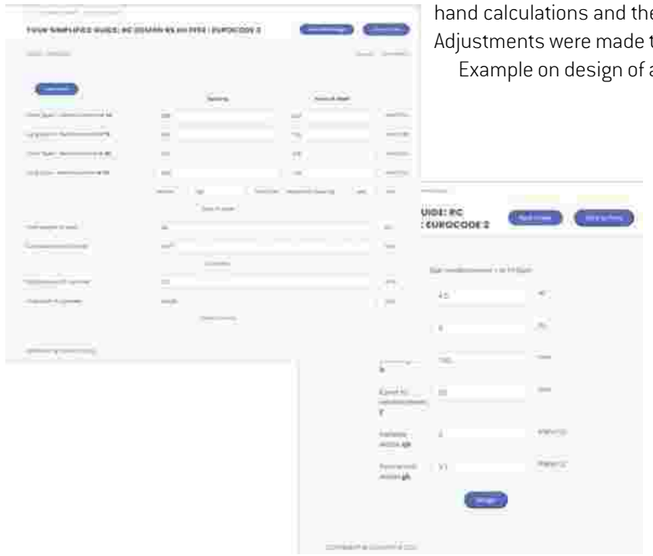
The take of quantities was based on the volume of the element to obtain the cost of concrete by multiplying by the market rate for one cubic meter for concrete. For steel, the area of steel provided was transposed into number and diameter of bars, the length of the element was used to get the total length of the bars with appropriate curtailments and lap distances accounted for, then getting the tonnage of steel to be used and multiplying with a market rate.

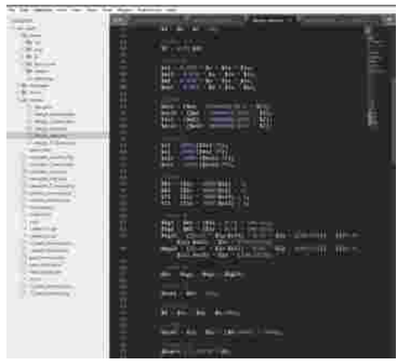
The front end, flowchart, output page and sample code are shown below.

The above procedures were repeated for beams, columns and pad footings and the main objective was thus realised. The program computes sizes of elements, design of main steel reinforcements and gives take off quantities and their costs.

For designs for testing and validating the software, all elements were designed by hand calculations and then run by the software and results compared. Adjustments were made to validate the software. (debugging)

Example on design of a column:





Column tributary area = 14.4m2, number of floors carried by column= 2, column height= 2.85m, variable action= 2kN/m2,

Design outputs;

Outputs	Hand calculation	Software
Column size	200mm x 200m	204mm x 204mm
Area of steel	1257mm²	1268mm²

Conclusion

It is evident that the yielded results are admissible with only a slight disparity. This therefore renders this software a useful tool for quick designs/checks. It is user friendly and easy to use with almost no learning curve required by the designer. Future updates in patches will enhance the software capabilities by covering other aspects as well as improving on the existing ones.

By Elijah Wainaina Gakubu, Tido Ishmael Dianga, Rodgers Angala Manyeve and Clement Kiprotich Kiptum (University of Eldoret)

JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY
COLLEGE OF ENGINEERING AND TECHNOLOGY (COETEC)

A Leader in Engineering Training, Research Technology and Innovation

Background

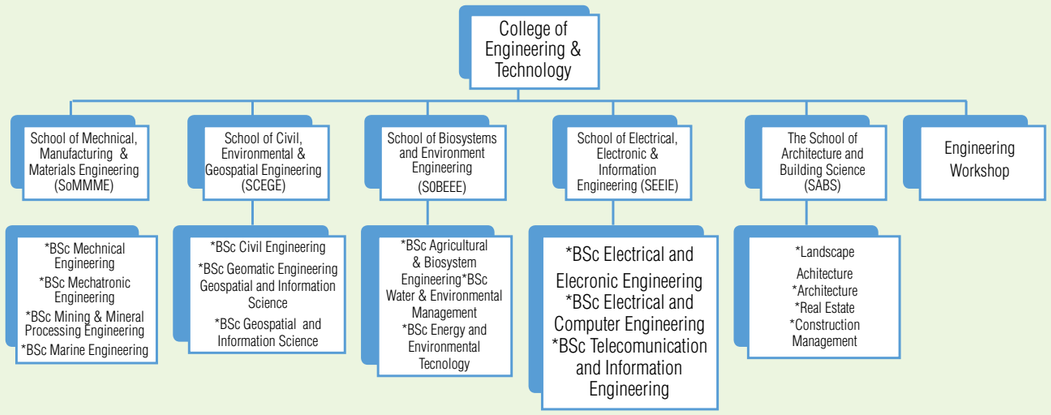
THE College of Engineering and Technology (COETEC), JKUAT is located at the main campus, 35km North-East of Nairobi on the Nairobi-Thika Highway, and about 10kms from Thika town.

The College (formerly the Faculty of Engineering) is the pioneer college in JKUAT, and is renowned for offering high quality top notch engineering programs at both undergraduate and postgraduate levels, as well as conducting ground breaking research, technology and innovations relevant to national and global needs. The college is headed by a Principal, who is the academic and administrative head of the College, assisted by 5 Deans of Schools, 13 Chairmen of Departments, Manager of Engineering Workshops as well as other teaching and non-teaching staff.

College Vision and Mission

The vision of the college is to be a globally competitive college of engineering and building science training and research to positively impacts on the wellbeing and prosperity of humanity and planet earth. The mission of the college is to foster and advance engineering learning, discovery and technology transfer in tune with industry and society needs, national goals as well as the evolving opportunities in a dynamic global village.

In line with Kenya's vision 2030, the Government of Kenya Big 4 agenda and global Sustainable Development Goals (SDGs), COETEC has enabled the expansion of access to engineering training and research, as well as availed cutting edge engineering and technological solutions to Kenya and the region. To achieve this COETEC's core values are Quality, Team work, Professionalism, Innovation, Dynamism, Transparency, Accountability and integrity. COETEC comprises of 5 Schools and 14 academic Departments and Research, Innovation and Consultancy Triangle that includes: Engineering workshops, Innovation Prototyping Integrated Centre (iPIC), Sustainable Material Research and Technology (SMARTEC), Centre for Scientific Equipment Maintenance (CESEM), Consultancy/Professional Development Centre



Skills Upgrading	Research &Flagship Projects	Innovations
* Digital Fabrication * Additive manufacture * Affordable Housing * Labour based road construction-Donou Technology * Engineering Training	* Sustainable Waste Managemant – JICA Funded * Maritime Technical Cooperation Centre (MTCC) Africa – EU/IMO funded * Sustainable Energy & Entreprenuership Development (SEED) – DAAD Funded * Research Chair Manufacturing – IDRC/ NaCOSTI funded * Education for Laser based Manufacturing (ELbM) – EU funded	* Mechanical ventilator * Oxygen Concentrator * Patient service robot * Stabilized block making machine

IEK Editorial Board Chairman, Eng. Prof. Lawrence Gumbe, with JKUAT Vice Chancellor, Prof Victoria Ngumi.

Members of the Editorial Board with JKUAT university management display copies of the magazine.

JKUAT DVC, Administration and Academic Affairs, Prof. Eng. BW Ikua and Principal College of Engineering, Dr Eng Hiram Ndiritu

DigiTalent Program breeding next generation of leading IT Experts in Kenya

DIGITALENT is the brand name for the Presidential Digital Talent Programme (PDTP), an internship programme that develops the ICT talent pool in Kenya through a collaboration between the public and private sectors. It is a partnership between government, public and private sector stakeholders and is to be implemented by the Ministry of Information Communications and Technology (MoICT) through the ICT Authority (ICTA).

The program is borne out of the need for government to enhance its capacity to use ICT in effective public service delivery, providing a training ground for potential employees and an affordable labour pool of freshly qualified individuals in government offices. Targeting recent graduates, PDTP offers participants an opportunity to understand government services, and provides them with a chance to contribute towards improving service delivery to Kenyan citizens.

The Digitalent program focuses on two key aspects. The first is Leadership development to develop ICT leaders in government management staff by entrenching them with ICT business principles to effectively run ICT structures. Secondly, the program ICT technical capacity development by training freshly qualified graduates through an internship programme to develop a ready and affordable pool of ICT talent for government.

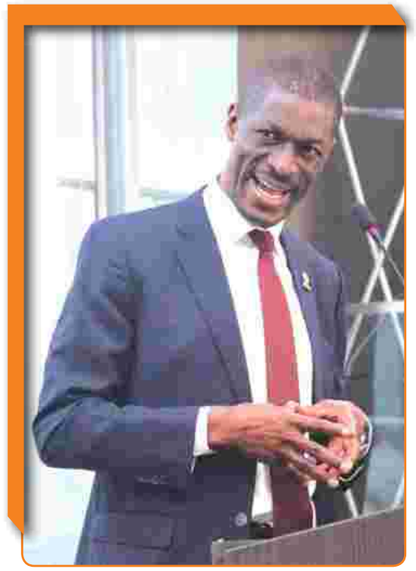
The program aims to achieve a transformed country and an engaged citizenry through innovative and sustainable ICT skill development, and hopes to build the next generation of globally competitive ICT, leadership and technology talent that will transform Kenya through world-class service delivery to the citizenry.

The Presidential Digital Talent Program is developing the ICT talent pool by leveraging collaboration between the public and private sectors. Specifically, its objective is to deliver a combination of structured training, coaching and mentoring, to develop a pipeline of future talent for government with a passion for ethical and accountable public service delivery, to train at least 100 interns over a revolving 12-month period and to promote innovation in local ICT product offerings.

The Presidential Digital Talent Program is expected to be beneficial in increasing youth employability, improving public/private sector collaboration, Accelerating economic impact through ICT effectiveness, enhancing service delivery by leveraging on ICT an supporting the ICT Authority's contribution to GDP.

IEK President's Dinner, Capital Branch Launch

By Maria Monayo



IEK President, Eng. Nathaniel Matalanga delivers a speech during the dinner.

THE event was held in partnership with the Kenya National Highways's Authority (KeNHA), showcasing the race to complete the Nairobi Expressway. It brought together hundreds of top-notch practising and eminent professional Engineers in Kenya and globally, including student and graduate Engineers, who shared experiences in their areas of work.

Guest speakers included EBK Chairman, Eng Erastus Mwongera and CEO of EBK, Eng Margaret Ogai, as well as former Regional Development Permanent Secretary, Eng Carrey Orege. A minute of silence was observed in honour of departed members of the Engineering fraternity in Kenya and their loved ones, with the event held in strict observation of Covid-19 protocols. Only a handful were in physical attendance while thousands of Engineers followed the event live virtually from around the globe. Institution of Engineers of Kenya (IEK) President, Eng. Nathaniel Matalanga, called for closer national and county government collaboration with professional engineering bodies, EBK and IEK.

"Training an engineer is very expensive and the government spends a lot of money training engineers in various public universities. An enhanced scheme of service both at national and county governments will maximise returns on this investment by retaining engineers in public service," said the IEK President.

EBK Registrar and CEO Eng. Margaret Ogai, IEK 1st VP Eng. Lucy Wanjiku, President, Eng Nathaniel Matalanga and CBM Committee Chair Eng. Grace Kagondu.

EBK Registrar and CEO Eng. Margaret Ogai, Eng. Grace Kagondu, IEK President Eng. Nathaniel Matalanga and KeNHA's Eng. Samwel Omwer cut the cake during IEK President's dinner.

A participant makes a pint during the dinner.

ACEK Honorary Secretary Eng. Peter Wandabwa

KURA Director General, Eng. Silas M Kinoti makes a point.

Eng. Mumina Wakyendo sepaks during the dinner.

EBK Registrar and CEO Eng. Margaret Ogai

IEK President with Capital Branch chair Eng. Damaris

A participant speaks.

A participant speaks.

Attendees follow the proceedings.

IEK Secretariat take registrations.






Postgraduate Diploma Programmes
- Postgraduate Diploma in Disaster Management and Sustainable Development
- Postgraduate Diploma in Disaster Preparedness and Engineering Management
- Postgraduate Diploma in Peace Cohesion and Integration

Masters Programmes:
- Master of Science in Disaster Management and Humanitarian Assistance
- Master of Science in Disaster Preparedness and Engineering Management
- Master of Science in Climate Change and Adaptation
- Master of Science in GIS and Remote Sensing
- Master of Science in Diplomacy and International Relations
- Master of Science in Peace and Conflict Studies
- Master of Science in Conflict Resolution and Management
- Master of Science in Disaster Management and Sustainable Development

Doctor of Philosophy Programmes:
- Doctor of Philosophy in Disaster Management and Humanitarian Assistance
- Doctor of Philosophy in Diplomacy and International Relations
- Doctor of Philosophy in Peace and Conflict Studies
- Doctor of Philosophy in Disaster Management and Sustainable Development
- Doctor of Philosophy in Disaster preparedness & Engineering Management

SCHOOL OF ENGINEERING AND BUILT ENVIRONMENT

Diploma Programmes:
- Diploma in Mechanical Engineering
- Diploma in Civil Engineering
- Diploma in Electrical and Electronics Engineering
- Diploma in Building Construction
- Diploma in Water Technology
- Diploma in Refrigeration and Air Conditioning

Degree Programmes:
- Bachelor of Science in Mechanical and Industrial Engineering
- Bachelor of Science in Civil and Structural Engineering
- Bachelor of Science in Electrical and Communication Engineering
- Bachelor of Science in Renewable Energy Technology
- Bachelor of Technology in Building Construction
- Bachelor of Technology Education (Civil Engineering)
- Bachelor of Technology Education (Mechanical Engineering)
- Bachelor of Technology Education (Electrical and Electronics Engineering)

Masters Programmes:
- Master of Science in Water Resources Engineering(M.Sc.WRE)
- Master of Science in Structural Engineering (M.SC.Struc.Eng)
- Master of Science in Mechanical Engineering
- Master of Science in Industrial Engineering and Management

Doctor of Philosophy Programmes:
- Doctor of Philosophy in Mechanical Engineering
- Doctor of Philosophy in Civil Engineering

SCHOOL OF NATURAL SCIENCES

Diploma Programmes:
- Diploma in Applied Biology

Degree Programmes:
- Bachelor of Science in Physics with Appropriate Technology
- Bachelor of Science in Chemistry
- Bachelor of Science in industrial Chemistry
- Bachelor of Technology in Cosmetology and Beauty Therapy
- Bachelor of Science in Mathematics with information Technology
- Bachelor of Science in Applied Statistics with Information Technology
- Bachelor of Science in Biotechnology
- Bachelor of Science in Biomedical Sciences
- Bachelor of Science in Biochemistry
- Bachelor of Science in Biology
- Bachelor of Science in Natural Resources Management
- Bachelor of Science in Environmental Science
- Bachelor of Science (Mathematics and Economics with Information Technology)

Masters Programmes:
- Master of Science in Applied Mathematics
- Master of Science in Pure Mathematics
- Master of Science in Statistics
- Master of Science in Chemistry
- Master of Science in Physics
- Master of Science in Bioinformatics
- Master of Science in Applied Entomology
- Master of Science in Immunology
- Master of Science in Microbiology
- Master of Science in Molecular Biology
- Master of Science in Environmental Science
- Master of Science in Genetics and Plant Breeding
- Master of Science in Crop Protection
- Master of Science in Natural Resource Management
- Master of Science in Medical Parasitology

Doctor of Philosophy Programmes:
- Doctor of Philosophy in Pure Mathematics
- Doctor of Philosophy in Physics
- Doctor of Philosophy in statistics
- Doctor of Philosophy in Bioinformatics
- Doctor of Philosophy in Immunology
- Doctor of Philosophy in Microbiology
- Doctor of Philosophy in Environmental Science
- Doctor of Philosophy in Natural Resources Management
- Doctor of Philosophy in Animal Physiology
- Doctor of Philosophy in Applied Entomology
- Doctor of Philosophy in Medical Parasitology
- Doctor of Philosophy in Molecular Biology
- Doctor of Philosophy in Applied Mathematics
- Doctor of Philosophy in Chemistry
- Doctor of Philosophy in Fish Biology and Aquaculture
- Doctor of Philosophy in Crop Protection

SCHOOL OF NURSING, MIDWIFERY & PARAMEDICAL SCIENCES

Diploma Programmes:
- Diploma in advanced Emergency Medical Technician
- Diploma in Community Oral Health and Therapy

Degree Programmes:
- Bachelor of Science in Midwifery (Upgrading)
- Bachelor of Science in Nursing (Direct Entry)
- Bachelor of Science in Nursing (Upgrading
- Bachelor of Science in Nursing (Upgrading – Distance Learning)
- Bachelor of Science in Global Community Health & Travel Medicine
- Bachelor of Science in Medical Social Work
- Bachelor of Science (Paramedic Science)
- Bachelor of Science (Occupational Health)

Masters Programmes:
- Masters of Science in Advanced Nursing Practice:
  Specialty Areas:
  - Nursing Education
  - Mental health and Psychiatry Nursing
  - Oncology and Palliative Care Nursing
  - Forensic Nursing
  - Midwifery
  - Community Health and Primary HealthCare
  - Nursing, Leadership, Policy and Management
  - Medical - Surgical Nursing
  - Critical Care Nursing
  - Paediatric Nursing
  - Trauma and Emergency Nurse
  - Pre - Operative Nursing
  - Anaesthesia

Doctor of Philosophy Programmes:
- Doctor of Philosophy in Nursing

SCHOOL OF PUBLIC HEALTH, BIOMEDICAL SCIENCES & TECHNOLOGY

Certificate Programmes:
- Certificate in Community Health & Development
- Certificate in Fitness Instruction
- Certificate in Coaching Science Education
- Certificate in Adapted Physical Education

Diploma Programmes:
- Diploma in Human Nutrition and Dietetics
- Diploma in Hospitality Management
- Diploma in Medical Biotechnology Mean
- Diploma in Community Health & Development
- Diploma in Health Promotion and Education
- Diploma in Sports Administration and Management
- Diploma in advanced emergency Medical Technician

Degree Programmes:
- Bachelor of Optometry & Vision Sciences (B.Optom)
- Bachelor of Science in Health Promotion & Sports Science
- Bachelor of Science in Community Health and Development
- Bachelor of Science in Epidemiology and Biostatistics
- Bachelor of Science in Human Nutrition & Dietetics
- Bachelor of Science in Medical Laboratory Science (Direct Entry)
- Bachelor of Science in Medical Biotechnology
- Bachelor of Science in Health Professions (Medical) Education (Upgrading)
- Bachelor of Science in Physiotherapy (Direct Entry)
- Bachelor of Science in Physiotherapy (Upgrading)
- Bachelor of Science in Clinical Medicine, Surgery & Community Health (BSc. CMSCH) (Direct Entry)
- Bachelor of Science in Clinical Medicine, Surgery & Community Health (BSc. CMSCH) Upgrading)
- Bachelor of Education Science (Physical and health education)

Postgraduate Diploma programme:
- Postgraduate Diploma in Health Promotion and Sports Science

Masters Programmes:
- Master of Science in Optometry and Vision Sciences
- Master of Science in Pharmacology and Therapeutics
- Master of Science in Health Promotion and Sports Science
- Master of Science in Community Health and Development
- Master of Science in Medical Dietetics
  - Clinical Dietetics Option
  - Nutrition Bioinformatics Option
  - Therapeutic Dietetics Management Option
- Master of Science in Food Science and Nutrition
- Master of Science in Public Health Nutrition
- Master of Science in Public Health
- Master of Science in Health Profession Education
- Master of Science in Biomedical Sciences
  - Medical Biochemistry Option
  - Forensic Science and Technology Option
  - Medical Microbiology Option
  - Medical Parasitology Option
  - Medical Immunology Option
  - Medical Parasitology and Vector Biology Option
  - Medical Biotechnology Option
- Master of Science in Medical Laboratory Sciences
  - Forensic Science and Technology Option
  - Medical Microbiology Option
  - Medical Parasitology and Vector Biology Option
  - Medical Immunology Option
  - Clinical Chemistry Option
  - Haematology and Transfusion Science Option
  - Histology/Cytology Option
  - Medical Virology Option
  - Medical Mycology

Doctor of Philosophy Programmes:
- Doctor of Philosophy in Pharmacology and Therapeutics
- Doctor of Philosophy in Health Promotion and Sports Science
- Doctor of Philosophy in Medical Dietetics
- Doctor of Philosophy in Medical Education
- Doctor of Philosophy in Biomedical Sciences
  - Medical Biochemistry Option
  - Medical Biotechnology Option
  - Forensic Science and Technology Option
  - Medical Microbiology Option
  - Medical Parasitology Option
  - Medical Immunology Option
  - Medical Parasitology and Vector Biology Option
- Doctor of Philosophy in Medical Laboratory Sciences
  - Forensic Science and Technology Option
  - Medical Microbiology Option
  - Medical Parasitology and Vector Biology Option
  - Medical Immunology Option
  - Clinical Chemistry Option
  - Haematology and Transfusion Science Option
  - Histology/Cytology Option
  - Medical Virology Option
  - Medical Mycology

SCHOOL OF MEDICINE

Certificate Programmes:
- Mortuary Science and Practice

Degree Programmes:
- Bachelor of Medicine and Bachelor of Surgery

APPLICATION GUIDELINES

Requirements for Online Application
1. A valid Personal Email Address and Password for the student
2. Scanned application fees payment slip
3. Scanned Academic Testimonials (e.g. Result Slips, Certificates etc.)

Procedure For Application
1. LOGIN to website www.mmust.ac.ke
2. Click on Online Course Application
3. Create User Account

TIP: Use the same password as that of Email

4. Verification of User Account
   - Login to your email address
   - Click on the link to verify account
5. Application of course
   - Login to your user account (Enter Email & Pass word)
   - Follow the instructions by filling all appropriate information
6. Complete application process
   - Print an acknowledgment slip

Checklist
Confirm the following;
- Ensure you have applied for your preferred course
- Confirm upload of application fees bank slip
- Confirm upload of relevant Academic Certificates/Result Slips.

Application Fees
Bachelors 1,000/=
Diploma & Certificate 500/=
The non-refundable fee may be deposited in the following bank accounts:

BANK	ACCOUNT NUMBER	BRANCH
KCB Bank	1101811269	Kakamega Branch
Equity Bank	0500294636103	Kakamega Branch
Equity Bank	1650264152539	Kakuma Branch
National Bank	01003070554000	Kakamega Branch
Cooperative Bank	01129033999900	Kakamega Branch
Family Bank	078000012655	Kakamega Branch

MESSAGE FROM THE AG. VICE CHANCELLOR, PROF. SOLOMON. I. SHIBAIRO

MASINDE Muliro University of Science and Technology (MMUST) prides itself in providing quality research, training and education through Science, Technology and Innovation. As a University, we have ensured that we play a significant role in contributing to a more sustainable world by mainstreaming Sustainable Development Goals (SDGs) and the tenets of the Big Four Agenda at all levels.

We as MMUST management, have worked hard to ensure that researchers who are willing to engage in top-notch research are effectively equipped and funded. The School of Engineering and Built Environment (SEBE) has been at the forefront of these efforts.

MMUST has endeavoured to fund research every year and in the year 2020/ 2021, the university set aside 30 million for University Research Fund (URF) and Institutional Research Fund (IRF).

Through this, 33 projects were funded and over one hundred researchers and fifty students have been involved. I commend our researchers from the School of Engineering and Built Environment for the meaningful

COVID-19 innovations such as the Automatic hand-washing machine (Sani-Booth) and Herbal Sauna (Sani-herb) among others that are in the process of being patented. As we look forward to making the objectives of vision 2030 a reality, MMUST has made a unique milestone of becoming the first University to be accredited to offer TVET courses through its TVET Institute.

We are happy that the government of Kenya through the Ministry of Education has funded the establishment of MMUST's Engineering and TVET Complex whose groundbreaking will be taking place soon.

MMUST's School of Engineering and Built Environment (SEBE) has stepped up efforts to link engineering students directly to the industry early in their training. This was exhibited on 6th August, 2021, when they hosted officials of the Institution of Engineers of Kenya (IEK), Western Branch. Having been accredited, MMUST is well placed to produce engineers to fill gaps in the country's engineering workforce.

IEK's engagement is a clear indication that MMUST is visible across the Engineering field in Kenya. This is an acknowledgement that MMUST plays an important role in nation building especially in attaining the BIG 4 Agenda. MMUST has had a cordial relationship with IEK as well as the County Government of Kakamega among a host of other organizations. We strive to engage the community in whatever we do. This is evident by the number of projects that have involved the organizations and residents of Kakamega County and beyond

MESSAGE FROM THE DEAN, SCHOOL OF ENGINEERING AND BUILT ENVIRONMENT AT MMUST, DR. ENG. BERNADETTE W. SABUNI

THE School of Engineering and Built Environment at MMUST was established in July 2008 as Faculty of Engineering, after splitting from the Faculty of Science and Engineering. This was necessitated by the unique challenges encountered in the Engineering profession such as statutory requirements and expectations of the stakeholders (students, sponsors and industries).

Our objective is to produce engineers that meet the expectations of the labour market. Therefore, the programmes offered have to be recognized by regulatory and professional bodies. As the only engineering School in the Western Kenya region, it is to be a centre of excellence in applied research and consultancy, and play a leading role in TVET programmes. The School supports students in gaining an in-depth understanding of basic engineering, broadening their perspectives, and developing their creativity, humanity and practicality, so they will become key players in industrial circles and international arenas.

The Chairpersons of Departments in the School of Engineering and Built Environment at MMUST include Dr. James Owuor (Electrical and Communication Engineering), Dr. Peter Cherop (Mechanical and Industrial Engineering) and Dr. Micah Mukolwe (Civil and structural Engineering). Dr. Micah Mukolwe is also the patron of the Engineering Students Association of MMUST

Our industry consultants specialize in the design and production of customized training courses, training manuals, skills audits, workplace assessments and occupational health and safety training. Training courses for engineering options are regularly updated to meet the changing needs of technology and production methods in Kenya and abroad.

The School dates back to 2002. Since then, it has extended in size and scope to meet the increasing need of engineers to keep pace with the growth of Kenyan economy. The Faculty is now composed of three departments covering a wide range of engineering sciences. Our undergraduate students gain hands-on experience in our laboratories, industry placements and final year projects. We have laboratories/ workshops in areas including but not limited to: - Concrete Technology, Soils and Highways, Hydraulics, Machining, Welding, Mechanics of Machines, Material Testing, Power systems, Telecommunication, Electronic controls, Micro-processors and micro wave.

ABOUT THE SCHOOL OF ENGINEERING AND BUILT ENVIRONMENT AT MMUST

Mission Statement

TO train innovative and career oriented engineers, conduct high quality research, disseminate and preserve knowledge, while enhancing ecological integrity.

Vision

To be an excellent Engineering and Technology centre for Development

General Objective

To contribute towards infrastructural development through teaching, research, consultancy and community outreach while adhering to professional ethics and sustainable development.

Philosophy

The School of Engineering and Built Environment holds the view that Science and Engineering is an indispensable tool in harnessing resources of nature for sustainable development and creating an environment in which human beings can survive and realize their potential.

Core Values

a) Customer focus

The School of Engineering and Built Environment shall endeavour to ensure customer satisfaction by striving to offer superior services that exceeds the expectation of our customers.

b) Collegiality

The School of Engineering and Built Environment shall uphold cooperation between academic peers and associates as a means of building interpersonal trust during interaction.

c) Excellence

The School of Engineering and Built Environment shall encourage excellence

in teaching, research, innovation and service to the public.

d) Professionalism

The School of Engineering and Built Environment shall conduct business with dignity and diligence, observe professional competence and objectivity in performing duties.

e) Equity

The School of Engineering and Built Environment shall ensure that there is equal opportunity for all irrespective of gender, status, race, creed, disability, age, religion, ethnicity or political affiliation at all times.

f) Accountability

The School of Engineering and Built Environment shall act transparently in performing our duties besides taking responsibility in all their decisions and actions.

g) Innovativeness

The School of Engineering and Built Environment shall endeavour to create and utilize new ideas in teaching, research and consultancy in addition to seeking to disseminate new knowledge and ideas in the same.

BRIEF HISTORY –THE GENESIS OF MMUST'S SCHOOL OF ENGINEERING AND BUILT ENVIRONMENT

Masinde Muliro University of Science and Technology (MMUST) started offering engineering programmes inherited from Moi University in 2002 under the then faculty of science and engineering. These were Bachelor of Technology in Civil and Structural Engineering and Bachelor of Technology in Production Engineering. Later in 2003, the University started Bachelor of Technology in Electrical and Communication Engineering, also inherited from Moi University. The first group graduated in the year 2008.

The School of Engineering and Built Environment (SEBE) was established in July 2008 as Faculty of engineering at MMUST, after splitting from the Faculty of Science and Engineering. This was necessitated by the unique challenges encountered in the Engineering profession such as statutory requirements, expectations of the stakeholders (students, sponsors and industries) and manpower development and retention among others

The faculty of engineering then reviewed the programs in 2008 after the mandatory five years naming them as Bachelor of Science in Civil and Structural Engineering, Bachelor of Science in Electrical and Communication Engineering and Bachelor of Science in Mechanical and Industrial Engineering. They were implemented from 2009/10 academic year.

Since then, the faculty developed more programs totaling to the current sixteen (16). In 2017, the faculty of engineering was renamed school of Engineering and Built Environment, as necessitated by the current trend, with three departments, namely Civil and Structural Engineering, Electrical and Communication Engineering and Mechanical and Industrial Engineering.

Civil and Structural Engineering Department

THE department of Civil and Structural Engineering (CSE) was established in 2002, under the then faculty of Science and Engineering, in the former Western College (WECO), The department operated under Western University College of Science and Technology, a constituent college of Moi University until December 2006, when the college was given a University charter. Since then the Department has injected over 200 graduates into the job market.

This department has a variety of human and material resources. It has a range of laboratory facilities, field equipment and highly qualified staff drawn from diverse fields, which is in phase with the nature of the departmental training programmes as well as research and consultancy activities.

Electrical and Communication Engineering Department

THE Department of Electrical and Communication Engineering (ECE) was started in 2003 offering Bachelor of Technology degree in Electrical and Communication Engineering, and wholly adopted the Moi University curriculum. Seven years later, that program was developed and upgraded to the current Bachelor of Science in Electrical and Communication Engineering. The department of Department of Electrical and Communication Engineering aims to continuously improve on systems and service delivery. In addition, it aims at imparting skills and knowledge in real life training that solves day to day Electrical and Telecommunication Engineering problems that is backed by a strong team of qualified staff in the area of Power Systems, Electrical Machines, Wireless/ Mobile Communication, Optical Fiber Communication, Electro-acoustics, Engineering Design, Electronics, Instrumentation and Control Engineering, Antenna and Radio Wave Propagation.

Mechanical and Industrial Engineering Department

THE Department of Mechanical and Industrial Engineering (MIE) was started in 2003 offering Bachelor of Technology degree in Production Engineering, and wholly adopted the Moi University curriculum. Seven years later, that program was developed and upgraded to the current Bachelor of Science in Mechanical and Industrial Engineering. The department of Mechanical and Industrial Engineering aims to continuously improve on systems and service delivery and we believe in real life training that solves day to day Mechanical and Industrial Engineering problems that is backed by a strong team of qualified staff in the area of Thermodynamics heat transfer and Engineering Systems, Engineering Design, Applied Mechanics and Material Science, Industrial Engineering and Management, Fluid Mechanics and Hydraulics, Renewable Energy and Manufacturing Technology.

MMUST'S PARTNERSHIP WITH IEK

Summary of IEK activities carried out in collaboration with MMUST:

- Presentation on research opportunities in Civil Engineering in February 2021 by Eng. Otwani Justus, Chairperson - IEK Policy Research and Advocacy Committee
- Presentation on Automotive Policy - Need to shift from vehicle assembly to vehicle manufacturing;
- Presented by Eng. Carey Mbaraka- Chairperson IEK Manufacturing subcommittee during MMUST international virtual conference in May 2021.
- Mentorship of MMUST students on 6th April by IEK Western Branch
- Engineers under KENHA currently constructing 1.6km MMUST Ring Road under the Kakamega-Webuye Road project. MMUST has requested KENHA for project laboratory equipment upon project completion.

Areas of mutual interest for future collaboration/ linkage (industry and academia) include:

Seminars/ workshops/webinars on current industry best practices and other topical issues. Mentorship of students - Career week and related IEK Western Branch activities; Continuous Professional Development courses and Research to develop local solutions for local problems.

EBK boss, Eng. Margaret Ogai (left) and Kiambu Governor James Nyoro (second left) address the press after a meeting in Kiambu town.

Kiambu County, EBK to work together to stop collapse of buildings

By EiK Correspondent

THE Kiambu County Government and the Engineers Board of Kenya (EBK) have joined hands with other regulatory agencies in a bid to stop collapse of buildings.

The two institutions formed a taskforce mandated to regularly inspect buildings under construction as well those completed in an attempt to diagnose the problem and arrest the situation before it is too late.

This comes after the recent collapse of buildings in Kinoo and Gachie, both in Kiambu County.

"Part of what we have found out is that there has been very poor coordination between the county and regulatory agencies. While the county approved architectural and structural engineering documents for the collapsed property in Kinoo, for example, unfortunately, we did not have involvement of other agencies thereafter," said Kiambu Governor James Nyoro.

"The agencies ensure what has been approved is what is exactly being followed and this is why we must now work together."

The task force will compris Kiambu County officials, Engineers seconded by EBK, National Construction Authority (NCA), National Environment Management Authority (NEMA) and other national government agencies regulating the built environment.

Dr Nyoro said his administration will henceforth liaise with a regulatory institution so that they will each be giving their own approvals and do site inspections during construction.

The county also appealed to tenants to ensure new buildings they move into possess valid certificates of occupation for their safety and safety of their loved ones.

"The worst that can happen is if these defective buildings were complete and they collapsed with tenants inside," said Governor Nyoro, who promised to rally the Council of Governors to work with professional bodies in the built environment.

EBK Registrar and CEO, Eng Margaret Ogai, said the recent spate of collapse of buildings pointed to structural engineering failure on the part of the contractors. She assured that EBK will be seconding professional engineers to the county.

"We urge all property developers in the country to engage professional engineers in the right discipline. In the case of buildings, we urge that developers to work closely with structural engineers to avert loss of life," said Eng Ogai.

She revealed that an estimated Sh2 billion has been lost due to collapse of buildings in Kenya in 2021 alone, warning that developers bent on saving hard on deployment of professional engineering services endanger the public.

Institution of Engineers of Kenya (IEK) President, Eng Nathaniel Matalanga, called on developers to adhere to the due process.

"Allow Engineers who submit drawings of buildings for approval carry on with the supervision to ensure structural integrity of developments in the country," he said.

Eng. Matalanga also urged professional engineers to distance themselves from projects whose owners have abandoned the due process and report such projects to authorities so that construction is halted before they result in disaster.

IEK President, Eng. Nathaniel Matalanga, EBK Chief Executive, Eng. Margaret Ogai, and Kiambu Governor James Nyoro.

NCA: Why Buildings Collapse In Kenya

The building that recently collapsed at Kinoo in Kiambu County.

By EiK Correspondent

BUILDINGS are premises where humans live and run their businesses daily. In Kenya, some buildings have collapsed from to time to time while under construction or after occupation. According to the National Construction Authority (NCA), the earliest documented case of building collapse in Kenya was in 1990, when a multi-storey building came tumbling down in Dagoretti, killing one person and injuring others. Thereafter, a total of 87 buildings have so far collapsed, with a record of 21 being recorded in 2015.

The construction sector in Kenya in the past three decades has been characterised by unsafe buildings that are very dangerous for human habitation.

This phenomenon has been so pronounced that it has attracted a lot of concern from players in the sector and also the country's top leadership.

The building Law and Regulation Review and Harmonisation Committee (2009) said the reasons for the collapse of buildings include erroneous building design; inadequate building maintenance; incompetence of the contractor; use of unapproved building plan; corruption; cost of building materials; inadequate enforcement mechanism and lack of supervision by professionals.

"It has been noted that in Kenya, residential buildings are more susceptible to collapse compared to any other type of buildings. Poor workmanship is a leading cause of these unsafe structures. Proper workmanship is the ability of a contractor to follow proper standards to deliver safe and quality buildings," says NCA Executive Director, Eng. Maurice Aketch.

"For instance, installing products and materials correctly, proper plumbing and proper concrete compaction. The consequences of poor workmanship include weak structures, leaking roofs and cracks in the foundation, among others."

According to NCA, some of the contractors, in a bid to cut costs and time, do not subject their building materials to professional testing. "Contractors in Kenya are companies, and the process of their registration does not put a lot of emphasis on the qualifications of the directors, unlike in other countries, where contractors are duly qualified individuals who undergo a rigorous examination process before being licensed," says Eng. Aketch.

The NCA now warns that poor maintenance of buildings even after construction renders them unsafe. "Periodic inspections are required for early detection of defects.

The provisions in the National Building Maintenance Policy 2015 have not been affected through relevant legal framework. Enforcement of Building Standards and Regulations is weak.

The stipulated standards and regulations are not entirely adhered to. Some county governments issue inspection cards but the inspection stages are not carried out as ought to be.

Inspections are ad hoc and rarely take place. These are concerns that we must address," says the NCA boss.

> "For instance, installing products and materials correctly, proper plumbing and proper concrete compaction. The consequences of poor workmanship include weak structures, leaking roofs and cracks in the foundation, among others."

Regulation of Engineering Technology Profession in Kenya

THE Kenya Engineering Technology Registration Board (KETRB) is a Statutory Corporation established by the Engineering Technology Act (No.23 of 2016). The Act makes provisions for the regulation, practice and standards of engineering technologists and technicians and for connected purposes. The mandate and functions of KETRB are derived from the Engineering Technology Act, 2016 and include among others:

(a) Issuance of practicing licences to qualified engineering technology professionals and taking disciplinary measures where necessary under and in accordance with the provisions of the Act;

(b) entering and inspecting business premises and sites where construction, installation, erection, alteration, renovation, maintenance, processing or manufacturing works are in progress and business premises to verify that:

(i) engineering technology professional services and works are undertaken by persons registered under the Act;

(ii) standards and professional ethics and relevant health and safety aspects are observed, in line with Occupational Safety and Health Act, 2007;

(c) assessment, approval or rejection of engineering technology qualifications of foreign persons intending to offer engineering technology professional services or works in Kenya;

(d) recommending for the suspension of any engineering technology professional services, works, projects, installation process or any other engineering technology works, which are done without meeting the standards

Mrs. Alice Mutai

KETRB stands by the tenet of teamwork; the engineering team which is composed of engineering artisans, technicians, technologists, engineers and scientist complement and need each other's expertise while undertaking engineering works and services. They should therefore engage each other professionally while respecting that each brings into the work/service unique contributions. A demonstration of this complementarity is expected of all professionals because of the confidence each has on what they bring to the team. While one member's training emphasizes theories and development of advanced concepts, the other emphasizes the application of engineering techniques (implementation and hands-on application).

The government caused the establishment of KETRB to ensure that the engineering profession in its entirety is regulated for the health and safety of the public. To realize the government's goal of a holistic regulated engineering profession, adherence to the rule of law is imperative. Employees and the general public are therefore informed that Kenya has two regulatory bodies for the engineering profession to cover the whole team of professionals, KETRB and EBK.

Mrs. Alice Mutai is CEO/Registrar, KETRB

Engineering at Technical University of Mombasa (TUM)

WE at Technical University of Mombasa (TUM) shed light on some of the best engineering courses we offer for the future job market.

THE SCHOOL OF ENGINEERING & TECHNOLOGY

The School of Engineering and Technology in TUM has the oldest departments with a higher enrollment in degree, diploma and certificate courses. The school has grown with time, with more and more students enrolling each year. With the School having been mentored by Jomo Kenyatta University of Agriculture and Technology (JKUAT), Bachelor of Science degree programmes were introduced in the school. These programmes are normally regulated by the Engineers Board of Kenya (EBK), which also provides guidance on matters related to staffing of engineering departments.

The School of Engineering and Technology is one of TUM's leading faculties in student enrolment with state-of-the-art equipment to enhance engineering science and engineering technology training. The school is rated for the high quality of its teaching and engineering innovations and it has cultivated close and productive links with its students. The ambition of the school is to transform into leading schools of Engineering Sciences and Engineering Technology, and this will have benefits not only for the surrounding community and region but also for the nation as a whole. Schools are the engines of growth for the University, TUM needs the leading schools likely to develop further and become global university in advancing knowledge, science and technology as per the vision.

ENGINEERING AT THE TECHNICAL UNIVERSITY OF MOMBASA

The School of Engineering and Technology houses five unique and integrated departments: Building and Civil Engineering, Electrical and Electronic Engineering, Mechanical and Automotive Engineering, Medical Engineering, Architecture & Built Environment.

The Directorate of Computer Science and Information Technology was one housed and nurtured by the School of Engineering and Technology to maturity and it now stands on its own. The programmes offered respond to the demands of regional, national and global industry priorities in engineering and technology education.

The school nurtures a desire for excellence among its members through various forms of interactions such as seminars, workshops, presentations, brainstorming sessions, exhibitions and conferences in order to spur the growth of technological capacity.

The school is confident that its diploma, undergraduate and in the near future, postgraduate programmes that are offered by highly qualified and experienced academic and support staff, meet the best university standards worldwide.

BUILDING AND CIVIL ENGINEERING

The Building and Civil Engineering department offers a fully integrated undergraduate Civil Engineering programme comprising up-to-date courses in all the traditional branches of Civil Engineering, such as Structures, Steel and Concrete Materials, Geotechnics, Hydraulics, Water Supply and Transportation. In our undergraduate programme, young aspiring Civil Engineers are developed and equipped for the challenges that face Civil Engineering in a fast-developing universal set-up through a demanding curriculum. Students are taught the theoretical aspects of civil engineering during their lectures with a major component of laboratory sessions incorporated. These involve investigating the properties of different construction building and construction materials, soil behavior and foundation design, the behavior of structural materials under increased loads, water quality and waste treatment.

The Department has a state-of-the-art Material Testing Laboratory that is certified by Kenya Bureau of Standards (KEBS), which is used for Testing of concrete materials (both fresh and harden) as well as Aggregate. The department is in the process of establishing a Public Health Engineering Laboratory that will concentrate on major public and environmental health issues.

Students trained in the Department of Electrical and Electronic Engineering gain an excellent foundation in the principles of electrical engineering. Furthermore, the department endeavors to develop the minds of our students and nurture their abilities to conceptualize, analyze and solve problems. The Department works in tandem with industry, and is therefore at the cutting edge of electrical engineering trends globally. Long term research vision for the department is to develop an integrated research program in satellite engineering, develop an integrated research program in electrical/electronic device manufacturing and develop an engineering business incubation program. Among the short-term research vision include developing capacity to do research and participating in external and internal research related events. The department endeavors to create synergies among the team members working within the same discipline, across different disciplines and in collaboration with other institutions.

Orientation of students to machines at the Medical Engineering laboratory at Technical University of Mombasa.

MECHANICAL AND AUTOMOTIVE ENGINEERING

The Department of Mechanical and Automotive Engineering is a vibrant department that is growing with an aim of integrating not only activities of the Mechanical and Electro-Mechanical Engineering programmes, but also marine engineering programmes. The aim of our undergraduate programme is to educate and train engineers for a professional career, to enable them to think independently and to approach problems in a logical and confident manner. These skills are specifically developed through group/team work and practical sessions that emphasize design. As Technical University of Mombasa embarks on a new chapter in its development, we intend to move along with it. In line with the Government of Kenya's vision 2030, the department is in the process of launching a number of research centers with the aim of enhancing research and development within the region. These centers will seek to bridge the gap between industry and academia thereby enabling us to produce market-oriented graduands who will be capable and competent enough to effectively meet local, regional and international industry needs in science and technology. To aid research, the department is adequately equipped with the engineering laboratories namely Mechanical science measurement laboratory, Fluid mechanics and hydraulic machine laboratory, Thermodynamics laboratory, Heat treatment and foundry, Metrology laboratory and Materials Testing laboratory. The Materials Testing laboratory is certified by KEBS. In tandem with TUM being a World Class University of Engineering Science and Technology, we have a simulator for Marine Engineering training and evaluation.

MEDICAL ENGINEERING

The department of Medical Engineering is concerned with teaching medical engineering programmes for the purpose of maintaining hospital and clinical equipment in private and public health-care facilities. The programme is broad based at the diploma level where the trainee is equipped with skills to handle both electronics, electrical and mechanical technologies which is a component of the modern science health technologies. The department has for a long time been associated with the Association of Medical Engineer Kenya, (AMEK), and it has also been collaborating with the World Health Organisation (WHO) and the German International Cooperation (GIZ) on Technology transfers.

The medical facilities and utilization management centre to be located in the department of medical engineering, is intended for organisations dealing with medical equipment, mainly found in hospitals, health research centres as well as in the pharmaceutical industry. The centre's concern on the facilities is by way of patient safety as well as that of the user and the environment. The department of Medical Engineering offers specialized training in medical equipment and plant. It also provides tailor made course, as well as structured skills upgrading courses in Hospital equipment maintenance and management, Refrigeration and Air-conditioning, Vaccine management, Diagnostic equipment and Sterilization as well as Clinical wastes management.

ARCHITECTURE AND BUILT ENVIRONMENT

Architecture and Built Environment is the youngest department within the school. Since the coastal region has heritage sites, the department seeks to capitalize on its niche to differentiate it from other Universities offering an Architectural programme, where creativity, culture and aesthetics will be product of the design, perspective drawings, models and final landscape.

ENGINEERING COURSES OFFERED

a. Architecture and Built Environment

- Bachelor of Architectural Studies/ Bachelor of Architecture
- Bachelor in Quantity Surveying (New)
- Diploma in Architecture
- Diploma in Quantity surveying

b. Building & Civil Engineering

- Master of Science in Civil Engineering (New)
- Bachelor of Science in Civil Engineering
- Bachelor of Technology in Civil Engineering
- Diploma in Building and Civil Engineering
- Diploma in Building Technology
- Diploma in Civil Engineering
- Certificate in Building and Civil Engineering

c. Mechanical and Automotive Engineering

- Bachelor of Science in Mechanical Engineering
- Bachelor of Technology in Mechanical Engineering
- Bachelor of Technology in Marine Engineering
- Diploma in Mechanical Engineering (Production or Plant option)
- Diploma in Automotive Engineering
- Diploma in Chemical Engineering
- Diploma in Nautical Sciences
- Diploma in Marine Engineering
- Certificate in Mechanical Engineering

d. Electrical & Electronic Engineering

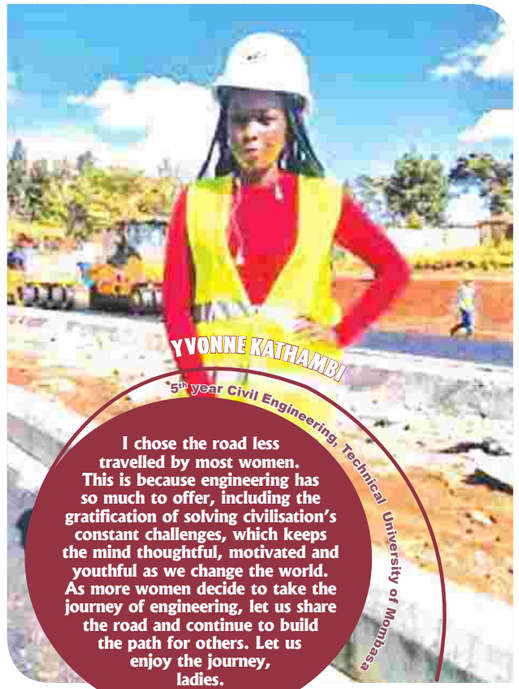
- Doctor of Philosophy in Sustainable Energy Engineering (New)
- Master of Technology in Mechatronic Engineering
- Master of Technology in Sustainable Energy Engineering
- Bachelor of Science in Electrical and Electronic Engineering
- Bachelor of Technology in Electrical and Electronic Engineering
- Diploma in Technology in Electrical and Electronic Engineering (Power Engineering, Telecommunication & Information Engineering or Instrumentation & Control options)
- Certificate in Electrical and Electronic Engineering

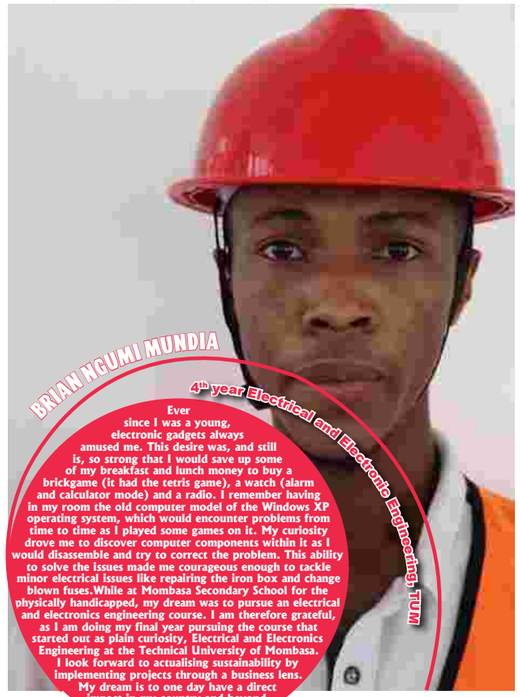
e. Medical Engineering

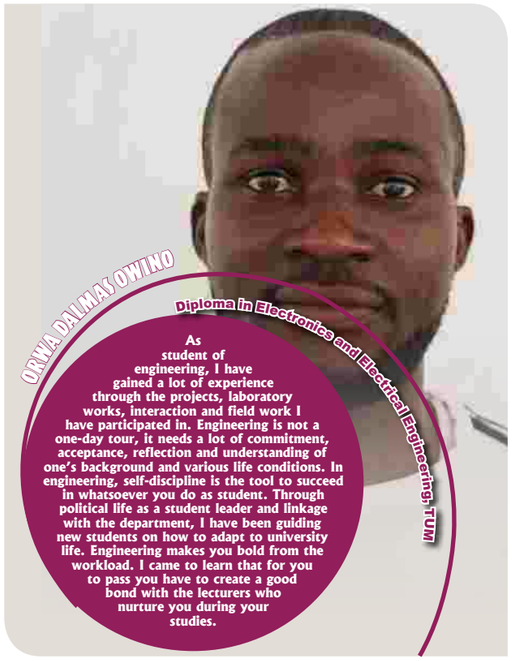
- Bachelor of Science in Medical Engineering
- Bachelor of Technology in Medical Engineering
- Diploma in Technology in Medical Engineering
- Diploma in Medical Engineering (KNEC)
- Diploma in Refrigeration and Air Conditioning

The School of Engineering and Technology (SoET) is a prominent source of internationally competitive and locally relevant programmes in Engineering Science, Engineering Technology, Architecture and the Built Environment at certificate, diploma, undergraduate and graduate levels. The School is well resourced in terms of teaching and lab facilities and maintains close links with the industry that supports the teaching programmes, especially in curriculum development, industrial attachments and internships. The multidisciplinary nature of the School of Engineering and Technology facilitates interaction across disciplines in both teaching and research activities.

STUDENTS VOICES







IEK MEMBERSHIP REPORT

The IEK Membership Committee meets every month to consider applications received at the secretariat to enable clear the long list of applicants wishing to become members of the Institution in the various classes. The latest membership for June - August update is as shown below;

Member Entry Class	June - August Registration
Graduate Member – GE	394
Graduate Engineering Technician – GT	2
Graduate Engineering Technolist – GTL	2
Student Membership – S	56
Corporate	39
Fellow	5
Total Number:	**498**

Between June and August, 5 members were registered in Fellow class and 39 members transferred from Graduate to Corporate class. Their details are given below. ***Their details are given below:***

S/N Member Name	M/No.
CORPORATE JUNE - AUGUST 2021	
NAME	**REG. NO**
1. Andrew Chief Okal Okinyi	M.5059
2. Anthony Joshua Mugo	M.4641
3. Arun Shivji Raghwani	M.6880
4. Charles Kwena Osore	M.7277
5. Charles Mwaniki	M.5727
6. Cicilia Njeri Kagwima	M.4886
7. Daniel Mosoti Onyancha	M.9059
8. Denis Githinkimwaniki	M.8775
9. Dennis Kipchirchir Kemboi	M.6349
10. Dennis Mwangangi Mwilitya	M.4878
11. Edward Pius Otieno Ndinya	M.9063
12. Florence Bukachi Ambuche	M.3854
13. Gatonye Ng'ang'a	M.4410
14. Geoffrey Mwangi Kihara	M.3437
15. Gitonga Njonjo	M.7055
16. Harrison Omari Isensi	M.9489
17. Hezron Mokua Otwori	M.7207
18. James Kinyua Mwaniki	M.3823
19. Jeremiah Kiragu Wanjohi	M.3891
20. John Opany Ogalo	M.7617
21. Joseph Nyutu Kamira	M.5819
22. Josiah Nyangaresi Nyagwachi	M.1773
23. Kennedy Owino Ogutu	M.6995
24. Kenneth Kinoti	M.6843
25. Kipkirui Langat Wilfred	M.7334

S/N Member Name	M/No.
26. Maina Edward Njoroge	M.3026
27. Maxwell Ochieng Ngala	M.7160
28. Michael Alfred Osewe Apudo	M.6175
29. Oyuko Onyango Mbeche	M.9425
30. Patrick Kanjuki Gitu	M.6111
31. Paul Kinyanjui Njehia	M.7561
32. Peter Maina Wachira	M.6689
33. Rassam Timimi	M.1554
34. Richard Kiplagat Kosgey Yagan	M.2760
35. Samuel Odhiambo Otieno	M.6363
36. Simon Njagi Nthiga	M.5309
37. Stephen Kipkorir Tonui	M.3959
38. Wesley Kiplangat Koros	M.3654
39. Zachary Waweru Macharia	M.7255
Fellow member registered June – August 2021	
1. David Gitari Mugo	F.3376
2. Erick Ngage	F.2496
3. Esyepet Vincet Sidai	F.3247
4. Patrick Simiyu Wambulwa	F.1380
5. Sospeter Francis Mbogo	F.1944

The council is calling upon members to apply for transfer of class from Corporate to Fellow and also Graduate to Corporate. Members can check eligibility requirement and how to apply for Fellow class on our website: **https://iekenya.org/downloads/REQUIREMENTS/FELLOW%20REQUIREMENTS%202020.pdf**

The IEK condoles with family and friends of our members who have passed away in the recent past. May their souls rest in peace.

Condolences to the family and friends of Eng Joshua Muema Nyamai, who served in the Functions Committee 2020 – 2022. May his soul rest in peace.

"Death is not extinguishing the light . It is putting out the lamp because the dawn has come."

The solution to fiber

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