KeSEBAE NEWS

Newsletter of the Kenya Society of Environmental, Biological and Agricultural Engineers

Volume 6. No. 9 02 December 2024

Food Engineering

By Yvonne Madahana

Food engineering is a branch of engineering that applies principles of physical, biological, and chemical sciences to the design, development, and optimization of processes for the production, preservation, packaging, and distribution of food. It combines aspects of food science, mechanical engineering, chemical engineering, and industrial engineering to improve food safety, quality, and sustainability. Food engineers design systems and technologies that enhance food processing techniques such as heating, cooling, fermentation, and drying, while ensuring that food products meet safety standards and nutritional requirements. Key areas within food engineering include food safety, which ensures that food items are safe for consumption by minimizing contamination risks and adhering to safety regulations; quality control, which involves implementing procedures to enhance and maintain the overall quality, taste, texture, and appearance of food products; food preservation, which develops methods such as canning, freezing, and drying to extend shelf life while retaining nutritional value; and nutritional enhancement, which focuses on creating fortified and enriched food products to meet dietary needs and improve public health.

DEAR READER

Welcome to KeSEBAE Newsletter.

A monthly Newsletter touching on topical issues affecting our environment.

KeSEBAE NEWS is a Newsletter of the Kenya Society of Environmental, Biological and Agricultural Engineers (KeSEBAE)

Inside this Issue!

Food engineers use the following core principles to design safe, sustainable, and efficient food systems enabling processes like freezing, pasteurization, and dehydration which ensures high-quality production. The key principles include:

a. **Fluid Mechanics**: This principle helps food engineers understand the behavior of fluids during processing, such as when food liquids are pumped, filtered, or mixed. It is crucial for processes like pasteurization, where liquids are heated to kill harmful microorganisms, and for designing equipment like pumps, pipes, and mixers used in food manufacturing.

b. **Thermodynamics**: Thermodynamics is fundamental in food engineering because it governs the transfer of heat energy during processes like cooking, freezing, and drying. By understanding heat energy and its movement, food engineers can optimize temperature control, reducing energy consumption and ensuring the desired quality and safety of food products.

c. **Mass Transfer**: Mass transfer principles are applied to understand how substances like moisture, gases, and nutrients move during food processing. This is especially important in food drying, freezing, and fermentation, where the movement of water or gases affects the texture, preservation, and safety of food products.

d. **Heat Transfer**: Heat transfer is essential for processes such as sterilization, pasteurization, and cooking, where food must be heated to a specific temperature to ensure safety and improve flavor, texture, and shelf life. Engineers use heat transfer principles to design efficient heating systems, ensuring uniform temperature distribution without over- or under-cooking the food.

Degree Programmes in Food Engineering

Several Kenyan universities offer degree programs related to Food Engineering:

i. University of Nairobi: Food Science, Nutrition, and Technology, integrating food processing and engineering systems.
ii. Egerton University: Food Science and Technology, focusing on preservation and safety.
iii. Jomo Kenyatta University of Agriculture and Technology (JKUAT): Food Science and Postharvest Technology, applying engineering principles to food systems.
iv. Masinde Muliro University of Science and Technology: Food Science and Technology with technical components.
v. Dedan Kimathi University of Technology: Food Science and Technology, emphasizing science and engineering.
vi. Open University of Kenya: Bachelor of Agri-Technology and Food Systems.
vii. Karatina University: Food Science and Nutrition program integrating food engineering principles.

Diploma Programmes in Food Engineering

Technical Vocational Education and Training (TVET) institutions in Kenya provide diploma-level education in food engineering and related fields:

i. Kabete National Polytechnic: Diploma in Food Technology, focusing on food science and processing.
ii. Kisiwa Technical Training Institute: Practical courses in food production technology.
iii. Sang'alo Institute of Science and Technology: Artisan and diploma-level programs in food quality management.
iv. Coast Institute of Technology: Programs in food production and processing.
v. Eldoret National Polytechnic: Diplomas in Food Science with a focus on technology and innovation.
vi. Machakos Institute of Technology: Diplomas in Food and Beverage Production and Sales.
vii. Kenya Utalii College: Diploma in Food and Beverage Management.

Value of Food Engineering to the World

Food engineering plays a vital role in addressing global challenges, from food security and sustainability to economic growth and innovation.

i. **Addressing Food Security**: Food engineers innovate in food preservation, ensuring extended shelf life and reduced spoilage. Techniques like freezing, canning, and fortification provide vulnerable populations with nutritious and accessible food.
ii. **Promoting Sustainability**: Sustainable food engineering minimizes environmental impact by reducing waste, conserving energy, and developing biodegradable packaging. The rise of plant-based alternatives and precision agriculture enhances efficiency while protecting resources.
iii. **Driving Innovation in Food Processing**: Advances like High-Pressure Processing (HPP), Pulsed Electric Fields (PEF), and ultrasound-assisted methods enhance safety, nutrition, and energy efficiency. Technologies like 3D food printing and nanotechnology further revolutionize food production.
iv. **Economic Contributions**: The food industry is a global economic powerhouse, creating jobs and driving GDP growth. Food engineers support innovation in production, packaging, and distribution, meeting consumer demands for healthier, sustainable products.
v. **Meeting Future Challenges**: As the global population grows, food engineers play a critical role in developing alternative proteins, smart packaging, and IoT-enabled supply chain systems. Their work ensures food availability and quality while mitigating climate change impacts.

The future of food engineering is both exciting and promising. As global populations increase and environmental concerns intensify, food engineers will continue to play a vital role in shaping the future of food production and consumption. Here are some trends shaping the future of food engineering:

a. **Sustainable Food Systems**: The future of food engineering is rooted in sustainability. Innovations like vertical farming, aquaponics, and urban agriculture are set to revolutionize food production by reducing land and water use while maximizing efficiency.
b. **Alternative Proteins and Personalized Nutrition**: As the demand for alternative protein sources grows, food engineers are exploring lab-grown meats, plant-based proteins, and insect-based food products. Additionally, advancements in personalized nutrition will allow for more tailored dietary options.
c. **Smart Packaging and IoT Integration**: Food engineers are also at the forefront of developing smart packaging solutions. Through the use of sensors and IoT technology, food packaging can monitor freshness and reduce food waste, enhancing both food safety and sustainability.
d. **Emerging Technologies**: Advancements in artificial intelligence, blockchain, and nanotechnology will continue to drive innovation in food engineering, optimizing everything from production processes to supply chain management.

Food engineering is a dynamic and essential discipline that drives the safety, sustainability, and innovation of global food systems. As the world demands healthier, more sustainable food, food engineers are stepping up to meet these needs, tackling challenges ranging from food safety to environmental sustainability. By developing cutting-edge solutions for food preservation, quality control, and packaging, food engineers are shaping the way we produce, process, and consume food. With every innovation, they ensure we have access to safe, nutritious, and sustainable food today—and for generations to come.

Engineers Act Cap 43 of 2011 Needs Urgent Amendments to Ensure Seamless Collaboration Between Industry, Academia and Public Service by Dr. Patrick Ajwang

The Engineers Board of Kenya (EBK) plays a pivotal and indispensable role in registration, licensing, regulation, professionalization and standardization of engineering practitioners in Kenya. The current board is the successor of the Engineers Registration Board (ERB) whose existence was terminated upon the enactment of the Engineers Act Cap. 43 of 2011. The EBK is a government institution which is meant to ensure order, discipline and adherence to internationally recognized quality standards and best practices by engineering professionals in Kenya.

EBK operates in tandem with the Institution of Engineers of Kenya (IEK) which is the professional society of engineers concerned with the welfare, professional development and promotion of best practices among its membership. Registration by EBK is a prerequisite for membership of the IEK implying that EBK and IEK operate more or less as one entity. Indeed, under Section 5 of the Engineers Act 2011, the chairman of the Institution of Engineers of Kenya is a member of the Engineers Board of Kenya.

According to Section 7 of the Engineers Act 2011, the Engineers Board of Kenya is vested with sweeping powers to develop and regulate the engineering profession, including approving and accrediting engineering programs for public and private universities – which has severally been contested by Commission for University Education of Kenya. Perhaps the most outstanding power of the board is issuing practicing licenses to individuals who have satisfied the criteria set by the board, to operate as legally recognized professional engineers within the territory of Kenya. People who are not licensed are not allowed by the Act to hold any notable professional engineering position in Kenya. In the past, there have been some murmurs on how the licenses are issued by the EBK/IEK.

The Engineers Act 2011, recognizes four levels of engineers; Graduate Engineer, Professional Engineer, Consulting Engineer and Accredited Checker. Graduate Engineer is the entry level in the profession and requires a university degree from duly accredited engineering programme from a chartered university. Graduate engineers are not eligible for a practicing license and must chalk up at least three years of practice under the supervision of a registered professional engineer before they can submit their project and training report to the board and proceed to the professional interview conducted by the board.

Induction into the practicing professional category (PE) is contingent on passing the professional interview/examination. There is currently no requirement for a Masters or Doctorate degree for the three professional cadres under the Act and Regulations. So, a Bachelor's degree holder can, in principle, progress to Consulting Engineer and Accredited Checker without going for any recognized post-graduate university qualification.

Whereas the current registration and licensing system seems logical and fair on the surface, there are several issues that have cropped up in the engineering fraternity in Kenya in relation to this system. For instance, out of over 25,000 people with engineering degrees in Kenya, less than 5,000 are licensed and recognized by the board as professional engineers. Thus over 75% of engineering graduates are either at the Graduate Engineer level or lost into other activities that they have not been trained for. This is a blatant wastage of engineering talent and economic resources that our poor economy can hardly absorb.

Within the 75% are numerous university lecturers and professors who hold Masters or Doctorate degrees who have not been licensed by the EBK. In particular, people who chose the

academic path in engineering have found it difficult to be registered, especially if they have undertaken post-graduate studies from universities outside the Commonwealth countries. Many are the times when serious scholars have appeared before the board to present their doctorate project work for registration and licensing only to be told the work was too theoretical or irrelevant. And those who have initiated the registration process after completing Masters and Doctorate degrees have infamously been told that the EBK requires only the undergraduate degree certificate to register. This has buttressed the suspicion that the EBK sees very little or no value in advanced engineering education.

It is intriguing that highly trained persons who are allowed by university councils to teach engineering courses at the university can be considered as non- engineers by the professional bodies. Yet when they come to accredit the university programmes, the same individuals are presented as resource persons for the programmes and they endorse. It is also rather simplistic to imagine that a Masters or Doctorate degree in engineering can be awarded without solving a tractable and practical problem in engineering, especially in the more developed countries of America, Europe or Asia. Indeed, some of the scholars they have refused to recognize locally, have been admitted at the highest ranks (Fellow) in some professional bodies abroad.

The dynamism of our higher education sector is breathtaking. Unlike the 1960s when the number of engineering graduates were countable, today there is large pool of graduates with the basic engineering qualifications. There are also so many engineers who have completed post-graduate degrees from reputable institutions, even if outside the Commonwealth. The Engineers Board of Kenya should move with speed to make it possible for all graduates from duly accredited engineering programmes to PRACTICE engineering at different levels of responsibility without much ado. What is the purpose of accreditation and audits if they cannot make universities produce the desired competencies?

I would propose that the Engineers Board of Kenya should issue practicing licenses to graduates from all accredited engineering programmes to enable them practice what they have learnt from the 5-year academic journey. The current practice of not licensing them negates the authority of universities and subjects the graduates to unending indignity. In any case we know that universities have always retained their best students for post-graduate training that makes them scholars. Accordingly, I think it would be better if we EBK introduces four levels of engineers with responsibility thresholds as follows;

Level	Initials	Admission Requirements	Responsibility Threshold
Professional Engineer	PE	Any graduate from an accredited/recognized engineering programme from a chartered university operating in Kenya or abroad. Experience; 0-5 years.	This category of engineers should handle relatively simple projects, even though most of them would find entry level employment in existing engineering organizations or already practicing engineers. Budget limits of the projects they can handle independently can be to be set by EBK. They can considered for operational and supervisory roles in organizations.
Senior Professional Engineer	SPE	Graduates with 5-10-year experience who have practised either independently or in employment and accumulated established CPD	This category of engineers should handle projects and tasks of medium complexity/size, with budget

		points and shown evidence of continuing involvement in engineering. Candidates for this level should undergo an assessment by the EBK to establish competencies and experience. A Master's degree should be considered as an added advantage for this level	thresholds set by the EBK. They can also review the work of PEs. They can be first line managers, section heads or departmental heads
Consulting Professional Engineer	CPE	Graduates with at least 10-15 years proven cumulative experience relating to planning, design, implementation, supervision and management of engineering projects, programmes, departments or institutions. A Master's degree should be mandatory requirement for this level. Candidates for this level should undergo an assessment by the EBK to establish competencies and experience.	This category of engineers can handle projects/tasks of any size/complexity in their respective engineering domain. Their budget thresholds are unlimited. They can review the work of SPEs. They can serve in middle management or senior management for large organizations
Fellow Professional Engineer	FPE	Consulting Professional Engineers (CPEs) can be elevated to this status provided they can show at least 20-year experience on proven engineering practice and commitment to CPD. A PhD degree from a recognized/accredited engineering university should be considered an advantage for this level. Candidates for this level should undergo an assessment by the EBK.	This is the apex level. They can handle tasks/projects of any complexity and budget. They can review the work of CPEs. They can also be thought leaders in industry or academia who can run large institutions or divisions

This proposal to rename and reclassify engineers provides several distinct advantages. It would restore and reinforce the authority of universities as the institutions mandated to provide holistic engineering training in the country. It would also be testimony that accreditations and audits done by regulatory bodies are not mere formalities. The graduates from the engineering programmes would also have the right to append the title ENGINEER (Eng.) to their names thus giving due recognition to university academic work as the cherished traditional and tested path to professionalism.

By making a Master's degree a requirement for Consulting Professional Engineer status, it would make it easy for consultants in industry to transition to academia and vice-versa. This approach would also give due respect to seniority and promote the generation of engineering knowledge for our economy. It could also help eliminate the unreasonable wage disparities between academia and industry. Lastly it would enable seamless interaction between engineers in academia and industry/government since nobody would feel out of place.

The competition for top engineering talent is stiff. And no country has ever developed without high level engineering talent. If we frustrate the career aspirations of upcoming engineers, then we shall end up only with a country of hawkers and salesmen of imported merchandise. And to eliminate universities in the professional engineering services value chain is to kill innovation, modernization and critical thinking, which are essential elements of a progressive society. So, let us amend the Engineers Act 2011 to give hope and meaning to the vast majority of our engineering graduates![1]

[1] *Dr. Patrick Ajwang, teaches Agricultural and Biosystems Engineering at JKUAT. He is a Fellow of the Kenya Society of Environmental, Biological and Agricultural Engineers.*

2025 Annual Conference

CALL FOR PAPERS

To the Next Editions of the JEAE

JEAE

Journal of Engineering in Agriculture and the Environment

The Journal of Engineering in Agriculture and the Environment (JEAE) is a Publication of the Kenya Society of Environmental, Biological and Agricultural Engineers (KeSEBAE) through which researchers in the fields of Environment, Agriculture and related fields share research information and findings with their peers from around the globe.

The JEAE Editorial Board wishes to invite interested researchers with complete work in any relevant topic, to submit their papers for publication in the next editions of the Journal.

Manuscripts may be submitted online or via email to:

Chairperson, JEAE Editorial Board via Email: jeae@kesebae.or.ke or Online via: https://kesebae.or.ke/journal/index.php/kesebae/about/submissions

Criteria for Article Selection

Priority in the selection of articles for publication is that the articles:

a. Are written in the English language
b. Are relevant to the application of engineering and technology in agriculture, the environment and biological systems
c. Have not been previously published elsewhere, or, if previously published are supported by a copyright permission
d. Deals with theoretical, practical and adoptable innovations applicable to engineering and technology in agriculture, the environment and biological systems
e. Have a 150 to250 words abstract, preceding the main body of the article
f. The abstract should be followed by the list of 4 to 8 "Key Words"
g. Manuscript should be single-spaced, under 4,000 words (approximately equivalent to 5-6 pages of A4-size paper)
h. Should be submitted in both MS word (2010 or later versions) and pdf formats (i.e., authors submit the abstract and key words in MS Word and pdf after which author uploads the entire manuscript in MS word and pdf)
i. Are supported by authentic sources, references or bibliography

Our Expert Reviewers are Highly Regarded Globally and Provide Fast and Rigorous Review Services For additional details and online support visit: https://www.kesebae.or.ke/journal/instructions.php or visit our JEAE website at: https://kesebae.or.ke/journal/index.php/kesebae

CALL FOR ARTICLES TO KeSEBAE NEWS

KeSEBAE NEWS Editorial wishes to call for topical articles for publication in future editions of KeSEBAE NEWS.

Please transmit the same via Email: info@kesebae.or.ke

NOTE: A payment will be made to the author of each selected article

CALL FOR MEMBERSHIP

Be a KeSEBAE Member:

The annual subscription fees, admission fees and reinstatement fees for members of all grades (except Honorary and Life Members who shall pay no dues or fees) are indicated below: The annual dues are as follows:

Membership Category	Annual Subscription (KES)	Admission Fees (KES)	Reinstatement Fees (KES)
Fellow	5,000	1,000	2,000
Member	2,000	1,000	2,000
Ass. Member	1,000	1,000	2,000
Aff. Member	500	1,000	2,000
Student	300	100	-

Membership Renewal

Members of all grades are requested to renew their **2024 membership as follows.**

Membership Category	*Annual Subscription Fee (KES)*
Fellow	**5,000**
Member	**2,000**
Ass. Member	**1,000**
Aff. Member	**500**
Student Member	**300**

Follow Us on Social Media:

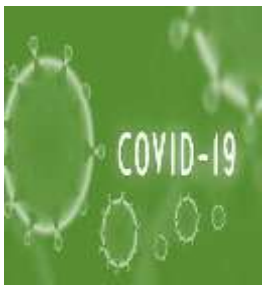
	https://twitter.com/kesebae1
	https://web.facebook.com/kesebae1/

PAYMENT DETAILS

Bank	
Bank	**Absa Bank Kenya Plc**
Branch	**Nairobi University Express Branch**
Account Name	**Kenya Society of Env. Bio. & Agric. Engineers**
Account No.	**2038150696**
Swift Code	**BARCKENX**
Currency	**Kenya Shillings**

M-PESA DETAILS

Pay Bill No.: **4002575**
Account No: **Your Full Name**



Important Links	
KeSEBAE	https://www.kesebae.or.ke/
JEAE	https://www.kesebae.or.ke/journal/
EBK	https://ebk.or.ke/
IEK	https://www.iekenya.org/
PASAE	http://www.pasae.org.za/
Email	info@kesebae.or.ke