

KeSEBAE NEWS

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3D Printing of Agricultural Machinery and Structures

Benard Odhiambo



What is 3D printing?

The 3D printing is a technological process where a three-dimensional (3D) object is built from a computer-aided design model by successively adding material layer by layer.

This technology helps in understanding of very complex systems and improving the process of prototyping and design.



A 3D printed farm display (Source: internet)

Generally, it is an emerging technology being used for developing prototypes, producing machine parts and substitutes.

Why is it gaining momentum in the industry? It is important to note that 3D printing has a wide range of

printing materials. The printing can be done on materials such as metals, carbon fibre, and high-temperature plastics with very high durability and functionality, rubber-like products, bio-based polymers, conductive filled or circuitry materials, soluble materials as well as on living cells.

3D printing is one of the technologies that are revolutionizing manufacturing industry all over the world. Thanks to the dropping cost of 3D printers. This has enabled the technology to be available to consumers.

In agricultural advancement, it is being utilized in production of farm machinery parts and infrastructure as well as building construction with an aim of transforming the efficiency of farm operations. Actually, this technology has been used by agricultural engineers since 1980s to design and produce machinery parts and prototypes. Owing to its availability to consumers, the technology is now being utilized to explain complex concepts in manufacturing.

It can reduce production costs by enabling distributed manufacturing of substitutes of equipment and other products.

We could shorten the supply chain with the use of 3D printing in manufacturing.



A 3D model of a John Deere 6195M farm tractor (source: internet)

Nevertheless, in developing countries such as Kenya, the complete adoption of this technology is still faced with challenges such as inadequate availability of 3D experts who are able to design, model and manufacture different products; limited and fixed materials as the commonly used materials are

plastics, ceramics, resins and metals. The commonly available 3D printers are limited to printing small-sized objects.

But no worries, numerous opportunities are available for us to exploit from this technology. Advancing in this 3D printing will improve our science education. We can use this in institutions of

learning to generate physical models for better understanding of rather complex systems. Let's grab this technology to create agricultural tools affordable to our farmers.

The future of 3D printing is quite promising in many sectors like disaster management. It could be used to print houses during disaster

occurrences like floods and earthquakes!!!

It is therefore conclusive to say that 3D printing presents an enormous prospect for our country. It offers us the ability to innovate, design and create tools that support and improve our lives.



Some examples of 3D printed farmhouses (source:internet)

Municipal Waste Management – A Waste to Energy Approach for Kenya

Ezekiel Oranga

The World Bank reports that by 2025, global urban municipal solid waste (MSW) is projected to increase to 2.2 billion tons per year from the current 1.3 billion tons per year. Infrastructures to reduce, re-use, recycle and recover waste in most cities around the world, however, remains absent, poorly established, or largely informal.

Kenya's MSW is largely dumped in open dumpsites. The Dandora dumpsite in Nairobi, Kachok in Kisumu, Kibarani in Mombasa, just to mention a few, are serious health and environmental hazards to the residents of these Cities. Other African cities are adopting sanitary landfills (SLFs) as an improvement from the open landfills.

However, serious challenges still accompany this method of MSW management. Anaerobic decomposition of organic waste in landfill sites also leads to the release of methane (CH₄), a GHG over 20 times more effective in trapping

heat in the atmosphere than CO₂ over a 100-year period.



SLF under construction in Arusha, Tanzania

CH₄ released from landfill sites to the atmosphere is not usually controlled or captured, and as such has been one of the most negative side effects of landfill sites. Leachate management is another challenge of sanitary landfills that require structured management through the development of treatment system, a facility largely lacking in many SLFs across the continent.

Waste Incineration: While more desirable waste diversion practices should be considered on a case-by-

case basis, non-toxic waste should be considered as a resource to produce energy especially in a continent where the majority of the population has no access to clean energy



Leachate pond in Arusha, Tanzania

This can help to address local and regional energy security concerns and mitigate climate change and local waste disposal challenges.

Waste can be used as a combustible fuel to produce energy. While incineration can have other environmental drawbacks (e.g. release of harmful particulates), it also represents an easy and cost effective solution for reducing the

amount of waste accumulating in landfills, while generating energy. A waste incineration plant however, would be a complete factory as shown in the figure.



A typical layout of an incineration plant for

production of energy (Source: www.enfi.com.cn)

The main advantages of waste to energy interventions include their low land requirements, clean thermal energy recovery and revenue generation per unit waste. The facilities can also be located within busy city environments. On the other hand however, these enterprises require high skills input, cannot be used with toxic substances, require high initial capital investments and high O&M costs. Where the power plant is small or the feedstock is intermittent the low efficiencies may mean

longer time for recovery of investment costs.

Conclusion

African cities need to consider innovative and cost-effective ways of sustainable MSW management strategies. Current practices pose serious hazard not only to the populations of these cities, but also to the overall environment. Kenya in particular need to consider developing waste to energy value chains within the main cities as a strategy of enhancing production of clean energy for her citizens.

Have your research published in in our Journal of Engineering in Agriculture and the Environment (JEAEE)

PASAE Nairobi 2018

The Editor



PASAE NAIROBI 2018 group photo

The Pan African Society for Agricultural Engineering (PASAE) 2018 Conference was hosted by the Kenya Society of Environmental, Biological and Agricultural Engineers between 25th – 28th March 2018 at the Southern Sun Mayfair Hotel, Nairobi, Kenya.

The theme of the conference was **Engineering and Technology for Agriculture Transformation in Africa**. The objective of the conference was to provide a forum

for the private, public and academic sectors to meet and explore business opportunities through networking and exchange of experience and knowledge.

The key subjects discussed during the three days of deliberations included: Mechanizing African Agriculture: Policy and Legal Frameworks; Engineering and Technology Solutions for Irrigating Africa; Agro-industries and Value Addition; Engineering and

Technology Solutions for Post-harvest losses in Africa; Energy and Machinery for Agricultural Transformation in Africa; Infrastructure and Buildings for Agricultural and Rural Transformation in Africa; Climate Change and Environmental Management; Education Systems for Engineers and Technologists for Transformation of Agriculture and Rural areas in Africa.

The conference was attended by participants from across Africa and from the USA. The American Society of Agricultural and Biological Engineers (ASABE) was represented by Prof. Lalit Verma, former President of the Society.

There was considerable support and cooperation from local universities, Government and International organizations

Some of the universities that played a key role include Technical University of Kenya (TUK), University of Nairobi (UoN), Department of Environmental and Biosystems Engineering and

Department of Food Science and Technology, Kenyatta University, and Jomo Kenyatta University of Agriculture and Technology (JKUAT).



Prof. Eng. David Some presenting a certificate to the Chair of the Conference Organizing Committee Prof. Eng. Lawrence Gumbo

Government ministries that gave their support to the conference include Ministry of Agriculture and Irrigation, Ministry of Energy, Ministry of Water and Sanitation and the Ministry of Environment and Forestry. World Agroforestry Centre (ICRAF), Log Associates Limited, Aquarius Media Kenya and Tertiary Consultants were among the local organizations who offered their support to the Conference.

The conference also received considerable support from individual participants and members of agricultural engineering profession from across Africa.

KeSEBAE Lecture Series

The Editor

The KeSEBAE series of lecture for this year are as tabled.

Date	Theme	Facilitator
11 September 2019	Irrigation and Water Storage in Kenya	Eng. J. Nyaguti
October 2019	Renewable Energy Resources	Eng. S. Mwamzali
November 2019	Environmental Engineering	E. Oranga
December 2019	Food Engineering	Prof. M. Okoth
January 2020	The Engineering Profession	Prof. L. Gumbe

KeSEBAE Conference 2019

The Editor

The society will organize a national conference and hold an AGM on 14-15 November 2019. The theme of the conference will be **“Engineering the Big 4 Agenda”**.

The sub-themes include:

1. Engineering for Food Security
 2. Engineering for climate change
 3. Engineering the environment
 4. Engineering our irrigation
 5. Energy for the Big 4 Agenda
 6. Engineering our infrastructure
 7. Engineering our water and sanitation systems
 8. Engineering and technical education
 9. Socioeconomics of the Big 4 Agenda
- The charges for the conference are KSh. 5,000 for regular participants and KSh.

1,000 for undergraduate students. Participants are encouraged to register and submit their presentations and manuscripts way before the conference date.

EDITORIAL

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

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