50 YEARS OF IEK

Engineering in KENYA

ISSUE 008

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Engineering Governance

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REPUBLIC OF KENYA

ENGINEERS BOARD OF KENYA

ENGINEERS BOARD OF KENYA

THE ENGINEERS STAMPS

Introduction/ Background

Pursuant to Part II, Rule 10 (4-8) of the Engineers Rules, 2019 the Board procured the Engineers Stamp. It states that "the Board shall, issue an official rubber stamp to every professional and consulting engineer registered under the Act on payment of the fees prescribed in the Third Schedule of the Rules. In addition, the rubber stamp issued shall be used for approving or certifying engineering documents including design calculations, drawings, technical reports, and other engineering documents. A professional engineer or a consulting engineer shall sign and date and affix the rubber stamp issued under paragraph (4) on any approval or certification given by the professional engineer or a consulting engineer.

Furthermore, in fulfilment of Section 7 (1) (m) of the Engineers Act, 2011, that mandates the Board to "set standards for engineers in management, marketing, professional ethics, environmental issues, safety, legal matters or any other relevant field" the Board developed Guidelines for use of the Engineers Stamp.

Purpose of Engineer's Stamp

To identify and distinguish all work prepared by a professional engineer, or under his/her direct supervision

- By affixing the stamp, the professional engineer assumes responsibility and is answerable for the quality of work presented. Signing and stamping of an engineering document by a professional engineer certifies that the professional engineering services rendered have been completely, adequately and/or reliably performed.
- Proper use of the stamp is essential, not only for complying with the Engineers Act, 2011 and the Engineers Rules 2019, but also for assuming the public that the stamp represents the profession's commitment to the set standards.

Importance of Engineer's stamp

- It gives assurance that the work meets the standards of professionalism expected of a professional engineer.
- By affixing the stamp, professional engineers assume full responsibility for their judgments and decisions based on their knowledge, skills and ethical conduct.
- It is a statement by a professional engineer to the intended recipient of the engineering document that he/she can rely upon the contents of the engineering document.

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From left: Eng. Margaret Ogai, Registrar EBK; , Prof. Arch. Paul M. Maringa (PhD), Corp, Arch, (Maak), Mkip, the Principal Secretary for the State Department of Infrastructure; and Eng. Erastus Mwongera FIEK, RCE, MBS during the launch of the Engineers'stamp at KICC

The Board Launched the Engineers' Stamp on 9th December 2021 at Kenyatta International Convention Centre graced by the Principal Secretary for the State Department of Infrastructure, Prof. Arch. Paul M. Maringa (PhD), Corp, Arch, (Maak), Mkip.

The issuance of the Engineers' stamp has officially commenced. The Board, through the Registrar, Eng. Margaret Ogai issued the 1st stamp to Eng. Christopher Atsyaya on 7th February 2022

1972 – 2022

THIS YEAR, IEK CELEBRATES

The East African Association of Engineers (EAAE), which was the precursor to the Institution of Engineers of the Kenya (IEK), was formed in 1945 as a professional and learned body, independent of control by governments and with membership spread in the original East Africa i.e. Kenya, Uganda, and Tanzania (Tanganyika and Zanzibar). The break up of the East African Community in the early 1970's resulted in the splitting of most of the professional/learned bodies, among them the EAAE. IEK was born out of this split. IEK was registered as a professional/learned and independent body in 1972.

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Call for Papers

Engineering in Kenya Magazine - Issue 009

The Institution of Engineers of Kenya (IEK) publishes Engineering in Kenya magazine, whose target audience includes engineering professionals, practitioners, policy makers, 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 invites you to contribute articles for our next and future editions. Articles should reach the Editor not later than August 24, 2022, for our next issue, whose theme shall be Aerospace & Aviation Engineering 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 readers in Kenya and beyond. The IEK Editorial Board reserves the right to edit and publish all articles submitted, in line with standing editorial policy. All articles should be in Word document format, 500-700 words, font type Times New Roman and font size 12.

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

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Speakers:

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(oxon) EGH. Cabinet Secretary, Ministry of Energy

Maj. Gen. (Rtd) Dr. Gordon Kihalangwa
CBS. Principal Secretary, Ministry of Energy

Vivienne Yeda, OGW
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Eng. Geoffrey Muli
Ag. Managing Director. The Kenya Power and Lighting Company PLC

Panelists:

Carol Koech
Schneider Electric

Folake Soetan
Ikeja Electric

Jerry Teka
Safaricom PLC.

George Aluru
Electricity Sector Association of Kenya (ESAK)

Eric Mwangi
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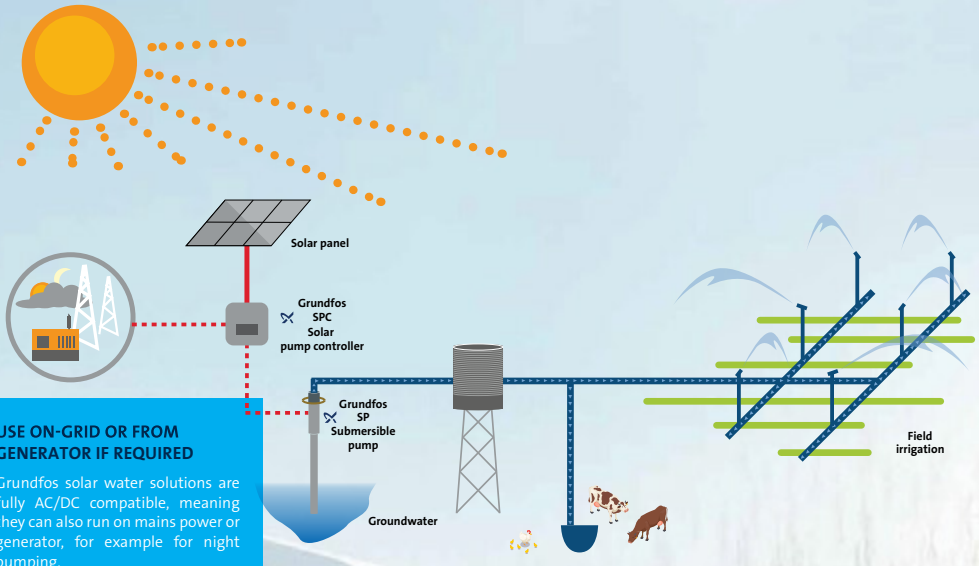

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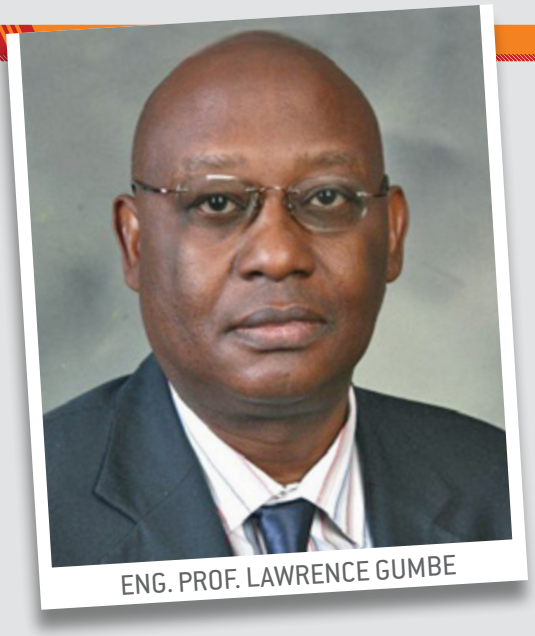

ENG. PROF. LAWRENCE GUMBE

Engineering Governance

GENERAL elections will be held in Kenya on Tuesday 9 August 2022.

Elections are important to Kenya because those who determine the direction of the country with respect to development are put into office by this event.

Every aspect of our lives from birth to death is governed by some law, policy or executive action effected by our political leadership. Politics is, therefore, too important to be left to politicians alone. Elections, from the cultivation of candidates to ensuring that our preferred candidates win, are, therefore, of extreme interest to organized learned societies such as the Institution of Engineers of Kenya.

Engineers elsewhere have organized to influence politics through advocacy and sponsoring of candidates in elections. The American Council for Engineering Companies, ACEC, is such an organization. It has its origins over 100 years ago.

ACEC's Political Action Committee, PAC, is the US engineering industry's primary tool for political engagement at the national level. Supported by engineering professionals from across the country who work for member firms, the sole purpose of ACEC/PAC is to elect candidates to the U.S. House of Representatives and U.S. Senate who support policies and legislation favourable to the engineering industry.

In China, former presidents Jiang Zemin (1993–2003) and Hu Jintao (2003–2013) as well as Xi Jinping (2013–present) all studied engineering. A high proportion of government officials at city, provincial, and national levels have had some form of technical education. For example, of the 20 government ministries that form the State Council, more than half are headed by persons who have engineering degrees or engineering work experience.

One can therefore conclude that having engineers at the political apex in China has contributed to the miraculous transformation of the country in the last few decades.

Dr. Kehdinga George Fomunyam has recently noted in his papers, ***The Political Dimensions of Engineering Education in Africa,*** that politics in Africa influences engineering education and therefore he recommended that engineers must provide leadership in all political processes and wealth creation.

In Kenya, we have had a few engineers elected to parliament and other political offices through their personal initiatives. They include Rt. Hon. Raila Odinga, Hon. Senator Eng. Ephraim Maina, Hon. Kipng'eno arap Ngeny and Hon. Eng. Muriuki Karue.

> It is now obvious that engineers in political leadership are very beneficial to the engineering community and the country in general. Engineers bring remarkable technical capacities to the formulation and implementation of policies, laws and programmes.

Therefore, engineers must organize to ensure that, from the general elections of 2022, we have an increased and increasing number of engineers in public office.

Thereafter, engineers must, through the IEK and other engineers' organizations, continue structural engagement with engineers in public bodies so that there is requisite engineering input in policies, laws and programes. So, we endorse the candidature of engineers who are running for public office in the 2022 general elections.

Raila Odinga is a presidential candidate. He is a fellow of the Institution of Engineers of Kenya as well as a registered engineer. He has worked at the University of Nairobi as a lecturer in the Department of Mechanical Engineering. He has also worked at the Kenya Bureau of Standards as its Deputy Managing Director.

Raila Odinga has also worked as a consulting engineer. He founded Spectre Ltd and Spectre International. The former firm manufactures liquefied gas cylinders. The later firm produced ethanol and other products from molasses.

Raila Odinga is the current African Union Ambassador for Infrastructure. We have seen him champion various engineering projects like the giant grand Inga electricity dam in the Democratic Republic of Congo and the recently commissioned 4km bridge in South Sudan.

Raila Odinga has been Minister for Energy, Minister for Public Works and Housing and Prime Minister of Kenya. He has demonstrated great vision in the transformation of Kenya, Africa and the world through development of infrastructure and proper governance systems. He is a champion of good governance and the rule of law.

In our opinion, Raila Odinga is the best person to be the 5th President of the Republic of Kenya.

We endorse the candidature of the Rt. Hon. Raila Odinga to be the President of the Republic of Kenya!


ENG. ERIC OHAGA

Engineers in Politics Strengthen Policy and Governance

> With Engineers gunning for elective positions in Kenya, it gives us a prime opportunity to advocate and create awareness of what matters to the engineering fraternity, hence make our contribution to the socio-economic development of our country and people.

GLOBAL emerging issues are increasingly piling on the need for the engineering practice to be reviewed to enhance and promote corporate sustainability, resilience and capacity to build back better when challenges arise.

COP26 on Climate Change, which has insightfully and exhaustively been discussed, calls upon engineers to discharge their critical role going forward towards ensuring that countries meet their commitments to the Glasgow Accord.

A 2.7 degrees' temperature differential on our planet earth presents a very dire situation for all humanity and future sustainability; including that of livelihoods and trades such as engineering. As a country, Kenya cannot afford to sit back and watch. Engineers in Kenya are called upon, to cast themselves through training and experience, and design technologies and solutions that will birth and sustain a sustainable world.

Our profession, as we all know it, relies heavily on the harnessing and processing of natural resources. Engineers need to be actively engaged within organizational contexts so they can make deserving, skilled, technical and knowledgeable contributions towards mitigating climate change.

For many generations, we have retained one type framework for the training, assessment and qualification of our graduate engineers to become professional engineers. Outcome-based engineering education (OBEE) is a new global direction that is increasingly being championed. In Kenya, OBEE not only finds relevance in engineering but also other professions as well.

As Engineers, and specifically those mandated with the examination and qualification of graduate engineers, global trends build pressure on us to review our assessment and qualification methods. We have for example since redefined the Young Engineers Chapter to Future Leaders, a critical decision that has resonated well with emerging issues in the engineering sector. With review and adoption of the various frameworks, we shall be able to respond better to the needs of our society and the general growth of demand for engineering services, which are increasing, driven by need in various development contexts.

I wish to applaud our regulator, the Engineers Board of Kenya (EBK), for facilitating a highly successful Engineering Partnerships Convention (EPC) towards this direction, and bringing together stake-holders in the academia, industry, regulation and practice.

This edition of Engineering in Kenya Magazine highlights matters electoral politics and governance. Electoral politics the world over play a central key role in influencing policy matters around engineers and the engineering practice. Policies that are so created, defined and established through politics result into governance structures, which define the quality of environment in which engineers work and live. Since Engineers believe in their solutions, it implies we take pride in ourselves as professionals and a community. I therefore challenge all of us to take the bold step and consider electing engineers at all levels of electoral politics, including supporting our own member Rt. Hon. Raila Amollo Odinga for President.

I am encouraged by the enthusiasm of our increased membership who have shown interest and taken the bold step to venture into active campaign for political office. I consider this to be the foundation steps that will increasingly interest engineers in future to participate in elective politics on an increased scale. With Engineers gunning for elective positions in Kenya, it gives us a prime opportunity to advocate and create awareness of what matters to the engineering fraternity, hence make our contribution to the socio-economic development of our country and people.

As an Institution and Council, we continue to work and collaborate with our members and all stakeholders towards the attainment of value proposition to our members. Regional, continental and global partners continue to work closely with us. The gender agenda continues to find vibrancy in our membership, and we shall continue to promote the same and deliver the mandate of putting all issues relevant to engineering on the table, for the growth and betterment of the profession in this country.


ENG.SHAMMAH KITEME

Engineering and Governance

> Engineers cannot afford to be politically illiterate. This is because politics affect virtually all areas of our lives. Policies crafted through political processes affect our work, food, fuel, transportation, education, health and virtually the entire operating environment we ply our trade.

ON 29th June 2020 I had the privilege together with other colleagues in the built environment to engage the committee of senate responsible for Roads and Transportation. The matter of consideration was the defects liability regulation that the government gazzeted and which many of us in the built environment considered harmful to the industry.

Working under the auspices of Joint Building and Control Council, we joined other professional societies including IQSK, AAK and made a case against the regulation. The committee gave us audience and also listened to the views of the CS transport, infrastructure housing and urban development CS James Macharia.

The committee also committed to address our concerns. Now, it emerged that the regulation was not rolled out in compliance with the requirements of the statutory instruments act and so it ought to be withdrawn. While the senators agreed with us, the executive through CS James Macharia thought otherwise. In the end, the regulation was nullified by the courts and it was a big win for us as we rightly thought a wrong was committed in gazzeting the regulation.

Now, it is important to note that the vice chair of the committee was Sen. Arch Sylvia Kasanga and she was instrumental in organizing the meeting for us to get audience with the committee. Another important point to note is that two senators who were members of the committee were Sen. Eng. Mahamud Mohamed and Sen. Eng. Hargura Godana. These three proved very useful because they would understand very well concerns of the industry not only from the point of view of being senators but also from the perspective of practitioners.

It is in this context that I invite you the reader to consider our issue 008 of the EiK magazine. In this issue we focus on Engineering governance and I have illustrated my experience in senate to drive a point home. And this is the point, we need as many of us as possible in all the arms of government. Whether in the executive, the legislature or even in judiciary. The popular saying that if you are not on the table you are part of the menu seems to indicate that it is our business to be where business is happening. And we are responsible for our own successes or failures. We have no one else to blame

It is for reason that we should make sure in this season of elections we take an active role in shaping the future governments at all levels. This can be through offering ourselves to be elected as Members of County Assemblies, Members of National Assembly, Members of Senate, Governors, President etc. in instances where we wouldn't offer ourselves, we need to build strategic alliances and actively participate in the political process by supporting candidates who once elected will be available to listen to our views and give us favorable audience in all levels of government.

After elections, we need to lobby to be appointed in cabinets in all counties. We also need to lobby to be appointed as speakers of county assemblies, national assembly and senate. It is important to note that if we participate now it is easier to get these appointive positions. There will be many appointments to be done by the new government. From the chairs of constituency development committees to parastatals and PSs

as well as CSs and ambassadorial positions. All these appointments will be available and we are qualified to occupy the positions as Engineers. But we have to show willingness to participate in the political process because it is through our participation that we will get the all-important presence and recognition leading to such offers when they are available. Engineers should note that by the time elections are over on 9th August 2022, cabinets will be in place. Whatever will be pending will be formalization of the appointment process. This is where if we wait to start campaigning for these appointive positions on 10th August it will be too late.

Engineers cannot afford to be politically illiterate. This is because politics affect virtually all areas of our lives. Policies crafted through political processes affect our work, food, fuel, transportation, education, health and virtually the entire operating environment we ply our trade.

One of the challenges we face is the issue of unemployment and underemployment. This is not only affecting engineers but many other professions also. Our point of concern as Engineers is that we have so many engineers in our different classes, graduates, professionals, consulting who don't have jobs in the midst of many government infrastructure projects being implemented by the national and county governments.

The sad reality is that the government seems to prefer foreigners over locals in the implementation of these projects. And so you find foreign nationals and firms are the ones carrying out the design, supervision and even construction of these projects. It is not because we do not have the local capacity. The main reason is that the politics of the day that inform government policies decided to trust the foreigners more than locals. Granted the financial arrangements like project financing may have preconditions like restrictions on who can do the projects, it is also possible to negotiate favourable deals that do not lock out nationals in these projects and this is where we seem to go wrong.

Another key aspect of governance in Engineering is the management of even the few projects entrusted to some of us. This goes hand in hand with organisations where engineers are managers, administrators etc. it is important that we demonstrate competence that delivers results to all stakeholders. This builds confidence in the appointing authorities and inculcates the belief that if you want a job done give it to engineers. It is John Maxwell who says everything rises and falls on leadership. Engineers must demonstrate leadership guided by highest ethical standards and a great focus on value addition. We must deliver results when given opportunity to do so.

When we are entrusted with projects and the projects cannot be delivered on time and within budget we fail terribly. A few of the mega infrastructure projects going on in the country have failed in all metrics used to measure success of projects. Without picking on any particular one, we have study cases all over the place of projects that will start and due to poor planning take forever to complete or even when delivered they have overshot on budget and time. This really dents our credibility to deliver and encourages the appointing authorities to start looking for other professions to deliver value to the projects.

We must invest in offering effective leadership that makes all stakeholders happy with our performance.

As IEK Council, we have put in place measures that seek to engage with leadership at all levels in this country. The CEOs round table began during the last Council will continue so that we can engage with agencies where many of our members are employed. This will help us understand key areas of advocacy relevant to our members and our continued partnership will deliver results. We will also continue to engage with the political class in both the national government and county governments so that we influence policies that are favourable to Engineers.

We will not only be reactive but proactive in developing policies on areas of focus where we are likely to draw a lot of value to our members. In deed the area of governance is wide and it is important we equip ourselves appropriately to play our role. In the end, politics as John Stott points out is the art of living together as a community. We must therefore actively participate in the political process because we are members of the community.

Governance and Politics in Kenya: The Pursuit of Progress, Equity and Inclusive National Politics

By Dave Anyona Kanundu

THE forthcoming elections on the 9th of August 2022 are epochal and most consequential elections for the future of the country in general and the engineering profession in particular. The outcome will have serious consequences for our politics and governance and the well-being of our people. It is a chance that we hope will catapult Kenya into a modern industrialising prosperous society where all our people enjoy dignity and high quality of work and life.

The future of Kenya is inextricably tied to the future of the engineering profession in the country. Industrialising Kenya is of necessity an engineering undertaking which therefore calls for the urgent need to expand the output of engineers to help reconstruct the country. The future of a thriving engineering profession is also dependent on an industrialising Kenya. If we continue being a dumping ground for foreign goods, our engineers will continue to lack decent jobs and incomes.

Time is therefore ripe for all cadres of our engineering professionals to pay close attention to and immerse themselves in re-engineering our politics, governance and public policy formulation

Governance and politics is about how power and resources are distributed and shared, how policies are formulated, priorities set and leaders made accountable. Governance also refers to the norms, values and rules of the game through which public affairs are managed.

In a broad sense, governance is about the culture and institutional environment in which citizens and leaders interact among themselves. Essentially, governance is therefore exercise of authority or power in order to manage a country's economic, political and administrative affairs.

As Harold Lasswell once observed, governance and politics is about the power to determine who gets what, when and how.

Kenya has Immense Potential

An analysis of Kenyan politics and governance today shows a nation of boundless potentials yearning for change. A nation of plenty in which the majority of the people are unemployed and live-in abject poverty while a handful enjoys obscene wealth siphoned out of public coffers. A nation repeatedly betrayed by a cabal of predatory politicians who misuse and abuse the solemn duty and trust bestowed upon them to lead and transform the country for the benefit of all. They have privatised the state. They seek to dismember the nation at the altar of personal aggrandisement. For them, Kenya is but a carcass for hounds.

On the other hand, the majority of our people continue to struggle for a democratic prosperous, just, equitable and inclusive Kenya. We stand on the threshold of momentous changes. These elections provide the opportunity for changing the trajectory of the country so that we build a powerful, vibrant, democratic and inclusive nation with a compelling national identity and strong core- values and principles. A prosperous nation in which those born into different circumstances enjoy equality of opportunity and hope and live dignified lives; a nation in which all

Kenyans feel at home.

Colonial Origins

The problems that we face today can be traced to bad colonial policies which have been compounded by myopic and narrow-minded post-colonial leadership.

Inherited colonial structures were bound to be a challenge to national development. However, a committed visionary leadership should have been able to transform such structures and create a strong and prosperous and inclusive nation capable of meeting the needs of the broad masses of our people.

Following the Berlin Conference and partition of Africa in 1884-1885 Kenya became a British Sphere of influence. As a result, The British East African Association (BEAA) started ruling East Africa in 1885. When the BEAA realised their limited powers, William McKinon sought a charter and obtained The Imperial British Company in 1888 from Queen Victoria giving him more power over the area. But they soon realised that the charter gave them limited powers over land alienation. Consequently, the Queen of England legislated a Constitution for Kenya in the 1897 East Africa order of Council, declaring Kenya a British Protectorate. By 1920, Kenya was declared a British Colony.

The politics and governance of the colonial state building project was not only brutal, repressive and authoritarian but also racist, parasitic and extractive. So on the completion of the building of the Kenya– Uganda railway, the rich highlands of Kenya were expropriated and alienated to white British settlers. This set-in motion the creation of an agrarian colonial economy whose primary purpose was to supply British industries and kitchens.

By 1915 there were about 1,000 white settlers to whom over 4.5million acres of land had been alienated. The social and economic infrastructure of the country was consequently organized to fulfil that purpose. African labour and resources were forcefully expropriated as part of the primitive accumulation of capital in the colonial economy.

Whereas the colonial office was concerned about metropolitan imperial interests, the settlers saw Kenya becoming a settler colony in the same manner as Australia and New Zealand. They had a vision of a Kenya dominated

by them as a ruling class dominating both the immigrant Indian dukawalas and the Africans. The colonial office was forced to issue the Devonshire White Paper in 1923 which asserted that Kenya was primarily an African country. This did not, however, stop settler interests from dominating the content and direction of state policy. The settlers depended heavily on the colonial state subsidies. The colonial state also ruthlessly extracted and repressed cheap African labour to keep them going, thus retarding African agricultural production.

No investments were made in providing education and health facilities for Africans. When the colonial government paid any attention to African education (the Phelps-Stokes Commission of 1924), it decided that Africans should receive only practical, agriculturally-oriented education suitable for rural communities. In fact, the settlers were mad with missionaries for attempting to give even rudimentary literacy to Africans.

No investments were made in African agriculture not to mention industry.

Betrayal at Dawn

At the dawn of independence Kenya African National Union (KANU) came to power as a popular nationalist movement with a promise, not only to liberate Kenya from the yoke of colonialism, but also our people from the degrading conditions of life they had been subjected to by imperialism. KANU promised to eradicate poverty, disease and ignorance. Kenyans were therefore extremely excited about the future.

However no efforts were made to restructure and remake the brutal, repress and extractive colonial state in the post colonial period. The incoming ruling elite and new bureaucracy inherited the colonial edifice lock, stock and barrel. So by the end of the first republic, the national dream for a new pro-people Kenyan state was dead. It had been killed by ethnic chauvinism and corruption perpetrated by an ethnic cabal that essentially privatised the state

Many segments of the society were treated as subjects rather than citizens in a manner quite similar to that of the colonial conquerers. President Mzee Jomo Kenyatta failed to restore displaced persons to their lands; in fact, this was a major point of disagreement within KANU. The million-acre scheme was hijacked by government operatives for their own gain – giving themselves large tracts of land as the intended beneficiaries remained landless.

> Corruption became a national pastime. The leadership forgot that nation building is a project that requires selfless work and patriotic dedication to the broader good.

This period also saw the death of political party politics in Kenya as Kenyatta replaced the party with state bureaucracy.

Kenyatta failed to engage in nation building; instead, he allowed the growth of a brutal, repressive and corrupt supremacist ethnic cabal around him. The enunciation and adoption of Sessional Paper Number 10 on Socialism and It's Application To Planning in Kenya, which was dismissed by some as being neither African nor socialist, ended any hopes that KANU would fulfill it's progressive promises of transforming the economy to fulfill the aspirations and needs of the broad majority of the citizens. Even though the economy grew, it followed the well laid out colonial pattern which marginalized large sections of the country. Kenya continued to run a dependent economy that essentially produced what we don't consume and consume what we don't produce. Public investment was directed to areas which already had well developed infrastructure.

This led to intense ideological and political struggles that split the party into two wings. In 1966 when the left leaning wing led by Jaramogi Oginga Odinga was isolated they broke off and founded the Kenya People's Union (KPU). In 1969, following the assassination of Tom Mboya, the Secretary General of KANU, KPU was proscribed and Odinga and the leadership of the party detained without trial. Increasingly large segments of society that felt it was "not yet uhuru" were alienated from the mainstream of national politics as KANU ran an acutely repressive defacto one party dictatorship.

The coming of Moi to power in 1978, following the death of Mzee Kenyatta, renewed hopes for a new beginning especially when he released those who had been detained without trial. Hopes that Moi would resolve the pressing national issues were soon dashed when he engaged in doing more of the same. He hurriedly declared Kenya a dejure one party state and soon re-introduced torture chambers and detention without trial as he unleashed a reign of terror on real and imaginary political opponents. Tribalism thrived under him even as he repeatedly preached about Love, Peace and Unity. However as political repression was intensified so did resistance to Moi's rule.

Under him, the economy all but collapsed especially when he was compelled to accept the structural adjustment programmes (SAPs) imposed by the Bretton Woods institutions. SAPs heralded de-industrialization and the collapse of domestic manufacturing industries as the protective fiscal barriers were ruthlessly dismantled allowing the dumping of imports in the domestic market. This is the genesis of the "mitumba" culture that continues to haunt the politics of re-engineering our domestic industrialisation policy to the present.

In politics Moi pretended to revive the party, KANU, but only as a government instrument of coercion. Furthermore, KANU was basically run by the Provincial Administration rather than the grass root party structures.

The Second Liberation and The Return of Multi-partism

Following the discredited Mlolongo1 Kanu nominations of 1988, the fight for a return of multiparty democracy gained momentum culminating in the first multiparty general elections in 1992. Multiparty democracy saw the rise and fall of popular people's parties.

The Forum for the Restoration of Democracy (FORD), which united the people against Kanu, emerged as a credible threat to the Moi regime. It subsequently split following a

1 A system of openly counting voters on queues as opposed to secret ballot. The proponents of the system also called it 'open air democracy'. The system was greatly abused as there was no way of verifying the results afterwards since this would entail reconstituting the queue. It was used to discredit many popular leaders.

leadership dispute. A split opposition made it easy for the incumbent to win the 1992 and 1997 elections with a slim margin.

Betrayal of the NARC Promise

In the 2002 elections Mwai Kibaki rode to power on the crest of a broad popular national movement not seen since the coming to power of KANU in 1963 but tragically squandered the opportunity to reverse the errors of the Kenyatta and Moi era. Within a few months he had betrayed the great hopes and dreams the people had invested in him to slay the demons ot corruption and tribalism.

By 2002 the opposition had learnt the painful lesson that unless they form a broad national front KANU would continue ruling with minority votes. Consequently, in October 2002 the National Alliance of Kenya (NAK), of Mwai Kibaki, Michael Kijana Wamalwa and Charity Ngilu, and the Rainbow Coalition, of Raila Odinga, George Saitoti, Moody Awori, Joseph Kamotho and Stephen Kalonzo Musyoka (who broke away from KANU), came together and formed the National Rainbow Coalition (NARC). Raila's Kibaki Tosha declaration at Uhuru Park on 14th October 2002 unleashed a powerful national movement that swept KANU away from power in the December election

The swearing in of Kibaki was viewed by many as the birth of the new republic. The majority believed him when he declared that " corruption will cease to be a way of life". In early 2003 Kenyans were voted as the most hopeful people in the world. Ordinary citizens were soon arresting corrupt policemen and frogmatching them to police stations across the country!

Sadly, this ebullient national mood would soon turn to despair and desperation as the NARC MoU that brought him to power was trashed and impunity, hubris and grand corruption returned to the centre stage of our public affairs. An ethnic cabal known as the Mount Kenya Mafia captured the state and in the words of John Githongo declared that: It is Our Time to Eat! They killed the NARC dream and restored ethnic exclusion in our politics.

The Kibaki promise of the new constitution within one hundred days was thrown to the dogs. By 2005 the regime had so butchered the draft constitution from Bomas that it was defeated in a bitterly contested referendum that pitted the two factions of government against each other. The government wing that supported the draft constitution was called the Banana group. On the other hand those opposing the draft constitution (known as the Wako Draft) led by Raila were named the Orange group. They joined hands with the opposition party KANU of Uhuru Kenyatta and William Ruto.

On losing the referendum President Kibaki sacked those in Cabinet who had opposed the Wako Draft and set the stage for the political tensions that exploded in the 2007 elections crisis and the post-election violence (PEV) that ensued.

The Orange movement was soon converted into the Orange Democratic Movement of Kenya (ODM-K) party that brought together the Raila led Liberal Democratic Party (LDP), Uhuru led KANU and the Julia Ojiambo led Labour Party of Kenya (LPK). When a faction led by Kalonzo broke off with the ODM-K the majority wing led by Raila adopted the ODM with which they ran for the 2007 general elections.

With the decimation of NARC President Kibaki's team belatedly fashioned the Party of National Unity (PNU) which performed dismally in the 2007 elections in the battle with the newly fashioned Raila led ODM Party.

Many believed that Kibaki lost. So, when he was hurriedly sworn in at dusk in State House, Nairobi on 30th December 2007 spontaneous demonstrations broke out all over the country as people protested what they saw as an injustice. These demonstrations soon blew up into an orgy of deadly violence. Government efforts to contain the situation only escalated the violence that now took on a life of its own.

It took frantic efforts by the international community to restore calm and stability after protracted negotiations led by the former UN Secretary General Kofi Annan. Finally, the National Accord that gave rise to the formation of the Grand National Coalition Government was signed on 28th February 2008.

Kenya was rescued from the precipice. We were pulled back from a full-scale civil war. In spite of a history of political assassinations and serious cases of pre-election violence especially in 1992 and 1997 officialdom had always projected Kenya as an island of peace and stability in a turbulent neighborhood. This crisis burst that bubble. The Post Election Violence(PEV) was particularly traumatic for ordinary citizens.

The violence resulted in 1,133 casualties, at least 350,000 internally displaced persons (IDPs), approximately 2,000 refugees, significant numbers of sexual violence victims, and the destruction of 117,216 private properties and 491 government-owned properties including offices, vehicles, health centers and schools. Though it was expected that our politicians and Election Management Bodies had learnt the lesson and would strive to facilitate trouble free elections the experience of the 2013 and 2017 elections leave a lot to be desired. Hopefully the forthcoming elections will see trouble free polls.

A New Constitution and Integrity in Leadership

Probably one of the most significant outcomes of this crisis were the promulgation of the Constitution of Kenya 2010 (CoK 2010). The CoK 2010 is a bold attempt at constitutionally restructuring our politics and governance. One of it's most consequential achievements is the dispersal and devolution of power and resources from the centre to forty-seven counties in the hitherto ignored periphery of the country.

Another notable innovation was the dedication of Chapter six of the CoK 2010 to Leadership and Integrity. Kenyans had suffered bad governance characterised by impunity, corruption and tyranny by those in leadership from the colonial days. Consequently, they were determined to transform the state by demanding very high standards of integrity from those aspiring to elective and appointative leadership in the public service.

Unfortunately, the members of parliament(MPs) who crafted the final document appear to have had ideas diametrically opposed to the people. By inserting article 93(3) and 193(3) the

CoK sets lower standards for politicians by turning the intentions of chapter 6 on its head. Whereas for non-politicians a person found guilty by a court remains guilty until declared otherwise by a superior court it appears that for politicians, they remain innocent until found guilty by the highest court. It is not easy to understand why politicians are treated in this favourable manner. Once found guilty by a court why can't they just sit out until they are cleared by a higher court? Why is it that, on the other hand, appointed public and state officers are automatically interdicted once charged in court? Hopefully next time we have opportunity to review the CoK 2010 we shall revisit these favours donated to aspiring politicians. Otherwise, elective leadership positions are going to attract conmen, spivs and vagabonds of every description. Then it shall be said of politics that it is the refuge of the scoundrel!

From 2013 to date our attempts to transform our electoral politics and governance by deploying chapter six standards have run aground and exposed the limitations of constitutions in transformative politics.

As Issa Shivji has aptly observed: "Constitutions don't make revolutions. Revolutions make constitution. But constitutions matter. Some of the finest constitutions have been erected on ugly socio-economic formations wrought with extreme inequalities and inequities. South Africa and Kenya are examples.

Money in Politics

In spite of the progressive and transformative intentions of the CoK 2010 our politics is increasingly developing a do or die character to it. There is a raging conflict between politics for private gain and politics for public service.

There are those for whom participation in politics is primarily meant to benefit them and their clique of shadowy financiers. For them, the organs of the state must be captured at all costs and using any means to serve self and cronies. To them, democracy is an irritant that must be tolerated for effect. Political parties are but dispensable electoral machines much like matatus that you board and disembark at your convenience.

On the other hand, are the people of Kenya who believe that politics should be organised to fulfil the aspirations of the broad masses; that the state has a duty to guarantee the fulfilment of these aspirations especially as promised in article 43 of the CoK 2010. These people believe that national leadership has a duty to serve all Kenyans irrespective of origin and status. For these Kenyans, the failure to capture the state and transform it to serve the needs of a majority through a democratic electoral process is a tragedy. It portends a dark future in which their needs and interests are trampled underfoot.

In the run up to the 1992 elections, when the ruling elite faced the risk of losing power, they organised major scams such as Goldenberg to siphon money out of public coffers to enrich themselves and fund politics and violence so as to retain power at all costs. This period saw the removal of legal limits to how much money one could use in elections campaigns in our electoral laws. It was also during this period that the so-called tribal clashes were first organised by the same people to prevent opposition parties from ascending to power.

This challenge remains an ever present danger to our growing democratic politics. In spite of legislation on political party financing, shadowy characters continue to fund political party activities and political campaigns. This continues to have a negative impact on our politics. They see that financing as investment which must be paid back with returns after an election. Apart from perverting public policy in their favour, they also pervert the public procurement process so that contracts in the public sector are over- priced and are never performed to the expected standards and timelines. This looting and misuse of public funds has also caused unemployment and poverty thus intensifying the bitterness of the resultant underclass which survives in squalor on the periphery of our urban and rural slums.

This monetization and commercialisation of politics continues to alienate large sections of potential leadership who have no access to the necessary resources to mount credible campaigns. In these circumstances, political parties cannot nurture a principled leadership that can effectively champion the interests of the broad majority. They have been reduced to accepting any candidate who comes along with enough resources to mount a credible campaign, whether they believe in the party programmes or not.

A Vision for a new Kenya

Kenya is truly at a crossroad. These elections provide an opportunity for all concerned patriots to rise to the occasion and mobilise to build a movement for a new Kenya with a strong national identity and equal opportunity for all. Our engineers must come out to influence our politics and must purpose to transform the degrading, dehumanising and back breaking conditions under which the majority of our rural and urban populations work and live. We must liberate them from the indignity of poverty, disease and ignorance. We must reject a politics that seeks to perpetuate such degrading conditions of existence and transform Kenya into a newly industrialising, middle-income country providing high quality of life to all its citizens in a clean and secure environment within our lifetime.

To transform and industrialise Kenya our engineers must also confront and defeat the forces that seek to make corruption an accepted way of life in Kenya

Finally, we must strive to cultivate a culture of healthy competition in politics predicated on the understanding that Kenya is a diverse nation with each of its communities yearning for a fair chance to play its role in nation building.

We need a social democratic movement committed to the struggle of our people for justice, equity and prosperity. We believe that national leadership is about defining the nation, her interests, destiny, and the means for getting there and protecting these relentlessly. It is time our engineers defined and took their proper place in this quest for the realisation of the aspirations of our people.

Dave Anyona Kanundu is former County Secretary, Siaya County. He has also previously served as a High School Principal.

President Uhuru Kenyatta Opens Kajiado Hospital. Right: President Kenyatta opens the Directorate of Criminal Investigations (DCI) National Forensic Laboratory. Photo/POOL

Uhuru Kenyatta: Big Push Investments Have Multiplied Kenya's Economic Liberation

By His Excellency Hon. Uhuru Kenyatta

NOW I will give a further account of how My Administration has multiplied the fruits of our liberation. And I will give this account using the Four Legacy Frames that have guided our execution of the mandate bestowed to us over the last 9 years. These are what I call the Big-Push Investments, Economic Acceleration, Restoration of Dignity, and Political Stabilization.

I begin with the first legacy frame of the Big Push Investments. And I want to start with this frame because, the question many have begged is WHY the heavy investment in infrastructure?

I have been asked why have we built mega dams; expanded ports and built new ones; increased our road networks; and revived dead railways as we have built new ones? And our logic here is simple: It has nothing to do with WHAT we have built; but WHY we did it.

The naysayers said that we should not invest so heavily in infrastructure. Because people don't eat roads and floating bridges. I refused their pessimism because I know what a new road means to the farmer who has for decades been unable to get their produce quickly to the market.

I refused to delay the dream of world-class ports and fishing-support infrastructure because I wanted that fisherman in our oceans and lakes to be able gain more from the sweat of their brow.

I looked at a Nation whose potential was being limited by road connectivity and I vowed to open up Kenya to ourselves and to the world. The result was that once sleepy villages and towns roared to life, becoming vibrant centres for economic and social activities.

The result was the appreciation in the value and utility of land in many rural and peri-urban areas, instantly elevating hundreds of thousands of homes out of poverty.

Similarly, as we learn from our history, when the colonizers built the Kenya-Uganda Railway, some people called it the 'Railway to Nowhere' passing through a swamp called Nairobi. But to the colonizers, the railway was NOT the end game. What the railway was meant to achieve WAS the end game.

Years later, what was called the 'Lunatic Express' by cynics converted a swamp called Nairobi into a mega-city that is in the top five in Africa. It opened up an entire hinterland corridor running from Mombasa on the Indian Ocean to Banana on the Atlantic Ocean in the Democratic Republic of Congo. The railway had transformed the East African landscape, opening up new frontiers of trade, commerce and urbanization.

This demonstrates that infrastructure has a way of turning swamps into cities, dead spaces into high value properties, and village shopping centres into city malls. Without infrastructure, there are no ways of finding new possibilities. And that is why we made it one of our Big Push Investments.

When My Administration took over the helm of leadership, we knew we had only a maximum of two terms to accomplish a very ambitious agenda. And the challenge was that the bar set by my predecessor, the late President Kibaki, was high. To face this challenge, we had to first embrace what previous administrations had done and accelerate their achievements. This was part of the big push.

And today, I am proud to record that, if the Third Administration built 2,000 Kms of tarmac roads, we accelerated his achievement by building over 11,000 Kms, which is close to six times what they built. In fact, we have built more roads in 9 years than what the previous administrations combined, including the colonizers, built in 123 years.

If the nation's Third Administration had set the bar high, we have set the bar even higher. And the record is there for all to see. Across all 8 former provinces, in each of the 47 counties, we have transformed Kenya a kilometer at a time.

Our world-class infrastructure, from iconic elevated expressways to floating bridges, have put Kenya on the global map. As a result, we have distinguished ourselves as an investment destination of choice, a regional and continental hub, and a leader on the African continent.

The speech is an abridged version of Madaraka Day State Address by HE President Uhuru Kenyatta, CGH on Wednesday, 1st June 2022 at Uhuru Gardens, Nairobi City.

Prof. Dr. -Ing. Aduol: Merge Engineering Registration Boards to Accommodate both Engineers, Technologists

Prof. Dr. -Ing. Francis Aduol is Vice-Chancellor, Technical University of Kenya. He was the founding Principal of then Kenya Polytechnic University College. He spoke to our ***Engineering in Kenya*** *magazine.*

As a Professor and Vice Chancellor of Technical University of Kenya. What is your day-to-day mandate?

My role as the Vice Chancellor is providing leadership and strategic direction of where the university should go. The Institution makes decisions after consultations with the three main bodies of the university that is the University Management Board concerned with the general management of the university, the University Senate that deals with Academic matters and the University Council that represents the interests of the Government. I have to ensure that the university is running in good order and students are learning.

Competent human resource for the economy. As an institution of higher learning, what measures have you put in place to ensure the institution produces graduates including Engineers who are ripe for the market?

TUK formerly known as the Kenya Polytechnic was started to train technicians in the areas of engineering and technology. In 2007, when Technical University of Kenya was made university, we were mandated to retain our objective of training in these technical fields. In the last count we were the only University with 5,000 engineers under government sponsorship alone. This requires us as an institution to be more sensitive in the way we teach, through hiring of competent staff and in the right numbers. Currently, only few courses are taught by part time lecturers.

> Engineering as an industry cannot stand independently, we need other scientists, technologists, technicians and artisans to complete the circuit"
> Prof. Dr. -Ing. Francis Aduol, VC, Technical University of Kenya.

Prof. Dr. -Ing. Francis Aduol, Vice-Chancellor, Technical University (Inset, first right) confers with Immidiate Past President of IEK Eng.Nathaniel Matalanga (Fourth, Left) and his delegation during a courtesy call in 2021.

We train our students and recruit them as staff, take them through masters and PHD and guide them in getting professional registration. We put a lot of weight in hiring staff with high practical skills to inculcate the same into the students. The Engineers Board of Kenya is constantly guiding the institution in tailoring courses that match with market needs. We do high consultations with professions in the industry to ensure whatever students are learning is relevant in the field.

Equipment and facilities are also key drivers in polishing our students to acquire proper training to meet professional standards. In a case where we do not have the equipment, we work with other universities and government institutions to facilitate our students to get the training they require. However, we do that on a temporary basis as we try to get our own equipment and facilities to fully train students in-house.

In your view, what is the future of engineering profession at the Technical University of Kenya?

Technical University of Kenya is the future equivalent of Massachusetts Institute of Technology of United State, and we look forward to the day people will all come to learn engineering at TUK.The institution is committed to the future, and there is no other option.

How is Technical University of Kenya acting upon the emerging trends in the market especially in the Engineering sector?

We are reviewing and redesigning our courses to fit into the demands of the market. Engineering as offered at local universities is quite satisfactory, especially when you have good staff and equipment, which is a challenge in most Third World countries. Academically, when our students go abroad for further studies, they excel just like other students.

The challenge comes on how we respond to professional needs and industry needs. Industry requirements are mostly not in mainstream engineering like communication, understanding elements of business, management skills and good personal relations with other people. These are things that many engineering schools do not teach right across the world yet these are some of the things the industry pays key attention to over and above the technical knowledge. These soft skills are also required for the graduates to fit in the professional market.

> "Engineering as an industry cannot stand independently, we need other scientists, technologists, technicians and artisans to complete the circuit" Prof. Dr. -Ing. Francis Aduol, VC, Technical University of Kenya.

Shed light on the accreditation of Engineers in the country.

Accreditation of engineers has become controversial in the country in the recent past. Currently, the Commission for University Education recently went to court and got a court ruling to accredit university programs. However, I still think that there should be different professional boards to accredit programs. University senate is the right board to decide what might be taught, how it might be taught and to whom. This is what is right.

Professional bodies should wait for engineering students to graduate then test them with professional exams just like accountants sit for CPA exams after graduating to be registered as professionals. This will keep engineering schools on toes to make their students be the best in the market. This will then improve the standard of engineering in Kenya. Courses like Electrical Engineering, Chemical Engineering and Aeronautical Engineering are not yet accredited at this institution because we do not have enough professional lecturers who are qualified to teach in universities for these courses, but we are working towards accreditation of the courses.

Highlight challenges Graduate Engineers are grappling with across the country. What remedies are you implementing in mitigation?

Kenya has a shortage of engineers to enable us fully take over as an industrialized nation, yet still many engineering graduates remain jobless, and professional bodies not doing enough to bridge the gap, neither does universities nor government. It is such a waste to take the brightest students to do engineering courses then render them jobless and nobody thinks it's such a serious thing.

Ironically, some organizations who want to hire engineers also claim they find no engineers to hire. The problem is in the way we train in universities; some of the curriculum is not sensitive to industry needs. Engineering institutions are running on different tracks with what the industry needs. We as universities are being challenged to bridge this gap.

In your view, what are the hallmarks of a well-run learning institution?

A well-structured and run University must fulfill quality teaching, research and community engagement. A good university will perform well in all those three areas.

Being a Vice Chancellor comes with a lot of responsibilities. How do you strategically plan your schedule to balance work and personal life?

My job as a VC is a 24-hour assignment. Even when on leave, I still tackle issues concerning the institution. Ours is a Third World country with so many issues, but you have a personal life to live and you have to build your career path as an academia.

What challenges exist in governing in the Academia, and how do you tackle them?

One of the biggest challenge is managing the teaching staff. We have highly educated professors in this institution who have been taught to be more skeptical and cynical and are already experts in their field. Professors only listen to their colleagues in the same field if they are willing to learn something from them. Students are much easier to handle compared to university professors.

What is your advice to budding Engineers trying to thrive in this field?

If you graduate from the university and you are able to secure a job, acquire as much skills as possible when you still have the energy. When you are above 40 years you should be leaving the employment sector and create job opportunities for others. My word to the graduate Engineers is, before you get a job do whatever you can to earn a living.

Who is Prof.Dr.- Francis Aduol?

I studied at the university of Nairobi at the Faculty of Engineering and graduated in 1976 with a Bachelor of Science in Engineering (Surveying and Photogrammetry) My area of specialization in Surveying is Geodesy. I worked with the Government Survey Department for a short stint before joining the University of Nairobi as a tutorial fellow in 1977. Later, embarked on my Post-graduate studies then became a lecturer at the University of Nairobi.

In 1993, I got a scholarship to study in Germany at the University of Stuttgart for my PhD and completed in 1998. I came back to the University of Nairobi and I was promoted to Senior Lecturer.

In 1995, I was appointed the Dean, Faculty of Engineering and later on appointed Principal of Kenya Polytechnic in 2008. I was promoted in 2013 to become the Vice Chancellor.

Closing remarks?

Engineering as an industry cannot stand independently, it needs scientists, technologists, technicians and artisans to complete the circuit. I remember some days back we fought for the introduction of a board to register technologists through engineering Technology Act in Parliament, the Kenya Engineering Technology Registration Board (KETRB). However, I don't think it should be so in an ideal situation. We should be having one engineering registration board with different sections for Professional Engineers, Engineering Technologists and Engineering Technicians. Having different bodies will make Engineers to start eating into the work of Technologists and vice versa. Most Chinese Engineers working on the Nairobi expressway are Technologists and at most one Engineer as the supervisor. The ratio of Engineers to Technologists should be 1:3 and 4:5 Technicians to Artisans.

Environmental Governance in Kenya

By Ezekiel Oranga

Introduction

THE National Environment Management Authority (NEMA), from 1st June 2022, reintroduced fees charged for environmental impact assessments and monitoring as well as environmental experts' registration and licensing fees. This was after the cabinet approved a request that had earlier been submitted by the Authority. In a press release that followed, the Institution of Engineers of Kenya (IEK) expressed concerns on the grounds that NEMA as an Authority is fully funded by the exchequer and that stakeholders, including IEK, were never adequately consulted. IEK strongly advised against the reintroduction of the various fees by NEMA.

> Environmental governance has to do with who holds the power, authority and resources necessary for environmental management, how key policy decisions on environmental matters are made, how budgets for the same are arrived at and appropriated and who is held accountable for the decisions made.

Environmental governance is the exercise of authority or power for management of a country's environmental resources.

Engineers are key stakeholders on environmental matters. Engineers design, construct, operate and maintain machines, equipment and facilities that are critical for development. Engineers determine energy utilization across various engineering components and facilities as well as waste management systems. Engineers also play an important role in conceptualization, design, construction and management of our infrastructure. They provide primary level advisory services to project proponents. In a recent survey of forest resources in Kenya for instance, the Kenya Forest Service identifies physical infrastructure as an important contributor to loss of tree cover especially in urban counties and thus recommended the development and implementation of green infrastructure development plans.

An assessment of the participation of engineers in environmental governance in the country is therefore of specific interest if effective environmental management interventions are to be implemented at all levels.

Legislations

Article 42 of the Constitution of Kenya 2010 guarantees every citizen the right to a a clean and healthy environment. Articles 69 and 70 obligates both the citizens and the state to protect and sustainably manage the environment and natural resources therein for our own sake and the sake of future generations.

Kenya enacted the Environmental Management and Coordination Act, 1999, as the first comprehensive environmental law in the country whose main objective was to provide the legal and institutional framework for management of all environmental matters. EMCA amendments of 2015 ensured that the environmental law was adequately oriented to be compliant with the CoK 2010 through recognition of devolved governments, incorporation of Strategic Environmental Assessments, among other pertinent issues that had emerged since the enactment of the original law. The Act created the National Environment Management Authority (NEMA) with the mandate to Implementation of all policies relating to the environment, and to exercise general supervision and coordination over all matters relating to the environment. NEMA has since gazette several regulations to facilitate her functions.

Other relevant legislations whose implementation impact directly on the environment include, but are not limited to the Water Act, 2016, Forest Conservation and Management Act, 2016, Land Act, County Governments Act.

Policies

Vision 2030 aims at having a nation that has a clean, secure and sustainable environment with a forest cover of not less than 10% and reduced burden of environment-related illnesses. To achieve this under the vision, Kenya is currently implementing activities targeted at a) ensuring protection of her water resources, b) securing of the nation's wildlife resources, c) reduction of plastic waste d) implementing solid waste management strategies in collaboration with county governments and other stakeholders e) securing various wildlife corridors, and f) conducting land cover and land use planning. These activities are multisectoral and require high level sustained coordination if their impacts are to be realized.

The National Environment Policy, 2013, provides a holistic framework to guide the management of the environment and natural resources in Kenya. The goal of the policy is to ensure *a better quality of life for present and future generations through sustainable management and use of the environment and natural resources.* It aims to integrate the environment n all government policies in order to facilitate and realise sustainable development at all levels. The policy helps promote green economy, enhance social inclusion, improve human welfare and create opportunities for employment and maintenance of a healthy ecosystem. The objectives of the national environment policy, 2013, are in tandem with most of the sustainable development goals (SDGs) including Goal No. 3 (good health and wellbeing), goal No, 6 (clean water and sanitation), goal No. 7 (affordable and clean energy), goal No. 11 (sustainable cities and communities), goal No. 12 (responsible consumption and production), goal No. 13 (climate action), goal No. 14 (life below water) and goal No. 15 (life on land).

The other relevant policy documents currently in use include the national climate change framework policy, 2016, national water masterplan 2030, national climate change action plan 2018-2022, national wetlands management and conservation policy, national land policy, among others.

Institutions

Several institutions across government play different roles in environmental governance. Table 1 summarises the key institutions involved at various levels and their mandates.

Table 1: Key Environmental Governance Institutions in Kenya

Institution	Mandate
Parliament	• Legislation on environmental and related matters • Resource appropriation for the sector • Oversight
Cabinet	• Enact environmental and related policies • Supervision of implementation of environmental policies
Ministry of Environment and Forestry	• Policy development and implementation • Supervision of MDAs under the Ministry
Ministry of Water & Sanitation and Irrigation	• Policy development and implementation • Supervision of MDAs under the Ministry
Ministry of Land and Physical Planning	• Development and implementation of landuse and physical planning policies • Supervision of MDAs under the Ministry
Statutory Institutions	
• National Environment Management Authority (NEMA)	• Implementation of all policies relating to the environment, and to exercise general supervision and coordination over all matters relating to the environment in accordance with EMCA
• Kenya Forest Service (KFS)	• Conserve, manage and provide leadership in the development and surveillance of all forest resources in the country in accordance with the Forest Conservation and Management Act, 2016
• National Environment Trust Fund (NETFUND)	• To facilitate research intended to further • the requirements of the environmental management, capacity building, • environmental awards, environmental publications, scholarships and grants.
• Kenya Water Towers Agency (KWTA)	• Coordinate and oversee the protection, rehabilitation, conservation and sustainable management of all the critical water towers in Kenya as per Executive Legal Notice No. 27 of 2012
• Kenya Forestry Research Institute (KEFRI)	• Undertake research and provide technologies and information for sustainable management, conservation and development of forests and allied natural resources
• National Environment Complaints Committee (NECC)	To investigate – • any allegations or complaints against any person or against the Authority in relation to the condition of the environment in Kenya; on its own motion, any suspected case of environmental degradation, and to make a report of its findings together with its recommendation thereon to the Council; • to prepare and submit to the Council, periodic reports of its activities which report shall form part of the annual report on the state of the environment; and • to perform such other functions and exercise such powers as may be assigned to it by the Council.
• Environmental Institute of Kenya (EIK)	• Empower her members and promote professionalism in environmental governance towards sustainable development in Kenya
• Water Resources Authority (WRA)	• Facilitate management of water resources in the country in accordance with Water Act, 2016
Public Service Commission	• Deployment of critical staff for the sector
County Governments	• Constitute County Environment Committees in accordance with EMCA • Perform environmental management functions specified in the County Governments Act
Judiciary	• Adjudication of environmental conflicts

Instruments

To help in actualizing its mandate under the law, NEMA has in place several legal and administrative instruments. These include the Summary Project Reports (SPRs), Environmental and Social Impact Assessments (ESIAs), Strategic Environmental and Social Impact Assessments (SESA), Environmental Audits (EAs), among others, that assist the Authority in conducting day-to-day functions. Project proponents and other stakeholders have opportunities through these instruments to voice their concerns and have the same addressed promptly.

Conclusion

As Kenya heads towards the August 9th elections, political players are voicing their promises to the electorate and making proposals for development projects, some of which could have significant adverse environmental impacts. These proposals, and the possible budgetary implications, require to be followed up through environmental lenses to avoid future pitfalls and disillusionment. It is important to appreciate that almost all projects with possible adverse impacts on the environment have some level of engineering input. Similarly, systems and methods for addressing these impacts would have some engineering component. Engineers are therefore important stakeholders in environmental matters and should be effectively involved in environmental governance of the country.

Mr. Ezekiel Oranga is Chief Technical and Operations Officer at Log Associates Consultants.

Political Participation by Professional Engineers: A Case for Political Action Committee

By Eng. Patrick Wambulwa

'Siasa ni Maisha. Siasa Mbaya, Maisha Mbaya. Siasa Nzuri Maisha Mazuri.

(Second President of Kenya H. E. Daniel Toroitich Arap Moi.)

Okay, so my mom has surgery that might cost 500k scheduled and NHIF just approved 15K she pays 1200 a month to NHIF and has been paying all her life as a teacher 30yeays plus. Someone tell me who I should talk to because I can't just let it go. What is the parliamentary committee responsible for this? And who is the parliamentarian that sits at the helm of that committee because I am finding them and contributing to the opponent's campaign. Just point me to who- if you fight dirty, we fight dirty too.

(a Kenyan on twitter in the run up to 9th August 2022 elections).

The Bill of Rights in the 2010 Constitution of Kenya provides for many rights to the people of Kenya. These rights include but are not limited to freedom of expression, freedom of association, freedom of family, freedom of scientific research, freedom of access and participation in the process of public policy formulation, freedom to assemble, demonstrate, picket and petition, and political rights. Consequently, political participation, also known as micropolitics, which describes the actions of individual actors within the political system, is envisaged, provided for and protected by our constitution.

Political participation activities may be broadly categorized into three; positive, neutral and negative or opposing actions.

Positive Actions include: offering oneself for political office, holding the office if elected, registering as a voter, voting, registering as a member of a political party, promoting the party of choice, proposing or participating in development of public policy. Neutral Actions include: abstaining from voting, remaining silent and not participating in public activities. Negative or Opposing Actions include: demonstrations, picketing and petitioning.

Politics is the set of activities that are associated with the making of decisions in a group, or other forms of power relations among individuals. In this regard politics should not be seen only as affairs of the state or city, as the Greeks would say, but affairs of all groups in which collective action and decision making is necessary. Such groups therefore include the family, community associations, business associations, trade unions, professional societies, political parties, civil societies, religious organizations, charitable and business organizations.

Professional or learned societies like The Institution of Engineers of Kenya (IEK) need a framework under which their members who are like minded can leverage on the befits of working together to make a bigger impact in developing of public policies, as a positive political action. And only in extreme cases have recourse to negative actions through petitioning.

> In a democracy like Kenya, public decisions should be based on agreed public policy. Public policy in this regard is used in a broad sense to include: the constitution, policy papers, legislation, rules and regulations, standards, guidelines and manuals, codes of conduct, and budgets.

The process of development of these documents calls for professional as well as political skills in equal measure in order to have public policy that is both sound and implementable. Two cases will serve to highlight the need for a good mix of professional and political skills. The first major initiative for constitutional change started in the 1980's and ending up in 2010 after a torturous journey that included a failed constitutional referendum in 2005. The second initiative to improve the 2010 constitution though the Building Bridges initiative popularly known as BBI failed to meet the legal test. In these two cases and maybe many other legislative and policy initiative that have yet to see the light of day, what has been wanting? Professional skills or political skills. How best can professionals participate to ensure efficient delivery and implementation of public policy thereby saving wastage of public resources?

One good strategy to be employed by professional societies to contribute to effective public policy development and implementation is formation of Political Action Committees (PAC) as part of their comprehensive long-term advocacy programs. A political action committee serves to support or oppose legislation, public policy issues, or candidate for public office. This allows a framework to raise resources financial as wells as intellectual work in support of agreed action or task assigned to the PAC. A PAC also provides the professional society and its leaders with improved access to those in public office due to commonality of interest.

One major shortcoming of the political parties in Kenya is that they are weak as institutions. Lacking coherent ideology or policy positions. They are seen basically as political vehicles that are only useful to win an election and thereafter may be abandoned for the next vehicle, built for the next election. The dilemma is that though a good number of the elected leaders may be professionals in their own right and sometimes also members of professional societies, they are not able to translate their professionalism into the running of political parties or public policy development process. There are of course many explanations to this shortcoming and maybe there is need

for detailed research in this area. But one possible explanation could also be that the professionals are not supported to develop political skills and deep ideological/policy positions while in their early stages of professional development and practice. PACs will provide a boost in this area by enlightening the professional on the rigors of public policy development and related political and professional skills, while they are still professional. They will build on this experience when they in future became political leaders. In other words, as part of positive political actions, professional societies should consciously develop political leaders though establishment of political action committees, as a contribution to good public policy.

The Kenyan constitution gives all the freedoms to operate a political action committee, but there is no legislation in place to guide operation of PACs. A beginning point for IEK would be to engage like-minded societies be they professional or business association to put in place a law that can guide on the operations of PACs. In the meantime, the advocacy committees should be deliberate about political engagement, and form Political Acton Sub-committees or working Groups, to initiate and get through good public policy documents. We should not wait for the tail end to make comments on what has already taken shape and sometimes cannot be changed, even when there are obvious shortcomings in the document. These work should be supported by good scientific research, which is protected in the Bill of Rights in the constitution.

The great Physicist, Albert Einstein observed that 'the world is a dangerous place to live in; not because of the people who are evil, but because of the good people who don't do anything about it.' Please do something about it, good people.

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Man of the Moment: Who is Eng. Raila Amollo Odinga?

By IEK Correspondent

Biography

ENG. RAILA Amollo Odinga was born at Maseno Church Missionary Society Hospital, in Maseno, Kisumu District, Nyanza Province on 7 January 1945 to the late Mary Ajuma Odinga and the late Jaramogi Oginga Odinga, the first Vice President of the Republic of Kenya.

He went to Kisumu Union Primary School, Maranda Primary and Maranda High School where he stayed until 1962. He spent the next two years at the Herder Institut, a part of the philological faculty at the University of Leipzig in East Germany. He received a scholarship that in 1965 sent him to the Technical School, Magdeburg (now a part of Otto-von-Guericke University Magdeburg) in the GDR. In 1970, he graduated with an Msc (Masters of Science) in Mechanical Engineering. He returned to Kenya in 1970. In 1971 he established the Standard Processing Equipment Construction and Erection Limited (later renamed East African Spectre), a company specialized in the manufacturing of liquid petroleum gas cylinders. In 1974, he was appointed group standards manager of the Kenya Bureau of Standards. In 1978 he was promoted to its Deputy Director, a post he held until his 1982 detention. Raila Odinga is married to Ida Odinga with whom they have four children; the late Fidel Castro, Rosemary, Raila Junior and Winnie.

Many moments define the man. The most poignant ones are those when he set aside personal political ambitions for the country's greater national good. The 2018 handshake with President Uhuru Kenyatta restored political stability in Kenya. His 2008 truce with President Mwai Kibaki - after bitterly contested elections - birthed Kenya's Grand Coalition Government and a modern-day Prime Minister.

Eng. Raila Odinga is not your ordinary politician. He is the first in Africa to successfully overturn a presidential election through a Supreme Court decision rendered by majority opinion of the jury. His supporters - and critics alike - agree on one thing: the man is an enigmatic icon. He is Africa Union (AU) High Representative for Infrastructure, professionally being an Engineer. At the very top of his Azimio la Umoja Party 2022 Manifesto, he is proposing manufacturing as the engine for creation of wealth and employment in Kenya. The Azimio la Umoja Party 2022 Manifesto promises to make Kenya a gate-way and manufacturing hub for Eastern and Central Africa.

A seasoned politician, he commands immense respect and following across Kenya, and has chaperoned the ODM Party as party leader for over 15 years. He is also very familiar with Kenya's socio-economic political terrain, like the back of the hand. He is now flag bearer for a presidential ticket that stands high odds of capturing power in Kenya on August 9th, 2022.

Governing Intergrity of Infrastructure Projects

By Eng. Alfred M. Joel, PE, HSC

KENYA'S construction industry contributes immensely to the economy and well-being of the citizens through employment and provision of housing and infrastructure. Consequently, this industry attracts massive public and private investment, and has consistently grown, prevailing through even the Covid- 19 pandemic. Local economic outlook remains positive, projecting unflustered growth of this industry into the future.

The construction industry however endures a poor reputation and continues to experience ethical problems manifested in collapsed buildings, corrupt deals and a general lack of honesty. A closer look into this industry reveals grim realities attributed to notable increases in preventable defects and failures silhouetted against increased production costs. As such, questions on declining quality, safety and value of products delivered by the industry have continued to arise. Unethical practices such as collusion, kickbacks and supplanting are mostly due to lack of honesty, greed and the desire to get rich quickly.

Most unethical practices are attributed to actions of corrupt individuals. For instance, research conducted by the National Construction Authority on the collapse of buildings shows that Kenya has recorded more than 50 building collapses since the year 2010. In the year 2021 alone, Kenya witnessed the collapse of more than 10 buildings in various parts of the country. These occurrences have often raised questions about the structural integrity of these infrastructural developments which are always capital intensive taking more than 30% of the country's budget in any given financial year.

What then is the challenge?

The challenge is not the absence of laws and regulations in the various professions governing the built environment. Notably, the Engineers Act, Surveyors Act, Architects & Quantity Surveyors Act etc, are governing tools which are not what really prepares the foundation of professionals in the built environment. To the contrary, it is quality education & training, exposure, experience and continuous professional development which are the foundational ingredients that make the engineering professionals.

The biggest problem and threat to the integrity of infrastructure projects therefore lies with an individual's integrity and ethics. Due to integrity deficits among individual professionals, corrupt practices set in and as a result, it becomes the biggest contributor to dilapidation of projects. Because of lack of ethics and integrity, collusion between professionals and contractors occurs leading to approval of poorly done works. Other forms of corruption and engineering malpractices include; price inflation, swapping and omitting materials, falsifying records, evading construction liabilities, upfront payments, avoiding quality testing and assurance, invalid contract period extensions, among others.

EACC CEO Twalib Mbarak addresses the press at a past event. Photo/POOL.

What is the solution?

> The solution to these and others is simple. **Seal the loopholes in the project life cycle.** Corruption is not the only problem in Kenya's construction sector. This negative phenomenon will only be curbed by changing the negative social values that support corruption.

Every project goes through the typical project lifecycle characterized by the following five phases; Phase 1: Project Initiation, Phase 2: Project Planning, Phase 3: Project Execution, Phase 4: Project Monitoring and Evaluation and Phase 5: Project Closure. All these phases are prone to corruption and engineering malpractices.

Phase 1 (Initiation stage). It's in this phase where goals are set, stakeholders identified and a project charter developed. However, infrastructure projects have been developed without public participation and awareness. In some instances, the projects initiation is wholly and singularly left to political aspirations but when they fail or the costs skyrocket, the professionals in the particular field are blamed for it.

Phase II (Project planning). This phase mostly deals with documentation. The technical details are put in place and other plans such as procurement plan, budget, communication plan, risk management plan, among others. It has however been a practice that works start even without full designs and without sufficient funds. The result thereof are claims from the contractors for delayed payments, variations arising from change of designs, demands for bribes so as to approve requests and payments, among other malpractices. Having a detailed and documented road map outlining the scope and deliverables and ensuring availability of resources will always ensure smooth implementation of a project to the satisfaction of all stakeholders. A checklist of all necessary requirements to be satisfied before entering into a contract would ensure that a project runs to completion with minimal or no hiccups.

Phase III (Project Execution). this is where the actual development/ construction takes place. This requires collaboration between all the stakeholders to ensure an efficient workflow. While this collaboration is key, Kenya lacks a functional and modern building code, a critical policy tool meant to guide, regulate and control the planning, design and construction of buildings. Practitioners

are supposed to rely on a defunct code enacted more than half a century ago in 1968. This Code cannot be looked upon to offer vital and relevant guidance in the construction industry of our time. Consequently, the capacity of the regulators and professionals to work, bite and be put to task in a rogue sector has been limited.

The acute dearth of competent professionals in our County governments, National government, and key regulators in the building sector needs to be addressed also. Stakeholders have often decried the level of incapacity in these entities. Emanating from their powers to issue building approvals and ensure compliance, thereby also deriving their income, these entities are vested with enormous responsibilities to protect the welfare of the public by ensuring safety of buildings under their respective jurisdictions. Unfortunately, most of them lack competent professionals, standard procedures and quality management systems to guarantee safety.

The 'contractor' question must also be confronted. The National Construction Authority was formed to regulate, streamline and build capacity of contractors. However, the poor quality of built products exhibits high incompetence in many contractors.

The Authority must implement reliable mechanisms of assessing, penalizing and reporting contractor performance. Finally, design and supervision professionals should serve the public with honesty and overcome greed, as guided by training, ethics and regulations.

Phase IV (Project monitoring and evaluation). This phase needs to run simultaneously with project execution to ensure project objectives and deliverables are met. For better results, there needs to be a separate team to oversee the M&E from the team undertaking the supervision of works execution.

Phase V (Project closure) This phase is meant to confirm satisfaction of project stakeholders by confirming that what was mean to be delivered has indeed been delivered together with lessons learnt and how to transition the project into operation. this phase has however not been without malpractices. In some instances, retention monies have been paid to contractors before the expiry of the defects and liability period. Other projects have been handed over and a final account remains pending for years without any follow up. Other projects have been handed over to clients without as built drawings thus posing a challenge when it comes to operation and maintenance. These anomalies when critically checked point to a lapse on the project official's willingness to fully execute their mandate as well as a possibility of them having been compromised at some point or some demands having not been met in the course of the project life cycle.

There is therefore a need to ensure that a project closure report is drawn and formally accepted and approved by the client and project stakeholders before the project team is released off from the site. By doing this, the deliverables from both contractor and consultants are checked, reviewed and accepted thus final payments can be remitted to the whoever owes the other.

The occurrences in these phases are meant to control the project constraints namely cost, time and scope affect the delivery of any project. If professionals in the built environment embrace project management ideas, abide and live by them, then the projects integrity can be vouched for and the burden of their governance eased.

Eng. Alfred M. Joel, PE, HSC is an officer at the Ethics and Anti-Corruption Commission (EACC).

Setting the Record Straight:

Raila Odinga's Education Credentials

By Prof. Dr. -Ing. Francis Aduol

RAILA Odinga went to Germany in 1962 when he was 17 years old. He was in Form 3 at the time. In Germany, he joined the Herder INSTITUT to complete his high school education and learn the German language taking 2 years.

In 1965, he got a Scholarship to study Engineering at Technische Hochschule (Technical College) of Magdeburg (now a part of Otto von Guericke University Magdeburg). Technische Hochschulen is a type of University or a department in the University that focuses on engineering sciences in Germany. 1970, he graduated with MSc in System and Process Engineering at the age of 25 years. In 1993, Raila's former Technische Hochschule, the School of Education, and the Medical Academy got united together to form Otto von Guericke University Magdeburg.

Since the Middle Ages, higher education institutions in Europe were called a UNIVERSITY only if a certain classical canon of subjects encompassing philosophy, medicine, law, and theology was taught. When engineering sciences became more important in academics due to the Industrial Revolution, institutions of tertiary education devoted to these were denied the prestigious denomination "university", and had to use the more general term Hochschule(college) instead of University.

Some institutions like Raila's former College opted not to do away with the little title of Technische Hochschule even when they are now legally allowed to be called university.

Prof. Dr. -Ing. Francis Aduol is currently Vice Chancellor, Technical University of Kenya (TUK). He studied Geodesy in Germany.

Concrete for Rapid Infrastructure Development

By Eng. Prof. David Koteng' & Susan Cherotich Kerio

1. Introduction

HIGH strength concrete (HSC) is defined as a dense homogeneous concrete that has improved durability and a specified compressive strength of 60 MPa or greater (ACI 211.4R). Caldarone et al. 2005, defined HSC as concrete that is engineered to meet mechanical, durability or constructability properties that exceed those of normal concrete. In other words, it attains high strengths that cannot always be achieved routinely using conventional constituents and normal mixing, placing and curing practices (ACI 232.1R). HSC is characterized by high early strength which allows early striking of formwork thereby reducing the construction time, high working stresses to reduce material consumption, and high durability to reduce life cycle costs from maintenance and early replacement (Jobse et al. 1984). These attributes are achieved through reduced water/binder ratio (w/b), use of a super-plasticizing admixtures, careful choice of well graded aggregates, high degree of compaction, proper bond between mortar and aggregates, incorporation of pozzolanic and other admixtures to Portland cement, and sometimes using special curing techniques (Neville & Aitcin, 1998) and (Elices and Rocco, 2008). Incorporation of pozzolanic admixtures to Portland cement has numerous advantages over Portland cement when used in the production of concrete. Portland cement is mainly composed of tricalcium silicate, C_3S, dicalcium silicates, C_2S, tricalcium aluminate, C_3A, and tetra-calcium aluminoferrite, C_4AF (Neville & Brooks, 1987). Early strength is obtained by the hydration of the calcium silicates (C_3S and C_2S) in clinker to produce a cementitious hydrated calcium silicate (C-S-H) compound and $Ca(OH)_2$ as shown in Equations (1) and (2):

$$C_3S + H_2O = C\text{-}S\text{-}H + Ca(OH)_2 \quad (1)$$

$$C_2S + H_2O = C\text{-}S\text{-}H + Ca(OH)_2 \quad (2)$$

The varying amounts of tricalcium aluminate, C_3A, present in Portland cement also hydrate to form hydrated calcium aluminate, C-A-H, with little cementitious value (Ofwa, Koteng & Mwero, 2020). However, the presence of free lime and C_3A in CEM I pose several durability problems to concrete due to undesirable effects such as alkali-aggregate reaction, leaching by soft water and acids causing efflorescence, and sulphate attacks (Ghrici, Kenai & Meziane, 2006). In addition to the above problems, it is estimated that the production of 1 ton of Portland cement releases approximately 1 ton of CO_2 to the atmosphere leading to immense pollution (Barcelo et al. 2014), and (Davidovits, 1994). Pozzolanic cements incorporate about 21 to 55% natural pozzolana (NP) which reduces the amount of clinker used during cement production. Less clinker means substantial reduction of CO_2 emissions to the environment and less energy consumptions. At early stages of curing, Portland cement exhibits a higher initial setting than pozzolanic cement (Massazza, 1993). This is because in the initial days, the pozzolanic materials in CEM II/B-P and CEM IV/B-P act as a dilutant. However, as time goes by, the SiO_2 and Al_2O_3 present in the pozzolanic cements begin to react with the free lime, forming additional cementitious C-S-H, C-A-H and C-A-S-H as shown in Equations (3) – (5), thereby enhancing the long term strength of the paste (Dedeloudis et al. 2018).

$$Ca(OH)_2 + SiO_2 + H_2O = C\text{-}S\text{-}H \quad (3)$$

$$Ca(OH)_2 + Al_2O_3 + H_2O = C\text{-}A\ H \quad (4)$$

$$Ca(OH)_2 + SiO_2 + Al_2O_3 = C\text{-}A\text{-}S\text{-}H \quad (5)$$

These pozzolanic reactions continue until there is no more free lime available for further reaction. In addition, the latter stage pozzolanic reactions increase the densification of pore structure of concrete hence reducing its permeability (Isaia, Gastaldini & Moraes, 2003) and (Rodriguez, Camacho & Uribe, 2002). Densification of pores also reduces the incorporation of harmful ions such as chlorides and sulphates thus reducing the likelihood of rebar corrosion. This brings about enhanced durability of concrete.

Water is necessary for the hydration of cement but in excess, free water is held in the pores of concrete and its subsequent loss leads to high shrinkage with the possibility for cracks and reduced compressive strength and durability. The voids left as the excess water evaporates results in permeability of concrete which invites water to seep through walls and floors. This free water also abets chemical reactions which are detrimental to concrete, exerts steam pressure in a fire situation thereby reducing fire resistance, and acts as electrolyte supporting rebar corrosion (Illston & Domone, 2005). To counteract the above problems, w/b ratio is reduced as much as possible and a superplasticizer (SP) is used to increase workability at the low w/b ratio so as to allow high flowability necessary for pumping. However, the SP must be compatible with the binder used. Malagavelli and Paturu (2012) observed that workability and compressive strength increase with the use of a compatible SP. Krizova and Novosad (2016) also observed that a w/b ratio as low as 0.25 can be used to achieve high workability depending on the type of SP added to the concrete. However, if not properly used, SP can create serious problems in concrete such as bleeding, segregation and loss of workability (Eckert & Carrasquillo, 1988). On the other hand, overexploitation of river sand for use in concrete causes soil erosion, destruction of riparian vegetation and also poses a major threat to the depletion

of such non-renewable resources. Nguru (2007), investigated the impact of sand mining along the coastal region of Kenya and concluded that it results in destruction of flora and fauna, and reduces water and nutrient holding capacity of the degraded landscape. This reduces the ability of the biological system to support the needs of the local communities. These implications can be minimized by utilizing quarry dust as fine aggregates in the production of concrete since it is produced in large quantities during rock crushing for ballast and has little alternative use.

This paper compares the strength development of HSC made from CEM I 52.5N, CEM I 42.5N, CEM II/B-P 42.5N, CEM II/B-P 32.5R and CEM IV/B-P 32.5R manufactured to KS EAS 18-2017 which conforms to EN 197. Favourable comparison of the strength gain characteristics of the cements blended with natural pozzolana with the Portland cements will enable recommendation for their adoption for structural works. This research however limits itself to the consideration of strength and does not carry out tests on durability, which is only deduced from published literature.

2. Experimental Work

2.1 Materials

Cements used were CEM I 52.5N, CEM I 42.5N, CEM II/B-P 42.5N, CEM II/B-P 32.5R and CEM IV/B-P 32.5R conforming to EN 197 and manufactured by local cement manufacturers. Crushed stone coarse aggregates of maximum size of 12.7 mm and quarry dust used as fine aggregates were obtained from a quarry within Nairobi area. Super-plasticizer used was polycarboxylate based. Potable water from Nairobi city mains was used for concrete mixing and curing.

2.2 Material Preparation and Pharacterization

2.2.1 Fine Aggregates

Quarry dust was washed through sieve size 75 µm to remove dust particles, then oven dried at 105 °c for 24 hours to remove any entrained moisture. The fine aggregate was then allowed to cool to room temperature and was then sieved through sieve sizes 2.40 mm, 1.20 mm, 600 µm, 300 µm, 150 µm and 75 µm to ensure that particle size distribution and fineness modulus (FM) conformed to the recommendations of ASTM C33. Three sieving tests were carried out with different samples of the FA in order to obtain an average value. The particle size distribution is shown in Figure 1 and the FM was determined as 2.74.

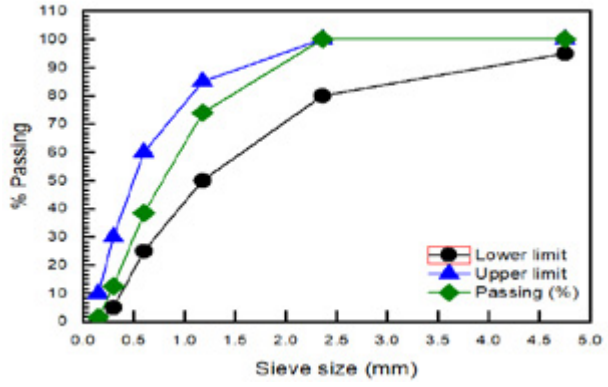

Fig. 1 Particle size distribution of fine aggregates

2.2.2 Coarse Aggregates

Coarse aggregates were washed through sieve size 1.59 mm to remove any fine particles, then oven dried at 105°C for 24 hours to get rid of any entrained moisture. The coarse aggregate was then allowed to cool to room temperature and was then sieved through sieve sizes 12.7 mm, 6.35 mm and 3.18 mm to separate the aggregates into categories of 1.59 mm - 3.18 mm, 3.18 mm - 6.35 mm, and 6.35 mm - 12.7 mm. The smaller aggregates were progressively packed into the larger aggregates to obtain the maximum dry density (MDD). Figures 2 (a) & (b) show the packing curves for the coarse aggregates. The aggregates were then blended and sieved to ensure that particle size distribution fall within the limits specified by ASTM C33 as shown in Figure 3. Aggregate Crushing Value (ACV), Aggregate Impact Value (AIV), specific gravity and water absorption tests were also carried out and the results are shown in Table 1.

Table 1 Physical properties of coarse aggregate.

ACV (%)	AIV (%)	Specific gravity	Water absorption (%)
17.2	12.4	2.52	3.50

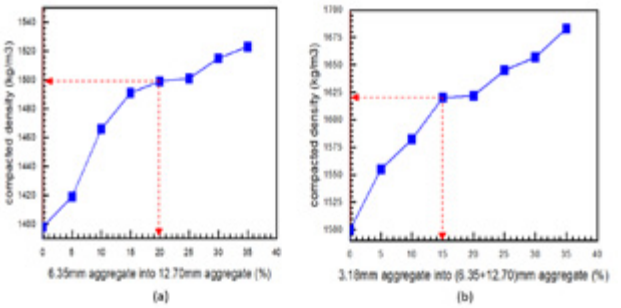

Fig. 2 Packing curves for coarse aggregate.

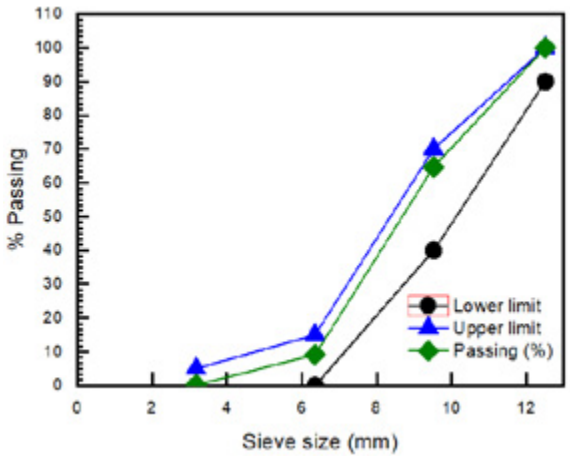

Fig. 3 Particle size distribution for coarse aggregates

2.3 Concrete mix design

The mix proportioning was carried out in accordance with American Concrete Institute guidelines, ACI 211.4R-08 for high strength concrete produced using conventional materials and production methods. A water cement ratio of 0.4 was used and SP was added to all the 5 concrete mixes to increase the workability of the mix. For mixes 1 – 3 SP dosage of 1.2 % was used to get a workable concrete. For mixes 4 and 5 SP dosage was increased to 2.6 % to get a workable concrete.

2.4 Preparation of Test Samples

Five concrete mixes were prepared using CEM I 52.5N, CEM I 42.5N, CEM II/B-P 42.5N, CEM II/B-P 32.5R and CEM IV/B-P 32.5R respectively. A paddle mixer with a capacity of 0.02m^3 was used for concrete mixing. Water was first added to the paddle mixer and about half of the total SP was added to the water and mixed. Cement was then added and mixed to produce a paste of uniform consistency. Fine aggregates was added to the cement paste in about one third quantities and mixed to produce a uniform mortar. The coarse aggregates was added to the mortar progressively, starting with the smaller sizes and mixed to uniform consistency before the next size up was added. The rest of the SP was added progressively to maintain a workable mix. For mixes 1 – 3 SP dosage of 1.2 % was used to get a workable concrete, while for mixes 4 and 5 SP dosage was increased to 2.6 % to get a workable concrete. The concrete was used to cast 18 No. 100 mm x 100 mm x 100 mm cubes and 3 No. 300 mm long x 150 mm diameter cylinders for each mix, a total of 90 cubes and 15 cylinders, which were then covered with a moist cloth and left to stand for 24 hours. The test specimen were then demoulded and cured in saturated lime water at room temperature until the time of testing.

2.5 Tests on Fresh Concrete

The initial workability of each mix was determined by the slump test to BS EN 12350-2:2009.

2.6 Tests on Hardened Concrete

2.6.1 Compressive Strength Test

Compressive strength test was carried out for all the mixes at 3, 7, 14, 28, 56 and 90 days. Test samples were removed from the curing water, wiped dry using absorbent cloth and air dried for one hour before testing. The test samples were placed between the compression plattens of a compression testing machine with a load capacity of 1500 kN. Load was applied manually at a constant rate of 30 - 40 kN per minute until the cubes failed and the maximum load was recorded. Three cubes were tested to obtain an average record.

2.6.2 Tensile Strength Test

Test cylinders for each mix were removed from the curing water after 28 days, wiped dry using a soft absorbent cloth and air dried for one hour before testing. Three specimens made from each mix were successively placed on the cylinder splitting test machine, one at a time. Load was applied uniformly at a constant rate of 30 – 40 kN per minute until failure of the cylinders occurred along the vertical diameter. The failure load was recorded for each of the three specimens and the average was calculated.

3. Results and Discussion

3.1 Tests on fresh concrete

The initial slump for the 5 mixes is shown in Table 2. Figure 4 shows the initial slumped concrete of mix 1 (CEM I 52.5N). The results show an increase in SP demand for cements incorporating natural pozzolana. This can be attributed to clay and dust in natural pozzolana which absorb SP and considerably reduce their workability (Chen et al. 2018).

Table 2. Initial slumps for the 5 mixes

Concrete mix	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Initial slump (mm)	105	85	65	35	15

Figure 4. Slump test on fresh concrete.

3.2 Tests on Hardened Concrete

3.2.1 Compressive Strength Test

The development of strength with age is given in Figure 5, showing a progressive increase in strength from Mix 1 – 5. Mixes 1 & 2 had early strengths in excess of 40 N/mm^2 at 3 days and attained strengths in excess of 60 N/mm^2 at 28 days rising to more than 70 N/mm^2 at 56 days. Beyond 56 days the graphs for both mixes level off. Mix 3 attained an early strength of 37 N/mm^2 at 3 days, 60 N/mm^2 at 28 days, 65 N/mm^2 at 56 days and the mix continued to gain strength beyond 56 days. Mixes 4 and 5 had strength greater than 30 N/mm^2 at 7 days, more than 50 N/mm^2 at 28 days, 61 and 58 N/mm^2 respectively at 56 days, and strength gain continued beyond 56 days.

Portland cement reactions are faster than pozzolanic reactions and contribute to early strength. Moreover, pozzolanic reactions take place only after the Portland cement reactions have produced sufficient $Ca(OH)_2$ which then react with the pozzolana. In mixes 1 and 2 the higher strengths attained in mix 1 can be attributed to the mix composition and the fineness of grinding. Both are not the focus of this study. The same applies to mixes 3 and 4 which by the requirements of the standard should have a pozzolana addition of 21 - 35 %. On the other hand, mix 5 is blended with pozzolana of between 36 – 65 % according to the requirement of the standard and therefore has less fast reacting Portland cement. This remarkable gain in strength is attributed to the hydration of calcium silicates in Portland cement to form C-S-H gel and release $Ca(OH)_2$. Neville (1987) observed that this fast and exothermic reaction takes place within the first three days after mixing concrete. The strength gain stops after all the reactants are consumed.

On the other hand, pozzolanic reactions while slow, converts the free lime produced by Portland cement reactions to cementitious C-S-H and improves the densification of the mix, leading to increasing strength with time. It is therefore possible for cements blended with pozzolana to surpass the ultimate strength of a Portland cement with time.

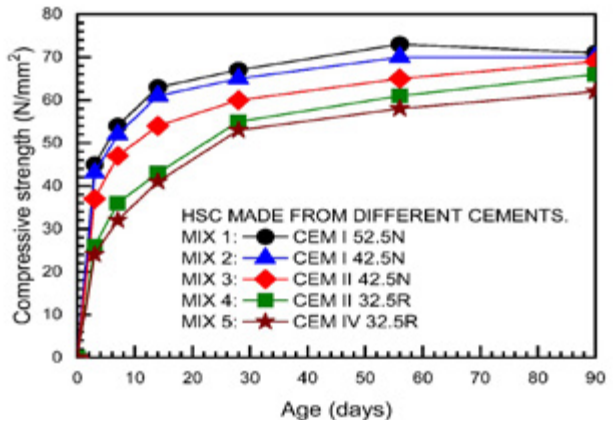

Figure 5. Development of compressive strength with age.

3.2.2 Tensile Strength Test

The 28-day cylinder splitting strengths for the five mixes is shown in Table 3 and show correlation with the compressive strengths of the mixes. It is observed that the tensile strengths lie between 8 and 10 % of the compressive strength.

Table 3. Tensile strength at 28 days.

Concrete mix	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Tensile strength (N/mm²)	5.4	5.4	5.1	4.5	4.0

4. Conclusions and Recommendations

4.1 Conclusion.

(1). Portland pozzolana cements CEM II/B-P 42.5N can be used to produce concrete which meets the requirement for high strength concrete with enhanced durability and reduced harm to the environment compared to CEM I/42.5N and CEM V/52.5N.

(2). Portland pozzolana CEM II/B-P 32.5R and pozzolanic cement CEM IV/B-P 32.5R both have good early strength, and a 28-day strength exceeding 50 N/mm² which are good working strengths for most civil engineering structures, and strength gain continues beyond 28 days.

(3). A good early strength achieved by all the blended cements allows early striking of formwork leading to fast construction and early project delivery.

(4). Quarry dust can replace sand as fine aggregate without compromising strength, and can reduce the degradation of landscapes..

(5). High strengths achieved can result in the design of smaller structural members and reduced consumption of raw materials for producing concrete, hence promote sustainable utilization of non-renewable natural resources.

4.2 Recommendations

(1). Portland cements blended with pozzolana should be given preference in the production of concrete for infrastructure development due to the demonstrated high structural strength and potential higher durability over concrete produced with Portland cement alone.

(2). The use of quarry dust as fine aggregate for concrete should be encouraged to mitigate the negative effects of sand harvesting for concrete production.

(3). Since high strength attained in 3 or 7 days can sustain construction loads and considering that user loads come into effect well after 28 days, consideration can be given to the design of structures for user loads using higher loads beyond 28 days, say at 56 or 90 days. This would further reduce member sizes, reduce cost, and enhance economy and sustainability of material usage.

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ENGINEERS, POLICY & LEGISLATION: IEK Council Members led by President Eng. Eric Ohaga (Front row, Second right) join legislators Hon. Sabina Chege (front, third right) Hon. Priscilla Nyokabi (front, third left) and Siaya County Gubernatorial aspirant Eng. Nicholas Gumbo (second left) for a photo session during Women Engineers Dinner event in June, 2022. The event was held to celebrate women in engineering, leadership and politics.

Engineers Governing in Academia

Eng. Prof. Bernard Ikua is the Deputy Vice Chancellor (Administration and Finance) at Jomo Kenyatta University of Agriculture and Technology (JKUAT). He spoke to ***Engineering in Kenya*** *magazine on the role Engineers working in academia play towards upholding and strengthening governance in academia.*

You are an Engineer, a professor and administrator. What is your day-to-day mandate?

As a Professor, I provide academic leadership in the discipline of mechanical engineering; mentoring students at undergraduate, postgraduate and PhD levels. As an Engineer, I conduct research in my area of expertise - Mechanical Engineering. As Deputy Vice Chancellor, I am in charge of Administration and Finance.

What, in your view, is the key to developing a good team that delivers key goals and objectives?

The key to success as a leader in any institution is to understand that everyone is gifted differently, and it is these gifts that must be tapped to achieve institutional goals and objectives. I have to ensure that the team is focused, share my vision with them, offer exemplary leadership and employ staff who have actual capacity to lead. Capacity building is key. We constantly train our staff to enhance skills. We conduct in- house training and sometimes invite the Kenya School of Government to conduct the training. Appreciating each and every member the team for what they have is equally important.

Competent human resource for the economy. As an institution of higher learning what measures do you put in place to ensure the institution produces graduates including engineers who are ripe for the market?

Mentorship and training is one of the key pillars that our institution offers to students, this enables them to design and communicate their ideas. The tradition of JKUAT is to focus is on practical skills. The institution uses high level equipment and in instances where we cannot procure those equipment, we design and make them. Lastly, we employ competent staff registered and recognized by professional bodies including the Engineers Board of Kenya, who also possess both practical industrial experience, skills and competency.

Tell us more about the JKUAT College of Engineering and why it stands out amongst your peers?

Today, a total of thirteen (13) universities offer engineering courses in Kenya. Jomo Kenyatta University of Agriculture and Technology established the College of Engineering way back in 2010. Previously, the University had a Faculty of Engineering. The college has several programs in various departments: Mechanical, Manufacturing and Materials Engineering, Geomatic Engineering, Agricultural and Bio-Systems, Architecture and Electrical Engineering.

The College stands out due to its focus on skills development of the students and well developed curriculum. We involve experts while designing the curriculum in accordance with the needs of the market.

In your view, what are the hallmarks of a well-run tertiary institution?

Well-run tertiary academic institutions must have focus on the core mandate, which is what they were established to do, and strong leadership. They must have dynamism and be sensitive to the changing needs of the economy and job market. These institutions must also employ staff with high integrity, because they inculcate these into their students.

How do you balance work and personal life to ensure you accomplish your goals?

It's quite a challenge because we have a lot of demands to fulfil various needs of our stakeholders and customers – the students we serve. This calls for proper planning. I sometimes have to work extra time to ensure I accomplish all I had laid down for the day. It's also important to delegate duties that can be done at other levels, to try and balance.

What challenges exist in governing in the academia, and how do you tackle them?

Heading administration presents you with challenges of human resource, technical challenges as well as challenges related to resources you need to conduct research. Reporting to this office for work daily means trying to solve these existential challenges. Stakeholders expect us to solve these challenges, to tailor-make solutions one challenge at a time. Where I don't have solutions, I have to escalate them to someone at a higher level.

As a professor, you have worked on many research projects. Share with us some of your most memorable?

I have done several research projects

> *The Key to Governance Success is Understanding Everyone is Gifted Differently – Eng. Prof Bernard Ikua*

especially on manufacturing, the most memorable is what we have been developing to improve the quality in machining and optimization driven at lowering costs and improving efficiency. We are currently working on a project on manufacturing research; intended to improve Kwale, Kilifi and Mombasa Counties coconut value chain. We are developing equipment to assist the small medium enterprises to improve on the quality of their production. We are taking the machines to them and they are improving their productivity. Lastly, we have introduced non-traditional machining methods in which we develop electro-discharging machining

What is your advice to young engineers trying to thrive in this field?

The future is bright for the engineering profession. When we talk of industrialization, it's engineers who will drive industrialization in Africa, the realization of vision 2030 and African Union Agenda 2063.

Engineering is changing with time and young engineers should keep up with the pace of the changing trends by staying in touch with new technology. This calls for Engineers to re-engineer themselves. The government is very supportive in terms of innovation. I urge budding Engineers to protect their intellectual property before sharing ideas with the public by registering it with the Kenya Industrial Property Institute (KIPI).

Who is Eng. Prof. Bernard Ikua?

I was born and brought up in Nyandarua County. I attended the University of Nairobi for my Bachelor's Degree, and Japan for my Masters and PhD. I am a married father of four children. - two daughters and two sons. Both my daughters are engineers.

Good for Manufacturing and Industry

Raila Odinga: An Engineer's Vision for Kenya

By IEK Correspondent

PREMISED on revolutionising manufacturing and industry, the Azimio la Umoja Coalition Party Manifesto promises deliberate government investment and reforms in Kenya's manufacturing sector; through credit reforms, tax reforms and preferential interventions. The party's presidential candidate, Raila Odinga, is offering to develop a new manufacturing policy for Kenya, to grow linkage between manufacturing and agriculture, mining, construction and other productive sectors. Is he on the cusp of engineering industrial and manufacturing revolution in Kenya? ***Engineering in Kenya*** *magazine examines.*

Azimio la Umoja Coalition Party this month launched a manifesto that promises a developmental state that puts manufacturing at the heart of growing the economy; supporting social capital, integrity, devolved units and freedom of expression. Manufacturing as the driver of economic revolution has the potential to spur economic growth of all sectors of Kenya's economy, resulting in employment and wealth creation.

Azimio la Umoja Party leader Raila Odinga has primed manufacturing and industrial revolution at the very top of his Inawezekana (It's Possible to Accomplish) Agenda

A Mechanical Engineer, Raila Odinga is banking on manufacturing to engineer complete economic turn-around for Kenya, hoping to jump- start the country's economy. His ambitious manifesto comes at a time when global manufacturing technologies are fast changing.

> "We present Kenyans with an opportunity to invest in emerging technologies which will provide employment opportunities to Kenya's young population, such as micro-chips which are already manufactured in Kenya," says Odinga.

The manufacturing sector in Kenya has the potential to produce input materials like steel, copper, and glass for further processing into finished products, and secondary production of goods like engineering manufacturing machinery, transport as well as agricultural machinery, tools and implements, to be applied in the mechanization and automation of agriculture, livestock, blue economy, mining and processing.

Starting with Medium, Small and Micro Entreprises (MSMEs), The Azimio la Umoja Coalition Party manifesto promises to bolster Kenya's JuaKali sector as a leading generator of employment in the country. The party is promising to deliver a deliberate policy of Recognition of Prior Learning certification program, to award certificates to artisans, craftsmen and technicians who have obtained skills and knowledge through apprenticeship and work experience, to enhance their employment opportunities, by empowering their efforts dubbed "Shahada la Jitihada". Tapping the sector, Odinga is promising to encourage the signing of MOUs between Jua Kali Associations and TVETs to develop partnerships and incubation hubs.

Raila Odinga has emphasized his focus on manufacturing is meant to bolster efficiency and increase productivity by MSMEs, as well as the creative and sports industries. "Likewise, manufacturing will be a user of MSME products. Manufacturing complemented by agriculture, livestock, the blue economy and ICT shall also spur and accelerate economic activities including entrepreneurship, economic growth and sustainable development to create decent and well-paying job opportunities."

He is banking on the manufacturing sector to spur education and knowledge, ICT research led technological revolution, efficiency in resource allocation; availability of affordable fuel, energy, transportation and raw materials, innovative financing and investment, along with revitalized foreign trade and economic diplomacy.

"The AZIMIO commitment is to support the growth of MSMEs, including the JuaKali sector, through improved productivity and efficiency to spearhead 'Made in Kenya' products. "Kazi kwa Wote" (employment for all) will secure the welfare of the people through decent and dignified jobs that uplift their standards of living," the manifesto states.

Kenya's geo-strategic location in Eastern and Central Africa, offers tremendous potential, including a vast market for goods and services made in Kenya. Raila Odinga's Azimio la Umoja Party is promising to promote, expand, and establish local industries that will serve this expansive region and capitalize on the African Continental Free Trade Area (AfCTA).

This regional market includes Uganda, Ethiopia, Somalia, South Sudan, Tanzania, Rwanda, Chad, Central Africa Republic, The Republic of the Congo- Brazzaville, Burundi and The Democratic Republic of the Congo. The region currently holds a population of over 400 million people which can provide a tremendous market for locally manufactured industrial and consumer goods.

For Kenya's next regime, cooperation with regional governments will be key in developing infrastructure for transportation of goods and services, as well as continued advocacy for creation of a landbridge connecting the Indian Ocean to the Atlantic Ocean, opening up the interior of the continent to reduce logistical challenges that add to the costs of goods and products.

In a famous unscripted address, he delivered at the Africa-Russia plenary St Petersburg International Economic Forum in Russia in 2019, Odinga cut himself out as a champion for the integration of African trade through infrastructure connections. "We all now agree that the aid era impoverished Africa. What Africa needs today is trade and development," he posited." Intra-African trade today stands at only about 15% in contrast to intra-Asian trade which is about 50% and intra-European trade which stands at over 70%." This trade imbalance, he argued, needs to be overturned by investment on infrastructure.

Underdeveloped transportation infrastructure across Africa remains a major hindrance to trade. This affects timely access to goods and services. Raila Odinga is well known for his passion for infrastructure development, having served as Minister for Roads and Minister for Energy in previous administrations in Kenya. The expansive Thika Road in the heart of Nairobi City, snaking its way into Central Kenya, is a testimony of what he can do with instruments of decision making.

Odinga says his promised economic revolution will deliver shared economic prosperity for all, informed by the belief that Kenya's wealth belongs to the people of Kenya and must therefore be grown and shared equitably among all the people of Kenya. "The economy must work for the people. The AZIMIO commitment will be to pursue a revolutionary economic framework to deliver more jobs for the youth, create inclusive wealth, reduce over reliance on imported products, ensure shared prosperity and poverty reduction, protect the environment, use natural resources sustainably and mitigate effects of climate change.

Global manufacturing technologies are fast changing. For example, in the automative industry technology is shifting from manufacturing of combustion engine vehicles to electric engines. "This provides an opportunity to invest in emerging technologies which will provide employment opportunities to Kenya's young population, such as microchips which are already manufactured in Kenya.

He has also promised to ensure the manufacturing sector shall produce input materials like steel, aluminium, copper, and glass for further processing into finished products. Additionally, Odinga is promising to promote secondary production of goods like engineering manufacturing machinery, transport and agricultural machinery, tools and implements to be applied in the mechanization and automation of agriculture, livestock, blue economy, mining and processing.

Inside Raila Odinga's Manifesto

Education
- Employment of all trained but jobless teachers
- Free education from Early Childhood to tertiary level
- One meal per day for all ECD, lower primary pupils

Cost of Living
- Expand electricity transmission and distribution capacity, reduce grid losses **from 23% to 10%**
- Reduce cost of Unga,sugar, farm inputs in first 100 days
- KSh1 billion revolving fund affordable loans for boda boda businesses

Youth
- Continuation of Kazi Mtaani Programme
- Waiver of licencing fees for youth owned businesses
- Seven-year tax holiday
- Kenyan Diaspora Investment Bank to tap diaspora remittances

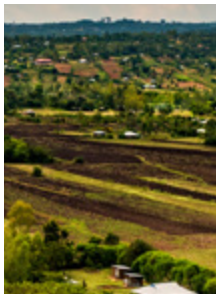
Social Protection
- **Ksh6,000** monthly to **2 million** vulnerable families
- Health insurance for all (BabaCare)
- Retiring Civil Servants to retain medical cover at cost of government
- Monthly stipend for single mothers

Public Debt
- Overhaul Kenya's Public Debt management
- Reduce the pace of accumulating national debt
- Pursue debt relief

Devolution
- Allocate **35% of national revenues** to counties
- Transfer all devolved functions that remain pending
- One county, One Product industries
- Improvement of agriculture
- To strengthen livestock farming sector, ASAL Counties
- Support for the blue economy, fish value chain







Innovation

Eng. Philip Gichuki:
TWWDA Chief Executive Officer

Tunnelling of Approximately 110m section of Chogoria Raw Water Gravity Main

INTRODUCTION

Chogoria Water Supply Project serving Chogoria Town and its Environs in Tharaka-Nithi County, had its source at River South Mara at elevation 1760m, at UTM Co-ordinates 341577.40m E and 9975192.7m S. Water abstraction at the Intake Works is 15,000m3 per day, conveyed through Raw Water Gravity Main, DN 450 mm, approximately 2.83 Km long Steel Pipe, to the New Kibaranu Water Treatment Works.

PROBLEM STATEMENT

Tana Water Works Development Agency (TWWDA) applied for abstraction permit from WARMA, which was issued with a condition that TWWDA provides storage at South Mara River via a dam. Feasibility study was done and Kajogu Dam was proposed to cater for the storage requirement. The proposed location for the Dam was approximately 600m downstream of the Intake and as a result, the Intake and a section of the Raw Water Gravity Main was to be submerged in the dam. This resulted in relocation of the Intake downstream of the dam.

JUSTIFICATION

As a result of relocation of the Intake Works to an elevation of 1741m downstream of the original proposed site to pave way for construction of Kajogu Dam, a section of the Raw Water Gravity Main alignment from Ch. 1+630 to Ch. 1+740 approximately 110m (**see Figure 1**) required tunnelling technique in order to ensure gravity flow by maintaining adequate residual head, as the depth of the pipeline was approximately 10m deep, and with open cut, a very big section of the forest was to be destroyed. This would have seriously affected the ecosystem along the raw water main.

WORKS

Construction of the Tunnel entailed survey work for the alignment of the Tunnel. Pits known as 'Portals' were excavated at the beginning and end of the tunnel. The Pits were excavated with sloping walls to avoid erosion as they served as access points to the horizontal Tunnel.

After completion of the Portals, boring using a Compressed Air Driven Mechanized Boring Device was done to provide a guide to the correct horizontal alignment of the Tunnel starting from one portal to the other. Horizontal excavation for the Tunnel followed along this alignment with pick-axes and shovels. The advancement of excavation was not greater than 600mm in soft ground conditions. After excavation of 600mm and carrying out spoil material, installation of precast concrete segments commenced immediately to reduce the open time to a minimum. Details of the precast concrete segments are given in **Figure 2**.

The sequence of installation of the precast segments was as follows:

- First, 'C' Bottom Segment
- Second, 'B1' Left Side Wall Segment
- Third, 'B2' Right Side Wall Segment
- Fourth, 'A" Crown Segment

Upon completion of installing the segments, the spaces between the precast segments and the excavation line were filled with concrete and hardcore packing while the joint between precast segments was sealed with mortar.

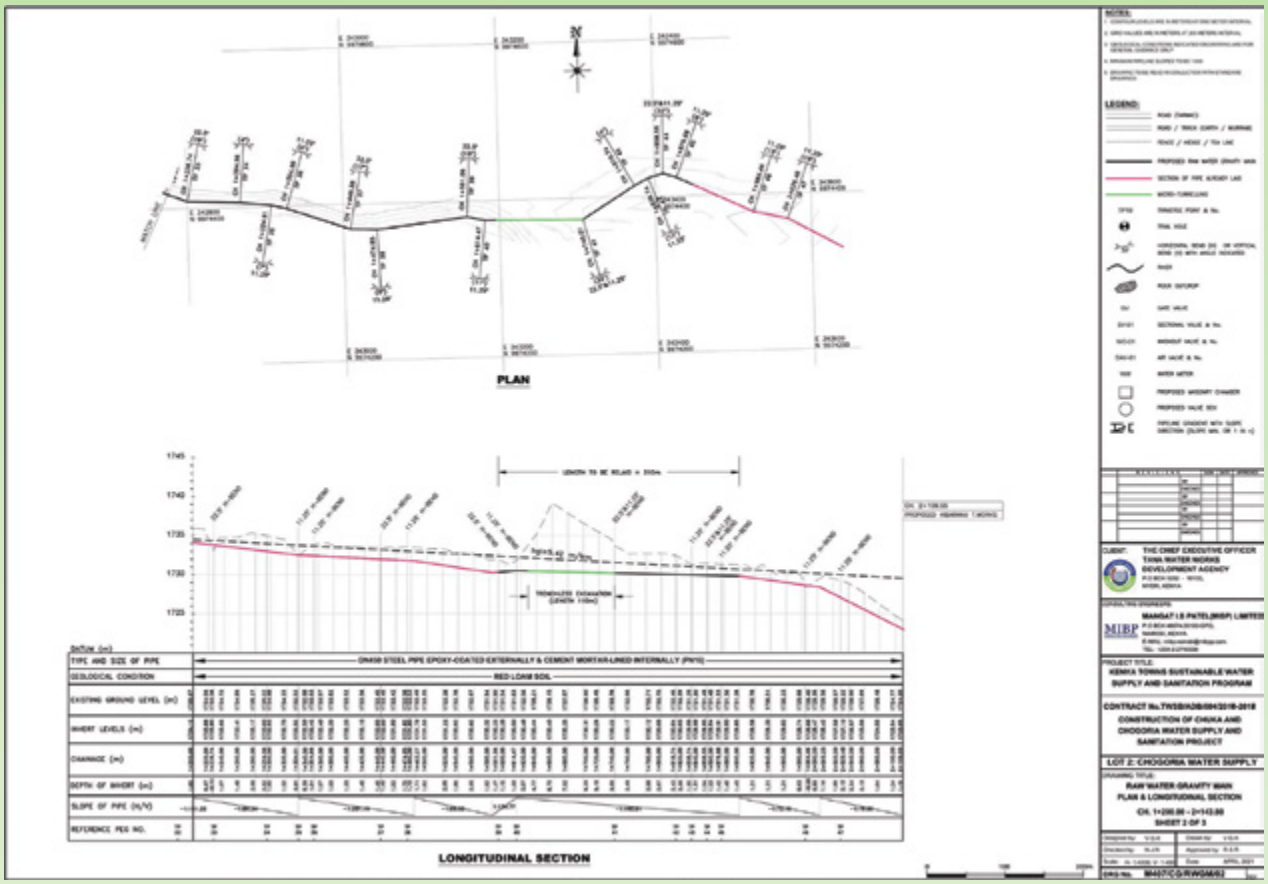


Figure 1: *Plan and Profile of Raw Water Gravity Main at Tunnelling Section*

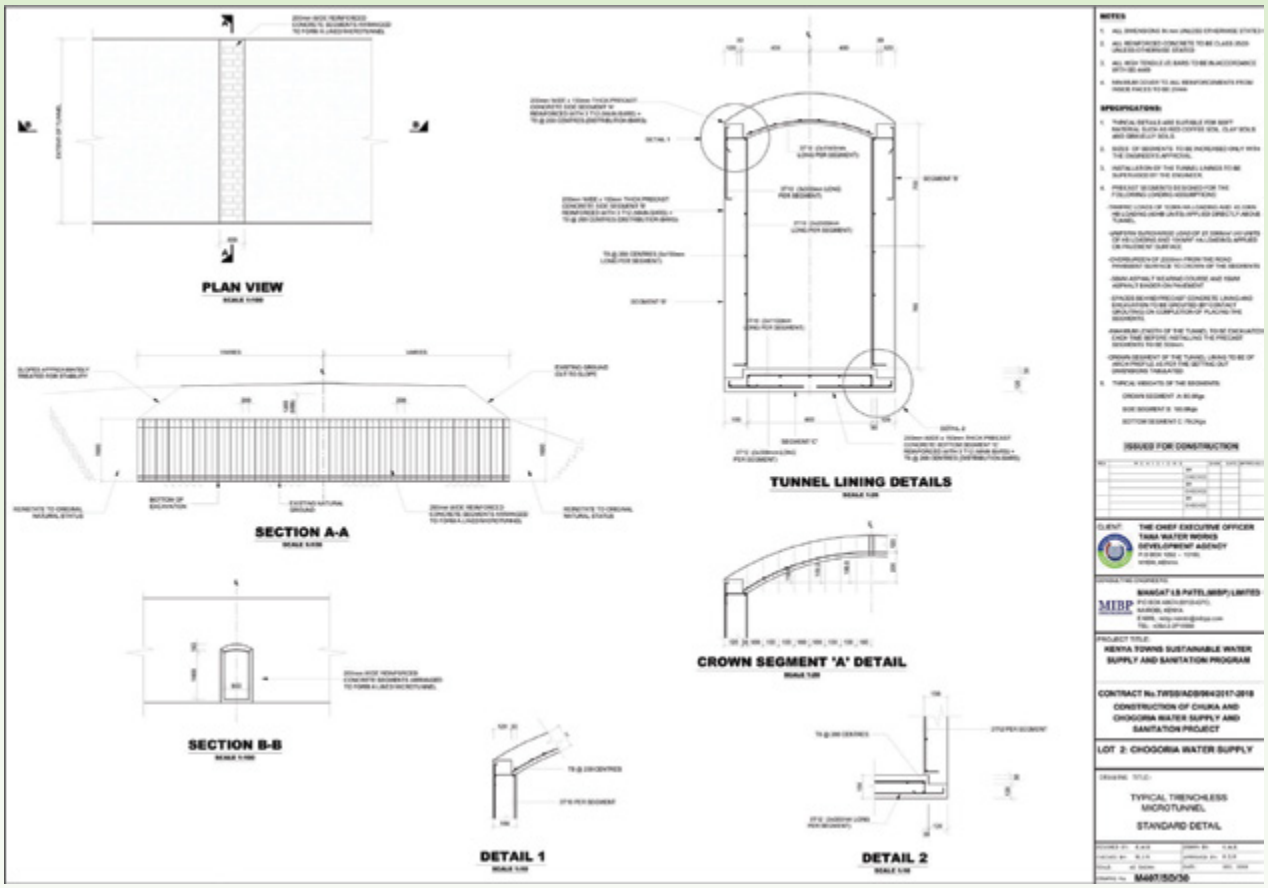


Figure 2: *Trenchless Tunnel Details*


Portal at one end of Tunnel


Installation of Precast Concrete Lining


Complete Lined Tunnel


Concrete Anchor Blocks on Pipe inside Tunnel


Pipe Laying through Tunnel

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KENYA VISION 2030

THE BIG 4
EMPOWERING THE NATION

Governance of Road Works Contracts in Kenya

By Eng. Joseph Anvar Alot

THE Roads and Civil Engineering Contractors Association (RACECA) was formed in 2008 by the construction companies engaged in roads and civil engineering construction in Kenya. It was officially inaugurated by the Minister for Roads, Housing and Transport in 2009. We are the representative body for companies who work day-to-day to deliver, upgrade, and maintain Kenya's infrastructure.

The membership of the association is open to any corporation or partnership engaged in Roads and/or Civil Engineering Construction.

Good Governance

> Governance has 4 major characteristics that RACECA embodies as it champions for the rights and interests of local contractors who are engaged in the building and maintaining of Kenya's critical infrastructure networks in the transport sector. They are participatory, transparent, responsive and accountable, and all follow the rule of law.

As an association we thrive to ensure that corruption in the construction industry is minimized, the views of contractors are taken into account and that the voices of all contractors are heard in decision making and policy making.

Participation

Participation and enthusiasm of the association and its members is a key cornerstone of good governance. By liaising with the government, financiers and other regulatory agencies on all matters affecting the industry we ensure that the concerns of all contractors are taken into consideration in all national decision making policies. We participate in all stakeholder engagement forums in order to share the sentiments of our contractors.

Transparency

RACECA ensures that decisions taken and their enforcement are done in a manner that follows rules and regulations. All information is freely available and directly accessible to our members and those who will be affected by such decisions and their enforcement.

Responsiveness

Good governance requires that institutions and processes try to serve all stakeholders within a reasonable timeframe. RACECA has access to first rate legal advice for members from experienced practitioners around Kenya, where members have issues with contractual matters, or wider challenges relating to construction law, our experts will be able to provide free initial consultations to help resolve any problems.

Accountability

Accountability is a key requirement of good governance. Not only governmental institutions but also the private sector and civil society organizations must be accountable to the public and to their institutional stakeholders. Our members encourage and support smaller local entrants to the industry by way of support such as lending equipment and providing finance. Accountability cannot be enforced without transparency and the rule of law.

Rule of law

Good governance requires fair legal frameworks that are enforced impartially. RACECA works closely with National Construction Authority (NCA) and Public Procurement Regulatory Authority (PPRA), institutions that have been very instrumental in developing laws that dictate the construction industry. As an association we study the industry and stay abreast with the industry trends and remain responsive to the present and future needs of the sector.

Code of conduct

The Association has developed a code of conduct for its members. The code of conduct calls for the members to uphold and enhance the honour, integrity and dignity of the construction engineering profession. They shall not engage in business or professional practices of a fraudulent, dishonest or unethical nature. The code also calls for transparency in procurement and execution of projects.

Conclusion

For the attainment of sustainable freedom and prosperity in the construction sector, good governance is important and must be embraced by all industry stakeholders.

The local construction industry is under threat due to various challenges affecting the sector such as the infiltration by unqualified and unregulated players, unfair competition and inadequate budgetary and financing mechanisms. Good governance ensures that the process of decision making and their implementation are catered for throughout the construction industry supply chain and will resolve majority, if not all the challenges faced by the construction sector.

Eng. Joseph Anvar Alot is CEO, Roads and Civil Engineering Contractors Association (RACECA).

Eng. Adai: Combine Forces with Informal Sector to Unlock Opportunities

Eng.Rodgers Adai is the Managing Director and founder of ARM Engineering. He started the company after working as freelancer around Africa for a while. The company has since been in operation for 16 years, striving to fill existing gaps in the energy sector. He spoke to our staff writers ***Lorein Odhiambo & Maureen Mwangi.***

ARM Engineers at a turnkey substation project. (Inset) ARM MD Eng. Rodgers Adai

ARM Engineering. What has your journey been like?

The company was founded and has grown since 2006, with a major focus on engineering, procurement, construction services, testing and commissioning. The idea of starting up the company was inspired by the need to expand operations in the engineering sector, having worked as a freelancer in commissioning and testing.

As a company, what outstanding range of products and services do you provide?

ARM Engineering offers a range of services including design, procurement, system studies, automation, construction and commissioning

How is your company positioning to meet various emerging challenges such as green energy adaptation?

Engineers have made it fashionable to talk about green energy. The country cannot afford to talk about green energy today, we are hardly using power in Kenya.The entire country only consumes 2000 MW which is highly low compared to our rising population. It is very ironical to have talks about green energy when the country is lagging behind in terms of industrialization. The country should aim at improving the rate of industrialization in the country before thinking about green energy.

On the other hand, there is no storage for green energy at the moment. ARM is agitating for more Engineers to participate in development in the country instead of majorly focusing on consultation work. We are partnering with KPLC and KenGen to advocate for consumption of local content in the Engineering sector for development to occur.

What are the main obstacles facing your business today?

Skewed procurement rules. The biggest challenge firms such as ARM encounter is that the country has adopted procurement rules that effectively block us from growing. We write proposals and take cases to court to increase consumption of local content but this has not borne much fruits. Those benefiting from this lop-sided procurement rule do not want to release the powers they have.

What are some of the opportunities for engineers in the energy sector in Kenya today?

If companies in the energy sector can combine forces and work together with people from the informal sector, we will have increased local content, hence leading to industrialization of the country.

If you had unlimited funding to delve into the energy sector, what unexplored, yet crucial areas would you focus on?

> If I had unlimited funding, I would increase local content in the entire energy sector because I do not understand why we import all our products even solar panels. What values do we get as locals? 95% of the money leaves the country.

Kenya Power and Lighting company has the capability of manufacturing transformers yet our country outsources the transformers. The drivers to consumption of local content are the users such as KenGen and Kenya Power.

What is your view on governance in the engineering industry today?

We have put too many bodies for regulation, people are selecting few things and making them look special. Once I am registered by Engineers Board of Kenya EBK, I should be able to deal with solar, wind, diesel and hydro power. I do not see the need for me to get another licence for operating solar.

Some of these bodies are also not led by Engineers. A regulating body should have leading professionals in the country. An Engineering body should be led by Engineers.We have problems of development in Africa because we voted down professionalism.

Trans-formative leadership. As a leader in industry, how do you ensure you provide a go-to support for engaging in Ally-ship, Advocacy and Activism?

I am a treasurer at the Energy Sector Contractors Association. In the last three years, we have engaged players in the energy sector in sensitizing them on how to increase local participation with mixed results and it's very expensive as we do the funding by ourselves. We have engaged Kenya Power and KETRACO to entrench local content consumption.

We have an on going court case at the Court of Appeal to advocate for 40% entrenchment of local content. It is hard since the people opposing this are fellow Kenyans. IEK should play a leading role responsibility in this and also involve Artisans and Technicians in growth of the economy, not only Engineers. We still have a long way to go especially in the roads sector, as Chinese have taken about 90% of roads construction work.

In your free time, how do you unwind?

I spend most of my time playing chess at Motor Sports Club in South C. I played for 2 years in the Olympics in Dubai in 1986.I used to be one of the best players in the country. Equally important, I walk and cycle for 12Kms per week.

Figure 1: Record-breaking Turkish diver sahika Ercümen draws attention to plastic pollution in the Bosporus.
Credit: Sebnem Coskun/Anadolu Agency/Getty

World Environment Day: An Important Global Movement

By Eng. Dr. Elisha Akech Ochungo, Ph.D., FIEK, CE(K)

WORLD Environment Day (WED) falls on the 5th of June every year. The United Nations Environment Programme (UNEP) usually provides every year's theme. The celebration's aim is to raise global awareness for positive environmental action to protect nature and the planet Earth by all. It was launched by the United Nations General Assembly (UNGA) in 1972 coinciding with the first day of the Stockholm Conference on the human and the environment. Beginning in 1973 with the theme "Only one Earth", many countries around the world, have used the day to rally their citizens about the importance of a healthy and green environment in human lives. And this has helped in addressing many issues by implementing positive environmental actions as well as to hammer an important point that everyone is responsible for saving his/ her environment and that only collaborative actions among all the levels of the society shall bring about the change. The day in some way demonstrates the inspirational power of individual actions that collectively become an exponential force for change in support of sustainable development.

This year's theme is 'Only One Earth.' The theme focuses on living sustainably in harmony with nature by bringing transformative changes – through policies and our choices – towards cleaner, greener lifestyles. Only One Earth was the motto for the 1972 Stockholm Conference; 50 years on, the motto holds true – this planet is our only home, whose finite resources humanity must safeguard. There is an intrinsic link between our quality of life and the health of ecosystems. That is why, beginning in 2008, when UNEP formed the Green Economy initiative human actions have taken the spirit of World Environment Day by promoting sustainable development as a way of utilizing the scarce natural resources, away from "business as usual".

The article by Garrett Hardin, 'The Tragedy of the Commons, in 1968 is always a reminder of the dilemma we face when it comes to the exploitation of nature's goods. Because, we do not literally own nature, everyone chooses to enjoy it to the maximum even when it means overdoing it because after all, there is no policeman on site. And as we do this, we also pollute the environment, coming as fire without smoke. It is said, the moment we all embrace a green economy, we shall achieve low carbon emissions and resource efficiency and at the same time, we shall become socially inclusive. There are literally thousands of ways that we can do something positive, small or big, for the environment. For example, engineers, need to design with nature for resilient infrastructure. At the same time, we must all abide to the ocean policy to protect and stop biodiversity loss. It is said that over a million species face extinction, highlighting the urgent need for conservation policies that maximize the protection of biodiversity to sustain its manifold contributions to people's lives. With the rising human population and the rapid urbanization, we need to strike a balance by choosing to do our actions that align well with nature's health, because we have only one earth.

Eng. Dr. Elisha Akech Ochungo is an IEK Council Member

IEK Capital Branch after planting trees to mark World Environment Day on June 5th, 2022 at Redhill link road, Westlands area.

IEK Capital Branch recently celebrated World Environment Day by planting trees in Red Hill area, Nairobi County.

Governance of the Construction Sector in Kenya

Officials asses a collapsed building in Muthiga area in Kiambu county. PHOTO/ COURTESY

(Inset) NCA Executive Director Eng. Maurice Akech

NCA Executive Director Eng. Maurice Aketch spoke to our staff writer ***Diana Kawira*** *on what ails the construction sector in Kenya. Here, excerpts.*

Comment on the NCA mandate and how you have worked to fulfil it?

The National Construction Authority (NCA,) is a government agency which regulates, streamlines and builds capacity for the construction industry. With this mandate, we have various functions which can broadly be classified into 3 functions.

The first is regulatory functions. NCA registers contractors so that firms and individuals carrying out any construction in Kenya must have valid licenses. We register under eight categories, depending on the size of the construction company. The first category is the largest in terms of capacity while the last category is the Small and Medium-sized Enterprise (SMEs)

Secondly, we conduct accreditation of construction works and site supervisors. We accredit skilled construction workers and supervisors so that when you want to know a qualified constructor or site supervisor they should produce an accreditation card.

Thirdly we also register projects. Before any construction work begins the project owner is responsible for applying for registration to get compliance certificates. This means they have complied with all stated regulatory requirements for the construction industry in Kenya. For projects that have been registered or those under construction, National Construction Authority (NCA) visits them from time to time, to check on compliance with regulatory requirements for the construction industry and to give quality assurance that they are being done in a quality manner.

Lastly, as a state agency, we also have capacity development functions, where we conduct research and advisory services upon request.

There has been increased cases of collapsed buildings and bridges in Kiambu County, and other parts of the country in the recent past. What measures have you put in place to weed out quacks and shoddy workmanship in the local construction industry?

As an authority, we have structures put in place to take care of quality assurance on ongoing projects and construction works. We make sure that before projects take off, the developers have all the necessary documents and requirements.

We are coming up with a Building Code, which is at an advanced stage of development. It will cure and bring sanity as far as standards of materials are concerned.

We are also collaborating closely with other sector players, for instance, the Engineers Board of Kenya (EBK) and the Board of Registration of Architects Quantity Surveyors (BORAQS). We are coordinating with the counties, especially Kiambu County, to set up a joint task force that puts us (NCA) and other players together, to do joint inspections for ongoing and planned construction works.

What challenges exist in construction regulation in Kenya? How are you working to address them?

> One of the major challenges we are facing is a lack of coordination between multiple players in the construction sector. There also exists blatant disregard for the law by some developers.

We have developed a strategic plan that focuses on collaboration and partnerships, to ensure we work as a team for the good of the industry. Regarding the change of legal frameworks, in 2020 there was an amendment to the law which introduced harsh penalties on individuals and organizations that fail to comply with the law.

A person who fails to obey the orders of an investigating officer is , for example, upon conviction liable to a fine not exceeding Ksh1 million , or a jail term of up to three years or both.

Share with us your major milestones as a sector regulator.

We have registered over 100,000 contractors in Kenya, licensing construction workers and site supervisors. Over 40,000 certificates have been issued per firm and per contractor, translating to over 40,000 construction projects registered across Kenya. We now have a database of construction projects and contractors. We have also supported construction companies in getting licenses to do construction work.

Who is Eng Maurice Aketch?

I am a Civil engineer by profession, with 22 years of practice.

What are your long term goals, as NCA?

We have a 5-year plan, in which we have identified the key result areas, including capacity building for local constructors. We believe if we build our capacity locally we can reap economic benefits that will also be sustainable.

The key result areas are innovation and efficiency, where services are offered on online platforms. We are also keen on partnerships and collaborations to grow effectively.

On skills and competency, does the country have enough skilled manpower for the construction sector?

The skills in Kenya are adequate. Where they may be inadequate, is when projects require specialized or unique projects that have not been done in Kenya before. There now exists deliberate government efforts, to ensure that even if it is the first a project being done locally, there is incorporation of local contractors, for instance, construction of the Standard Gauge Railway (SGR). At the end of the project, we must make sure the skills and technology have been transferred locally.

Why Engineers , Technical Staff Must be Part of Procurement Committees

By GE Wilson Nyakundi Omae

THE Public Procurement and Asset Disposal Act (No. 33 of 2015), herein referred to as the Act- was enacted by the Kenyan Parliament to give effect to Article 227 of the Constitution of Kenya by providing procedures for public procurement and asset disposal by public entities, and for connected purposes.

The Act fails to recognise the technical management of the entities and the lead role the technical departments and staff play in the procurement process, and therefore creates room for conflicts to arise during the procurement and implementation of complex and specialized contracts. This paper points such areas of conflict, with the view of bringing them to the attention of the stakeholders for resolution.

Areas of Conflict

Responsibilities of the Accounting Officer

Section 44 of the Act states that an accounting officer of the public entity shall be primarily responsible for ensuring that the public entity complies with the Act. In the performance of this responsibility, an accounting officer shall ensure that procurements of goods, works and services of the public entity are within approved budget of that entity and also constitute all procurement and asset disposal committees within a procuring entity in accordance with the Act.

The management structure in public technical institutions is such that the Director Generals, heads of technical departments, and staff are technical persons such as Engineers. Whereas there are other non-technical departments in these entities, the accounting officer (non-technical person) cannot solely and duly constitute procurement committees as per Section 44 subsection (2) for works and services of technical nature. By virtue of the nature of technical works and services, it is inherent that a qualified technical person should constitute procurement committees composed of technically qualified persons, and others members such as may be nominated by the accounting officer for compliance with procurement regulations the Act.

Evaluation Committee

Section 46 of the Act states that an accounting officer shall ensure that an ad hoc evaluation committee is established in accordance with this Act and Regulations made thereunder and from within the members of staff, with the relevant expertise. An evaluation committee established under subsection shall have as its secretary, the person in charge of the procurement function.

The secretary of the Evaluation Committee for technical works and services should be technical person who can record a technically reliable proceedings and determinations of the committee. This does not negate the need to have a procurement professional as a member of the Evaluation Committee.

Inspection and Acceptance Committee

Section 48 of the Act states that an accounting officer of a procuring entity may establish an ad hoc committee known as the inspection and acceptance committee.

The inspection and acceptance committee shall be composed of a chairman and at least two other members appointed by the accounting officer or the head of the procuring entity on the recommendation of the procuring unit.

The inspection and acceptance committee shall immediately after the delivery of the goods, works or services inspect and where necessary, test the goods received; inspect and review the goods, works or services in order to ensure compliance with the terms and specifications of the contract; and accept or reject, on behalf of the procuring entity, the delivered goods, works or services.

> The inspection and acceptance committee shall ensure that the correct quantity of the goods is received, ensure that the goods, works or services meet the technical standards defined in the contract and ensure that the goods, works or services have been delivered or completed on time, or that any delay has been noted;

The inspection and acceptance committee should have technical qualification to deliver its mandate as per Section 48 (3) and (4) of the Act, for works and services of technical nature.

In view of the management structure of public technical institutions, and international best practices of contract administration and management of technical works and services (for instance FIDIC Conditions of Contact), the accounting officer may not have the mandate and qualification to establish an inspection and acceptance committee as per Section 48 (1) and (2). Such mandate, in public technical entities,

rests with the head of the procuring unit/department, or the head of the institution, which are both technical persons.

A good example of such technical institutions established by an Act of Parliament (The Roads Act, 2011), include Kenya National Highways Authority, Kenya Rural Roads Authority, and Kenya Urban Roads Authority, where the Director Generals and Directors of all technical departments are Engineers.

Standard Tender Documents

Section 70 of the Act states that a procuring entity shall use standard procurement and asset disposal documents prescribed under subsection (1), in all procurement and asset disposal proceedings. An accounting officer of a procuring entity shall be responsible for preparation of tender documents in consultation with the user and other relevant departments.

The role of the accounting officer in preparation of tender documents as per the Act in Section 70 (4) is an overreach. In practice, preparation of tender documents for use in technical works or services is solely done by a technical person, and the accounting officer's role is reviewing the prepared tender documents to ensure that the technical entity is compliant with Section 70 (2) of the Act.

Evaluation of Tenders

Section 80 of the Act states that the evaluation committee appointed by the accounting officer pursuant to section 46 of this Act shall evaluate and compare the responsive tenders other than tenders rejected under section 82(3).

The accounting officer may not have the mandate and qualification to appoint a technically able evaluation committee for evaluation of tenders. The heads of the technical departments or the technical head of the institution should appoint the evaluation committee members of tenders for technical works and services, who shall include a person nominated by the accounting officer for compliance with procurement regulations.

In consideration of the complex and specialized nature of contracts procured by the technical institutions, it is clear that the technical persons and professionals play the lead part. Therefore, accounting and procurement officers should not take credit and benefits of work done and led by technical professionals.

It should therefore be underscored that accounting officers and procurement professionals do not play the lead role in procuring technical works and services, and should therefore play an advisory role rather than an executive role.

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EBK Chairman Eng. Erastus K. Mwongera, RCE, CBS,FIEK and IEK President Eng. Eric Ohaga address the press on the sidelines of the Engineering Partnerships Convention 2022. PHOTO /POOL

Design and Fabrication of a Manual Bean Planter

By Alice Nyaga

Introduction

AGRICULTURE sector in Kenya is the fundamental part of the economy contributing 25% of the total Gross Domestic Product (GDP), and another 27% indirectly. The sector employs over 40% of the total population and over 70% of the rural people.

In June 2008 Kenya adopted the Kenya Vision 2030 as a new blueprint for Kenya's development aimed at transforming Kenya into "a newly industrializing, middle-income country providing a high quality of life to all its citizens in a clean and secure environment".

In the Vision, agriculture is identified as a key sector in achieving the envisaged annual economic growth rate. This shall be achieved through transformation of smallholder agriculture from subsistence to an innovative, commercially oriented, and modern agricultural sector (GOK, 2008).

However, smallholders have relied heavily on rain-fed and poorly mechanized production systems (GOK, 2009). Agricultural mechanization is the application of tools, implements and powered machinery as inputs to achieve agricultural production (Clarke and Simalenga, 1997). The aim of mechanization is to increase output, reduce costs, or both as well as reduce drudgery of farm operations. Hence the need to increase mechanization status of the smallholder in Kenya, who account for 75% of the total agricultural output and 70% of marketed produce (ASDS, 2010).

In horticulture sub sector, smallholders produce 94% of vegetables for local and export markets, and French beans, which are produced for fresh market or for canning, is no exception (GOK, 2017).

For the producers focused on higher incomes and really market oriented production system, production is staggered, and sowing is done every 2 - 3 weeks to achieve year-round production and maximize output during the peak period of October to May.

This calls for proper timing of all operations and hence the need to mechanize planting to reduce planting lead time. Recommended spacing for French beans is 30 cm between rows and 10 - 15 cm between plants. A seed rate of 30 - 35 kg per acre is recommended for ultimate plant population and productivity per unit area (SHEP UP, 2015).

Currently, the sowing is done manually; the planting furrows are made using hand hoes, and seed and basal fertilizer is placed in the furrow by hand. Generally, it takes 20 people to plant 1 acre of French beans. This method is quite laborious, time consuming, costly, and inefficient.

Sometimes there are incidences of labor shortages making timeliness of operation impossible which results in loss of income for the farmer.

Smallholder producers should adopt efficient production systems geared toward cost effectiveness in order to attain higher incomes from the investment. Consequently, there is need to introduce improved planting methods for enhanced timeliness, reduction of sowing labour requirements and overall efficiency in French bean production.

Based on the foregoing, the development of a bean seeder was undertaken. The objective of this work was to design, fabricate and test a push type, two-row bean seeder machine appropriate for small scale French bean planting.

2.0 Materials and Method

2.1 Philosophy of the Design

The seeder was conceived as a low cost, portable, hand-operated, push-type, two-row machine for precise placement of single seeds of French beans and other related species of beans in the soil during planting. It was intended to perform the following essential tasks:

i) Move forward by pushing

ii) Open furrows in pulverized soil in prepared seedbed

iii) Meter one or two seeds correctly,

iv) Drop the seeds in the opened furrow uniformly spaced

v) Spread a thin layer of granular fertilizer in the furrow

vi) Cover the furrow with a thin layer of soil and lightly press the soil.

These tasked were to be carried out simultaneously. The material used to fabricate the machine was mild steel due to its low cost and wide availability.

2.2 Design Considerations

i) Spacing: The single row spacing of 30 cm between rows and 10 -15 cm between plants was considered at one seed per stand in the design of the drive wheel and seed metering mechanism. The drive wheel was to cover 1 meter in one revolution. To achieve the desired circumference of 1meter in one revolution, the following formula was used;

Where D is the external diameter of the wheel

ii) Seed metering device: The seeder was conceived as a precision planter and so seed picking and dropping of seeds were critical parameters to consider. Being operated by the drive wheel, the metering device was to meter 6 to 10 seeds in one revolution of the drive wheel. Axial dimensions of selected French beans were used to design the metering device.

3.0 Results

3.1 Machine Parts Description

i) **Drive wheel:** The drive wheel was built from a 1034 mm long mild steel flat bar of 50 mm width and 6.0 mm thickness. The effective external diameter of 326 mm was achieved after rolling the bar and welding the ends.

Stability of the wheel was achieved by 4 spokes of 12 mm diameter welded on the internal circumference. Traction of the wheel was achieved by 16 spikes made from MS angle bar of 50mm and 4.5mm thickness cut into 40mm length pieces welded along

external circumferential surface of the wheel. A bush made of brass was installed at the centre. The bush had a bore of 12 mm diameter for installation of a drive shaft.

ii) Furrow opener: A full runner type furrow opener was designed and fabricated from 2 pieces of sheet metal measuring 150

mm x 50 mm and 4.5mm thick mounted on a handle made from a square hollow bar of 15 × 15 × 300 mm and thickness of 2mm.

iv) Seed hopper: Seed hopper was fabricated from a sheet metal of 1mm thickness to accommodate the metering device and seeds. It was fitted with a chute to deliver the seeds into the opened furrow. One hopper was designed to hold about 700 seeds. The target is to plant 1 seed per drop at a spacing of 30 cm by 10 - 15 cm from one seed to the other. Since there are two hoppers, they hold 1400 seeds with the view to plant about 0.02 ha before refill.

v) Delivery chute: is made from sheet metal of thickness 1.0 mm folded and then spot welded onto the front side of the hopper.

The seed chute extends 60 mm below the hopper to facilitate delivery of the seeds into the opened furrow.

vi) Seed metering mechanism: A disc of 100 mm diameter was grooved at 300 with 6 equidistance grooves of 10 mm radius.

The grooves hold the seed pick up cups made from a 20 mm long 12 mm solid bar with grooves of 17, 9 and 8 mm in length, width, and depth respectively.

vii) Basal fertilizer application mechanism: The mechanism consists of a hopper, metering device and delivery chute. The

hopper is made from 1.2 mm sheet metal bent and welded to form a half-fluted shape at exit side fitted with two delivery tunnels opened by an adjustable sluice gate. The inside was rounded to reduce turbulence as the fertilizer granules travel to the metering device. The fertilizer metering device was made from a Poly Vinyl Siloxane (PVS) roller with grooves of 2.5mm deep and 16 mm long and 6 mm wide.

vii) Soil coverer: A soil covering device is provided to cover the furrow and compact the soil lightly over the seed. Soil cover device was made from sheet metal formed to the desired shape and the handle from a square hollow bar of 15 × 15 × 300 mm.

viii) Frame: The frame was made to hold all parts effectively during operation and storage of the machine. It was made from sheet metal of thickness of 3.2 mm and brackets made to fix the attachments onto the main frame.

ix) Front wheel: The front wheel was built designed to provide stability during operation. It was made from made from a sheet metal of 628mm long 100mm and 4.5mm thickness rolled and welded to form a diameter of 200 mm and width of 100 mm.

A reinforcement circular plate of 200mm diameter and 6 mm thickness, with 4 holes of 50mm diameter cut out equidistance

at each quadrant was welded on to the internal circumference.

x) Handle: The handle was made from two hollow pipes of 2 mm thickness. Two longitudinal parts were made from a hollow pipe of 19 mm diameter and 1200 mm length, while the lateral part was made from a hollow pipe of 32 mm diameter and 600 mm length. The longitudinal pipes were welded onto the lateral pipe.

Plate 1: The developed prototype machine

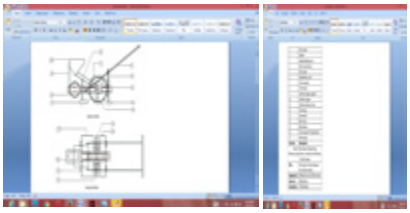

Figure 1: Plan and side view of the prototype Machine

3.2 Laboratory Test Results

The seed sizes used in the tests were generally uniform with the major, minor and intermediate diameters of 10 - 16 mm, 6 – 8 mm and 5 – 7mm, with a standard deviation of between 0.3 and 0.9 for all the 3 varieties used. The test method was adopted from Regional Network for Agricultural Machinery Test Codes and Procedures for Farm Machinery (2016).

Laboratory tests done showed that the machine metered the seeds with an efficiency 80%. The picking efficiency was also evaluated, and the results showed a satisfactory performance. From the data collected, it was evident that one cup performed excellently, with no miss and no double pick, while other 3 cups performed well with no miss. Unfortunately, one cup was found to have the highest probability of miss, with 40% probability of miss. Another 4 cups had no probability of double pick.

The basal fertilizer application was tested in the laboratory. The fertilizer metering efficiency were 1.5g and 1.2 g from the right and left side rollers, respectively. This was deemed satisfactory considering the recommended requirement for 1 g per hill.

3.1 Field Test Results

The field tests were done to evaluate the slip of the prototype planter and the seed rate and the operation speed.

Slip: The method for slip measurement is as given by Ajit, 1993 and Brewer, 1988. The distance covered by the drive wheel in 10 revolutions was measured using a tape measure and found to be 12.1 metres.

The circumference of the wheel, C=πD =3.14 0.326 m = 1.023m; Percentage slip (π is given by the formula, where, π =percent slip L = distance covered by the wheel in 1 revolution C = circumference of the drive wheel.

The theoretical interval of seeding(s) is given by where, S = theoretical interval of seeding C = circumference of the drive wheel 6 = Number of seed pick-up cups π= % slip

The actual spacing between seed dropping on the field showed results in the range of 150 ~ 180 mm and row spacing gave an average of 300 mm.

3.1.2 Seed rate: From the parameters of the machine, seed rate was found to be comparable to the recommended seed rate of 30-35kg per acre (SHEP UP, 2015)

Parameters considered include:

a) Effective diameter of drive wheel = 0.326 m

b) Distance covered by one revolution = p × 0.326 = 1.023 m

c) Area required for one seed = row spacing x seed spacing = 0.3 × 0.15 = 0.045 m2

d) Total number of seeds per hectare = 10,000/0.045 = 222,222

e) Taking the average weight of the seeds to be 0.35g, the seed required per hectare = 222222 × 0.35/1000 = 77.77 kg/ha

Parameter	Specifications
Type of seeder	Manually operated, push-type
Number of rows	2
Nominal working width	30 cm
Hill to hill distance	10 cm ~ 15cm
Seed for which seeder is suitable	Oblong and oval
Suitable crops	French beans, field beans
Overall length	1430 mm
Width	600 mm
Height	850 mm ~ 950 mm
Overall weight	33 kg
Metering mechanism	Circular plate with cups
Suitable travelling speed	0.3– 0.6 m/s
Fertilizer facility	1 hopper
Hopper capacity- seed	1.4 kg
Hopper capacity- fertilizer	5 kg
Type of furrow opener	Full runner type
Type of covering mechanism	Leaf plate type

Table 1: Specifications of bean seeder

4.0 Discussion

The material selection for fabrication of the seeder was Mild Steel due to its availability and affordability. The objective of the project was to deliver an effective French bean planting machine that is affordable to smallholder French bean producers.

The final total weight of the machine was 33 kg. This may be slightly difficult to operate for weak persons

and hence the need for more work to make the machine lighter and easier to operate.

The prototype bean planter is an improvement over manual planting with hoes and hand placement of seed and fertilizer.

With this device, labour requirement for planting one acre was reduced from 20 people to 4 (about 80% labour reduction), planting depth and germination was more uniform, plant population is maximized, more output is guaranteed, and drudgery is greatly reduced.

The device is easy to handle, adjust, operate and transport to the field, however, it should be kept in horizontal position during operation and operating speed should be maintained at 0.4 - 0.6 m/s. At higher speeds, the probability of "miss" increases.

The machine may be adapted for planting other species of beans after changing the seed metering device to suit the axial dimensions of the selected bean variety. The option of planting without the basal fertilizer application is also feasible since the fertilizer application mechanism is detachable and the rest of the machine works efficiently.

5.0 Conclusion

The prototype machine fabricated can substitute the hand hoes in French bean sowing and increase efficiency of seeding. The seeder is affordable and can easily be operated with minimum skills.

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IEK Immediate Past President, Eng. Nathaniel Matalanga presents IEK proposals on the Kenya Roads Board Ammendment Bill 2022 to the Transport Committee of the National Assembly in June 2022.

The Isuzu EA Assembly Plant located on Mombasa Road, Nairobi.

Skills Transfer Sustains Job Creation for Kenyans

By Dancan Muhindi

Technology has rapidly evolved and created vast opportunities for continuous innovation in all sectors. Digitization of services, learning and dissemination of information has revolutionized our daily lives. In the Automotive Industry, technology has changed motoring experience for millions across the world. Every year vehicles are rolling off the production line with smarter, more savvy tech gadgets aimed at enhancing safety, efficiency, comfort, and environmental conservation.

Isuzu is a leading automobile maker in the world which has perfected diesel engine technology over the last 80 years. The company has continuously improved its engines to give efficiency and power to the millions of trucks and buses that provide transport solutions around the world.

Isuzu East Africa which started local assembly of Isuzu trucks and buses 45 years ago, created opportunities for the training of Kenyan engineers and technicians. The experience and skills that the technicians, mechanics and engineers have amassed over the years has been invaluable. Engineers and technicians at Isuzu East Africa are supported by world class tech gurus from its innovation and research centres in Japan and Dubai. This has created a homegrown pool of Kenyans who in turn have trained younger cohorts of technicians.

Part of the objectives of supporting local assembly of vehicles in Kenya was the push by the Government of Kenya to create wealth for locals, employment, grow GDP and facilitate skills transfer to Kenyans. Apart from the training by Isuzu, the company is required to source some of its parts from local suppliers. This has created opportunities for local investors to build enterprises around building bodies for trucks and buses, production of exhaust pipes, harnesses, radiators, seats, automotive paint, windscreens, batteries and much more.

More recently, the Ministry of Industrialization, Trade and Enterprise Development directed that the age of imported trucks and buses be reduced to zero and prime mover trucks be reduced progressively from 8 years to 5 years in 2019, then to 3 years by 2021 and finally to zero years by July 2023.

Therefore, the Kenya Bureau of Standards (KEBS) introduced the Kenya Standard 1515 after public consultations with automotive stakeholders. The Standard was approved in 2019 then gazetted and enacted by the government in 2021 to promote local assembly of vehicles. The 1st of July 2022 was provided as the deadline for the full implementation of KS1515 when imported used trucks and buses between 3.0 to 30 tonnes will no longer be imported into the country.

Local vehicle assemblers have demonstrated that there is capacity and skill to build vehicles locally. Combined, they produce about 12,000 vehicles annually, to cater for public service transport, educational institutions, construction, transportation of fast-moving consumer goods, agriculture, agribusiness and last mile deliveries. Over 100,000 vehicles are registered in Kenya annually and out of this, only about 12,000 are locally produced. With the newly introduced legislation, this annual production can easily double as the demand grows.

Part of the benefits of spurring local assembly of vehicles is the skills and technology transfer. Engineers and technicians working in the production lines are equipped with updated skills in vehicle assembly, engine and gear box maintenance and repairs, bodywork, fabrication and refurbishment, electrical technology and digital innovations.

Similarly, manufacturers of locally sourced components are required to meet stringent quality standards set by Isuzu.

Makers of automotive paint, exhaust pipes, seats, harnesses, radiators, steel brackets, bodies for trucks and buses and other parts employ over 5,000 people within the Isuzu value chain. These technicians regularly receive training which keeps them fully abreast of new technology in the sector and the high specifications by the automaker.

Isuzu service technicians have for the last 7 years participated in the annual Isuzu I-1 Grand Prix International Technical competition. Apart from gaining valuable skills and experiences from this competition, the technicians bring back home crucial learnings to share with their peers and thereby boost the quality of service to customers.

Isuzu has a countrywide network of vehicle dealers and authorised service centres. The staff employed in the service centres are trained and fully equipped by Isuzu to deal with any issue ranging from repair and fitting of engines, gear boxes, suspension, electrical system to body work.

The Isuzu assembly line is also staffed by a large number of women engineers and technicians who have demonstrated that they too can thrive in an industry previously dominated by men. This has opened doors for other young women aspiring to join various technical fields and proven that with commitment anyone can excel.

Isuzu East Africa is keen to continue developing and growing local talent and deploying them to ply their trade either within the Isuzu network or elsewhere. Isuzu East Africa is the number one vehicle assembler in Kenya and promotes the use of the right tools, equipment, and knowledge to serve vehicle owners in the region.

Dancan Muhindi is the Communications Manager, Isuzu East Africa.

A Case for use of Permanent Magnet Motors in Borehole Pump Applications for Water Utilities

Introduction

Groundwater provides drinking water to at least 50% of the global population and accounts for 43% of all irrigation water according to United Nations Food and Agricultural Organization.

In Kenya, groundwater is a critical water source in most water utilities, contributing an often easier-to-treat water source. However, groundwater has to be pumped to the surface, so borehole sources often come with the attendant initial investment in power supply (mostly generator or solar) and when connected to mains supply, there is there are running costs to cover power bills.

Most water utilities are keen to have smarter asset management and a recent trend also includes at converting borehole pumps systems from mains power supply to solar driven systems.

For these reasons, pump systems need to be designed for high efficiency. There are various points to consider in design of an efficient borehole pump application. The main driver of this being to keep the total lifecycle costs of the installation at a minimum. This entails selection of a wellfield with lowest specific energy, selection of the right pump, consideration of the best power source, design of the pipe system to reduce losses, water storage, and lowest cost of treating and delivery of water to the end users and efficient billing (if any) among other factors.

Though various advances have been made in all the above areas, there is still a drive to reduce the cost of water and more specifically to reduce energy costs which in most cases contribute the largest portion of recurring costs. The purpose of this article is to highlight another recent development that can further reduce energy costs by use of high efficiency permanent magnet motors.

Permanent Magnet Motor Technology.

Permanent magnet motors have a rotor with internal permanent magnets as opposed to the squirrel-cage copper rotor in standard motors. Design using permanent magnets has a significant improvement in efficiency.

Tesla, Nissan, Porsche use permanent magnet motors in their electric cars. This increases the cars range due to the motors high efficiency and reduces the maintenance costs as the motors are also quite robust. In 2017 Tesla started moving from induction motors to PMM and this allowed them to larger car model.

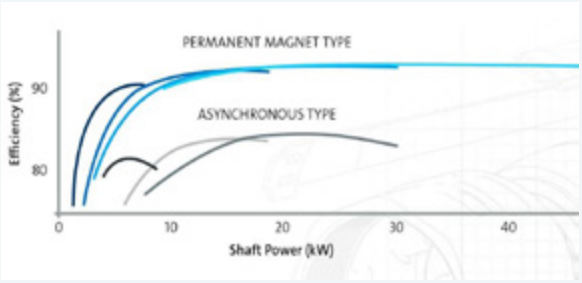
As reported in InsideEVs, the overall drivetrain efficiency improved by and average of 10% gaining further technical benefits related tot the use of permanent magnet motors.

The same technology has now found its way to the borehole pump applications. Previously the cost vs benefit has favoured the more common motor design with copper rotors but with improved design the cost of permanent magnet motors has led leading pump manufacturers to introduce this technology to the market. The improved efficiency and design has a number of benefits which we shall now explore.

Benefits of PMM technology in Submersible pumps

a. Higher efficiency

The main benefit of PMM vs standard motors is improved efficiency. A comparison of some of the best standard motors vs a permanent magnet motors shows that the permanent magnet motors are 7-10% points better.



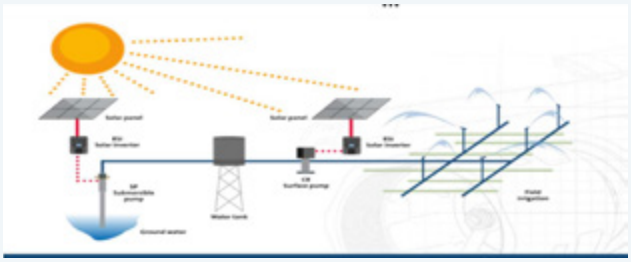
Higher efficiency has a quite a large number of gains for pump installations.

b. High temperature applications

The permanent magnet motor as standard is able to handle higher temperature water due to more efficient cooling. High efficiency of the rotor means reduced losses. Reduction in losses means less heat is generated by the motor. Whereas most submersible motors will handle water temperature up to 40 degrees, the more efficient cooling of the PMM motor means it can handle higher temperatures (routinely up to 60 degrees C). This extends the life of the motor and also offers a solution in very deep boreholes where water temperatures are elevated.

c. High efficiency over varying demand

In applications where the load on the pump is varying, PMM motors show a high efficiency over varying load. This translates into even more savings in installations with varying demand such as irrigation, installations with significant drawdown, as well as solar powered installations.



d. Reduction of investment in power sourceS

In solar powered systems, the improvement in efficiency means that less power is required to run a pump. For example a 10% improvement in efficiency means that the size of the solar array required to run the pump can be reduced in the same proportion.

Challenges with PMM technology

Initial cost

Price and design of Permanent Magnet Motors continues to improve globally bringing the technology within a sustainable margin. However they are still higher on price when compared to standard motors. Designs have been improved by hermetically sealing the rotor to eliminate both the risk of demagnetization as well as corrosion.

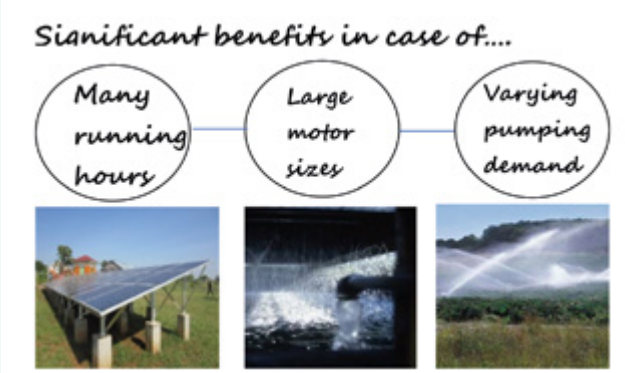
Additional Controls

Most permanent magnet motors run synchronous requiring a variable speed drive instead of standard motor protection. This has the short term disadvantage of higher initial cost but improves the running costs of the system.

Conclusion

Where to use the PMM technology?

Given the aforementioned benefits and challenges, permanent magnet motors show the best benefit in installations where there are long running hours, larger motor sizes, as well as in installations with varying pumping demand. Large borehole installations, municipal ground water intakes, dewatering in mines and irrigation applications can benefit most from this technology.



In solar applications where the cost of the inverter is already considered, the benefits are even more significant.

The reduced number of solar panels means lower cost as well reduced space requirements for those panels. This also reduces the size and number of other required accessories including use of a smaller cables.

As water resources become constrained, efficiency in obtaining groundwater will be a key driver in borehole installations. Cost of power, water temperature and varying water levels will continue to be challenges that consumers and water utilities need to grapple with. Application of technologies such as permanent magnet motors is one of the ways to overcome such challenges.

References

Reprinted with excepts from Grundfos white papers on same topic as well as below references:

1. Groundwater use for Irrigation – A Global Iventory - S Siebert - 2010
2. Grundfos SP Engineering Manual Kenth H. Nielsen – 2008 Ed.
2. Drinking Water Standard DIN 1989-1:2001-10
3. https://insideevs.com/news/374744/tesla-industry-leading-efficiency-teamwork/
4. State of Green, Alfred Heller, Jens Norgaard et.al. (2015).

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Africities Take Away . . . By Maria Monayo

FROM the 17th to 21st May 2022, stakeholders converged in Kisumu City for the 9th Africities Summit. This year's theme was *The Role of Intermediary Cities of Africa in the Implementation of Agenda 2030 of the United Nations and the African Union Agenda 2063.*

The global event hosted over 90,000 delegates with 11 heads of state attending and discussed the development of urban centers.

The institution of Engineers of Kenya exhibited at the global event which hosted over 90,000 delegates. Several dignitaries visited the IEK stand. Of mention was the cabinet secretary for Ministry of Defense, Hon. Eugene Wamalwa who stopped by the IEK stand and appreciated the growing number of women Engineers in the country. In his address to the Institution's CEO, he attributed such developments to efforts of welfare organizations such as IEK.

5th June is World Environment Day. IEK Capital Branch in partnership with the North Eastern Branch organized a series of events to mark the day, including a webinar discussing Engineers' solutions to climate change, nature loss & pollution. over 30 Engineering students from University of Nairobi, Kenyatta University and JKUAT planted of over 100 trees along the Red Hill link Road, Off Waiyaki Way, sponsored by the Center for International Forestry Research and World Agroforestry.

(Left) Defence & Devolution Cabinet Secretary Eugene Wamalwa signs the visitor's book at the IEK Africities stand. (Right) Kisumu County First Lady Dorothy Nyong'o (Right) poses at the IEK stand.

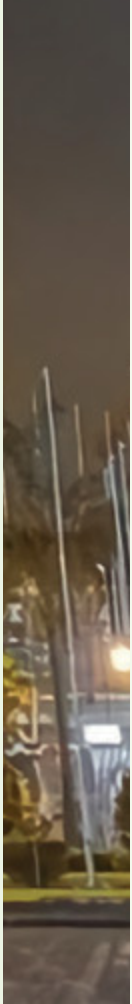
REPUBLIC OF KENYA

ENGINEERS BOARD OF KENYA
Enhancing Professionalism

ENGINEERING PARTNERSHIPS CONVENTION | 2022

"BUILDING BACK BETTER – EMERGING ISSUES IN ENGINEERING"

4 QUALITY EDUCATION
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
13 CLIMATE ACTION
17 PARTNERSHIPS FOR THE GOALS



Speech by Chairman, Engineers Board of Kenya Eng. Erastus Mwongera, RCE, CBS, FIEK

The enactment of the Engineers Act 2011 effectively transitioned the Board and comprehensively expanded its mandate to cover engineering education, training, and practice. This has allowed the Board to bring global perspectives to the entire Kenyan engineering value chain to be globally competitive.

The Board is excited to host policymakers, industry experts, academicians, researchers, trade-in services experts, and engineers at this Engineering Partnership Convention 2022 to create dialogue, reflection, and partner together to strengthen Kenya's engineering education, training, and practice. The EPC 2022 Pillars are perfectly aligned with the EBK's commitments to Sustainable Development Goals (SDGs): SDG 4 on Quality Education; SDG 8 on Decent Work and Economic Growth; SDG 9 on Industry, Innovation, and Infrastructure; SDG 13 on Climate Action and SDG 17 on Partnerships Creation. The Convention further aligns very well with the Aspiration of the African Unions Agenda 2063 of a Prosperous Africa based on inclusive growth and sustainable development.

The Engineers Board of Kenya has several programmes aligned towards the attainment of the pillars. While championing the shift to outcomes-based engineering education in Kenya, the Board's ongoing programmes include:

1. The Board is working towards attaining the signatory status on the Washington Accord under the international Engineering Alliance by 2023. The Signatory status will ensure global recognition of our engineering programmes, global mobility of our engineers and attraction of local engineering programmes by students globally.
2. The Board is engaging all the stakeholders in the engineering education sector including universities, industry, ministry of education, CUE and Council of Engineering Deans to have a well-coordinated sector; and
3. The Framework for Collaboration Between Academia and the State Department of Infrastructure on Research and Capacity Building for Sustainable Road Infrastructure was inaugurated on 10th June 2022. The collaboration will lead to applied Research & Development undertaken in specific areas of focus by road agencies and thereby provide solutions needed for sustainable road infrastructure and other transport facilities.

Under the Second Pillar on opportunities for growth in the liberalization of professional engineering services at the regional, continental and global levels.

1. The Board is currently participating in Trade Talks at the African Continental Free Trade Area (AfCFTA) and the East African Community (EAC) for liberalized engineering services. The Board participation will ensure the country's stand and the interest of the local engineers are safeguarded; and
2. In April the Board successfully organized the Trade In-Service (TIS) Conference in which key-built environment stakeholders were sensitized on opportunities, threats and strengths of liberalization of professional services. The conference helped the Board to come up with the draft country position which shall be highlighted during this Convention.

The third pillar will focus on Kenya's commitments at (COP26 26th meeting of the Conference of Parties) and aligning the engineering practice to mitigate climate change. The presentation will ensure the alignment of engineers' standards and practice towards the commitments that were made by Kenya. It will also give us a chance to understand the funding and capacity-building opportunities that exist. e.g. start incorporating green practices in housing, transport, energy etc.

The fourth and last pillar is on Safeguarding Public Safety and Welfare in Engineering Services. Under this:

1. The Board has completed the Countrywide Structural Assessment of ongoing Buildings and developed a draft report with recommendations to address gaps to prevent further building collapse and loss of lives.
2. The Board has established Adhoc committees to conduct disciplinary hearings on all cases referred by National Construction Authority (NCA) and those that have been received by the public. The hearings are expected to

commence in the next two weeks.

3. The Board continues to develop and issue compliance and enforcement tools that include Engineers Stamp and Engineers IDs; and
4. The Board has further developed a collaborative framework with the Board of Registration of Architects and Quantity Surveyors (BORAQS) and the National Construction Authority (NCA). The Framework has been approved by the Office of Attorney General and signed by the respective CEOs. A launch is being organized soon to launch the MOU and roll out implementation.

In conclusion,

The Board in its aspiration to register 10,000 engineers by 2027 has recruited the 3rd Cohort of Graduate Engineers in January 2022. Secondly, the Board has developed Agency-Based Structured Graduate Engineer training with Isuzu, Kenya Bureau of Standards (KEBS), Kenya Electricity Transmission Company (KETRACO), and Schneider Electric. Out of this Agency Model, the Board has registered the first 13 engineers from Isuzu. We, therefore, encourage other institutions to partner with the Board to develop structured training for their graduate Engineers.

The engineers' scale of fees was recently passed by parliament and we are looking forward to its implementation.

The Board is under-resourced to effectively deliver its mandate. Discussions are ongoing with the Ministry for additional funding and donor support. Adequate funding will enable the Board:

- Upscale compliance and enforcement function
- Upscale Graduate Engineering Internship Program
- Establish a School of Engineering to introduce specialized engineering programmes and bridging courses.
- Kenya Academy of Engineering and Technology for Leadership and Policy advisory on matters engineering.

There is also a need to harmonize Regulations in the built environment particularly Engineering education, building code among others.

The Board shall be submitting policy proposals for consideration.

EBK milestones have been made possible by the immense support of all our stakeholders including our staff and Board members, the Government of Kenya through the Ministry and Cabinet Secretary Transport, Infrastructure, Housing, Urban Development and Public Works, James Macharia, as well as the PS Infrastructure, Arch. Prof. Paul Maringa.

Remarks by Principal Secretary, State Department of Infrastructure Prof. Arch. Paul M. Maringa (PhD), CBS, F.A.A.K., MKIP

on the Inaugural Meeting on the Adoption of the Proposed Framework for Collaboration Between State Department of Infrastructure and Academia on Research and Capacity Building for Sustainable Road Infrastructure

The PS noted that Kenya's development blueprint, Vision 2030, emphasizes the development of infrastructure sectors which includes energy and roads. He noted that the Government has spent more on infrastructure projects because this would lay the foundation and framework for all other sectors of the economy to thrive. Further, at the global level, Kenya's infrastructure development aligns with SDG 9 on Industry, Innovation and Infrastructure. Goal 10 of Africa's Agenda 2063 is to have world-class infrastructure crisscrossing Africa and this prioritizes the development of infrastructure connectivity. Therefore, in support of the above goals and aspirations, there is need for partnerships from the Government, academia and industry leaders that will develop and deploy the engineering human resource capital that will not only help Kenya achieve its developmental goals but also safeguard Government investment through coordinated efforts from all stakeholders.

A colloquium held in February 2021 was chaired by the PS and attended by Chairpersons of Agencies under the SDOI, Director Generals & CEOs of Agencies under the SDOI, the leadership of the Council of Engineering Deans & Principals and representatives from various institutions noted that

there was need for a coordinated effort to establish strong linkages between government (represented by the Engineers Board of Kenya), industry (represented by Agencies in the Roads Sector) and academia (universities offering accredited civil engineering programmes). Areas of mutual interest discussed in the colloquium included:

- Advancement of Knowledge
- Applied Research
- Sustainable economic performance
- Design of resilient infrastructure
- Focus on local material
- Capacity-building opportunities
- Design of outcomes-based curriculum
- Improvement of human capital development for infrastructure development

Given the above, an Interim Steering Committee was formed to develop a collaborative framework. The overall goal of the Coordination Framework is to harness knowledge, experience and technology through collaboration between the Agencies in the SDoI and academia for the development of sustainable infrastructure in Kenya.

The thematic areas of the collaborative framework are as follows: -

- **Cluster 1:** Research, Innovation and Development
- **Cluster 2:** Training & Capacity Building
- **Cluster 3:** Knowledge Management

The PS highlighted some of the negative impacts of not having a collaboration framework as high cost of infrastructure development, lack of data sharing, duplication of efforts leading to wastage of resources and low adaptation of emerging technologies.

In his remarks, the PS noted that the Collaborative Framework would benefit all stakeholders through: -

- Sharing of knowledge and resources;
- Reducing duplication of efforts;
- Provision of opportunities for attachment and internships;
- Promotion of research that will create a positive impact in the roads sector;
- Improvement of curriculum for courses relevant to engineering education;
- Professional development training and mentorship; and
- Capacity building initiatives for stakeholders in academia, the agencies and the contractors.

He committed to supporting the Collaborative Framework by establishing efforts that will see funding mechanisms developed to support the activities of the Framework and the development of key policies from recommendations that are made within the clusters.

Keynote address by the Chairman, RPDCC Eng. Johnson Matu, CE

on Safeguarding Public Safety and Welfare in Engineering Services During the Engineering Partnership Convention Conference 15th to 17th June 2022

The Board is mandated to carry out the following functions as provided for in the Engineers Act, 2011 with a view to safeguarding public safety and welfare in matters of engineering services.

Engineers Act, 2011 Section 1) 7) :

(f) 'carry out inquiries on matters pertaining to registration of engineers and practice of engineering'

(g) 'enter and inspect sites where construction, installation, erection, alteration, renovation, maintenance, processing, or manufacturing works are in progress for the purpose of verifying that-professional engineering services and works are undertaken by registered persons under this Act and standards and professional ethics and relevant health and safety aspects are observed.'

(j) enter and inspect business premises for verification purposes or for monitoring professional engineering works, services and goods rendered by professional engineers;

(k) instruct, direct or order the suspension of any professional engineering services works, projects, installation process or any other engineering works, which are done without meeting the set-out standards;

(m) set standards for engineers in management, marketing, professional ethics, environmental issues, safety, legal matters or any other

relevant field;

(u) develop, maintain and enforce the code of ethics for the engineers and regulate the conduct and ethics of engineering profession in general

(x) also states that the Board is to 'carry out other functions related to the implementation of this Act.

This conversation on safeguarding public safety and welfare couldn't have come at a better time. This is because engineering crosscuts all the facets of our lives. We all recall the speech by the Chief Guest, Prof. Arch. Paul Maringa, the Principal Secretary, Infrastructure, highlighted extensively the importance of the engineering profession and practice in the offering of solutions to the problems facing humanity. This applies to all the sectors of the economy, such as the energy sector, housing sector, mining sector, telecommunication sector, manufacturing sector, agricultural sector, transport & infrastructure sector, water sector, etc.

It must be taken to account that the solutions, often will involve the design and implementation of a project or projects. These projects must be economically viable, technically feasible, sustainable, and above all, safe. In other words, the projects must be implemented within budget, it the stipulated time and to the required quality/ standards.

The regulatory framework in the engineering and construction industry or space needs to be strengthened to not only mitigate or reduce the collapse of infrastructure, especially buildings but most importantly to guarantee public safety and welfare.

The Board has taken note of the recent collapse of infrastructure, such as buildings, part of roads, bridges, powerlines, etc. We all recall the crane collapse in Nairobi County last year. At one point, there was a massive leakage of petroleum from the pipelines. This was followed by the collapse of the Paai Bridge in Kajiado County. This points to a problem that must be urgently addressed. This is a real risk to the future of our beloved Nation as a whole, especially on the untold and needless loss of lives and investment to the citizens, the 'ordinary wananchi'. Another risk is the realization of the African socio-economic developmental blueprint as espoused in the Africa Agenda 2063.

To get to the bottom of this matter, the Board conducted a Country-wide Structural Assessment on Buildings under Construction in March of this year. The Board then had a series of workshops engaging the stakeholders, after which a draft report has been prepared. I was part of the team that went to Mombasa County and can confirm that indeed we have a problem, but this presents us an opportunity to address the problem for posterity.

This exercise was not just for buildings under construction but on the whole value chain of engineering practice in so far as project design and implementation are concerned, particularly in the county governments. The Board developed terms of reference which were used to establish the capacity of the county governments to design and supervise the projects, assess the approval processes with a view to finding out gaps, to make recommendations for the betterment of the industry.

This is the first phase of the project, which focused on buildings in just a few selected counties. The strategy, especially for the 2nd and 3rd phases would be to widen the scope in terms of the number of counties as well as the sectors which include; energy, water, mining, transport, marine, agricultural, manufacturing, etc. The Board would be carrying out in-depth research, with a view of enhancing and safeguarding public safety and welfare.

The Board has adopted a 'Zero Tolerance to Collapse of Infrastructure' and is committed to go as far is required to safeguard the safety and welfare of the public.

The Board is also in the process of:

- developing Engineers' Portal where Engineers will be required to register the projects they are handling for purposes of enhancing monitoring and verification.

As stipulated in the Engineers Act, 2011 and Engineers Rules, 2019, Accredited Checkers will be reviewing the designs works of other engineers for the purpose of ensuring safety in the designs. This will go a long way in strengthening the practice.

In addition, the County Government of Kiambu recently inquired from the Board on the list of licensed engineers and engineering consulting firms. This is to inform you that the Board is partnering with Kiambu County in terms of confirming the professional and consulting engineers and that only those in good standing with the Board will be able to be registered on the County online approval system. 1606No. professional and consulting engineers, 108No. Engineering Consulting Firms and 4No. Temporary Professional Engineers.

It is envisioned that all the County Governments will be expected to develop online approval systems of which the Board will share the required information whenever required.

East African Community Position on Trade in Services
Ms. Magdaline Morijio

Trade-in-Services are increasingly becoming a core part of world trade today and therefore it is important for our sector to align itself accordingly and speak with one voice when it comes to the services we regulate and represent.

Trade-in-services play an important role in economic transformation, employment creation and value addition, enabling countries to diversify and upgrade their economies.

The services sector has emerged as the largest segment in and driving force of the economy contributing a growing share to our country's GDP, trade and employment. Many services, engineering and architectural being some of them have emerged as promising tradeable services as a result of technological advances and investment in infrastructure. Leading exports to East Africa by Kenya include insurance, accounting, financial, engineering and architectural services. Kenya has a competitive advantage in the perceived high quality of its professional services and their lower costs relative to developed countries.

The Engineering and Construction sector is very vital in our country and hence it is necessary to ensure that we negotiate good offers for Kenya for our engineers and architects to be able to compete globally. There is a thin line between the protection of local content and the expansion of the industry to global markets. Hence this training is aimed at equipping us with the necessary skills to understand our offers as Kenya under our specific sectors, the offers and requests by other countries and how we can respond to ensure we have maximum gain.

The State Department of Trade has invited the Engineers Board of Kenya and other Regulators to take part in the negotiation process for offers under the Africa Continental Free Trade Area. Representatives from the Board and the Engineering Sector have attended meetings on the EAC Trade-in-Services Strategy and on the AfCFTA in the regional front.

Kenyan engineers face various challenges in the export of engineering services.

They include but not limited to:

a. Different & stringent taxation levels for nationals and foreigners;

b. Different & stringent frameworks for certification and recognition of qualifications of professional engineers;

c. Stringent regulatory requirements which foreign engineers and firms must fulfill prior to offering engineering services;

d. Preferential procurement conditions for public service contracts;

e. Input supplier credit impediments i.e. difficulties in opening credit lines with material suppliers due to lack of financial track record; and

f. Work permit impediments.

Policy interventions:

1. The regulatory framework on engineering services in Partner States should be harmonized to cover engineers, technologists and technicians.
2. Diagnostic studies in the engineering sector should be conducted to give status as well as identify gaps to ensure planned strategic interventions
3. The introduction of Annual Sector Statistical Reports within Partner States to collect data on the sector to facilitate informed decision making and measure uptake
4. Development of capacity building and skills development programs for engineers, technologists and technicians.
5. Harmonization of the framework for certification and recognition of qualifications held by professional engineers.

The Engineers Board of Kenya has established a Trade-in-Services Taskforce comprised of membership from the Board, the Association of Consulting Engineers of Kenya and the Institution of Engineers of Kenya to take lead in the Trade-in-Services process. The Taskforce will take part in the negotiation meetings under the AfCFTA and EAC and will make recommendation to the Board on stakeholder engagement and capacity building for the sector on Trade-in-Services.

East African Community Mutual Recognition Agreement
Eng. Alexis Dushimire

The Mutual Recognition Agreement for engineers was signed on 7th December 2012 after the competent authorities of Uganda, Kenya and Tanzania carried out a conformity assessment in the engineering profession and were satisfied that the adequate levels of equivalence had been met. Rwanda joined the Mutual Recognition Agreement on 1st March 2016.

The main purpose of the agreement was to set the conditions under which engineers in a partner state may have their qualifications recognised and be eligible to practise in another partner state that is a party to the MRA.

The objectives of the MRA are;

i. To facilitate mobility of engineers and professional engineering services to enable the realization of commitments made by Partner States for liberalizations of trade in professional engineering services across the East African Community (EAC) in accordance with the Protocol;

ii. To encourage, facilitate and establish mutual recognition of engineers' qualifications and set up standards of education and practice and commitment to professional development in the engineering profession in the EAC Partner States.

iii. To facilitate the exchange of information in order to promote adoption of best practices on standards of engineering education, professional qualifications and professional practice and ethics.

The agreement provided for a Coordinating Committee comprising of the Registrars of the regulatory agencies in each country. The role of the coordinating Committee is mainly to spearhead and monitor the implementation of the MRA.

Under the MRA, the competent authorities undertook to:

i. Advocate for the elimination of restrictions in their laws, regulations, practices and procedures to facilitate the implementation of the provisions of the Protocol and of this Agreement;

ii. Assess individual applications for recognition from applicants from another Partner State;

iii. Seek verification from the Competent Authority of the applicant's Country of Origin that the applicant is in good standing with the Competent Authority;

iv. Provide such verification on a timely basis;

v. Register an applicant within 30 working days upon receipt of a complete, valid and acceptable application for registration meeting the criteria laid down in the national laws of the Partner State and in this Agreement;

vi. Notify an applicant in writing within 30 working days from the date of receipt of the application, the acceptance or rejection of the application giving reasons in case of rejection;

vii. Issue an applicant with a registration certificate in the event of acceptance.

viii. Exchange information on a timely basis on continuous professional development programs.

ix. The implementation of the MRA has faced several challenges which have hindered its optimum performance. The challenges include:

x. Low awareness of the MRA by engineers in the Partner States.

xi. Restrictive labour and immigration laws in Partner States hence making the mobility of engineers difficult.

xii. Different levels of development/readiness in the Partner States hence making fair competition a challenge.

xiii. Lack of constant dialogue between MRA Partner States making it difficult to constantly identify gaps in the implementation process and propose timely interventions.

The MRA Co-ordination Committee intends to implement the following strategies to enhance the uptake of the MRA:

i. Ensure quality and relevance of engineering education in the region by working with higher learning institutions in the accreditation of engineering programs and their curriculum so that they can be competitive on the market.

ii. Widen the scope of application of MRA to include harmonization in some areas where possible such as basic training requirements, academic curriculum and registration of engineering firms.

iii. Harmonization of immigration rules in issuing work permits for professional engineers.

A representation of Registrars from the East African Community.

iv. Promotion of intra-EAC joint ventures and mergers for Engineering Consulting Firms in professional engineering services so as to have stronger firms in EAC capable of competing with international firms.

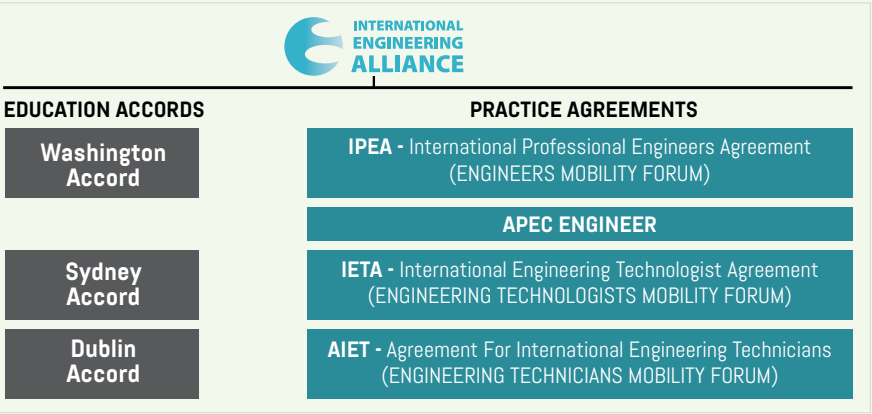
v. Domestication of MRA provisions into the existing and new laws across the EAC Partner States.

vi. Harmonization of the registration of foreign engineers coming from the countries outside the EAC for efficient and effective regulation.

vii. Establishment of common standards for Continuous Professional Development (CPD) courses within EAC region.

viii. Support other EAC Partner States i.e. South Sudan, Burundi and DRC to join the MRA.

Outcome-Based Engineering Education: Pathway To Washington Accord Signatory
A Presentation By Assoc. Prof. Ir. Abdul Aziz Omar



Washington Accord

The Washington Accord was signed in 1989. It recognizes substantial equivalency of an accreditation system within a country – that assesses/assures that the graduates of accredited programmes in their country are prepared to practice engineering at the entry level of the profession.

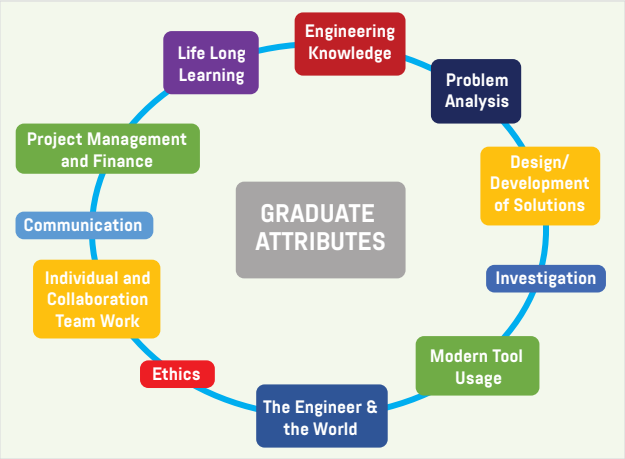
There were 21 signatories including USA, UK, Australia, Canada, New Zealand, Singapore, Malaysia, China, Hong Kong China, Chinese Taipei, Japan, South Korea, Russia, South Africa, Peru, Costa Rica, Turkiye, Ireland, Sri Lanka, India and Pakistan. The seven provisional Signatories include Chile, Thailand, Bangladesh, Mexico, Philippines, Myanmar and Indonesia

Outcome Based Education

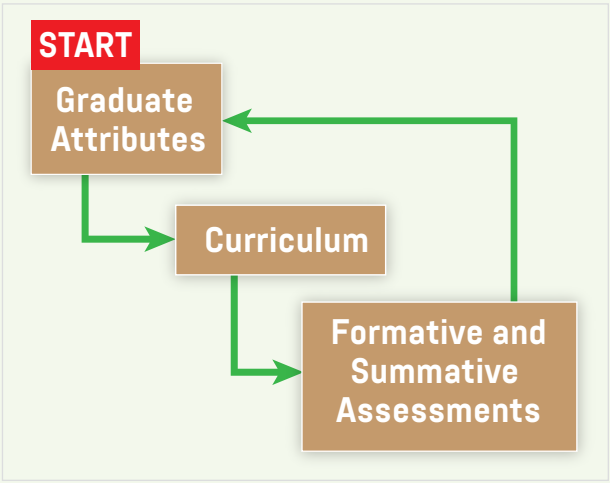
According to Spady (1994), outcome-based education means starting with a clear picture of what is important for students to be able to do, then organizing the curriculum, instruction and assessment to make sure that this learning ultimately happens

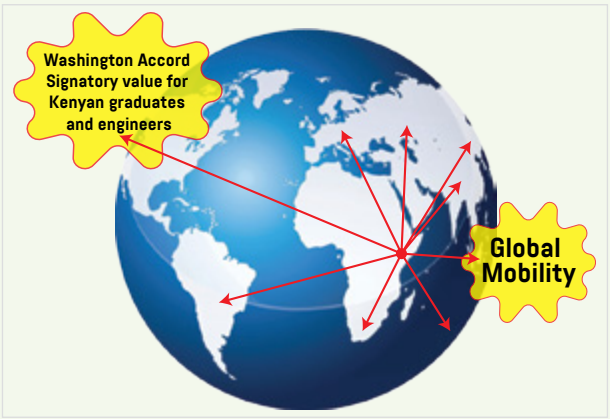
Washington Accord Graduate Attributes

The Graduate attributes form a set of individually assessable outcomes that are the components indicative of the graduate›s potential to acquire competence to practice. They are clear, succinct statements of the expected capability. They are intended to assist signatories and provisional members to develop or review their outcomes-based accreditation criteria. These attributes guide bodies in developing or revising their accreditation systems with a view to seeking signatory status.



No	Attribute	Remarks
WA1	Engineering Knowledge	Breadth & depth of knowledge, both theoretical and practical
WA2	Problem Analysis	Complexity of analysis
WA3	Design/ Development of Solutions	Breadth & uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified and codified
WA4	Investigation	Breadth & depth of investigation and experimentation
WA5	Modern Tool Usage	Level of understanding of the appropriateness of technologies and tools
WA6	The Engineer and the World	Level of knowledge and responsibility for sustainable development
WA7	Ethics	Understanding and level of practice
WA8	Individual and Collaborative Team Work	Role in and diversity of team
WA9	Communication	Level of communication according to type of activities performed
WA10	Project Management and Finance	Level of management required for differing types of activity
WA11	Life-long Learning	Duration and manner





Conclusion

The Washington Accord is of great is of great value to Kenyan Engineers and Graduates as it will afford them greater mobility. They will be able to practice freely in the signatory countries.

Kenya's Cop 26 Commitments And Climate Action Plans By Dr Jasper Omwenga (NEMA) and Dorcas Koome (National Treasury)

Climate change impacts are expected to intensify with additional warming. interacting with environmental challenges such as a growing world population, unsustainable consumption, a rapidly increasing number of people living in cities, significant inequality, continuing poverty, land degradation, biodiversity loss due to land-use change, ocean pollution, overfishing and habitat destruction.

The Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change is an annual event that brings together governments from around the world to discuss and review how climate is managed. The 26th meeting, called "COP26" was held in Glasgow Scotland in 2021. About 120 countries came together in the UK to commit to take action on climate change and forge the Glasgow Climate Pact.

The Key themes of COP26 are: the expansion of greenhouse gas (GHG) emission reduction targets, financing the energy transition of the poorest countries, the reduction of methane emissions and the organization of the carbon market.

To actively fight against global warming, COP26 is structured around four main objectives: Reach carbon neutrality by 2050 and keep global warming below 1.5+ °C; adapt to protect communities and natural habitats, particularly those most threatened by climate change; mobilize climate finance (at least US 100$ billion a year) to achieve the first two goals and working together to achieve carbon neutrality: the challenges of the climate crisis can only be overcome if everyone plays their part.

As part of the Paris Agreement, the Intergovernmental Panel on Climate Change (IPCC) was asked to examine the consequences of a 1.5 °C increase in temperature for the planet. It concluded that such an increase would cause extreme weather conditions (forest fires, floods, etc.), but that these phenomena would be much less than those associated with an increase of 2 °C.

National Climate Change Policy

At a National Policy level, the Government enacted the first climate change- dedicated policy in Africa – Climate Change Act, -2016 to provide an enhanced response to climate change and to provide mechanisms and measures to achieve low carbon climate-resilient development. The Act is the first climate change-dedicated legislation in Africa.

In the 2022-2018 action plan, priority areas include:

a. **Water** - Ensuring access to and efficient use of water

b. **Housing and Sanitation** - Increasing the resilience of human settlements, including improved solid waste management in urban areas

c. **Transport & Infrastructure** - Establishment of efficient, sustainable world-class transport systems and logistic services that can withstand the expected impacts of climate change

d. **Renewable Energy** - Ensuring electricity supply mix based mainly on renewable energy that is resilient to climate change and promotes energy efficiency; encourage the transition to clean cooking that reduces the demand for biomass

Climate Change Policy in PPPs

The Government of Kenya has embarked on the prioritization of the development of climate-resilient projects (climate screening) in priority sectors such as Water and Sanitation, Energy

Through the Public-Private Partnerships (PPP) Act, 2021 the Government has introduced climate resilience as one of the key criteria in the identification and selection of PPP projects. Also, the Government with the support of the World Bank has commissioned a Technical Advisory to assist in developing climate-resilient PPP infrastructure investment criteria, recommending regulatory amendments that facilitate the development of Low Carbon Resilient (LCR) infrastructure PPPs and provision of training to build capacities in order to mainstream climate considerations in infrastructure PPP regulations and finance.

Kenya's Commitments

Kenya's commitments include both mitigation and adaptation components based on her national circumstances

i. Mitigation Commitments

These are geared towards reducing emissions. by increasing renewables in the electricity generation mix of the national grid, enhancement of energy and resource efficiency across the different sectors, Increasing tree cover to at least %10 of land area in Kenya and achieving land degradation neutrality, scaling up Nature-Based Solutions(NBS) for mitigation. Others include the enhancement of clean, efficient and sustainable energy technologies to reduce over-reliance on fossil fuels and non-sustainable biomass fuels and low carbon and efficient transport systems.

ii. Adaptation commitments

These are aimed at helping those already impacted by climate change; These commitments include enhancing generation, packaging and widespread uptake of the use of climatic information in decision making and planning across the sector and at the county level, enhancing uptake of adaptation technology –and incorporating scientific and indigenous knowledge and enhancing climate-risk vulnerability assessments in projects and programmes

Adaptation Commitments in the Infrastructure sector

Some commitments in the Energy sector include developing and adopting guidelines on how to climate-proof energy infrastructure using vulnerability risk assessments, enhancing climate-proofing energy infrastructure along the renewable energy supply chain and an increasing number of companies participating in energy-efficient water-use initiatives by %40 from the baseline

In the **Road sector** commitments include upscaling the construction to systematically harvest water and reduce flooding, enhancing institutional capacities on climate-proofing vulnerable road infrastructure through vulnerability assessments and promoting the use of appropriate designs and building materials to enhance the resilience of at least 4500km of roads that are vulnerable to climate risk

COP 26 OUTCOMES

Kenya is a party to both the UNFCCC and PA agreements. It is bound by any CoP decision/outcome including Cop26. CoP 26 outcomes included;

1. **Mitigation** - countries agreed to come back with a new UN climate programme on mitigation ambition, and move away from coal power, halt and reverse deforestation, reduce methane emissions and speed up the switch to electric vehicles.
2. **Adaptation** - Sharm el-Sheikh Work Programme on the Global Goal on Adaptation was agreed upon, which will drive adaptation action. adaptation finance has been pledged, including committing to doubling 2019 levels of adaptation finance by 2025.
3. **Collaboration:** work together to deliver dialogues on energy, electric vehicles, shipping and commodities finalized the Paris Rulebook agreeing the 'enhanced transparency framework' (common reporting of emissions and support), a new mechanism and standards for international carbon markets, and common timeframes for emissions reductions targets.

The Way Forward

In order to develop a Resilient Infrastructure (RI), there is a need to:

a. Formulate policies on RI - Mainstreaming of Climate-related risk assessment tools to collect and analyze climate risk data

b. Capacity Building of Stakeholders both Private and Public on to foster better understanding in assessment and management of the risks & RI

c. Formulation of an Inter-Ministerial Framework.

d. Risk Mitigation Products – Support from Multilaterals

e. Form a RI Fund, RI Hub for innovative and cost-effective solutions

f. Prepare and participate in the next COP 27.

g. Take individual responsibility on matters of climate change

CONCLUSION

Engineers are the major actors of development and custodians of the built environment. Hence, they should promote the use of renewable energy, transport management and innovation and exploring technology.

Closing Remarks at the Engineering Partnership Convention 2022 by Engineers Board of Kenya Registrar/CEO, Eng. Margaret Ogai, CE,

The Engineering Partnerships Convention (EPC) 2022 provided a platform for policymakers, industry experts, academicians, researchers, trade-in services experts and engineers to discuss the emerging issues from local and international perspectives. The discussions with various stakeholders provided insights and inputs that will be used to develop policy briefs, country positions and strengthen compliance to the Engineers Act 2011 and Engineers Rules 2019 and establish valuable partnerships locally and internationally.

This year's theme for the Convention was "Building Back Better – Emerging Issues in Engineering." The theme was premised on four pillars: outcomes-based engineering education in Kenya, opportunities for growth in the liberalization of professional engineering services, Kenya's commitments at COP26 and aligning the engineering practice to mitigating climate change and Safeguarding Public Safety and Welfare in Engineering Services.

The keynote address was delivered by Prof. Arch. Paul M. Maringa (PhD), CBS, F.A.A.K., MKIP, Principal Secretary, State Department of Infrastructure. He highlighted the role the engineers contributed to society and their critical role in economic development. The opening sessions were then followed by the presentations and panel discussion on championing the shift to outcomes-based engineering education in Kenya before afternoon breakaways on industry and academia collaboration to empower engineering education, engineering standards in Kenya, and promoting local manufacturing for socio-economic development.

The second day focused on liberalized professional engineering services at regional, continental, and global level and aligning practice to meet Kenya's COP 26 commitments and climate action plans. The afternoon breakaways covered climate resilient infrastructure, transforming professional engineering services to be globally competitive, and infrastructure scorecard. The third and the final day covered safeguarding public safety and welfare in engineering services and panel discussion on engineering regulatory framework before the closing ceremony remarks by Principal Secretary, State Department for Public WORKS, Mr. Solomon Kitungu, CBS.

The successful completion of the Convention ensured the expected outcomes were met. These are stakeholders' commitment to outcome-based engineering education, outcome-

based curriculum development for engineering education, agreement framework on Trade in Services for Professional Engineering Services, use of standards to accelerate sustainable development, a roadmap of engineers' input towards implementation of the COP26 commitments, engineers' input in the implementation of the program, improved compliance to Engineers Act 2011 and Engineers Rules 2019, strategies for strengthening the engineering human resource capacity for the infrastructure sector, the importance of investing in research and development for sustainable solutions, improved compliance to the Engineers Act 2011, established mitigation measures against collapsing of buildings, and policy recommendations.

The notable resolutions that came out from this Convention include: Scale of fees to be effected immediately they are printed out; Call for all engineering to be regulated by Engineers Board of Kenya; Engineers Board of Kenya to accede to Washington Accord under the International Engineering Alliance by 2023 and universities to review curriculum to Outcome-Based Education (OBE); Workshop to be organized by Trade Department for engineers to be sensitized on trade in services and going forward engineering professionals to be involved in trade talks; East African Community (EAC) Mutual Recognition Agreement (MRA) to be reviewed and expanded in areas of cooperation including harmonizing standards for registration, regional capacity building and to include Burundi, South Sudan and Democratic Republic of Congo (DRC); Engineering practice notes and design standards to be reviewed to align to COP26. Also, engineers to be represented during COP27; Engineers Board of Kenya (EBK) to submit structural assessment report to cabinet through Ministry to strengthen/ harmonize regulatory framework; Counties to enhance technical capacity by engaging Professional Engineers in all stages of building control. Also, to establish panel of engineers

for review of engineering plans; and Hold Engineering Partnership Convention (EPC) annually. The Board is therefore committed to ensure all these resolutions are fully implemented and Engineers Board Kenya will take the leading role in lobing the stakeholders through partnership and collaboration.

Finally, in a special way I wish to thank all the sponsors that partnered with us to ensure the successful organization and completion of the Convention. The EPC 2022 platinum sponsors were Kenya Rural Roads Authority (KERRA), Kenya Electricity Transmission Company Limited (KETRACO), Kenya Power and Lighting Company (KPLC), and Kenya Bureau Of Standards (KEBS), Athi Water, ATHI Water Works Development Agency, and Konza Technopolis

Development Authority. I also thank all the participants, foreign delegates representatives from Malaysia, South Africa, Tanzania, Rwanda, Uganda, Democratic Republic of Congo, South Sudan, Burundi, and Zimbabwe, NCA Executive Director, Eng. Maurice Akech, BORAQS Chairman Arch. Muli, KeNHA Chairman, Eng. Wangai Ndirangu, the EBK Board Members, the Steering, Technical and Management Planning Committees, EBK Staff and Management, the Government of Kenya through the Ministry and Cabinet Secretary Transport, Infrastructure, Housing, Urban Development and Public Works, James Macharia, PS Infrastructure, Arch. Prof. Paul Maringa and PS Public Works Mr. Solomon Kitungu, CBS.

PICTORIAL

Infrastructure PS Prof. Arch. Paul M. Maringa (PhD), CBS, F.A.A.K, MKIP signs the visitors book at the EBK stand, accompanied by EBK Chairman Eng. Erastus K. Mwongera CE, FIEK, CBS and EBK Registrar Eng. Margaret Ogai, CE.

Infrastructure PS Arch. Paul Maringa (centre), EBK Chairman Eng. Erastus K. Mwongera CE, FIEK, CBS (second right) IEK President Eng. Eric Ohaga, CE (first right), EBK registrar Eng. Margaret Ogai (second left), and IEK Immediate Past President Eng. Nathaniel Matalanga, CE at the EPC 2022.

EBK staff members at the EPC 2022.

Infrastructure PS Prof. Arch. Paul M. Maringa (PhD), CBS, F.A.A.K, MKIP and EBK Chairman Eng. Erastus Mwongera join other delegates for a photo session on day one of EPC 2022.

Eng. Margaret Ogai, CE (EBK C.E.O/Registrar), Eng. Grace Onyango, PE (EBK Director Capacity Building & Accreditation) and Registrars from the East African Community.

PS, State Department of Public Works Mr. Solomon Kitungu,

Delegates pose for a photo with the EBK Chairman Eng. Erastus K. Mwongera CE, FIEK, CBS, and EBK C.E.O/Registrar Eng. Margaret Ogai, CE.

A light moment at the EPC 2022. From Left (Eng. Nathaniel Matalanga, CE, Eng. Margaret Ogai, CE (EBK C.E.O/Registrar), Eng. Eng. Alexis Dushimire)

Infrastructure PS Arch Paul Maringa addressing the media flanked by EBK Chairman Eng. Erastus K. Mwongera CE, FIEK, CBS and Registrar Eng. Margaret Ogai, CE.

Eng. Grace Onyanog, PE (EBK Director Capacity Building & Accreditation) shares a light moment at the EPC 2022.

Delegates follow the presentation online at the EPC 2022.

Break Away Session Panel discussion during the EPC 2022.

EBK Board Members pose for a photo with the PS, State Department of Public Works Mr. Solomon Kitungu on the last day of EPC 2022.

EBK members of staff pose for a photo with the PS, State Department of Public Works Mr. Solomon Kitungu on the last day of the EPC 2022

Students' Voices

AGING IN A DIGITAL WORLD; FROM VULNERABLE TO VALUABLE

World Telecommunication and Information Society Day (WTISD) has been celebrated annually every 17th May since 1969 to mark the founding of ITU and the signing of the first International Telegraph Convention in 1865. A celebration of this day is a reflection of the contribution by the technological space to the society. During the pandemic, the world has experienced the possibilities that digital technologies can provide and the transformation the digital space can bring to our future.

This year 17th May 2022, The Institution of Engineers of Kenya through North Eastern branch saw the need to host this celebration. It was a celebration marked with a reflection in congruence to the global theme on *'Digital Technologies for older persons and healthy ageing'*. This discussion is centered by the demographic paradigm shift in the 21st century population. People worldwide are living longer and the population is ageing. Today most people can expect to live into their sixties and beyond. According to World Health Organization, by 2030, 1 in 6 people in the world will be aged 60 years or over. Moreover, the size of older persons in the population i.e those aged above 60 years have significantly exceeded those aged under 5 years.

Cognizant of the above, there is a need to retool and reconfigure our digital space to accommodate our older persons and promote healthy ageing or rather ageing gracefully. This means changing the narrative from vulnerable to valuable. We must therefore make them active participants and valuable contributors to the digital world through breaking cycles of exclusion and bridging all gaps in quest to promote digital accessibility for all.

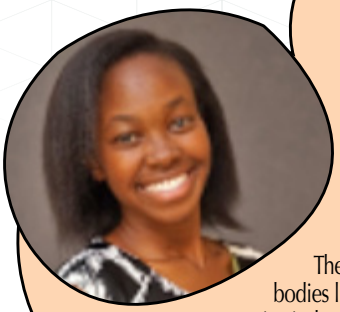
G.E Samuel Muraguri Maina is a member, IEK North Eastern Branch

OUTCOME-BASED EDUCATION

There has been growing concern about the lack of market preparedness among graduates in the engineering field. A large number of engineers are compelled to start their career as interns, a stage that is marked with meager pay and lasts a considerably long period, even beyond a year for some. Employers and other industry players argue that this is necessary because engineers graduate with insufficient skills to solve engineering problems in the market. Why is this the case? An Engineering course in Kenya takes about five years with up to three industry-based trainings, normally referred to as attachments. How then do we have graduate engineers who are acutely unprepared for field practice? This necessitates a review of the training process of engineers. In June 2021, IEK invited engineers to join a training by NPU-FEIAP Belt & Road Engineering Education Training Centre (NFTC) on Outcome Based Education by Dr. HT Chuah.

An interesting concept in OBE is Programme Education Objective (PEO). PEO is the expected achievement of graduates in career and professional in a few years (3-5 years) after graduation. This means the university should set the objectives as relates to graduates of their courses post-training. Evaluation of the performance of their graduates in the market some years post-graduation, and in collaboration with industry players, should provide the basis for improving training for the graduates. Of course, there must be well-defined performance indicators for this to succeed. A point of emphasis in OBE is the molding of an all-rounded graduate. Bloom's Taxonomy, a framework for teaching, learning, and assessment is considered fundamental in OBE. In this framework, a student is expected to learn, be assessed and quality improvement done in the Cognitive, Affective, and Psychomotor domains. Many countries have embraced OBE such as India and Malaysia and are implementing it. South Africa implemented it from 2005-2010 and deemed it unsuitable. However, the concepts of OBE and its ideology of nurturing an all-rounded graduate who is abreast with the current workings and technologies in the industry are to be admired. OBE can give us insights on how to incorporate the visions of industry players and other stakeholders in the process of training all-rounded engineers who are more prepared for field practice.

GE Mabatsi Jane works for LAPSSET Corridor Development Authority.



ARE CARBON MARKETS THE SOLUTION TO CLIMATE CHANGE IN KENYA?

Carbon Markets are a market-based approaches designed to deal with the challenge of climate change. They are created for the trading of carbon emissions allowances, to encourage or help countries and companies limit their Greenhouse gas emissions. Carbon markets aim to reduce Greenhouse gas (GHGs or carbon) emissions cost-effectively by setting limits on emissions and enabling the trading of emission units which are instruments representing emissions reductions.

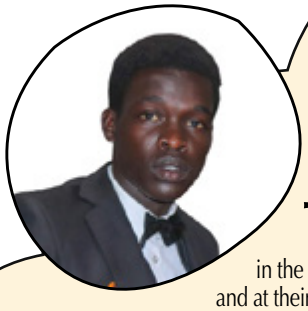
The First type is Cap and Trade Scheme Under Cap-and-Trade scheme, governments or inter-governmental bodies like EU set a cap on emissions. The government then allows trading by issuing carbon permits/ allowances to major industries who are then allowed to trade these permits with other industry players who can reduce their emissions more cost- effectively.

The second type is Offsetting Schemes. For this second type; instead of cutting emissions at source; companies and sometimes international financial institutions, governments and individuals finance emissions- saving projects outside the capped area.Examples of carbon projects: Forestry sequestration projects, methane capture from livestock, energy efficiency and renewable energy projects. The carbon offset is calculated according to how much less Greenhouse gas enters the atmosphere that would have been the case in the absence of the project.

Advantages of Carbon Markets include helping businesses to identify low cost and less carbon-intensive methods of reducing emissions on site such as investing in energy efficiency hence preserving the environment.

Carbon markets are key to aid in the sustainable development agenda of Kenya, achievement of the Kenya Vision 2030, reduce the emissions reduction potential to 30% and curb the adverse effects of climate change. Through Carbon markets, SDG. Number 13- (Climate Action) would be achieved in an effective and sustainable way.

Ivy Mwango Getanda is 5th Year Civil Engineering Student at JKUAT and an Attaché at the State Department for Housing and Urban Development, Kenya.



BIRTH OF MUKESA A WELCOME DEVELOPMENT AT MMU

The Faculty of Engineering and Technology at the Multimedia University of Kenya is roaring to life with a beehive of student activities, professional and industry engagements. The new baby in the block is slowly learning from the slightly more experienced UoN and KU Engineering Institutions, and at their current pace, are surely going to outshine the giants.

Just recently, the faculty, through their Engineering Students Association(MUKESA) did a mass IEK student membership mobilization which was fruitful by all standards. The outcome of this initiative was that 20 students successfully completed applications and were all accepted as Student members of the IEK during the 489th convening of the Council of IEK.

The Chairperson of Engineering Students Association, Faith Bocherei, and her IEEE counterpart, Dennis Kemboi attribute such positive tracks to the support of the Faculty Administration through the Dean, Prof.(Eng) Abel Mayaka who has been working tirelessly to direct the dedicated team of students towards the path of opportunities. It is because of this combined effort between Students and Staff that the Engineering Students Association(MUKESA) is collaborating with the Capital and South Rift Branches of IEK in their member activities. This is in an attempt to expose the students to an environment of Engineers as early as possible. After all they say, experience is the best teacher

MUKESA has planned another student membership drive during April-August Semester, targetting 100 students. Additionally, the student organisation has successfully petitioned for and formed

Denis Kemboi is Chairman, IEEE Multimedia University Chapter

Engineering Candidates Running for Office in 2022

Governor aspirant, Kwale County

Lung'anzi Chai Mangale MSC, MISC

LUNG'ANZI Chai Mangale holds a Bsc Degree in Electrical and Electronics Engineering from The University of Dundee. He holds a MSC in Port and Shipping Management from World Maritime University Sweden from 2008 to 2009.He previously worked as a high school teacher and as a Principal Electrical Engineer at Kenya Ports Authority from September 1995 to April 2022. While at the Port he designed and implemented major projects among them the 132KV power supply to Port of Mombasa. He has also worked as Kwale CDF Chairman, where he proposed and commissioned many developments in schools, dispensaries and roads. Engineer Lunga'nzi main agenda is to improve and raise the social and infrastructural developments for Kwale County residents once elected into office. His manifesto revolves around unity of purpose for the people of Kwale irespective of different religion, race and tribe, improvement on quality of education, employment creation through improvement of agricultural production and livestock, tourism, investment on blue economy and industrial development, provision of clean drinking water and water for agriculture, improvement on health services provision, responsible mining activities for the benefit of the country and the local community, improvement of the road network and put in place right systems to enable local business communities access loans and business opportunities with county government and other corporate bodies within the county.

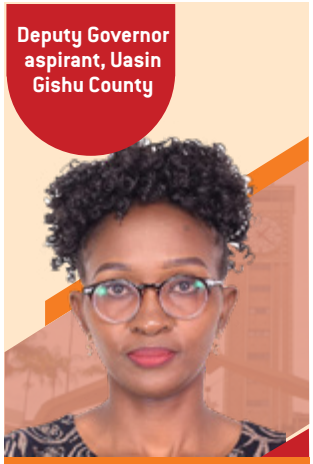
Governor aspirant, Siaya County

Nicholas Gumbo

NICOLAS Gumbo WAJONYA was the Member of Parliament (MP) for Rarieda Constituency from 2007 to 2017, where he broke the one term jinx and remains the only Rarieda member of parliament to do so. He served as Chairman Public Accounts Committee, Member House Broadcasting committee, Member Constituencies Fund committee and Member of Energy committee. He also served as Kenyatta National Hospital board chairman.

Eng. Gumbo attended Atemo Primary from 1972 to 1973, Lwak Mixed Primary School from 1974 to 1975, Orengo Primary School from 1975 to 1976 and Opapo Primary School in Kamagambo from 1977 to 1978. After earning the highest marks in CPE in the then Bondo District, he pursued his secondary education in Cardinal Otunga High School, Kisii from 1979 to 1984.

He holds a Bachelor of Science Degree (BSc) in Electrical and Electronics Engineering from The University of Nairobi class of 1986 and a Master's in Business Administration (MBA) in Management Information Systems (MIS) from The University of Nairobi. He is also an active member of various professional societies in his field. Eng. Gumbo is a Fellow, Institution of Engineers of Kenya and Engineers Board of Kenya-Registered Consulting Engineer. He is a Professional Engineer (PE) registered with Engineers Board of Kenya and a Member, Institution of Engineers of Kenya. He is a Member of the Association of Consulting Engineers of Kenya, a Corporate Member of the Architectural Association of Kenya and member of the Institution of Engineering and Technology.



Deputy Governor aspirant, Uasin Gishu County

Lucy Ng'endo Njoroge

LUCY Ng'endo Njoroge is a licensed solar photovoltaic technician who prides in providing borehole services, renewable energy services, irrigation systems and water purification solutions. Lucy has worked with Davis & Shirtliff Ltd as a sales engineer. Politically, Lucy is vying for Deputy Governor position, Uasin Gishu County on UDM Party ticket that is affliated to Azimio la Umoja One Kenya Alliance. She believes that their leadership with her fellow aspirant governor, William Kemboi Arap Kirwa will take Uasin Gishu County to the next level. She looks forward to ensuring that Eldoret becomes the fifth city in Kenya. She later joined Epicenter Africa Ltd as a senior sales engineer. Currently she is the technical director at Glacier Green Africa Ltd. Background. She holds a Bsc. (2nd Class Hons. Upper Division.) in Soil Water & Environmental Engineering (JKUAT, 2010).

Senatorial aspirant, Kirinyaga County

Anthony Murigu

ANTHONY Murigu Jane was born and raised at Gatugura, Kabare Ward, Gichugu Constituency, Kirinyaga County. He schooled at Gatugura Primary school and Kamuiru Boys and later, Dedan Kimathi University (BSc.Civil Engineering, 2016) He is an ongoing Msc student (Civil Engineering, University of Nairobi), working on an automated project that will help mitigate collapsing buildings.

His work experience includes engineering an automated traffic control system. He has also been a lecturer at KIHBT. He runs Earch Designers Company, which offers design and build services.

He is the founder of Ukulima platform, composed of Ukulima TV, Ukulima magazine, Ukulima Digital, and Farmers Award which have been instrumental in the agriculture space across the country.

He has previously run the ever Kirinyaga County Farmers Award, which he hopes to conduct annually. "Am fighting for a Senatorial seat in Kirinyaga County. I will lobby for more projects within my County as well as offer oversight duties.

I will be the voice of youths and Engineers in parliament. I will be the lion that will not cease to speak for the sake of the Engineering profession which is the mother of economic growth," he says of his bid.

Mathew Mukuha Mwangi
REG. NO EBK: B17790

I was born in a small village called Gathanji, I am the only Engineer in a population of 12000.I went to Murata Wa Twana Primary later to Chania Boys high School and did my undergraduates in The Technical University Of Mombasa where I pursued Bsc. Civil Engineering and graduated with First class honors. I have continually devoted myself to leadership, having served as a student leader in campus and served the community all through in different areas including the famous karimenu 2 dam project affected persons.

From representation, oversight to advocacy, the engineering fraternity will have an upper hand in shaping its long term goals while the residents of this great nation will benefit equally. One of the easiest way to curb corruption, embezzlement, misappropriation of funds is to have Engineers taking up the mantle, we have been trained of Structural integrity which I liken to the integrity that 'sustains'.

We have very vital committees in the government which would run effectively if run by our engineers, most of which are approved in the parliament: politics influences alot. Having many of us in the Assembly, both national and County would influence this. I long for the day, the country will be run by a president who has practiced Engineering and a member of IEK. Who upholds and appreciates the engineering world so that the growth of the country and the economic impacts would be protected.

My main focus is to serve the Engineering fraternity and my honorable constituents not as individual but through active participation and integration of both.

Finally, how would we promote the growth of our fraternity without supporting our own as we support the rest?

Denis Mukoya Makokha

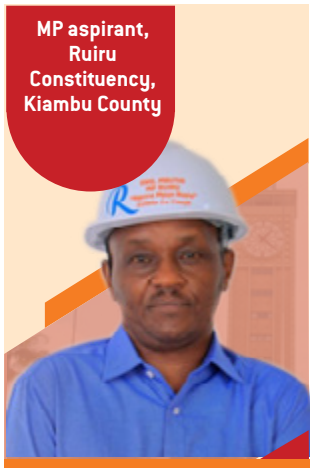
DENIS Mukoya Makokha has been cleared by the IEBC to contest the Lurambi Parliamentary seat. He is a Graduate Member of the Institute of Engineers of Kenya (IEK). He is also a Graduate Engineer with the Engineers Board of Kenya (EBK). He holds a Bachelor of Technology Degree in Electrical and Communications Engineering from Masinde Muliro University of Science & Technology (MMUST) obtained in 2013.

He is currently the Director of Operations and Advertising at Titek Solutions Limited, a Kenyan Telecommunications and ICT contracting firm, he co-owns with friends.

He is also a writer at the Dennis Mukoya 'No Chills' Blog and has a Youtube Channel, Dennis Mukoya TV.

He has previously worked at Brolaz Angola Telecomunicações, LDA in Luanda, Angola serving as a Chefê de Zona (Regional Manager) for Luanda & Bengo regions. Before that, he worked at Multichoice Kenya Limited as a Customer Service Representative. He was a Telecommunication Systems Technician at Masaba Services Limited, a Telecom Engineering Contractor firm. He has nearly 10 years' experience in Telecommunications, Broadcasting and Data Communications Infrastructure and some management experience. He has been a team leader for the Nokia NSN Project that upgraded the GSM and WCDMA to LTE in Nairobi, upbraiding the antiquated jumper cables and replacing them with Fiber Optic strands.

He is a holder of the IMWE Class a Telecommunication Technical Personnel License from the Communications Authority of Kenya. He is fluent in several languages including English, Kiswahili, French with basic competence in Portuguese.



George Alan Mbuthi

MBUTHI BSc. (Mech Eng. Hons Upper Division, University of Nairobi) is registered with the Engineers Board of Kenya, and a Cooperate Member of the Institution of Engineers of Kenya. He has over 30 years of experience in the Oil Industry, Construction industry, and the Aviation sector.

He has handled major projects worth hundreds of millions in his capacity as an engineer, manager and consultant in private multinationals and government corporations which include: Bamburi Cement, Caltex Oil Company, Total Kenya Ltd, Kenya Pipeline Company Limited, National Oil Corporation of Kenya, and most recently, Kenya Airports Authority; where he worked as the only registered Mechanical Engineer for more than 14 years. He has worked on assignments in East Africa and has international experience in UK, USA, Netherlands, China, Romania, France, South Africa and Eswatini.

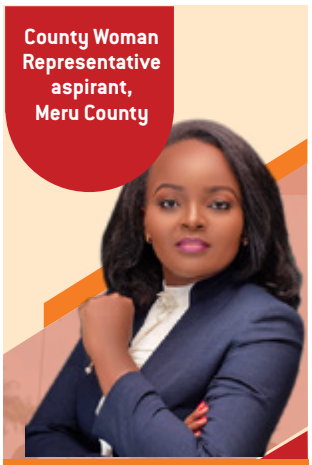
Eng. Mbuthi says he has lived and invested in Ruiru for many years and the time has come for him to serve the people of Ruiru through a leadership that will set the standard. "My 3-point plan for Ruiru is to focus on: Infrastructure &Industries; Social Justice and responsibility for all genders; and to make Ruiru a model Constituency especially in Women and Youth Empowerment. He is vying on an ODM ticket under the Azimio Coalition and hopes to win the hearts and minds of the people and serve with diligence.

Butichi Ramadhani Khamisi

BUTICHI Khamisi holds a B.Sc. in Civil Engineering, Jomo Kenyatta University of Agriculture and Technology (2008) and is currently pursuing M.Sc. in Construction Engineering and Management at Jomo Kenyatta University of Agriculture and Technology. He is an alumni of Matundu Primary School Kakamega Government School and a Professional Engineer with EBK, registered as a Consulting Engineer and a Corporate Member of IEK.

His work portfolio includes conducting feasibility studies, engineering designs and construction/maintenance supervision of pavements, buildings and storm water drainages and contract administration civil engineering projects. He works for Butichi and Associates Engineering Consultants Ltd since Aug 2017 as Managing Director. He previously worked at Kenya Airports Authority (KAA) as Resident Engineer, Kenya Urban Roads Authority as Assistant Engineer/Assistant Resident Engineer and at CAS Consultants Ltd as Assistant Civil/Structural Engineer as well as at CAPE CONSULT Ltd in similar capacity. He was 2nd Runners Up, Member of National Assembly Ikolomani Constituency 2017, is currently Vice Chairperson, JKUAT Alumni, was President-Jomokenyatta University Student Union (JKUSO) 2007-2008 and was Pioneer Vice Chairperson East Africa Community Student Union 2007-2008.

His milestones include the construction, supervision and design review of Isiolo International Airport, Resident Engineer, design and construction supervision of Wajir Town Paved Roads, Resident Engineer, Elwak-Wargadud-Bambo-Rhamu stage construction supervision, detailed design of Mariakani Bridge over road, detailed design of Libyan prestressed voided bridge deck and detailed design of Fourways Estate.



Edith Mwirigi

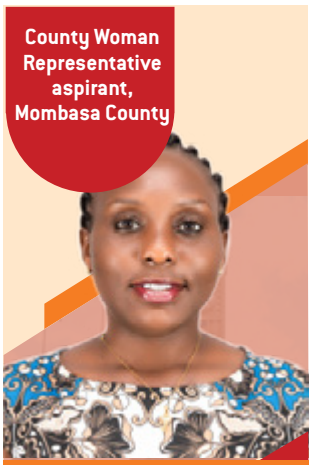
NKATHA Mwirigi is a 32 years old graduate Civil Engineer (University of Nairobi). She holds an MBA (Strategic Management) and is currently pursuing an MSc. Civil Eng. (Environmental Health).

Her leadership experience dates back from student leadership where she served in various capacities in the Students organization of Nairobi University (SONU), where as Hansard Editor for the SONU Parliament, Vice president of the Students Union, and the first woman Secretary General of SONU.

Before national politics, she worked at the National Construction Authority (NCA) for 5 years as Quality Assurance Officer.

"My plans for the County Meru if elected as a County Woman representative to the National Assembly is to be a legislative voice to the many challenges that my people go through," she says. "I hope to push for employment reforms especially for young people and women through tax incentives and many other legal incentives meant to encourage organizations to take up these two groups. I want to be an education champion and fight early marriages especially for school-going girls who are underage," she adds.

"With the understanding that education is the key to success and being a big beneficiary, I will create a network of opportunities for young people who want to pursue their academics to greater levels and pursue scholarship opportunities for them." "I will empower the women of Meru County through training and affordable financing opportunities. I will be a champion of the family institution by constructing rescue centers for victims of gender-based violence. I will mobilise pro bono legal representation services for desperate victims. Orphaned children old people and people with disabilities remain close to my heart too. I will take care of them," she says.



Elizabeth Muthoni Waweru

ELIZABETH Muthoni Waweru holds a BSc. Civil Engineering (Technical University of Mombasa, 2016).

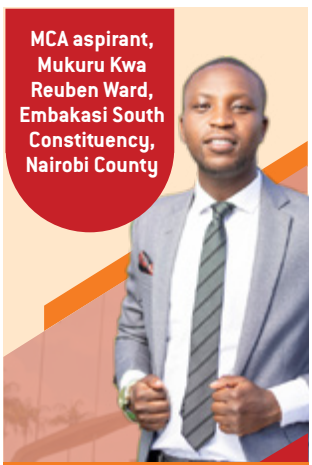
She is a candidate for Mombasa County Women Representative position with Umoja Summit Party (USP) ticket.

The 33 year-old is an Anglican choir member and choir team leader at of ACK Emmanuel, Kengeleni. She attended Kiambu Primary School, Kijabe Girls Secondary and the Technical University of Kenya where she earned a Diploma in Construction Technology. She also holds a Higher Diploma in Building Economics.

Jasper Karunga Ireri, MIEK

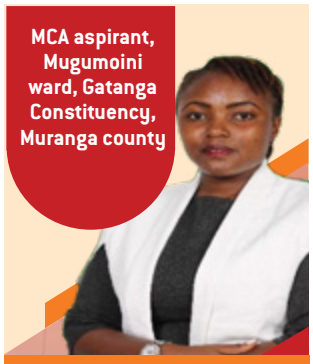
JASPER Karunga Ireri holds BTech degree in Civil and Structural Engineering from Moi University and Master of Arts (Project Planning and Management) from The University of Nairobi.

He has over 15 years of Cement Industry experience having worked as a Projects Engineer at East African Portland Cement Company Ltd. He spearheaded engineering projects geared towards factory expansion in the company's strategic growth. Currently he is the Managing Partner at Infracon International Engineers ltd an Engineering and Project Management Firm in Nairobi, Kenya.



Job Mititi Mochama

JOB Mititi Mochama, Electrical Engineering (JKUAT) is vying for MCA Mukuru Kwa Reuben Ward, Embakasi South Constituency, Nairobi County. His manifesto anchors on improving access to free and clean water, education, accessible and affordable medical facilities and access to electricity.



Catherine Nyawira Mwai

CATHERINE Nyawira Mwai (25- year old) has served at Gulsan and Gauff Ingenieure under Kenya National Highway Authority on Merrile- Marsabit Road A2 as well as at Frinconsult Limited, a structural engineering firm, at Kabuito Contractors under Kenya Rural Roads Authority on Rivertex-Kapkatembo road project (RWC345) as well as Kenya National Highway Authority (KeNHA) on the rehabilitation and improvement of Uplands-Githinguri-Ruiru C560 road. She is currently working as an Assistant Engineer in the supervision team on the LAPSSET corridor in the stage construction of Lamu-Ijara-Garissa (A10). Guided by the fundamental principles of engineers on enhancement of human welfare and being honest and impartial in serving the public with fidelity, Catherine is vying for the elective position of Member of County Assembly (MCA) in Mugumoini ward, Gatanga constituency in Muranga county.

Engineering Candidates Running for Office in 2022

1. Malaba Keya - *MP, Sirisia Constituency*
2. Hilary Nyaanga - *MP, Nyaribari Masaba Constituency*
3. Denis Mwangangi - *MP, Kitui South*
4. Mathew Mukuha Mwangi - *MP, Gatundu North,*
5. Peter K'Ojwang - *MP, Ndhiwa Constituency*
6. David Mutinda Mutuku - *MP, Masinga Constituency*
7. Kennedy Omolo - *MP, Suba South*
8. Karuiki Muchemi - *MP, Mukurweini*
9. Vincent Musau - *MP, Mwala Constituency*
10. Hon Paul Nzengu - *MCA, Mwingi North Constituency*
11. Hon Mark Nyamita - *MP, Uriri Constituency*
12. Hon Kassim Sawa Tandaza - *MP Matuga Constituency*
13. Hon Onkundi Maaga - *Deputy governor, Kisii County*
14. Simon Chirchir - *MP, Konoin Constituency*
15. Godana Hargura - *Senator, Marsabit County*
16. Collins Ochieng - *MP, GEM Constituency*
17. EHon Samuel Wekulo - *MP, Navakholo Constituency*
18. Joseph Bismarck Olango - *MCA, Central Sakwa Ward, Siaya County*
19. Evans Machoka Kimori - *MP, Bomachoge Borabu Constituency.*
20. Serem Anderson - *Governor, Nandi County*
21. Booker Ngesa - *MP, Gem Constituency*
22. Fredrick Otieno - *Senator, Nairobi County*
23. Patrick Wainaina - *Governor, Kiambu County*
24. Antony Murigu - *Senator, Kiringaya County*
25. Ephraim Maina - *Governor, Nyeri County*
26. Ndegwa Nguthiru - *Naivasha Constituency*

2022/2024 IEK COMMITTEE MEMBERS

During the 497th Council meeting, the IEK 2022 – 2024 Council approved the following committee members pursuant to clause 10.08 of the IEK Constitution: -

1. Executive Committee
1. Eng. Erick Ohaga *President*
2. Eng. Grace Kagondu *1st Vice President*
3. Eng. Christine Ogut *2nd Vice President*
4. Eng. Shammah Kiteme *Honorary Secretary*
5. Eng. Justus Otwani *Honorary Treasurer*

2. Resource Mobilization and Partnership Committee
1. Eng. Nathaniel Matalanga *Chairperson*
2. Eng. Abdulrazaq Ali *Vice Chairperson*
3. Eng. Justus Otwani *Member*
4. Eng. Carol Ofafa, *HSC Member*
5. Eng. Fanuel Mwashigadi *Member*
6. Eng. James Mwangi *Member*
7. Eng. Collins Juma *Member*
8. Eng. Emelda Odhiambo *Member*
9. Eng. Patrick Wambulwa *Member*
10. Eng. Elisha Omega *Member*
11. Eng. Ezekiel Fukwo *Member*

3. Membership and Mentorship Committee
1. Eng. Christine Ogut *Chairperson*
2. Eng. Paul Ochola *Vice Chairperson*
3. Eng. Lilian Kilatya *Member*
4. Eng. David Mutonga *Member*
5. Eng. Joakim Mutua *Member*
6. Eng. Dr. Rev. Samuel Charagu *Member*
7. Eng. Rev. Sospeter Mbogo *Member*
8. Eng. Stanley Musau *Member*
9. Eng. Kahoro Wachira *Member*
10. Eng. Petronilla Ogut *Member*
11. Eng. Angela Odera *Member*
12. Eng. Kennedy Sidera *Member*

4. Capacity Building and Leadership Development Committee
1. Eng. Grace Kagondu *Chairperson*
2. Eng. E. Akech Ochungo, Ph.D *Vice Chairperson*
3. Eng. Harisson Keter *Member*
4. Eng. Opere Akomo *Member*
5. Eng. Japheth Bwire *Member*
6. Eng. Peter Githiomi *Member*
7. Eng. Doreen Kirima *Member*
8. Eng. Michael Maiyo *Member*
9. David Muthike *Member*
10. Diana Ogeto *Member*
11. Tabitha Wang'ombe *Member*
12. Halkano Roba *Member*

5. Outreach Committee
1. Eng. Damaris Oyaro *Chairperson*
2. Eng. Harrison Keter *Vice Chairperson*
3. Eng. Joel Ouma *Member*
4. Eng. Moses Kilimo *Member*
5. Eng. Cyrus Kanda *Member*
6. Christine Ndolo *Member*
7. Brenda Kamau *Member*
8. Chaltu Marta *Member*
9. Khadija Omar *Member*

6. Welfare Committee
1. Eng. E. Aketch Ochungo, Ph.D *Chairperson*
2. Eng. Jennifer Gache *Vice Chairperson*
3. Antony Ndolo *Member*
4. Eng. Nancy Abira *Member*
5. Eng. Doris Murungi *Member*
6. Eng. Matu, Ph.D *Member*
7. Eng. Kahoro Wachira *Member*
8. Edith R. N. Njeru *Member*
9. Eng. Thomas Koech *Member*

7. Legislative Committee
1. Eng. Paul Ochola *Chairperson*
2. Eng. Hannah Njeri *Vice Chairperson*
3. Eng. Victor Magerer *Member*
4. Eng. Stariko Nyamori *Member*
5. Mr. Joseph Odero *Member*

8. Policy Research and Advocacy Committee
1. Eng. Justus Otwani *Chairperson*
2. Eng. Jennifer Korir *Vice Chairperson*
3. Eng. Benjamin Nyawade *Member*
4. Eng. Carey Mbaraka *Member*
5. Eng. Fidelis Kilonzo *Member*
6. Eng. David Mwaniki *Member*
7. Eng. Dr. Timothy Oketch *Member*
8. Eng. Christopher Nyarotso *Member*
9. Eng. Dick Ndiewo *Member*
10. Eng. Wambui Maina *Member*
11. Adrian Omambia *Member*
12. Elizabeth Ekakoro *Member*

8. 1 Publicity and Brand management subcommittee
1. Eng. Jeniffer Korir *Chairperson*
2. Eng. Fred Olango *Vice Chairperson*
3. Eng. Catherine Munyi *Member*
4. Jerinah Amurah Lukakha *Member*
5. Ekakoro Elizabeth *Member*

8.2 Building Sector
1. Eng. Nyawade Benjamin *Chairperson*
2. Eng. Paul Karara *Vice Chairperson*
3. Eng. Nashon Tambo *Member*
4. Tabitha Soo *Member*
5. Betty Chebet Langat *Member*

8.3 Production/Manufacturing Subcommittee
1. Eng. Carey Mbaraka *Chairperson*
2. Eng. Kitonga Mutuku *Member*
3. Eng. Jasper Ireri *Member*
4. Eng. Nixon Oloo *Member*
5. Nancy Oprong *Member*

8.4 Agricultural Subcommittee
1. Eng. Dr. Fidelis Kilonzo *Chairperson*
2. Nathan Kiplagat Yego *Vice Chairperson*
3. Cecilia Wangechi Mwangi *Member*

8.5 Water and sanitation subcommittee
1. Eng. Dick Ndiewo *Chairperson*
2. Eng. Kigutu James *Vice Chairperson*
3. Eng. Benard Ochieng *Member*
4. Phoebe Murage *Member*
5. Eng. David Mugo *Member*

8.6 Energy Sub committee
1. Eng. David Mwaniki *Chairperson*
2. Eng. Angela Wairimu *Vice Chairperson*
3. Cynthia Kafwa *Member*
4. Eng. Dedan Kuria *Member*
5. Anvar Alot *Member*

8.7 Transportation sub committee
1. Eng. Dr. Timothy Oketch *Chairperson*
2. Eng. Julius Wagai *Vice Chairperson*
3. Eng. Jeniffer Korir *Member*
4. Eng. Calleb Ogado *Member*
5. Eng. Christine Ogut *Member*

8.8 Innovation and Knowledge management Sub committee
1. Mr. Adrian Omambia Onsare *Chairperson*
2. Wambui Maina *Vice Chairperson*
3. Eng. Carol Chomba *Member*
4. Eng. Salmon Osare *Member*
5. Nicholas Parapara *Member*

8.9 Telecommunications Subcommittee
1. Eng. Christopher Nyarotso *Chairperson*
2. Eng. Stephen Kiambi *Vice Chairperson*
3. Mr. Omae Malak Oteri *Member*
4. Christine Mutayi *Member*

9. Events and Functions Committee
1. Eng. Jennifer Gache *Chairperson*
2. Eng. Florah Kamanja *Vice Chairperson*
3. Eng. Lucy Mutinda *Member*
4. Eng. Dennis Busolo *Member*
5. Eng. Cedric Obonyo *Member*
6. Waes Abdullahi Abdinoor *Member*
7. Eng. Roseline Ambasi Jilo *Member*
8. Nathan Yego *Member*
9. Eng. Catherine Nyambala *Member*

10. Alternative Dispute Resolution Committee (ADR)

1. Eng. Mwaka Mungatana *Chairperson*
2. Eng. Jennifer Korir *Vice Chairperson*
3. Eng. Alexander Mbugua Murugi *Member*
4. Eng. Desmond Barongo Nyangwoka *Member*
5. Steve Lipesa Pembere *Member*
6. Eng. Aluoch Odhiambo Fredrick *Member*
7. Eng. Robert Korir *Member*
8. Eng. John Mutu Ndungi *Member*

11. Strategic Plan Committee
1. Eng. Shammah Kiteme *Chairperson*
2. Eng. E. Aketch Ochungo, Ph.D *Vice Chairperson*
3. Abdifatah Jama *Member*
4. Eng. Gideon Gitonga *Member*
5. Eng. Audrey Obwanda *Member*
6. Eng. Collins Changole *Member*
7. Eng. Kigen Wilfred Obed Kipngeno *Member*
8. Eng. Maxwell Ochieng Ngala *Member*
9. Eng. Albrian Mueke *Member*

12. Women Engineers Chapter

1. Eng. Florah Kamanja C*hairperson*
2. Eng. Christine Ogut *Vice Chairperson*
3. Eng. Angela Karigo Wairimu *Member*
4. Ms. Martha Cheruto *Member*
5. Diana Macodawa Member
6. Elizabeth Mwende Mwendwa *Member*
7. Eng. Mercy Mugure *Member*

13. Future Leaders Committee
1. Eng. Lilian Kilatya *Chairperson*
2. Eng. Fred Kiema *Member*
3. Radiance Rabillo Mungu *Member*
4. Nyambedha Clifford Owuor *Member*
5. Annastacia Waitima Maina *Member*
6. Grace Nzivo *Member*
7. Eng. Kennedy Kiunga *Member*

14. Governance, Audit and Risk Committee (GARC)
1. Eng. Eric Ngage *Chairperson*
2. Eng. Albert Mugo *Member*
3. Benjamin Onyancha *Member*
4. Valentino Michira *Member*
5. Dennis Onyango *Member*
6. Eng. Christian Akuku *Member*
7. Eng. Benjamin Kiema *Member*

IEK Membership Report

The IEK membership committee meets every month to consider applications for membership of the various classes received at the secretariat. The IEK council at its 499th council accepted the following members under various membership categories as shown below;

MEMBERSHIP CLASS	Number Accepted
FELLOW	1
CORPORATE	9
GRADUATE	92
GRADUATE ENGINEERING TECHNICIAN	1
GRADUATE ENGINEERING TECHNOLOGIST	1
STUDENT	36
TOTAL	**140**

During the period 1 member transferred from the class of Corporate to Fellow member and 9 transferred from Graduate to Corporate member. In addition 92 graduates, 1 graduate engineering technician, 1 graduate engineering technologist and 36 students accepted as members.

Gender Data

Class	Male	Female	Percentage (Male)	Percentage (Female)
Fellow	1	-	100%	-
Corporate	7	2	77.8%	22.2%
Graduate	82	10	89.1%	10.9%
Technologist	1		100%	-
Technician	1		100%	-
Student	19	17	52.8%	47.2%
TOTAL	**111**	**29**	**79.3%**	**20.7%**

Summary

Gender	No	Percentage
Male	111	79.3%
Female	29	20.7%
	140	**100%**

The 20.7% representation of women is impressive as it is an increase from the previous intakes this year of 16.2% and 16.7%. On the student category, the percentage of female is 47.2% is a cause for celebration as it shows more young girls are taking up engineering courses. IEK continues to encourage young girls to take up STEM subjects in schools, we also continue to encourage initiatives from all sectors to support the development of female leaders in engineering and to support the number of women engineers in all sectors.

FELLOW

S/NO	NAME	MEMBER NUMBER
1	David Oriewo Maganda	F.941

CORPORATE

S/NO	NAME	MEMBER NUMBER
1	Zachariah Anyona	M.4045
2	Lenah Mutheu Wambua	M.7605
3	Valentine Nyandika Moronge	M.5181
4	Rodgers Kipkemoi Ngeno	M.7064
5	Sally Livoyi Musonye	M.8845
6	Justine Ongeri Ombogo	M.8176
7	Valentino Mbaka Michira	M.8088
8	Julius Kitaka Nyamai	M.8161
9	Stephen Owino Oduor	M.8851

The council invites Engineers and affiliate firms to apply for membership in the various membership classes, kindly follow the link **Membership Classes (iekenya.org)** for a list of classes available.

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

Deceased Members

1. Eng. Apollo Okelo Rogo
2. Eng. Bernard Namano
3. Dr. Simeon Otieno Dulo

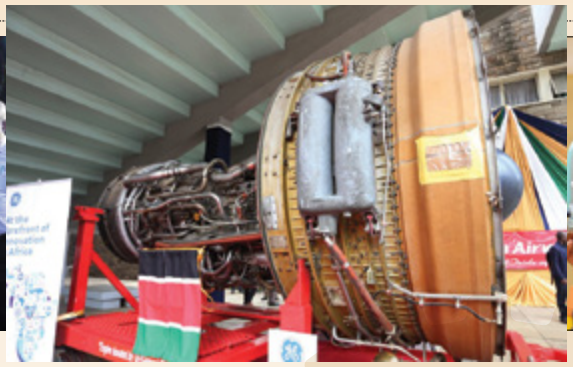
"Death is not extinguishing the light . It is putting out the lamp because the dawn has come."

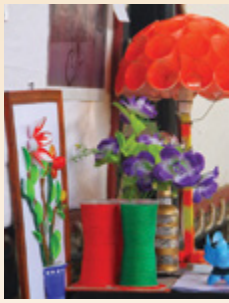
IEK 1st Vice President Eng. Grace Kagondu & Future Leaders Committee Chair Eng. Lilian Mumbua Kilatya (first left, standing) during mentorship workshop for JKUAT Society of Engineering Students in June, 2022

THE TECHNICAL UNIVERSITY OF KENYA

MODULE II PROGRAMMES **POSTGRADUATE, UNDERGRADUATE** AND **DIPLOMA**

STARTING **JULY** 2022



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:

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

- School of Architecture and Spatial Planning
- School of Aerospace and Vehicle Engineering
- School of Chemical and Biological System Engineering
- School of Construction and Property Studies
- School of Civil and Resource Engineering
- School of Electrical and Electronic Engineering
- School of Mechanical and Manufacturing Engineering
- School of Surveying and Geospatial Sciences

FACULTY OF APPLIED SCIENCES AND TECHNOLOGY

- School of Biological and Life Sciences
- School of Computing and Information Technology
- School of Chemistry and Material Science
- School of Health and Biomedical Sciences
- School of Mathematics and Actuarial Science
- School of Physics and Earth Sciences
- Centre for Integrated Water Resource Management (CIWRM)

FACULTY OF SOCIAL SCIENCES AND TECHNOLOGY

- School of Business and Management Studies
- School of Creative Arts and Media
- School of Hospitality and Human Ecology
- School of Information and Social Studies

ONLINE APPLICATION PROCEDURE:

1. Create an Account with us or sign in if the account is already created;
2. Enter your personal details to obtain a **REFERENCE NUMBER** which is in the form of **APP/xxxxx/2021**;
3. Enter your academic qualifications and upload scanned copies of the corresponding certificates or result slips. Please note that result slips for examinations taken more than two years ago will not be accepted;
4. Pay the application fee of KES 2,000 for Diploma/undergraduate programmes, KES 3,000 for postgraduate programmes and KES 3,600 for foreign applicants. These payments should be made through **MPESA Paybill number 5236153** and account number should be your application **REFERENCE NUMBER** obtained in 2. above. The payment will be confirmed automatically after 24 banking hours;
5. After the elapse of 24 banking hours, return to this portal, log in and choose your preferred programme of study; thereafter,
6. SUBMIT your programme of choice and wait for the selection process to be concluded. Meanwhile, you are advised to frequently log in, using your account details, to establish the status of your application.

Please note that applications should be submitted **NOT later than 3rd June, 2022.** However, you are advised to frequently visit our website for extended deadlines, if any. Also note that the **2022/2023 Academic Year** commences on **4th July, 2022.**

Enquiries or clarification on the application for the programmes above may be made through the dedicated Admissions Office telephone number +254 20 2216136.

Haile Selassie Avenue • P. O. Box 52428 – 00200, City Square, Nairobi • Tel. +254 20 2219929, 3341639 (General enquiries) • Fax: +254 (020) 2219689 • E-mail: registrar.academic@tukenya.ac.ke

NuPEA
NUCLEAR POWER & ENERGY AGENCY

VISION

A premier hub for nuclear power development and sustainable energy solutions

Nuclear Power and Energy Agency (NuPEA, formerly the Kenya Nuclear Electricity Board (KNEB) is a State Corporation established in law through the Energy Act No.1 of 2019. The Agency's mandate as stipulated in Section 56(1) Act are to: a) be the nuclear energy programme implementing organization and promote the development of nuclear electricity generation in Kenya; and (b) carry out research, development and dissemination activities in the energy and nuclear power sector.

MISSION

To develop nuclear power, and undertake research and capacity building in the energy sector for socio-economic prosperity

Core Values

I-TEC: Integrity, Teamwork, Excellence, and Creativity and innovativeness

KRA (Key Result Area)	Strategic Objectives
Nuclear Energy Infrastructure Development	• Ensure readiness of key nuclear power infrastructure • Have an adequate and supportive legal and regulatory framework • Inculcate nuclear safety culture among the key stakeholders
Public Education and Stakeholder Engagement	• Increase stakeholder's awareness and support of NuPEA's mandate
Energy Research and Development	• Champion use of safe, efficient and sustainable energy systems • Enhance uptake of new technologies and innovations in the energy and petroleum sectors
Energy Sector Capacity Building	Ensure availability of skilled and competent human capital in the Energy and Petroleum sectors
Institutional Capacity	• Enhance good corporate governance • Promote a positive corporate image • Have a versatile, competent, highly performing and motivated workforce • Enhance efficiency and effectiveness in service delivery • Enhance financial sustainability of the Agency

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