

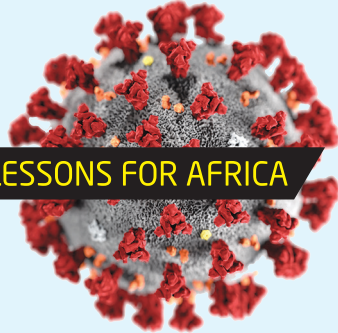


# ScienceAfrica

APRIL- AUG. 2020# 02

PROMOTING SCIENCE AND SOCIO-ECONOMIC DEVELOPMENT

*A New Conversation about Africa*



**COVID-19: CRITICAL LESSONS FOR AFRICA**

*Focus on ICIPE's Transformative Push-Pull Technology*



**Inside**

- Kickstart's Money Maker Pumps
- TVET Revolution in Kenya
- WACCI's innovative seed scientists
- Role of ATPS in attainment of SDGs in Africa
- The Future of Work- Prof. Leopold Mureithi
- Prof Mary Abukutsa : Reintroducing Indigenous Vegetables
- Kenya Marine and Fisheries Research Institute



*Dr. David Amudavi Entrenching Ecologically Sustainable Agriculture in Africa*



## MINISTRY OF HEALTH KENYA



- Wash your hands regularly with soap and running water or boiled and cooled water or using an alcohol-based hand sanitizer.
- Cough or sneeze into a disposable tissue or bent elbow, and wash your hands immediately. Dispose the tissue in a trash or burn it.
- Maintain a distance of at least 2 meters (6 feet) between yourself and anyone who is coughing or sneezing.
- Avoid shaking hands, hugging or kissing with people with flu-like symptoms
- Stay at home and avoid travelling when you have flu-like symptoms.
- Persons with a cough or sneezing should stay home or keep a social distance, and avoid mixing with others in a crowd.
- Maintain a good respiratory hygiene by covering your mouth and nose while coughing and sneezing with a handkerchief, tissue or flexed elbow.



Kenya Medical Research Institute's KEM-RUB® hand sanitizer is an alcohol-based hand rub with Isopropyl as the active ingredient. WHO-recommended formulation used guarantees 99% riddance of pathogens in both vegetative and spori-form states. This product adheres to strict quality control.

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## EDITORIAL

# COVID-19: VALUABLE LESSONS FOR AFRICA

COVID-19 pandemic is rapidly getting entrenched in Africa and there are already major lessons to be learnt if the continent is to survive, develop sustainably, and avail basic human needs to the rapidly increasing population while competing with other nations in the remaining years of the 21<sup>st</sup> century.

A timely report by the African Union on Impacts of the new *Coronavirus (COVID-19) on African Economy* should promptly serve as an eye opener for top policymakers, including parliamentarians, various professionals and universities.

The COVID-19 pandemic should make Kenya and other African nations note that they have been very mistaken to take certain key survival issues for granted, especially matters of health, food security, water and the funding of science, and above all, the urgently needed homegrown industrialization.

Close observers easily noted that self-preservation steps taken by some countries in Europe and Asia made it clear that because of the emerging devastating impacts of COVID-19 pandemic, they were ready to stop export of some drugs, biomedical items and equipment.

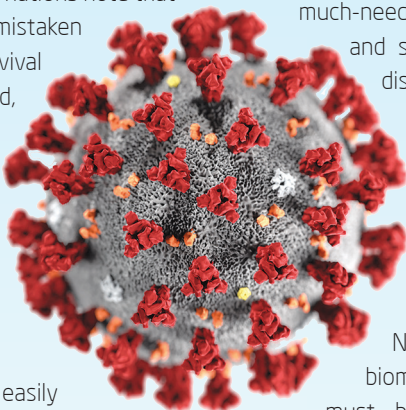
In other words, African countries must come up with policies that boldly facilitates sustainable industrialization, including capacity to fully manufacture pharmaceutical products, biomedical items and equipment. The COVID-19 pandemic should remind the continent of the proverb that *it is your own club(rungu) or stick (fimbo) that will help you kill a poisonous snake.*

India, Turkey, Germany and Russia understandably made it clear that national

needs must be fully met before certain pharmaceutical or biomedical products are exported.

India is also said to be ready to stop the export of controversial malaria medicine that is alleged to treat COVID-19. For Africa, widely circulated comments from Europe (even by individuals) that such controversial anti-coronavirus drugs are ideal for experimentation in Africa for control of Covid-19, as was done with commercial sex workers during HIV vaccine trials, tells volumes on the need to return to the drawing board with radically new policies.

Development and university education policies must be re-oriented towards empowering local experts to go beyond just having useful knowledge in their brains with no related and much-needed homegrown products and services in the war against diseases and food insecurity.



In Africa, Egypt, South Africa, Ethiopia, Nigeria, Senegal, Tanzania and Kenya should be able to easily entrench and sustain home-rooted pharmaceutical industries. National and regional biomedical research institutions must be empowered by African nations allocating at least one percent of their budget for research and development activities.

Almost six decades after independence there is no reason for Africa to lack sustainable capacity to produce its own essential medicines. Top officials and the politicians are always planning and re-planning. India is an example of a nation that boldly defied all odds and has excelled in building its pharmaceutical industries despite certain challenges.

It is high time African leaders stopped trooping to foreign capitals and returned to the drawing board to chart the path towards increased self-reliance in critical areas like medicine and food security. To succeed, African must mainstream and invest heavily in science, technology and innovations for therein lies the solutions the continent's myriad problems.

## Virus Dismantling Modern World?

- Could Spark Global War if tempers don't cool-

Global war may finally erupt if simmering tempers don't cool over who should be held responsible? However, it is said that all earthly tragedies, including COVID-19, eventually end and there is always light at the end of the tunnel. The human "spirit" will overcome.

However, for now, it is time for Africa overcome very hash impacts of the new coronavirus pandemic. The most important weapons at the center of coping are staying indoors, keeping social distant, washing hands and using appropriate masks.

Whichever way one looks at it, there is much more that needs to be fully understood, in transparent environment, about the sudden emergence, rapid transmission, illness,



## What should I do if shops are sold out of hand sanitizer?

That's okay. **Washing your hands using regular soap and water is also effective against COVID-19.** Remember to wash between your fingers, the backs of your hands and around your nails.



## Explosive Blame Game

Unfortunately, the US-China blame-game found its way into major western media outlets. China was nicknamed ‘the sick man of Asia who never plays by the decent rules of a globalized world’. They blamed China for mercilessly chewing all sorts of precious wildlife, including those which may have triggered COVID-19 outbreak.

An assertive China, with a worldwide media network, shouted back dismissing accusations as loaded with prejudice but, at the same time, pointing fingers at negative aspects of the West’s history.

But for now, all seem to have cooled down as the reality of the severity of COVID-19 sinks in.

deaths and the ongoing socio-economic stranglehold impacts of Coronavirus Disease-2019 (COVID-19) pandemic caused by a new or novel coronavirus, which virologists call *Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)*

The virus has stealthily infected heads of state, royal families, military leaders, top health experts, doctors, children, young men, the elderly, health ministers, nurses and many others in both poor and rich nations. In other words, the war against this virus is painful and tough. In China, which still leads the world with hands-on experience, the virus is said to have infected at least 3,600 health workers.

However, it is a different story when world’s top biomedical experts in Britain and United States say with apologies that the ongoing pandemic may finally kill even well over 200,000 people in each of the two global superpowers.

It means doctors, nurses, medical laboratory experts, epidemiologists, infectious diseases specialists, virologists, pharmacists, dentists, psychiatrists, radiologists, physiotherapists and all other related experts in the biomedical community plus top policymakers, including heads of state, parliamentarians and all men and women of goodwill in Africa, must be prepared to go an extra mile.

The things that defined modernity are at a standstill or gone in barely three months. The “modern world” seems to be wobbling towards a chilling socio-economic chaos or halt. Thus, the virus by simple projections of swelling daily data was clearly set to infect well over 3 million people or more by June if the same trend continues. The emergence of COVID-19 in early December 2019 from the epicenter -Wuhan, China, was loaded with lots of unnecessary controversies. This included “US-China” openly blaming each other for triggering the outbreak of the pandemic.

## Redefining Life

*The new coronavirus that has paralyzed, or imprisoned, modern humans is considered to be at the lowest step in the ladder of life or at the borderline between living and nonliving things. But it is shredding the apparently very weak threads that bind the 21<sup>st</sup> century world.*

The war against COVID-19 remarkably began with the closure of learning institutions- schools, colleges and universities. These institutions practically symbolize human being’s efforts and determination to acquire knowledge and skills needed to attain sustainable survival or development - including good health,

Many other important activities and institutions have ground to a halt. Businesses, sports and games, including the Olympics which bring nations together, will not be held this year.

Air travel, railways, cruise ships, hotels, are grinding to a halt. Churches, Mosques, Temples and other major centers of spiritual nourishment have been shut down due to the fear of coronavirus and attempts to stop it. Nations have closed their borders and want people to keep indoors in the name of curbing the spread of the new coronavirus that seems determined to push modern civilization back to stone-age.

Manufacturing and global trade faces major challenges, leading to mass layoff of employees thereby occasioning unprecedented spike in numbers of unemployed people. At the onset, and may be due to panic, some nations, like India, Russia, Germany and Turkey, are said to have decided to curb exports of essential drugs and medical items that may be needed to help them cope with increased illness.



## KEMRI, KU

**A**frican nations may find themselves focusing on homegrown manufacturing of essential items needed to cope with the pandemic thus opening room for policies that emphasize self-reliance. Indeed, In Kenya, Kenyatta University has produced a prototype ventilators. There is an explosion in production of masks barely a week after some French medics allegedly talked of a continent unable to make even face masks and protective clothing. It means a new window of opportunities for universities, technical and research institutes have unique opportunity to convert a mistune into success availing much needed products and services of their innovations and R&D activities.

Another example that deserves continuous highlight is the Kenya Medical Research Institute's high-quality sanitizer, which has been taken for granted over the years. It is suddenly in great demand, opening a new window for more home-grown manufacturing sector or industrialization and also making it easier to push R&D funding. Even more policies to allow institutions to appropriately gain from their innovations are urgently needed. This will minimize the time and resources spent searching and pleading with donors.

Humans must chart a new path to sustainable survival on the planet earth during the coming years of 21<sup>st</sup> century. The murderous story of the new corona virus will be retold unless another vicious virus emerges to surpass its disruptive and fatal impacts of ongoing ruthless dismantling of "modern infrastructures and entrenched ancient spiritual institutions"

Finally, African countries are increasingly giving the pandemic the attention it deserves after what initially seemed like a slow start and fear to boldly stop importation of the COVID-19 from other developed continents into the region.

However, the focus for Africa should be on where this vicious new coronavirus is heading. It is already busy killing people in the continent. Medical community and global health institutions and organizations are deeply worried about the potentially unlimited problems facing African nations.

# COVID-19 MICRO-DROPLETS AIRBORNE?

**T**here are whispers of sneaky tiny micro-droplets that may stay in the air for a while and can be pushed by air-steam when windows are open.

One of the world's leading experts in microbiology and infectious diseases, Prof Kazuhiro Tateda, who also studied internal medicine and President of Japanese Association for Infectious Diseases, says that so far the world has considered only two main routes of transmission. One is infection by coming into contact with something that has the virus on it. The other is infection through droplets emitted in sneezes and coughs. However, Prof Tateda says there is possibly a third infection route which might be the key to preventing a further spread of the virus.

"It seems transmissions are happening during conversations and even when people are standing a certain distance apart. These cases can't be explained by ordinary droplet infection. We think infection comes from "micrometer particles". This transmission mechanism can be called "micro-droplet infection which occurs when people are in close contact to or when just talking," Prof. Tateda and his team claim.

A number of people infected do not remember anyone sneezing or coughing near them and the spreading of micrometer particles may appeal to many. It may promote the use of appropriate masks. Some experts generated confusion among the public when they initially explained in vain that masks were not necessary except for medics.

**HOW IS CORONAVIRUS TRANSMITTED?**

- The virus lives in droplets of water in an infected person's respiratory system.**
- If they sneeze, cough or touch their mouth, these particles can spread.**
- These particles can then land in the mouths or noses of uninfected people.**
- The coronavirus particles can then even be inhaled.**

World Health Organization  
REGIONAL OFFICE FOR Africa



## Tracking Covid-19 Worldwide Communication Gaps

The Professor and his team are tracking particles in the air using laser beams and a high sensitivity camera. This technology to detect droplets as small as 0.1 micrometer wide.

The experiment starts by first sneezing. Large droplets around 1 millimeter in diameter quickly falls. But looking through high sensitivity camera small particles smaller than 10 micrometers glitter while floating in the air.

They are small and light you can see them drifting through the air. These are micro-droplets meaning sneezing isn't the only source of droplets.

*Same experiment is run on a close-range conversation. People generate a lot of micro-droplets when they talk loudly. The droplets between these two stay where they are, they don't drift away.*

It's not yet known what volume of micro-droplets leads to infection but Prof Tateda says we can't rule out the possibility that micro-droplets can spread the virus to some extent.

"Micro-droplets carry many viruses. We produce them when we talk loudly or breathe heavily. People around us inhale them, and that's how the virus spreads. We're beginning to see this risk now," he said.

The risk of infection through micro-droplets becomes even greater in a closed space with poor ventilation. This lab is simulating the movement of micro-droplets in an air tight room. About 10 people in an enclosed space, the size of a classroom. A person coughs once and spreads about 1,000 droplets.

In the experiment, large droplets are shown in blue and green, most of these fall to the ground within one minute, but the micro-droplets shown in red continue. When simulation uses only micro-droplets. Five 20 minutes later, the micro-droplets are still floating in space.

"If the air isn't flowing, the micro-droplets won't move. And since they can't move on their own, they stay in place for some time," says Marashi Yamakawa, Associate Professor at Kyoto Institute of Technology.

But there is a way to prevent this stagnation of micro-droplets. Opening windows and increasing air circulation believed to be effective. When you open a window, micro-droplets are quite quickly swept away. They are very small and light, so any air flow will get rid of them.

"What's important is to create two openings. Do this at least once an hour, that lowers the risk of infection considerably," adds Tateda. For millions of ordinary people the new corona virus is found in the air and contaminated items and surfaces with hands playing a key role.

***(Not Airborne? Half-airborne for Medics? Floats or Stays in the air for a short period? , Masks not a must? May be Masks? Masks Needed? Jail if no masks?)***

The pandemic emerged into the world of human beings barely three months ago and there is much to be learnt about it although the world already seems overloaded with all sorts information with overwhelming emphasis on keeping safe distance

However, like other seemingly strange and vicious viral diseases that have emerged in the last five decades Covid-19 pandemic has also emerged with a few complex communication problems. The transmission from hand to mouth, nose and eyes seems well understood.

Is the academic or "medical" definition of airborne also for the public during this tragic period congested and overloaded with unlimited information including pseudo-science worsened by poorly explained science in face of what currently seems to be endless deaths. However, is it also partially or fully airborne or both? Or even none of these? When it comes to this question, answers may even get more complex. What about elements of time, distance, humidity, wind speed, temperature especially detail about the sun's ultraviolet radiation?

*Updates on key sources or drivers of COVID-19 already include sneezing, coughing, contaminated surfaces, discharge from the nose and the latest even points at talking and even breathing.*

Some researchers have also talked of micro-droplets which may float in the air for a while but the claim is yet to be subjected to rigorous peer reviews and has found its way into the social media and news outlets not peer reviewed journals.



By

**Dr Matshidiso Moeti**  
**(WHO Regional  
Director for Africa)**

**“In the COVID-19 response, nurses are working non-stop to provide quality care, share health information, implement infection prevention and control, serve in intensive care units, and ensure routine services continue to be delivered. Midwives are continuing to support mothers to safely deliver their babies”**

## Nurses, Midwives at Frontline of War against COVID-19

This year, on World Health Day, as front-line health workers lead the charge against the COVID-19 pandemic, we at WHO want to appreciate the life-saving roles of nurses and midwives. This is a year-long celebration, as part of the International Year of the Nurse and the Midwife.

Nurses are at the core of the primary health care approach, which is a cornerstone for attaining universal health coverage. They make up at least half of the global health workforce. Midwives and nurses are critical links between individuals, families, communities and the health system. They provide support along the continuum of care, from promotion, to prevention, treatment, and rehabilitation to end-of-life care.

In the COVID-19 response, nurses are working non-stop to provide quality care, share health information, implement infection prevention and control, serve in intensive care units, and ensure routine services continue to be delivered. Midwives are continuing to support mothers to safely deliver their babies.

We must do more to recognize the contributions of nurses and midwives in empowering patients and communities, facilitating multidisciplinary teamwork, and providing holistic care.

Survey responses from 39 countries in the African Region, show a slight increase in the number of nurses and midwives from 1.02 per 1000 people in 2005 to 1.06 in 2018. This is still far below the number needed to achieve universal health coverage and the Sustainable Development Goals. In low- and lower-middle-income countries globally, the number of nurses is not keeping pace with population growth.

To improve this situation there are key actions we can collectively take:

To better understand the challenges and develop evidence-based policies, health workforce data collection, analysis and use needs to improve.

Education and training should be quality assured and relevant to evolving disease burdens in countries. So far, around 30 countries in the African Region have an accreditation body for training institutions. More investment is needed in retention and career development, and to ensure decent work conditions.

Nurse mobility and migration must be effectively and ethically managed. Presently, over 80% of the world's nurses are in countries that account for half the global population. Regulation must ensure nurses and other health workers are accountable for the health of populations.

Finally, nursing leadership and governance is critical to nursing workforce strengthening, including through collaboration between chief nurses and relevant ministries (such as education, immigration, finance, labour) and the private sector to address the needs of nurses and midwives.

In taking forward these actions, I'm pleased to join the WHO Director-General and my WHO fellow regional directors in launching the first ever State of the World's Nursing Report 2020. This report details the significant contribution that nurses make to promoting health, keeping the world safe and serving the vulnerable. This report is an excellent tool to shape policies and strategies based on evidence.

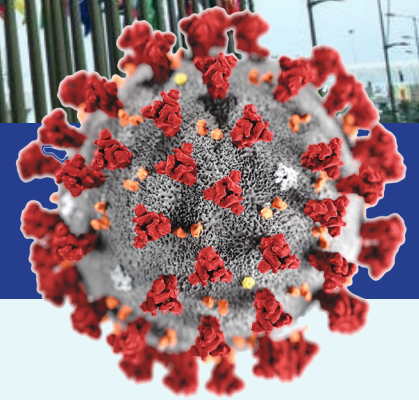
Even more so as we respond to the COVID-19 pandemic, and every day, I ask that we appreciate the valuable service of nurses and midwives in improving health and well-being and saving lives.





African Union 

## African Union Reviews COVID-19 Impact on Economy



The African Union has moved fast to develop and present a timely report alerting member states of the emerging socio-economic impacts of COVID-19. For example, direct trade links with other continents will be affected while remittance from the African Diaspora will decline. Still deaths and illness will take a heavy toll on the economy.

Key Recommendations include:

- Systematically checking all suspected cases, forestalling contacts between infected patients and those not infected. Appropriate use of lockdown to curb the spread of COVID-19.
- Countries should report the health statistics and collaborate with WHO and the African Centre for Disease Control and Prevention.
- Countries should prioritize spending in health care and medical research. Coordinate through Africa CDC all efforts to mobilize laboratory, surveillance, and other response support where requested and make sure medical supplies go where they

are most needed.

- Take economic and financial measures to support enterprises, SME and individuals as a response to temporary jobs cut to safeguard economic activities. Waive tax payments in critical sectors and local sourcing by the public sector in its response to the crisis would support the SMEs and other businesses.
- Countries should renegotiate external debt payment plans, including suspension of interest rates payments for the time of the crisis. Lead negotiations of an ambitious plan for the cancellation of total African external debt (\$US236 billion). A first order of magnitude is the call by Ethiopia's Prime Minister, Abiy Ahmed, for a \$150 billion aid package as part of an Africa Global COVID-19 Emergency Financing Package.
- Call for a cease-of-fire with rebels and armed groups to ensure there is no distraction in

efforts to contain the pandemic. Ensure closure of borders does not trigger a food crisis.

- African countries need to increase trade within themselves and increase agricultural production. Sub-Saharan Africa spent almost US \$ 48.7 billion on food import (US \$ 17.5 billion for cereals, \$4.8 billion for fish etc).
- Tanzania's effort on self-sufficiency in rice and maize is to be set as an example.
- Countries should sign and ratify African Medicine Agency (AMA) to produce medical and pharmaceutical products to reduce Africa's imports and ensure high quality control of the production.
- Accelerate the implementation of the Continental Free Trade Zone and Financial Institutions to achieve industrialization as quickly as possible.



### Push-Pull technology

Resilient, adaptable conservation agriculture technology for Africa

Push-Pull technology addresses concurrently problems of stemborers, striga weed, soil fertility and soil moisture retention in cereal crops. It opens significant opportunities for small-holder growth and, represents a platform technology around which new income generation and human nutritional components, such as fodder and livestock keeping, can be added.



## FOCUS ON *icipe*'s TRANSFORMATIVE PUSH-PULL TECHNOLOGY

### Innovative Push-Pull Technology: Proven method for controlling striga weeds, stemborers, Fall army worm and soil fertility improvement



By **George Achia**  
(Managing Editor)



**Sharon Atieno**  
(News and Online Editor)

For many years, farmers across Sub-Saharan Africa (SSA) have experienced low production of most cereals due to many constraints including degraded soils, effects of stem-borers, Fall armyworm and parasitic striga weed, resulting in reduced agricultural productivity and increased incidences of hunger and poverty for small-holder farmers within the continent.

According to experts at Nairobi-based International Centre of Insect Physiology and Ecology (*icipe*) losses caused by stem-borers alone can reach as high as 80 per cent in some areas and an average of about 15-40 per cent in others, while striga weeds on the other hand can cause losses ranging between 30 and 100 per cent in most areas, and are often fueled by low soil fertility prevalent in the SSA region.

As farmers were battling with these challenges affecting cereal productivity in SSA, scientists at *icipe*, were busy in their laboratories to find out a sustainable solution to salvage farmers from the devastating effects of the parasitic striga weed, poor soil fertility and the stemborer.

In the team was Prof. Zeyaur Khan, the Push-Pull Technology programme leader and Principal Scientist, based at *icipe* Thomas Odhiambo Campus (ITOC) in Mbita, Western Kenya, Dr. Charles undertaking research on chemical ecology of the technology, David Amudavi, the Executive Director of Biovision Africa Trust, who had just returned to the country and started his post-doctoral research on the programme in 2006 and Mr. Jimmy Pittchar piloting innovative ways of engaging with the farmers on the emerging technology.

While Prof. Khan was leading the team at *icipe* to investigate the ecology of stemborers, Dr. Amudavi on the other hand was leading efforts to set up Biovision Africa Trust and to create the Farmer Communication Programme (FCP) including training and education of farmers on the technologies that were being developed by *icipe* and other research institutions in the area of sustainable agriculture.

Initially, Prof. Khan's team was keen on answering the one key question; how could the resource poor farmers in sub-Saharan Africa be cushioned from the yield losses caused by stem borers, striga weed and poor soil fertility to improve their livelihood?

The Push-Pull Technology story began in 1994, with the original research focusing only on stem borer control. Striga weed control was an accidental discovery in the process of research which necessitated further studies to elucidate the mechanism of striga suppression by not only Desmodium but also food legumes. Additional benefits of the technology were discovered later as more farmers took up the technology and provided feedback to researchers at *icipe*.

Prof. Khan's team was working on the fact that stem borers naturally fed on wild grasses, but the insects began feeding on maize when farmers started maize cultivation across Africa. Lack of defense mechanism in maize allowed insect population to flourish and became a problem of economic importance.

"It used to be thought that native grasses caused the stem borers problem and that getting rid of them would remove stem borers too," says Prof. Khan in one of the *icipe's* reports on *Climate-smart, Sustainable Agriculture for Africa*.

Yet, many grasses provide a habitat for stem borers' natural enemies, to help keep their population under control. At the time, no one had studied the relationship between the grasses and the stem borers in depth, a development that prompted the team to explore more.

The scientists undertook a study on over 400 wild grasses in order to understand stem borer migratory behavior, and host preferences during off and on seasons. As a result of this study the grasses were grouped according to their efficacy in attracting the gravid female moths to lay eggs and their ability to support larval development.

"We already knew that some wild grasses act as 'trap plants', enticing egg-laying

female stem borers but depriving the larvae of a suitable environment," says Khan, adding that this is because the grasses also attract the stem borers' natural enemies.

The study results indicated that around 30 grass species were suitable hosts for stem borers, but only a few of them attracted both moths and their enemies. "These grasses were the ones with potential to be exploited as trap crops to draw the borers away from the maize and reduce their populations," adds Khan.

Two grasses – Napier grass and Sudan grass – appeared particularly promising as trap crops. The grasses were providing a 'pull' effect by releasing overhead volatiles (semiochemicals) with an effective defense mechanism to protect themselves against stem borer attack.

The researchers were stunned with the Napier grass which had an ingenious way of defending itself by secreting a sticky gum that could trap the borer and preventing most larvae from completing their life cycle. By 1997, the researchers began on-farm validation trials to evaluate the suitability and effectiveness of Napier grass as a trap crop.

While visiting Kenya Agricultural & Livestock Research Organization's Kitale research station, Prof. Khan describes how he came across the repellent effects of another fodder crop, molasses grass. This discovery was to become the 'push' component of their research study.

Meanwhile, at Rothamsted Research, *icipe's* research partners in the United Kingdom (UK), scientists there, led by Prof. John Pickett, who is the Scientific Leader of Chemical Ecology, were also busy piecing the puzzle together by investigating the nature of the plant volatiles that attract or repel stem borer moths.

"The next step was to investigate the volatile produced by the intercrop plants – the 'push' chemicals – and to find out why the Molasses grass (*Melinis minutiflora*) repels stem borers but attracts their natural enemies," explains Prof. Khan.



Prof. Zeyaur Khan, Principal Scientist and leader Habitat Management Programme at ICIPE (pictured) says that so far, 250,000 farmers have embraced push and pull technology in Sub Saharan Africa (SSA) where it has proven worthy in the management of Fall Armyworm (FAW) besides farmers controlling of striga and stem borer, have fodder and improved soil fertility.

## Accidental discovering of Desmodium

Molasses grass was already accepted by farmers as a 'push' intercrop because of its added benefits; as fodder for cattle, and also a tick repellent. Literature indicated that intercropping with legumes (mixed cropping systems) reduced pest infestation, the scientists embarked on testing different legumes to find additional plants that had similar pest repellent traits as the molasses grass.

Prof. Khan came across silver leaf Desmodium seeds at Simlaw (Kenya Seed) along Kijabe Street in Nairobi, while purchasing vegetable seeds for his garden. He decided to buy small quantities to include in the maize legume experiments.

The team focused their energy now on legumes, since the legumes not only provide nutritious food and forage, but also improve soil fertility because they fix part of their nitrogen requirements from the atmosphere. Silverleaf Desmodium (*Desmodium uncinatum*) turned out to be the most effective legume intercrop in the control of striga weed not only above the ground but also below the ground through

depletion of striga seeds. At this time when the research was ongoing, the then Suba district agricultural officer visited *icipe* team at their Mbita research station and inquired if there was anything the researchers could do about the devastating effects of the parasitic *Striga* weed, which had infested many farms around the Lake Victoria region. Fully focused on the stem borer research, the team declined the officer's request, but little did they know they were on verge of yet another milestone discovery.

"All our experimental plots were infested with Striga," says Prof. Khan. "So imagine our amazement when we discovered that maize plots with Desmodium intercrop not only had little stem borer damage but also had very little or no *Striga* infestation after only one growing season which had even greater effect on increasing maize yields than when only stem borers were controlled," says Khan.

Fast forward, when scientists from *icipe* announced the breakthrough in use of Desmodium legume in controlling of cereal pests like stem-borer and *Striga* weed, the announcement offered a sigh of relief to many farmers who had been struggling with the pest and the weed.

The discovery of Desmodium's ability to control striga weeds and stem borers, with capability to fix more nitrogen in the soil thus improving soil fertility, led to the use and adoption of what the scientists at *icipe* called the **Push-Pull Technology**. By 1997, dissemination of push-pull package of silverleaf Desmodium and Napier grass had begun and the number of farmers using the technology had started to grow steadily.

By 1998, after *icipe* scientists had introduced silver leaf Desmodium as a pest control strategy, more than 2,000 farmers had started intercropping their food crops with Desmodium and bordering their farms with *Napier* grass.



## 'Push-Pull' as crop management strategy



According to Dr. Amudavi, 'Push-Pull technology' is a conservation agricultural method that was developed for integrated management of stemborers, *Striga* weed, soil fertility and now the Fall Armyworm.

The technology was developed by scientists at *icipe* and Rothamsted Research, in the UK, in collaboration with national partners like the Kenya's Ministry of Agriculture; Kenya Agricultural and Livestock Research Organization [KALRO, formerly Kenya Agricultural Research Institute (KARI)]; Uganda's National Agricultural Research Organisation (NARO); and Tanzania Agricultural Research Institute (TARI). Further research and dissemination of the technology has been supported by various partners including Send a Cow, One Acre Fund, Heifer International, Food for the Hungry, International Center for Tropical Agriculture, Conservation Farming Unit, among others.

The Push-Pull Technology has proven to be appropriate and economical to the resource-poor smallholder farmers in the

region as it is based on locally available plants, not expensive external inputs like use of fertilizers, and fits well with traditional mixed cropping systems.

"This is a green conservation technology for controlling agricultural pests **such as stemborers, by using repellent «push» plants and trap «pull» plants**, with an ability to improve soil fertility, control soil erosion and aflatoxin while providing fodder all year round", Dr. Amudavi told **ScienceAfrica**.

The technology involves intercropping maize with a repellent plant, such as *Desmodium*, and planting an attractive trap plant, such as Napier grass, as a border crop around this intercrop.

In simple terms, he explains how the technology works: *Desmodium* produces a smell or odour that repels (the push) the stemborers moths from the cereal crop. The Napier grass produces a scent that attracts stemborers moths (the pull). The stemborer moths like to lay eggs on *Napier* grass; however, these grasses do not allow the stemborers larvae to develop into adults, thus they die.

He further notes that *Desmodium* also controls *striga* weed by producing two sets of chemical compounds through its roots (root exudates). The first set of chemical compounds encourages rapid germination of *striga* seeds while the second prevents root-to-root attachment of the parasitic *striga* to the crop leading to suicidal germination (*striga* dies).

In addition, *Desmodium* controls soil erosion, helps fix nitrogen, adds organic matter to the soil, increases carbon sequestration and phosphorus bioavailability thus improving soil fertility, and being a live mulch, it also improves soil moisture retention.

The research and development for the push-pull strategy was funded by a number of partners including the Gatsby Charitable Foundation of the UK, Kilimo Trust of East Africa, the Rockefeller Foundation, the UK's Department for International Development, and the Global Environment Facility of the UNEP, Biovision Foundation, the European Union among others.



## Scale up of the technology beyond East Africa

This crop management strategy leads to economic benefits on the level of individual smallholder and subsistence farmers through different income streams coming from the sale of surplus grain, Desmodium seeds, fodder, and milk. It is this wide range of benefits it provides to farmers and its adaptability to individual needs that necessitated its scale up to other countries within SSA.

According to Dr. Saliou Niassy, Scientist and Head of Technology Transfer Unit at *icipe*, for a long time, Push-Pull technology was confined in East Africa until 2016 when they started expanding to other regions within SSA through the funding from Biovision Foundation.

The technology was first implemented in Kenya, Uganda, Tanzania and Ethiopia. By 2017, over 160,000 small-scale farmers had adopted the technology. In Kenya, it became very popular among the farmers in Western Kenya where striga weed has been a major challenge with increased need for animal fodder amidst growing reduction in land sizes and the uptake continues to rise. The technology was also disseminated in Central Kenya.

According to Dr. Saliou, the Push-Pull for SSA project was launched in 2016 and aimed to reach 350,000 farmers in SSA and anticipated a 20 per cent adoption (70,000) by 2018.

To date, the technology has been scaled up/out to 17 SSA countries including Malawi, Zambia, Zimbabwe, Rwanda, Burundi, Kenya, Uganda, Tanzania, Ethiopia, Ghana, Senegal, Togo, Benin, Burkina Faso, Cameroon, Nigeria and Congo, with other countries already showing interest in adopting the technology. So far, over 235,000 farmers have adopted the technology.

## Training of farmers

In order to fast-track uptake and sharing the knowledge around the technology, the Technology Transfer Unit at *icipe* has been leading efforts to train and educate farmers on how the technology works while Biovision Africa Trust is involved in communication component of the technology through its radio programme and other channels like the TOF magazines.

“Training in scientific methods encouraged farmers to experiment and own the technology and pass on their new knowledge to others,” explains Dr. Amudavi.

By training a network of farmer-teachers, helping establish farmers’ groups, and facilitating farmer field days, they created a mechanism for rapid adaptation.

Dr. Amudavi’s key role when he joined *icipe* in 2011 was to establish Biovision Africa Trust which was to handle the farmer communication programme including training of farmers and the communication components to educate farmers on different technologies developed by *icipe*.

“This was one of the foundational program responsible for communicating and passing information to farmers and training farmers on different technologies that are waiting to be put into use,” he says.

His team has employed different methods in disseminating information to farmers. Some of the ways they have successfully employed include use of their maiden *The Organic Farmer Magazine*, popularly referred to as TOF, use of farmer videos, training modules for farmers, outreach centres in eleven counties in Kenya and TV and radio talk shows.

“We educate smallholder farmers on sustainable farming practices to help them improve their livelihoods while conserving the environment through Push-pull technology. Most of these families rely solely on farming for their income but struggle to make a decent living due to low yields caused by inappropriate farming methods and inaccessibility to information on appropriate farming methods,” says Dr. Amudavi.

# Push-Pull Technology and Fall Armyworm

Even as farmers across the region were beginning to enjoy the benefits that comes with the technology in addressing the challenges of stem-borer and *Striga* weed, another disaster befell upon farmers in the region: The invasion of Fall Armyworm.

The Fall armyworm was reported to have migrated across Africa reaching 50 African countries by 2016, according to United Nations Food and Agriculture Organisation (FAO). By 2017, the Fall armyworm had reached parts of eastern, southern and northern Africa, attacking 250,000 hectares of maize.

The pest posed serious threat to SSA farmers since it spreads fast because one female moth lays 1,500 to 2,000 eggs in three weeks. The larvae feed on 100 plant species including maize, rice, sorghum, millet, sugarcane, vegetables and cotton. They devour leaf whorls, ears and tassels of maize crops, resulting in zero yield.

“The push-pull technology was initially designed for the control of the cereal stem borers, but now it has an added innovation for the management of the fall armyworm. It can minimize 80 per cent destruction caused by



the Fall Armyworm,” explains Dr. Saliou.

Just like in stemborer management, Desmodium offers protection by emitting substances known as semiochemicals, which repel fall armyworms. Then semiochemicals released by the border crop and Napier grass attract the fall armyworms from the crops.

## Challenges

With the invention of the Push-pull technology as a crop management strategy, over 235,000 farmers across the region are now using the technology to improve their livelihood. According to Dr. Saliou, most farmers adopting the technology have increased their maize yield by over 100 per cent. However, just like any novel innovation, this strategy has had its own share of challenges in adoption within the region.

Both Dr. Saliou and Dr. Amudavi agree that these challenges stem from access to seeds by farmers to policy constraints that limit effective and efficient deployment of the technology in different countries within SSA region.

The experts note that Desmodium is labour-intensive. Initial push-pull plot establishment requires more labour since the farmer has to plant three crops and measurement is involved.

Dr. Saliou says that access to *Desmodium* seeds and its availability to farmers was a major obstacle that they had to contend with in their efforts to scale up the technology.

“As word spread about *Desmodium's* ability to suppress striga, farmers in some trial sites started clamouring for seed thus creating serious shortage. In addition, its price was high which hindered access for some farmers,” says Dr. Saliou.

To address the seed shortage, *icipe* started working with various stakeholders including seed producers, distributors, regulators to support local production. Meanwhile, farmer-based seed multiplication projects are being established along with seed bulking plots for vegetative propagation.

The project was also geared to help build the capacity of farmers. Three local seed producers have been engaged in Desmodium and Brachiaria seed production in Ethiopia, Zimbabwe and Rwanda, an effort that is anticipated to make the seeds more available locally at low costs.

Dr. Amudavi notes that the need for mandatory national performance trials

on the technology by some countries for three seasons is time consuming. The performance trial needs two conditions to be met before commercialization and wide promotion of a technology; to be tried on station and also on some selected farms to examine how the technology/system works under the control conditions and on the farm respectively.

“One of the big challenges especially in the area of scaling up the technology has been the bureaucracy in the institutions that are supposed to provide approvals for integration into national systems and their inhibiting regulations,” points out Dr. Amudavi.

Further, the technology faced long-standing policy constraints such as regulation concerning seed supply and certification. “Seed Production requires a thorough strategy which includes assessing the demand for the technology. This demand can only be created if we continue promoting the technology and creating awareness about its multiple benefits,” explains Dr. Saliou.

Lastly, land ownership has been another challenge facing farmers since the push and the pull plants are perennial, one can only practice the push-pull on land they own. However with diminishing land sizes, farmers have to rent additional land for cultivation which the landlords often repossess mid-way the contract once their land becomes productive. Land intensification systems in some countries prohibit farmers from adopting available desired technologies.

## Conclusion

The Push-pull technology is one that explicitly demonstrates the concept of ‘from science to impact’. The technology provides a good illustration of the need to base new agricultural technologies on sound science to address the many challenges facing African farmers to improve their farm productivity.





## Gender Disparity in the Push-pull Technology

Addressing gender disparities to increase productivity of agriculture and livestock systems is central to improving security of food and nutrition. This has been a basic principle in the dissemination of push-pull technology. *icipe* estimates that out of the 235,000 plus farmers who have adopted push-pull technology since 1998, of these 52 per cent are women while 48 per cent are men.

According to *icipe*, the high uptake of push-pull technology by women, has been as a result of the technology reducing labour in activities such as weeding which is mostly done by women; increasing grain production thus fulfilling the traditionally female role of 'putting food on the table' and growing household income through improved production of grain, milk or both especially in female-headed households. This means that more time is freed to concentrate on other productive work.

The technology has also tried to bridge the gender gap by reaching women scientists, both social and natural, through hosting the fieldwork of doctoral researchers registered at a number of different universities across eastern and southern Africa.

Out of the 22 PhD students gone through the Push-pull technology programme, 10 were women and 12 were men. In addition to the contributions from their research, some of the former doctoral students have been instrumental in rolling back geographic frontiers of the spread of push-pull.

*icipe* notes that some of Linnet Gohole's work with the McKnight Foundation, for example, concentrated on how push-pull can be adapted to overcome the challenges of adoption in Ethiopia while Lefu Lebesa's position as a government agricultural research manager in Lesotho meant that when striga recently arrived in her country, she was involved in establishing a trial to

evaluate different *Desmodium* species from southern Africa to adapt the technology to local conditions.

However, obtaining gender parity in the uptake of the push-pull technology has been challenging especially in recruiting women as extension agents.

"When we advertise positions for field staff, we say women will be given preference, but unfortunately there are very few women applicants," decries Prof. Zeyaur Khan, *icipe*'s Principal Researcher in *icipe*'s report, *From Lab to Land: Women in push-pull agriculture*.

In an interview carried out by *icipe* on women extensionists, some of the challenges they face include: mode of transportation in rural areas (motorbikes), difficulties in balancing family responsibilities with a job that involves a great deal of travel, challenge of being taken serious by farmers, and overcoming the attitude that it is a man's job. These have been a barrier to attracting female extension officers and farmer-teachers.

In addition, the *icipe* report notes that the technology is not available to all women for various reasons and does not radically transform the life of every woman who adopts it as female farmers have several challenges. These range from: land access, decision-making and labour.

The benefit of the push-pull technology can be maximized only if a plot remains in place year after year, however, access to land including clear and secure tenure is often difficult. This is because in most cases women's access to land is through their husband's family or renting and paying through cash or a proportion of the crop they grow; very few own land outrightly.

Though women want to become push-pull farmers, their husbands have the ultimate power to make decisions about the farm. It takes a lot of persuasion for some of them to allow the adoption of the technology on their farms.

Despite push-pull's labour saving benefits such as less weeding in subsequent seasons, absence of digging over or ploughing the whole plot each season, and significant labour savings in gathering fodder for animals; adopting the technology requires a lot of labour in the first season to ensure the companion plants are weeded correctly and become established. This makes adoption difficult due to the shortage of labour as most households are based around nuclear rather than extended families.

Moreover, the late Sue Edwards of Institute of Sustainable Development of Ethiopia, an *icipe* partner said in the *icipe* report that despite a strong tradition of collective farming, field management for something like push-pull, which is knowledge intensive, farmers can't be borrowed from adjacent fields, or families, such as during harvesting, sowing or weeding, as the optimum labour available is what is in the family.

"Although women in the push-pull programme are majority as adopters, men have dominated numerically as both scientists and extensionists. The development and spread of this programme illustrates how men and women have different roles in the spread of agricultural technology, and that access to the resources necessary for adoption is gendered," *From Lab to Land: Women in push-pull agriculture* report reads.



**Dr. David Amudavi,**  
*Executive Director,*  
*Biovision Africa Trust*

**BvAT works in different countries where it has various projects. The farmer communication programme is being implemented in Kenya and Tanzania while other African countries benefit from the Infonet platform which is virtually accessible from anywhere on the planet.**

## Profile: The Biovision Africa Trust

Established in Kenya in 2009 by the Biovision Foundation for ecological development in Switzerland, Biovision Africa Trust (BvAT) seeks to alleviate poverty and improve the livelihoods of smallholder farmers in Kenya and other African countries through supporting dissemination of information and knowledge on appropriate technologies to improve human, animal, plant and environmental health.

It is supported by *icipe* and has four key priority areas including: research, information communication, educating farmers and resource mobilization.

BvAT conducts research on Ecological Sustainable Agriculture (ESA) to generate technologies and create new knowledge that is key for the smallholder farmers practicing sustainable agriculture.

The organization focuses on value chain development and thus looks at research issues touching on entire value chains as a means of raising rural household incomes. BvAT also undertakes extensive research on policies that are agriculturally sound and promote practices that favor such policies.

In information communication, BvAT packages the information generated from research into different formats including magazines, online database, videos, radio audios, trainers' manuals etc and disseminates it to different users especially farmers. The information is categorized into human, animal, plant and environmental health.

BvAT educates smallholder farmers on sustainable farming practices to help them improve their livelihoods

while conserving the environment. Training is done through demos, farm visits, on-farm group training and farmer training at their resource centers (e.g. Murungaru in Nyandarua County, SINGI in Busia County, Kakamega in KALRO Centre, KALRO Katumani Centre in Machakos County, Kagio in Kirinyaga and Gilgil in Nakuru County).

In addition, BvAT supports resource mobilization strategies to provide grants\technical assistance to public charitable trusts or institutions working with rural communities in organic agriculture.

BvAT works in different countries where it has various projects. The farmer communication programme is being implemented in Kenya and Tanzania while other African countries benefit from the Infonet platform which is virtually accessible from anywhere on the planet.


The Ecological Organic Agriculture Initiative (EOA-I), a continental initiative that holds promise for increasing the productivity of Africa's smallholder farms, with consequent positive impacts on food security is being implemented in 9 countries namely Kenya, Uganda, Tanzania, Ethiopia, Rwanda, Senegal, Benin, Mali and Nigeria.

Moreover, the Global Knowledge Centre for Organic Agriculture (KCOA) project to support a network of regional knowledge hubs for organic farming in Africa will be implemented in 6 countries: Ethiopia, Kenya, Tanzania, Rwanda, Burundi and Uganda.

The organization's strategic partners include Africa Union, Biovision Foundation, *icipe*, Swedish Society for Nature Conservation, Swiss Agency for Development and Cooperation and GIZ.

# PUSH-PULL: MAIZE FARMER'S FIVE-FOLD YIELD

By Duncan Mboya



Dan Ochieng', a 42-year-old farmer from Kisumu County, Kenya, shares his success story of the push-pull technology. Dan was experiencing serious infestations of both fall army worm and striga in his maize fields, when another farmer introduced him to push-pull.

**D**an established his first push-pull maize plot in 2018. In the second season of 2018, the push-pull plot had no Striga (Witchweed) flowers and less damage from fall armyworm (*Spodoptera frugiperda*) than the rest of his farm. When Dan introduced the Push-pull idea to his wife, she encouraged him to expand into a second field and, in 2019, his farm suffered no damage at all from either fall army worm or striga.

"Before Push-Pull Technology, I was getting less than 50kg of maize from my farm. Now I am getting three bags [approx. 270kg] from the two Push-Pull plots."

"I have cows, which I now feed entirely from push-pull fodder - I used to have to ask my neighbours to allow me to graze the animals on their farms. After three seasons of push-pull, I have more peace, no worry, my animals are at home and safe. I have reduced weeding time and so have more time to cultivate vegetables."

When one of his daughters started secondary school, he sold 40kg of maize and some desmodium to pay the initial fees of KES 4,000 a term. He also paid the registration fees of KES 700 each for his two children attending primary school.

Dan has more hope for the future,

"We are not yet food secure, but it is a definite step from where we were," he says. He plans to expand his vegetable plots and use the money from selling the produce to lease or buy more land. By explaining his farm and area of push-pull, he reckons he will achieve food security for his family in the near future.

Neema Machuri and her husband both work on a five-acre farm where they cultivate maize, beans, cassava and cotton in Tanzania's Bunda District. Neema is a member of a Heifer International group and adopted push-pull in 2013.

At first, says Neema, "My husband did not want me to go to the group. But I remained persistent. I ensured that each time I came back from a meeting, I came with something new, with some benefit. And he found it very difficult to refuse. When he realised he could not stop me, he joined me instead."

When the group had developed sufficiently, Heifer International called a meeting to introduce goat, dairy and poultry projects, and asked them to choose which they would like to adopt.

"Women mostly went for goats and

poultry," says Neema, "but I went for dairy, I told my husband and he said 'it will be too difficult for you'. But I said 'no, I will manage,' and said that if he refused me, I would ask for land from a neighbour. In the end he accepted, but told me to accept no support from him."

The other women in the group also tried to discourage her, saying that dairying was too much physical labour for a woman, but Neema wanted a dairy cow. She started the application process and began constructing a unit. Her husband, realising that there was no stopping her, chipped in with time and money for the construction.

"And when the dairy cow was finally brought the husband was really happy," she said.

When the group was introduced to push-pull the year after Neema received her cow, her husband accepted the new Push-Pull technology. He helps Neema on the Push-Pull plot because, she says, he can see that is where the fodder comes from. With her nutritious diet, the dairy cow gives 12 litres of milk a day, and the couple have been able to invest the profit from their sales into digging a well in the compound.



**Prof Abukutsa Mary Onyango: One of Africa's leading researchers on indigenous vegetables for over three decades, is a Professor of Horticulture and Deputy-Vice Chancellor Research, Production and Extension (RPE) at the Jomo Kenyatta University of Agriculture and Technology (JKUAT)**

## FOOD SECURITY

# INDIGENOUS AFRICAN VEGETABLES

*By Henry Owino (Senior Science Correspondent)*

According to Prof. Mary Abukutsa Onyango, Africans have traditionally made use of edible leaves of species growing wild as weeds whose origin was in the African continent. These vegetables were well known to the rural people and were often planted in home gardens as intercrops with staples and could find their way to local markets. For some traditional vegetables, wild collection is still practiced in many parts of Africa especially Southern Africa.

The Research, Production and Extension (RPE) Division, co-ordinates research, production and extension activities which includes co-ordination of exhibitions, workshops and seminars; soliciting for research funds, and production and extension. The division also facilitates income generating activities, besides managing the bookshop and Jomo Kenyatta Academy.

Some work done in selected countries in Africa has identified some of the traditional vegetables that are utilized throughout the continent and could be developed as cultivated crops. Some of the indigenous vegetables that were consumed on the African continent include vegetable amaranths, (*Amaranthus species*), spiderplant (*Cleome gynandra*), African vegetable nightshades (*Solanum species*), cowpeas (*Vigna unguiculata*), African eggplant (*Solanum aethiopicum*), African kale (*Brassica carinata*) and jute mallow (*Corchorus olitorius*).

The use of these vegetables was part of cultural heritage, playing a significant role in customs and traditions and in maintaining equity within the family structure since the appearance on the family table depends largely on the activities of women (Mnzava, 1997).

The introduction of exotic vegetables in the African continent had some negative impact on the consumption and domestication (cultivation) of indigenous vegetables. During the colonial time, a deliberate suppression of the indigenous vegetables was done and a lot of efforts were made to promote the exotic vegetables such as cabbage.

The net effect of such suppression flowed into the post independent era where the governments perpetuated the agricultural policies developed by the colonial rulers. It is only very recently that there has been a significant interest toward Africa's indigenous vegetables grown in home or backyard gardens.

Even in the area of crop research, indigenous vegetables have only won some recognition recently at the International, Regional and National institutions. These institutions include AVRDC-The World Vegetable Center -Regional Center for Africa in Arusha, Tanzania, International Plant Genetic Resources Institute (IPGRI)-now Bioversity International, Nairobi



*Prof. Abukutsa in AIV farm*

and ICRAF-World Agroforestry Centre.

Others are; Plant Resources of Tropical Africa (PROTA), National Agricultural Research Centres (Kenya Agricultural Research Institute (KARI), National Museums of Kenya (NMK)) and Universities in various countries (Maseno, Moi, Egerton, Jomo Kenyatta University of Agriculture and Technology in Kenya, Makerere and Mbarara University of Science and Technology in Uganda, Sokoine University of Agriculture, and Dar es salaam in Tanzania Dscsshang in Cameroon, Hannover in Germany and University of Greenwich in UK) and Indigenous Vegetable Research Group, Ministry of Agriculture and Non-Governmental Organization among others.

African Indigenous Vegetables (AIVs) have been grown and utilized traditionally by many African communities and possess several advantages and potentials that have not been fully exploited (Schippers, 2000). The AIV can be defined as those vegetables whose primary or secondary

centre of origin is known to be in Africa (Schippers, 2000). Vegetables whose secondary centre of origin is Africa may be referred to as 'African traditional vegetables' (Schippers, 2000).

However, the word traditional is used when indigenous or introduced species which due to long use have become part of the culture of a people. Vegetables are a vital component of human diet as they provide essential micronutrients that ensure proper development of the human body and good health (Abukutsa- Onyango, 2007a).

Vegetables have also been known to contain substantial amounts of chemicals normally classified as anti-oxidants. These chemicals are essential for scavenging for and binding harmful radicals in the body if left unchecked and could cause diseases like cancer and diabetes.

# Value of African Indigenous Vegetables (AIV)

## Nutritive Value

**A**frican Indigenous Vegetables have high nutritive value. They contain high levels of minerals especially calcium, Iron and Phosphorus. They also contain significant amounts of vitamins and proteins (Mnzava, 1997). In most cases the mineral and vitamin contents is equivalent to or higher than that found in popular exotic vegetables like cabbage.

On average 100g of fresh vegetable contain levels of calcium, iron and vitamins that would provide 100% of the daily requirement and 40% for the proteins (Abukutsa-Onyango, 2003). African indigenous vegetables are therefore a valuable source of nutrition in rural areas where they contribute substantially to protein, mineral and vitamin intake (Mnzava, 1997).

They are compatible to use with starchy staples and represent cheap but quality nutrient source to the poor sector of the population in both urban and rural areas where malnutrition is widespread. Healthy people need a balanced diet consisting not just of starchy foods but also protein and micronutrient rich foods.

People often consider vegetables to be of limited importance, mainly because they are not aware of the nutritive value. This is a clear misconception because the human body needs major minerals like iron, calcium, phosphorus, magnesium as well as trace elements and vitamins that are essential for the health of the people, especially vitamins such as  $\beta$ -carotene and ascorbic acid.

The nutrient content of these vegetables could be affected by several other factors like stage of growth, storage, cooking, processing and these factors need to be investigated if the nutritional potential is to be fully exploited.

Loss of between 57% and 78% of Vitamin C after 30 minutes of cooking has been reported. For the case of vitamin A, there is low conversion rate of beta-carotene to retinol equivalent the form in which vitamin A is utilized in humans. In case of mineral nutrients such as calcium, iron and zinc the bioavailability is not assured as certain phyto-chemicals like phytates bind them making them unavailable (Makokha and Ombwara, 2005). There is need for studies on bioavailability of such micronutrients.

# Medicinal Value and Health benefits

**A**frican Indigenous Vegetables have medicinal properties as they are usually bitter and some have been known to heal stomach-related ailments (Olembo et al., 1995). Most of such vegetables have been reported to have medicinal properties (Kokwaro, 1993, Olembo et al., 1995). For instance, spiderplant has been reported to aid constipation and facilitate birth while African nightshades have been reported to cure stomachache.

Limited information available on the mode of preparation suggests that the presence of undesirable chemical compounds in these potential crops cannot be overruled. Most of the indigenous vegetables have been reported to contain anti-nutrient factors.

Oxalates found in Amaranthaceae and Solanaceae vegetables may bind calcium and render it unavailable. Alkaloids found in the bitter types of *Crotalaria* and *Solanum* species may cause stomach-ache if eaten in excess, Spiderplants contain phenolic compounds which bind proteins thereby reducing the nutritional value of the vegetable.

The smell of spiderplant caused by an acrid volatile oil has a high phenolic content and glucosinolates which interfere with iodine metabolism as occurs in *Brassica carinata*. These factors need to be investigated as some of the phenols can be anti-oxidants. Due to the limitations mentioned above, successful commercial exploitation of African Indigenous Vegetables, need to be explored.

Another area that could be exploited is phyto-chemicals or Nutraceuticals which are biologically active, non-nutrient compounds that provide health benefits. These phytochemicals help promote optimal health by lowering risk of occurrence of chronic diseases like cancer. Some of the phytochemicals are called antioxidants, scavenge for and bind free radicals that occur in the body these radicals could cause cancer and other ailments if left unchecked.

Further investigation need to be done to elucidate the medicinal properties of these African indigenous vegetables.

## Agronomic Advantages

Indigenous vegetables are well adapted to harsh climatic conditions and disease infestation and are easier to grow in comparison to their exotic counterparts.

African indigenous vegetables can produce seed under tropical conditions unlike the exotic vegetables. They have a short growth period with most of them being vegetables ready for harvesting within 3-4 weeks, and respond very well to organic fertilizers. Most of them have an in built ability to withstand and tolerate some biotic and abiotic stresses.

They can also flourish under sustainable and environmental friendly cropping conditions like intercropping and use of organics. Furthermore, because most of them have not been intensively selected, they have wide genetic bases, which will be important in sourcing for new genotypes and/or genes for adaptation to climate change.

## Income, Employment

African indigenous vegetables have considerable potential as cash income earners, enabling the poorest people in the rural communities to earn a living (Schipper, 2000, Onyango, 2003). Socio-economic survey on traditional vegetables conducted in various parts of Africa particularly in Central, Western and Eastern Africa (Abukutsa-Onyango, 2002; Schippers 2000) revealed that indigenous vegetables are important commodities in household food security.

They provide employment opportunities and generate income for the rural population. Nowadays there appears to be a high demand of indigenous vegetables in cities and major towns. As a result, it makes the intensive production in and around the towns and trading of the same important sources of household income for the urban poor and the unemployed. Over 70% of the traded vegetables in rural markets were indigenous vegetables while in bigger towns was about 10%.

However, there was generally a poor marketing system in some of the countries. (Abukutsa-Onyango, 2002, Schippers, 2000).



## Constraints

### Neglect , Stigmatization

Changed food habits in favour of introduced temperate vegetables lowered the demand of indigenous vegetables, due to the fact that the former fetched higher prices in local markets. Indigenous vegetables were considered out of fashion, poor man's food that could only be used as a last resort.

Thus they enjoyed less social prestige, being associated with the low-income group. As the poor sought to imitate the eating habits of the affluent and were exposed to more fashionable exotic species, the indigenous species became neglected.

The neglect and stigmatization was perpetuated by stakeholders like the policy makers, agricultural training institutions, traders, researchers, consumers and the traders. (Mnzava, 1997). Having been branded and denoted by the agriculturalists and researchers as weeds, the tendency was to eradicate them and not conserve them as it were.

This trend started changing gradually after the promotion and sensitization workshops that were held in Nairobi, Limbe and Maseno in 1995, 1997 and 2003 respectively. (Guarino, 1997, Schippers and Budd, 1997 and Abukutsa-Onyango et al. 2005).

### Value, Potential of AIVs

Lack of awareness of the merits and opportunities of indigenous of vegetables was due to negative attitudes developed by all stakeholders. Although there were indications that indigenous vegetables had some great attributes many stakeholders did not take the facts seriously. This therefore called for deliberate awareness campaigns to promote these indigenous vegetables. This started in the early 1990's and intensified with time.

## Seeds

Lack of quality seeds has been a major hindrance to sustainable production and utilization of indigenous vegetables. Some of the vegetables perpetuate themselves untended, they were harvested whenever they occurred and this system of seed procurement heavily depended on the soil borne seed pool and the ability of these species to reseed themselves.

Seed production has for a long time virtually remained in the hands of farmers, although seed sale in markets was common. For a very long time these vegetables were harvested from the wild, but as the pressure on land increased, they were domesticated and the need for quality seed set in. Normally AIVs are grown as a subsistence crop and most farmers save their own seed from season to season, and sell surplus to other growers.

The quality of such seeds is poor in terms of purity, viability and seed dormancy issues. There is need for production and supply of quality seed to increase yields and quantities produced to meet the unsatisfied market demands of priority indigenous vegetables especially in urban centres

### Lack of Agronomic and Utilization Technical Packages

Indigenous vegetables have often been grown as intercrops with other vegetables or staples, however there has been hardly any technical information on optimal production and appropriate cropping systems. There has been lack of agronomic and preparation packages and access to technical information has been very limited, therefore extension workers have limited knowledge to advise indigenous vegetable growers.

This necessitated research on development of optimal production packages for indigenous vegetables and recipe development.

### Short Shelf Life and Lack of Preservation and Processing technologies

Most of the African leafy vegetables are highly perishable with a shelf life of less than 24 hours at room temperature. This problem would affect quality of the produce at the market and to overcome this problem preservation and processing technologies need to be developed.

## Poor Marketing Strategies

Marketing of indigenous vegetables has been poor dis-organized leading to great losses of the produce in transit or in markets. The major constraints of marketing include: abundance of vegetables during the rainy season leading to low prices and scarcity during the dry season; exploitation of traders due to lack of market information; lack of inadequate market and transport infrastructure.

This calls for identification and creation of markets for indigenous vegetables and possibly linking farmers/farmer groups to appropriate markets

### Consequences of the Constraints

The consequences of the constraints were low production and poor distribution of indigenous vegetables. Farmers achieved very low yields of 1-3 tonnes per hectare, far below the optimal levels that range from 20 to 40 tonnes per hectare (Abukutsa-Onyango, 2003) leading to low consumption and utilization resulting in loss of biodiversity.

Increased and sustainable production and utilization of AIVs can be attained by ensuring supply of quality seed and development of environment-friendly production and utilization technologies. Improved production technologies like spacing, fertilizer rates and use of organic sources of manure will lead to increased yields and improved nutrition and economic empowerment of the rural communities in Kenya and other parts of Africa, and in urban and peri-urban regions.

Professor, Mary Oyiela Abukutsa-ONYANGO is currently the Deputy Vice Chancellor, Research, Production and Extension (RPE), Professor of Horticulture, Faculty of Agriculture, Researcher, a member of Professor's Forum Committee at the Jomo Kenyatta University of Agriculture and Technology (JKUAT), based in Juja town, Kiambu County, Kenya.

(Prof Abukutsa's Mission Statement Reads as follows: "I am committed to Live, Learn and Provide Excellent Service with Integrity, Love, Joy, Kindness, Humility and Honesty so that I am Optimally used for Worthy Purposes in the Community and Leave a Legacy")



# TVETA DEVELOPS NEW MANAGEMENT INFORMATION SYSTEM

By Dr. Kipkirui Langat



**T**echnical and Vocational Education and Training Authority (TVETA) is a public corporate agency established under the Technical and Vocational Education and Training (TVET) Act No. 29 of 2013 to regulate and coordinate training in the country through the accreditation of institutions and programs and the registration and licensing of TVET trainers.

TVETA has developed TVET Management Information System (MIS) or service portal that has automated the accreditation of TVET institutions and programs and the licensing of trainers/assessors and verifiers.

Since it started providing services to the public in 2014, we have been rendering most of our services manually with limited automation.

For instance, previously those applying for consideration as TVET trainers used to download forms from the Authority's website, print, fill, scan and then sent to an email provided in the forms. The TVETA staff would also download these applications, evaluate and send them to the TVETA Board for consideration. Feedback is then provided to all applicants via their emails. This was a tiresome and time-consuming exercise.

However, now with the development of the online portal for all services, we have successfully managed to make the application process seamless, faster and easier for our clients as we endeavor to meet the tight deadlines specified in the TVET Act, 2013 and complemented in our Service Charter.

In the first phase, the portal has automated the whole application and feedback process for the accreditation services. Those applying for registration and licensing of colleges will now apply through the portal and attach all the required documents. The applicant will receive the Board's decision either approving or declining accreditation of college or program in their signed-up account in the system. In between, the applicant will be given alerts and can track the status of the application.

In case the Board approves the registration and or licensing of the institution or program, a registration certificate and or license is automatically generated by the system. The applicant can then download and prints. The same will also apply for individuals seeking licensing as either TVET trainers, verifiers and assessors.

The MIS has now made it possible for TVET institutions to henceforth start submitting their annual returns to the Authority online via their signed-up accounts. This includes information about their student enrolments, staff, infrastructure, course uptake, dropout rate, and any other relevant information.

Equally, individuals seeking for "Letter of No Objection" for submission to the registrar of companies for purposes of registration of names of institutions will now make an application online instead of coming to TVETA offices with hard copies. The Authority will approve or decline and send the letter to the applicant to download, print and take to the registrar of companies.

The system, therefore, has been created to improve efficiency by allowing the users and our staff to track the entire process of registration from the first to the last step. The portal guides the users during the entire application process and prompts them on all the requirements at each step. This includes the uploading of all the required documents and online options for the payment of service fees.

Once the process is completed and the application submitted, the system automatically gives an alert. It also gives notifications whenever an action has been taken by our staff or when certain requirements are needed to be fulfilled or met within specific timelines. This has made the application process very interactive and responsive to the needs of our clients.

It is important to point out that the system has also been developed to be compatible with mobile devices such that those applying for registration and licensing of colleges and programs, as well as trainers, can easily do so within the comfort of their mobile phones.

While an application for accreditation of training institutions, programs and trainers will now be done online, it is important to note that the MIS comes with the ability to produce custom reports based on the specified parameters. This would be reports on the number and gender of trainers per institution and county, the list

of accredited institutions per category/ type and per county and other system customized reports.

In the second phase of development, which is currently going on, the MIS will seek to introduce advanced features that will enable more intelligent processing of data to obtain information. The functionality revolves around building data models and the corresponding software that will make it possible to flag critical cases that require immediate intervention, help predict certain outcomes, help plan more accurately, among many other data-supported decisions.

The MIS will have a Service Desk that will allow our clients to seek any information about all the services we offer. The Desk incorporates a knowledge base that provides the most sought-after information and adapts to the ever-changing client requests. It will be integrated into our social media platforms like Facebook,

Twitter, Instagram, and YouTube to create seamless service delivery. It will also have a user-friendly platform for client feedback and complaints.

The system provides features for conducting tracer studies which will help determine the relevance of each training program and the delivery method(s). The tracer studies will go up to 18 months after the student graduates and will be done at a 6-month interval.

Even more fundamentally, the TVET MIS will have an interface through which other systems within the Ministry of Education and the rest of the government can be integrated to facilitate smooth knowledge and information sharing. Among the systems that the MIS will integrate to include; IPRS, Ecitizen, KUCCPS, HELB, NeMIS, Labour Market Information System, KNEC, CDACC, and KNQA sites.

The TVET MIS brings about the new age

where everything is done by the touch of a button with limited interaction with paperwork. It will not only allow us to reach out to more clients and provide feedback within a shorter time, it will also immensely improve our efficiency in collecting factual and timely data on institutions, trainers and students. This will be useful for the efficient regulation of the sector.

Technology is out here to make our work easier and efficient and the TVET MIS does not fall short of expectations. However, any good thing is improved over time and depending on the lessons learned and changes in time, we will keep on improving the portal and even bring more, if not all our services, under one-stop-shop.

*The writer is the Director General/CEO, TVET Authority (Email:langat.langat@tveta.go.ke)*

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## TVETA MANDATES TO TECHNICAL INSTITUTIONS IN KENYA

By **HENRY OWINO (Senior Science Correspondent)**

**T**he Technical and Vocational Education and Training Authority (TVETA) is a State Corporation established under the Technical and Vocational Education and Training (TVET) Act No. 29 of 2013.

Section 7 of the Act, 2013 gives the powers and functions to the Authority to regulate and coordinate training at TVETs in Kenya and promote access, equity, quality and relevance in programmes and courses at TVETs. It ensures these by registering, accrediting and licensing TVET institutions, trainers among other functions.

The Authority is governed by a Board to implement functions, is appointed by the Cabinet Secretary responsible for Technical and Vocational Education and Training while the day to day affairs are managed by the Board's Secretariat, headed by a Director General.

The Kenyan TVET sector comprises of National Polytechnics, Technical Training Institutes (TTIs), Vocational Training Centres (VTCs), Technical Trainer Colleges and any other category specified by the Cabinet Secretary, Ministry of Education Science and Technology.

TVET Authority main aim is to deliver a competitive workforce meant to be relevant in the Kenyan market. To do this, the institution oversees the registration, licensing, development and accreditation of technical institutions within its mandate.

This is in addition to certifying trainers and developing the curriculum in conjunction with Curriculum Development Assessment and Certificate Council (CDACC).

The Technical and Vocational Education and Training Curriculum Development, Assessment and Certification Council (TVET CDACC) is a body corporate established under the TVET Act, 2013. The Council is mandated to undertake design and development of Curricula for the training institutions' examination, assessment and competence certification and advise the Government on matters related thereto.

This is in line with Sessional Paper No. 2 of 2015 that embraces Competency Based Education and Training (CBET) system. The CBET is a methodology used to deliver technical and vocational education and training that focuses on what the learner "should be able to do" at the end of a learning experience.

## Rationale for CBET Approach

Initially, Kenya adopted an education and training system that was knowledge-based rather than competency based. It was time-bound rather than demand-driven approach while certification system based on completion of courses and passing examinations rather than demonstration of competency.

Current reforms in TVET training embraces CBET approach that entails: Accreditation of multiple curriculum developers, development of competency based TVET training programmes that address the needs of the industry and offering reliable measures for competence assessment.

The Council awards two types of certificates to competent individuals: Certificate of competence which is awarded upon demonstrated competence in a Unit of Competence in a skill area. The other is national certificate awarded upon demonstrated competence in all Units of Competence in a skill area.

The TVET CDACC accredits curriculum developers, assessors, verifiers and assessment centers. **Curriculum developers** are accredited by the Council to develop curricula in various trades. **Assessors** are accredited by the Council to carry out competence assessments while a **Verifier** is accredited by the Council to monitor the work of assessors involved with the qualification by ensuring reliability, credibility and validity of the qualifications and providing advice where necessary.

**Assessment Center:** Accreditation of an assessment center is the process whereby the Council grants recognition to a training institution, industry or a set up indicating that it meets established standards of quality to conduct competence assessment.

The qualifications levels are determined by the Kenya National Qualifications Framework. This means certification is done in conjunction with the assessment center.

The TVET Authority on the other hand, emphasizes on the accountability and professionalism of its members while ensuring integrity, teamwork and public participation.

## Improving TVET in Kenya through Life Skills

Currently the Kenyan Government is integrating life skills into TVETs to ensure technical students are well equipped with skills needed in the labour market. Combination of technical and employability skills makes TVET graduates competitive. This can only be achieved by looking at the current skills mismatch in the work place and coming up with programs and solution to fill the gaps.

The Ministry of Education and stakeholders in the TVET sector are committed to reforming the sector to produce relevantly skilled human resources required for social economic development. In this regard, the Government enacted TVET Act No. 29, 2013 based on Sessional Paper number 4 of 2016 (Previously no. 14 of 2012), on Reforming Education, Research and Training.

In order to enhance access, equity and quality of training, the Government established new TVET institutions. The aspiration is that by the end of 2020, each Constituency will have at least one technical training college.

To improve the quality of training, the Ministry of Education is implementing Competence Based Education and Training (CBET) in TVET institutions aimed at producing an internationally competitive workforce. The CBET system is based on an industry and business demand-led model and established, approved and industry-validated occupational standards for all vocational jobs and trades.

In addition, a flexible and blended method of training is being developed to ensure that Kenya's technical capacity is attractive and globally competitive.

Education develops the productivity of skilled labour and arguably is increasingly the most significant factor in economic productivity and competitiveness (World Bank, 2007). The World Bank suggests that investing in education as human capital is the best way of improving economic performance.

## CBET Policy Guidelines and Implementation

Since 2013, the National Government has been running a series of TVET reforms to drive up the growth of TVET institutions and achieve enrollment target of 3.1 million over the next five years. The Government has been very keen on creating jobs for the youth, and one key component of that is ensuring that youth population gains skills through TVETs.

Presently the CBET policy guidelines and implementation are offered at National Polytechnics, Technical Trainers College, Technical and Vocational Colleges, Vocational Training Centers, Industry, private sector and any other institution offering TVET programmes.

Currently, TVETA has accredited over 1800 training institutions in all the 47 counties in Kenya. Registered private TVET institutions are about 800 while registered public TVET institutions are nearly 1000. More information visit <https://www.tveta.go.ke/institutions>.

**Universities under TVETA :** Cooperative University of Kenya, Murang'a University of Technology, Technical University of Mombasa, Dedan Kimathi University of Technology, Meru University of Science and Technology and Technical University of Kenya

The Government funds the Higher Education Loans Board to avail loans for university and TVET students. The Government continues to support the TVET sector in a bid to develop sufficient human capital for the growing economy. The emphasis on TVET is aimed at developing relevant skills required to support the Big Four Agenda and other national development plans.

# FISHER'S TECHNOLOGY HARNESSING THE GREEN GOLD OF AFRICA

By **HENRY OWINO (Senior Science Correspondent)**



**T**housands of poor citizens of African states, such as Kenya, have been able to transform their lives and build successful small businesses because of the ingenious inventions and non-profit support organizations created by Dr Martin Fisher.

Born in England in 1958, Dr Fisher moved with his family to the United States when he was eight years old. He entered Cornell University, where he earned a bachelor's degree in mechanical engineering in 1979. From there, he pursued graduate studies; he holds masters and doctoral degrees in mechanical design and theoretical and applied mechanics from Stanford University.

Dr Fisher took some time off to travel after finishing his studies in 1985 and was profoundly affected by experiences he had while visiting South America. In Peru, he saw people living in extreme poverty and noted that they were using crude, old-fashioned tools to perform daily tasks, for which simple, new technologies existed elsewhere. He wondered whether having access to these types of tools might help a rural village pull itself up. He realized this was a problem he could devote his life to.

After returning to the United States, he came up with a plan. He traveled to Kenya on a Fulbright Scholarship to study the relationship between Technology and Poverty (Appropriate Technology Movement). Dr Fisher decided to remain in Kenya after his 10-month Fulbright program was completed.

He joined a British non-profit organization ActionAid where he helped develop intervention programs, such as a rural water project, creating inexpensive construction

technologies, building schools and training women to start their own businesses, among others.

Dr Fisher noted how hundreds of billions of dollars could be spent by different organizations in providing aid and other forms of assistance to African countries. Though well-intentioned, was very little if any sustainable return on these investments.

It was out of this frustration of traditional development models that Dr Fisher luckily met with Mr. Nick Moon as workmate at same organization in Nairobi, in 1991 and strategized a way forward. Upon meeting in their first job as development practitioners, both compared observations and shared frustrations over the fleeting impacts of the projects on which they worked.

Mr. Moon, on the other hand, was born in Mumbai to British parents and exposed to the dynamism of the developing world from a young age. A strong-willed idealist, Mr. Moon sought alternatives to traditional education and left school at the age of 17 to pursue his own entrepreneurial endeavors around the world. He came to Kenya as part of the Voluntary Service Overseas (VSO), the British equivalent of the US Peace Corps.

So, the two soon discovered that their vastly different experiences had culminated in a shared recognition of the need to examine the shortcomings of traditional development. Together, they applied the lessons they had learned over a period of five years in the large British aid organization.

Dr Fisher and Mr Moon took a look at the work they had done to answer this vital, but controversial question. When the pair felt they had identified some of the root causes of these failures, they took these takeaways to their supervisors and other leaders of the major aid programs in the region.

What they found were big bureaucracies closed to new ideas. Critical self-examination was not only discouraged, it was considered dangerous. Far from heeding this discouragement, Dr Fisher and Mr. Moon's desire to put their takeaways into action grew stronger with each indication that there was a sector-wide resistance to new approaches to development.

They remained convinced that there was a better way to address poverty, a model that would bring together the power of technology with the proven sustainability of the marketplace and private sector.

Dr Fisher, rooted in his engineering background, believed that the right technology could change the lives of millions of people. Mr Moon's own entrepreneurial experience and appetite for risk added another layer: individuals must have the opportunity to invest in and purchase these technologies themselves.

Both agreed that the number one need of the poor is a way to make more money and that, with income security, individuals would prioritize and address their remaining needs for themselves.

They decided to take on a risk that the private sector was not willing to: designing a product exclusively for some of the poorest people in the world, rural African farmers, that would enable them to make a lot more money. Rather than giving these technologies away, they set out to sell them at an affordable price.

## Product Innovations

Consequently, in same year (1991), they founded ApproTEC (Appropriate Technologies for Enterprise Creation), which in 2005 became KickStart International. So, KickStart was founded by Dr Fisher and Mr. Moon.

The two built a new model to create a new way to help people escape poverty. Their model was based on a five-step process to develop, launch and promote simple money-making tools that poor entrepreneurs could use to create their own profitable businesses.

With KickStart International, Dr Fisher and Mr. Moon aimed to create a new model for success in helping impoverished communities in third world countries to pull themselves out of poverty. They believed that, rather than merely being recipients of charity, people in these communities need to be infused with entrepreneurial spirit and given access to modern tools and technology that they could use to build their own businesses. This would allow them to reap their own cash rewards.

They identified a common skill among Kenya's poor farming and began developing tools that would help them to become better farmers. Dr Fisher designed devices such as a press for soil blocks and an oil-seed press before he realized that irrigation technologies would help. More than anything else, the idea was to allow farmers to move into commercial-scale farming. This, he knew, would have the greatest impact on farmers' communities.

The target here was to kick-start hence the organization's name, an award-winning, non-profit social enterprise with a mission to lift millions of people in Africa out of poverty quickly, cost-effectively, and sustainably. Thus, they accomplished by designing and mass-marketing durable yet affordable MoneyMaker branded irrigation pumps.

*MoneyMaker pumps are low-cost, high-quality irrigation technologies designed for small-scale farmers in Africa.*

These low-cost (\$70 and \$170) pumps are nowadays purchased by very poor farmers who use them to irrigate their land, enabling them to move from rain-fed subsistence farming to year-round commercial irrigated agriculture.



## Rebranding for wider reach

In 1996, Dr Fisher developed the Super MoneyMaker Pump, inspired by a treadle pump design used in Bangladesh and India. Powered by a human operator, the MoneyMaker pump can pull water from as deep as 30 feet underground and has the ability to irrigate up to two acres of land.

KickStart's vision of success is to take millions of people out of poverty sustainably, and in doing so, to change the way the world fights poverty. **Irrigation is Africa's biggest opportunity, so partnership with donors across Africa makes it possible.**

Dr Fisher returned to the United States in 2001 and opened a small fundraising office for ApproTEC in San Francisco. The overseas and the US offices combined in 2005 to rebrand it **KickStart International**, for which Dr Fisher currently serves as Co-founder and Chief Executive Officer.

They reframed beneficiaries as customers and the products and programs born out of this pivot which have since empowered 1.3 million people to lift themselves out of poverty on their own terms.

As non-profit social enterprise focused on lifting millions of African farmers out of poverty, Dr Fisher helped communities to establish profitable businesses before completing his Ph.D. in Engineering at Stanford. It was after his graduation when he first encountered extreme poverty. In all its depth and nuance, poverty struck him as a great engineering challenge facing mankind

KickStart International sells the pumps instead of giving them away as Co-Founder Dr Fisher believes it kills local initiative and that people don't necessarily appreciate things that are given. Instead, Dr Fisher believes selling the pumps promotes entrepreneurship instead of dependence.

## Results

KickStart International has since improved the Super MoneyMaker into a lighter weight, durable, rust resistant, and easy to operate pump, the MoneyMaker Max. Put into production in 2012, the MoneyMaker Max replaced the Super MoneyMaker.

A less expensive pump, the MoneyMaker Hip Pump, was developed later, retailing for around \$70 and the bigger MoneyMaker Max Pump at \$170 in average but depending on a country where one resides. This pump is easier to operate, allowing a user to pump using his limbs or torso. It can irrigate up to one and a quarter acre of land. Dr Fisher estimates that by deploying either of the pumps, a farmer can expect to grow enough produce to earn up to \$850 a year, almost a 500% increase from their previous annual income of \$150.

As of 2019, KickStart International has sold 350,000 pumps, created 260,000 enterprises, and moved 1.3 million people out of poverty. Many of these farmers may now be considered wealthy, by national standards, and are able to support their families, build better homes, and send their children to school, even college.

KickStart, meanwhile, have grown to include 17 countries in Africa and 7 offices with 2 offices in USA. Nairobi, Lagos, Lusaka, Dar es Salaam, Bamako, Accra, San Francisco and New York.

All offices have permanent and part-time staff numbering over 150. Dr Fischer continues to design and invent for KickStart, which makes not only irrigation pumps but also cooking oil presses and construction machinery.

## Recognition

KickStart talks are about the campaign to end extreme poverty in Africa. In December 2018, Dr Fisher, KickStart's CEO and Co-Founder, shared what KickStart is doing to lift millions of people out of poverty at the Global Citizen Festival: Mandela 100. Held in Africa for the first time in Johannesburg, South Africa, the festival celebrated the centenary of Nelson Mandela's birthday by mobilizing global leaders, artists, influencers, and thousands of global citizens to raise awareness of extreme poverty.

*Dr Fisher's technology and innovation has changed many people's lives by growing businesses and communities across Africa, he has been honored with numerous awards for his work.*

Among the many awards received: Schwab Foundation's Outstanding Social Entrepreneurs (2003) an IDEA Design Gold Medal, Gleitsman Award of Achievement (2003), Skoll Award for Social Entrepreneurship (2005), Lemelson -MIT Award for Sustainability (2008), Social Capitalist Award Fast Company Magazine & the Monitor Group (2008), Forbes Magazine Impact 30 List-World's leading social entrepreneurs (2011), US State Department "Innovation Award for Empowerment of Women and Girls" (2012) among others.

Sadly, Mr Moon lost his fight to leukemia on October 10th, 2018, may his soul rest in peace. The KickStart community mourned the passing of their beloved Co-Founder and Board Member. Dr Fisher and staff all over Africa are committed in ensuring the late Mr Moon's mission and vision stays on.

## Money Maker Pumps In Africa: Growing Businesses and Communities

By HENRY OWINO (Senior Science Correspondent)

Several new technology innovations developed specifically for BOP markets are already making a noticeable impact. KickStart (formerly ApproTech) has been developing and promoting such technologies since 1991, with the explicit goal of helping entrepreneurs in Sub-Saharan Africa establish and run profitable small-scale enterprises.

To date, the organization's efforts have resulted in the creation of more than 260,000 businesses which currently generate a total of \$220 million in new profits and wages annually. Kickstart International, an organization founded in Kenya, aims at lifting people out of poverty in Africa.

Contrary to common perception, there is plenty of water in Africa. Enough rain falls on the continent each year to satisfy the water needs of approximately 9 billion people. The challenge is how to manage it, access, store, distribute and use it judiciously.

In many parts of sub-Saharan Africa, one can dig or drill a hole and water is there. The potential for irrigation is huge as KickStart International estimates 25 million households in Africa could benefit.

"Africa faces poverty and food security challenges which if not addressed, its people would starve to death. Hunger and poverty are conjoined twins to separate hence great threat to Africa," said Mr. Peter Juma, President & Chief Operating Officer, KickStart International.

There is need to empower family farming in Africa as feeding families is becoming a monumental task, and more pressure than ever before. Small farms are capable of feeding thousands of people yet depend on rain-fed agriculture.

In the dry season after the rains have stopped, food becomes scarce and prices rise, sometimes as much as ten times. Farmers stay poor and never have enough to purchase adequate inputs for the next.

### Solutions

KickStart International comes with solutions to small-scale farmers in Africa on feast-famine production cycle that is totally misaligned with demand, which is constant and growing by introducing MoneyMaker Irrigation Pumps. The technique here is to move a farmer from subsistence rainy season agriculture to profitable, family-farming enterprises.

According to Juma, across Africa, the organization designs and sells low-cost, durable, portable and rust proof irrigation pumps that allow poor farmers to grow and sell high-value fruits and vegetables year round, especially in the long, dry "hungry" seasons when food is scarce. The pumps are human-powered, so farmers never use more water than they need.

"Irrigation allows a farmer to produce food year-round, timing production to meet market demand, achieve higher yields on often diminishing acreage and grow crops that are more nutritious and fetch higher prices," Juma explains.

"This is the best of the best manual treadle pumps. It's called MoneyMaker because that's what it does." The most important lesson that KickStart co-Founder, Dr Martin Fisher, and I learned from our years of development work is that a poor person's number one need is a way to make more money," Juma says.

"KickStart's impact monitoring data consistently has shown that farmers who adopt KickStart's pumps increase their annual net farm income from an average of \$150 to \$850 within 36 months, or nearly 500 percent," KickStart President & Chief Operating Officer affirms.

Farmers have greater purchasing power and can pay for what they need including food on the table, kids in school, health care and further investments in their business and future."

KickStart creates opportunities for poor, rural, entrepreneurial farmers in Sub-Saharan Africa to make money and offers a permanent solution to address the poverty.



## Two types of Irrigation Pumps

KickStart International offers two types of irrigation pumps - MoneyMaker Max (Bigger) and MoneyMaker Hip (Smaller) pump and they are affordable, durable and a low cost capital investment for poor entrepreneurs in Africa. Each pump is able to increase farm income up to tenfold. The MoneyMaker pumps are human powered and allow small-scale farmers to access water, which enables them to increase their crop yield.

### MoneyMaker Max

**A unique, high-quality, human powered treadle irrigation pump that retails across Africa for \$170, including hosepipes. The following are benefits:**

- Easy installation and operation with no tools required
- High flow rate - irrigates up to 2 acres of land per day
- Sprays 16 gallons per minute
- Pulls water from depths of up to 23 feet (7 meters)
- Maximum pumping height of 46 feet (14 meters)
- Weighs just 35lbs (16 kg)
- Durable, rust resistant, highly efficient with guaranteed quality

### MoneyMaker Hip Pump

**A unique, high-quality, human powered, hip operated irrigation pump that retails across Africa for \$70, including hosepipes. Benefits include:**

- Easy installation and operation with no tools required
- High flow rate - irrigates up to 1.25 acres of land per day
- Sprays 10 gallons per minute
- Pulls water from depths of up to 23 feet (7 meters)
- Maximum pumping height of 46 feet (14 meters)
- Weights just 10 lbs (4.5 kg)
- Durable, rust resistant, highly efficient with guaranteed quality

## Model

KickStart's model for development empowers people and provides them the opportunity they deserve to create a better life for themselves and their families. Farmers increase their annual income through irrigation from \$150 to \$850, almost a 500%. For the first time, they can properly feed and educate their children, afford healthcare and plan for their futures.

KickStart As a leader in the appropriate design movement, KickStart develops and mass produces high quality irrigation tools that meet the needs of the poorest farmers in Africa. The pumps are affordable and durable lasting up to eight

## Training Farmers

KickStart International is an award-winning, non-profit social enterprise with a mission to lift millions of people in Africa out of poverty quickly. So, KickStart Agropreneurship team trains both farmers and non-governmental organization staff on best practices in agriculture and business or as people like to calling it, "Agropreneurship."

Pumps do not need skills for operating, repairs because no bolts or nuts affixed to it, designed to fit farmers' need hence simple to use.

Trainings encourage participants to take up irrigation and introduce brand-new, never-before-seen technologies to some of the toughest customers in the world: Small-scale farmers in Africa, who are entrepreneurial but risk-averse, hard to reach, and have limited resources.

KickStart has trained over 7,000 farmers in agro-preneurship since the program began in 2015. They are growing more robust and sustainable crops, and have found new confidence and prosperity for their families and communities.

## MoneyMaker Pumps Impacts

Farmers produce enough fruits, tomatoes, cabbages, kales, carrots, lettuce, etc (horticulture) including green maize and local vegetables such as managu, suja etc that feed 13 million people a year, and generate \$210 million in new profits and farm wages annually. It has dissolved circumstances of poverty for 1.3 million people. MoneyMaker pumps add value to existing programs focused on small-scale farmers in rural Africa.

The impacts of MoneyMaker pumps have been validated by decades of internal and external studies and enable farming families to: Start Profitable Businesses; Promote Food Security; Decrease Post-harvest Loss; Build Resilience to Climate Change; Empower Women; Improve Nutrition and Health Outcomes; Create Jobs; Increase Access to Education; and Manage Livestock

## Supply chain

Kenya is home to KickStart's Innovations Hub in Africa where it partner with other companies and organizations to develop and test new high-impact irrigation products and last-mile innovations that will enable millions of additional farmers to irrigate.

KickStart operates in 17 Africa countries divided into three major regional hubs; Eastern Africa, West Africa and Southern Africa hubs. In Eastern Africa there are Tanzania, Ethiopia, Uganda, Rwanda, South Sudan and Kenya its headquarters.

West Africa hub focus countries are Ghana, Mali, Burkina-Faso and Senegal and Nigeria as it headquarters. Southern Africa are; Zimbabwe, Malawi, Mozambique, DR Congo, Angola while Zambia is the head office.

To overcome the "Last Mile Challenge", KickStart has recognized that new, innovative products, marketing and distribution solutions are necessary, and constantly develop new ways to market and promote its tools, especially among women, youth, and marginalized communities.

MoneyMaker branded irrigation pumps are designed in Kenya and sold across sub-Saharan Africa. KickStart have appointed and branded over 400 local retail shops in Kenya, Zambia and Tanzania

# WACCI: PUSHING THE BOUNDARIES OF SEED SCIENCE IN AFRICA

By Daniel Otunge



Daniel Otunge

All good stories have three elements in common. They are honest, authentic and inspiring.

The West African Center for Crop Improvement (WACCI) is a perfect fit. It exhibits all these three elements of a complete story. WACCI is a beacon of hope. Hope that an agrarian revolution is possible in Africa.

WACCI's story breathes life into the immortal words of Ghana's founding President, Dr Kwame Nkrumah that "It is within the possibility of science and technology to make even the Sahara bloom into a vast field with verdant vegetation for agricultural and industrial development."

President Nkrumah spoke these wise, visionary words some fifty-seven years ago and he was not just engaging in idle rhetoric or idle talk as most leaders do. For good measure, he backed up his word with action by forming the Council for Scientific and Industrial Research (CSIR), a fourteen-institute agency

mandated to spearhead Ghana's scientific development agenda from agricultural innovation, nuclear science to scientific policy.

During Nkrumah's time, many a student was sponsored to study agriculture and other sciences at local and international universities and colleges. Indeed, this scenario obtains in many African states. One would, therefore, expect Nkrumah's vision of a food secure Africa to have been realized decades ago.

Why then is Africa, especially the sub-Saharan Africa (SSA), still a hungry lot? I put this very question to WACCI Director, Prof Eric Danquah, when we met at the 2<sup>nd</sup> AU-ASRIC Scientific Conference in Abuja, Nigeria, recently. He said many theories and models have been advanced to explain this poignant question

They include, *inter alia*, poor policies and inadequate technical capacity. Indeed, any casual examination would validate the veracity of Prof Danquah's observations that the twin challenge of food and nutrition insecurity in SSA remains unabated. Low farm productivity makes Africa a net food importer. About 250 million people sleep hungry daily. He warns that the situation may worsen in the coming years if nothing is done. He is right.

The food sector is saddled with ever increasing population and rapid rural urban-migration. Impacts of climate change coupled with poor policies, poverty, pests and pathogens perilously combine to confine SSA's food security in the doldrums. The COVID-19 pandemic is only adding salt to a festering wound. There is no silver bullet-like solution to such biotic and abiotic agricultural stresses, says Prof Danquah.

Though not a panacea, he avers, innovative plant breeding can significantly contribute towards bridging the food gaps. Development and adoption of smart seeds, resilient against pests, diseases, bad weather and poor soils, would certainly contribute to higher crop yields, he affirms.



Director of WACCI, Prof. Eric Danquah, working to produce the best seed science specialist for Africa



To achieve this, a large pool of highly-skilled plant breeders must be realized through focused training. It was against this backdrop that the Alliance for a Green Revolution in Africa (AGRA), the University of Ghana and Cornell University partnered under Danquah's leadership to establish a center of excellence in plant breeding.

This led to the birth of WACCI in June 2007. WACCI is a semi-autonomous Centre of excellence domiciled at the College of Basic and Applied Sciences of the University of Ghana at East Legon, Accra. True to its stated mission, WACCI has become a leading center for postgraduate training and research in crop improvement in Africa.

It is producing the next generation of plant breeders and seed scientists needed for the transformation of Africa's Agriculture through high-quality research, teaching and learning thereby fulfilling Nkrumah's vision.

WACCI offers both master's and doctorate degrees. The master's degree offered by the center is a two-year course in Seed Science & Technology. It consists of one-year coursework and up to 3 months experiential learning at private seed companies or national seed programs and one-year thesis research and writing.

The Doctorate in Plant Breeding offers foundational Courses and modules of special topics in plant breeding, genetics, biotechnology, biometry and related subjects. After a period of internships and mentoring in advanced Laboratories, students return to WACCI to submit their theses. The PhD course takes 2-4 years, depending on the speed of the student and the research topic chosen. So far in terms of academic outputs, WACCI has enrolled 127 and 55 students for PhDs and MPhil programs respectively.

They focus on a number of tropical crops including rice, maize and potatoes, among others. The students, who are mainly drawn from the Economic Community of West African States (ECOWAS) bloc, are strictly required to return to their home countries and institutions to apply their newfound knowledge in crops research and development.

Prof Danquah intimated that out of these, 81 PhD graduates in Plant Breeding and

14 MPhil in Seed Science and Technology have become game changers and history makers not only in their home countries but in Africa. In Ghana, for example, WACCI released three seed maize hybrids, which are now registered in the national variety catalogue.

The parental lines of the seed maize hybrids, which were low at the time of release, 29 kg to be exact, have been boosted through partnership between WACCI and local agencies. The partners now produce the breeder and foundation seeds to facilitate certified seed production while WACCI works on maintenance and production of breeder seed. WACCI's maize research program mainly focuses on resistance to maize streak virus, drought tolerance, low nitrogen tolerance and heat tolerance.

They also focus on resistance to Striga weed. The center also applies mutation breeding technique to identify novel genotypes for resistance to fall armyworms that are currently decimating crops in Africa. Besides the hard science, WACCI, like the American Land Grant Universities, lays a lot of emphasis on extension and community engagement to boost uptake of the new seed varieties.

In addition, WACCI has produced over 165 publications written by students and faculty staff. "As you know, effective engagement of stakeholders, such as farmers, scientists, the media and policy makers, to inform, educate, advocate and communicate the role of modern science, technology and innovation in development, is critical to acceptance and adoption of these innovative new technologies," says the WACCI Director, Prof Danquah.

In just over a decade, WACCI has emerged as reputable modern center of excellence in seed science with state-of-the-art facilities, including the WACCI Multipurpose building, thanks to the partnerships with Cornell University and other donors. The building houses a tissue culture, seed science and seed testing laboratories.

It also has a cold room for seed storage/bank, a bioinformatics lab, an enterprise hub, a 150-seater auditorium, a Board Room with latest Video Conferencing Facilities, two 25-seater lecture halls, a library, research commons for independent work, and 13 offices for the staff. Besides,

WACCI plans to transform the over 42 ha University of Ghana farm land into a world class platform for phenotyping.

The WACCI International Conference on Food and Nutrition Security is also fast becoming a house-hold name among global scientists, industry leaders and policy makers. The Cambridge University-trained Professor Danquah is categorical that high levels of investments are required to unleash the potential of agriculture for sustainable development and poverty reduction in Africa.

He decries the low public budgetary allocations to the agriculture sector because it stifles innovation and slows growth in the sector. To address this problem, he says, innovative partnerships that bring together business, government and civil society actors needs to be increasingly promoted as a mechanism for pooling the much-needed financing while mitigating some of the risks of doing business in the agriculture sector.

The WACCI Conference is one such networking opportunities where public-private partnerships (PPPs) can be invented. He identifies four common types of PPPs that can change Africa's food security misfortunes for the better. They include partnerships for developing agricultural value chains; developing joint agricultural research, innovation and technology transfer; building and upgrading market infrastructure; and delivering of business development services to farmers and small and medium enterprises. True to his word and networking prowess, Prof Danquah has ensured that WACCI's projects are partnership-driven for maximum impact.

As another illustrious and brilliant African, Prof. Thomas Odhiambo, the Founder of International Center for Insect Physiology and Ecology (ICIPE), rightly said succinctly: "Africa needs science, not just technology... What is required in Africa in the future is much more first-class science, conducted by African scientists, to solve the problems of African agriculture." And WACCI is doing exactly that.

*The Writer is the Executive Editor and Deputy Executive Director of ScienceAfrica*



AUC Commissioner for HR and Science and Technology H.E. Prof Sarah Anyang Agbor and ASRIC Chairman Prof Ratemo W. Michieka, jointly presenting a certificate to recognition to ASRIC Goodwill Ambassador, H.E. Emmanuel Mpfoyokurera, who is also Burundi's Ambassador to West Africa, during the ASRIC 2<sup>nd</sup> Congress Official Opening Ceremony in Abuja Nigeria. Looking on are the Executive Director of the AU Scientific Technical and Research Commission and ASRIC, Dr. Eng. Ahmed Hamdy (left) and Prof. Kalu Mosto Onuoha, President of Nigeria Academy of Sciences.

# AU-ASRIC LEADS WAR AGAINST POVERTY, DISEASE, HUNGER IN AFRICA

By Daniel Otunge (Executive Editor)

**A**frican Scientific Research and Innovation Council (ASRIC) held its second conference in Abuja, Nigeria, November 2019. About 200 participants from over 27 countries attended the congress to deliberate on how to free Africa from poverty, hunger and disease.

The following countries were represented at the congress: Burundi, Cameroun, Cote d'Ivoire, DR Congo, Ethiopia, Gabon, Ghana, Kenya, Mali, Morocco, Nigeria, Rwanda, Senegal, South Africa, Sudan, Tanzania, Togo, Tunisia Uganda, Zambia and Zimbabwe.

The four-day congress was officially opened by the AUC Commissioner for Human Resources, Science and Technology, H.E Prof. Sarah Anyang Agbor. Ceremony was also addressed by other dignitaries including the chairperson of the Africa Scientific Research and Innovation Council (ASRIC), Prof Ratemo W. Michieka, the Executive Director of the AU Scientific Technical Research Commission (STRC) and ASRIC, Dr Eng. Ahmed Hamdy, and Ambassador of Burundi to Nigeria, H.E. Emmanuel Mpfoyokurera.

Prof. Agbor said the Congress was special as it dealt with a very pertinent subject of freeing Africa from poverty, hunger and diseases which are the main enemies of the continent. The congress also tackled four sub-themes of Health Sciences; Agriculture,

Forestry and Fisheries; Water, Energy and Environment; and Governance, Sociology, Business and Economics.

She recalled the vision of the African Union of "An integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in the global arena". To actualize this vision, the overarching continental framework, *Agenda 2063*, was developed to address developmental challenges in Africa.

And to catalyze rapid achievement of the framework's sectoral strategies and policies, such as the *Science Technology and Innovation Strategy for Africa 2024 (STISA 2024)*, among other development initiatives, have been initiated by the Union.

The STISA 2024 was adopted by the AU Assembly in 2014 as an incremental continental framework for accelerating Africa's transition to an innovation-led, knowledge-based economy within the overall framework of the AU *Agenda 2063*.

Four pillars define STISA 2024 in fulfilling its mission. The pillars include building research infrastructure, enhancing

technical and professional competencies, innovation and entrepreneurship and providing an enabling environment for STI development in Africa. To achieve its mission of “Accelerating Africa’s transition to an innovation-led and Knowledge-based Economy”, prerequisite pillars and priority areas have been defined by ASRIC.

Among the pillars are: physical infrastructure development; technical competency; innovation and entrepreneurship; and enabling environment which is the domain of law, regulations, policy and communications. Launching and operationalizing of the ASRIC are among some of the intermediate achievements of STISA 2024.

The Council has a broad mandate to promote research and innovation to address developmental challenges on the continent. According to the ASRIC’s Statute, the main objects are to mobilize African research excellence; build and sustain continental research-policy nexus; and mobilize resources for research programs. The Constituting Act further mandates the Council to promote dialogue and boost the voice of the scientific community; advocate for knowledge and technology creation and acquisition; and link the scientific community with the economy’s productive sector.

ASRIC is therefore instrumental in supporting and strengthening national and regional councils’ STI capacities by striving to bridge the gap between research and policy, and boost intra-Africa and international collaboration in research and innovation.

The ASRIC has assembled top African Scientist and technologists to address the scourge of problems that was envisioned by its leaders and captured in continental overarching development frameworks, including the STISA 2024. ASRIC has abroad mandate to promote research and innovation to address Africa’s socio-economic development challenges. In order to execute the mandate, it is important for the Scientific and Innovation Committee to identify and mobilize African research

excellence.

This requires an aggressive awareness program aimed at bringing scientists to the same level of knowledge of the tools and opportunities available to them through the AU’s scientific research and technology agenda. This will be achieved by strategic assessment of knowledge and needs in the countries that are science under-resourced.

ASRIC should devote more resources in such areas compared with scientifically resourced countries on the continent. Program activities that will be developed will strategically be linked to the objective on creating collaboration among key stakeholders in scientific, innovation and technological sectors.

The involvement of industry players will

**To achieve its mission of “Accelerating Africa’s transition to an innovation-led and Knowledge-based Economy”, prerequisite pillars and priority areas have been defined by ASRIC.**

result in more structured linkages between the African scientific community with the productive sector of the economy. Mobilization of African research excellence should result in collaboration and strengthening of national and regional STI research councils and scientific academies.

Therefore, cardinal to achieving collaboration is the need for scientists and other key role players to meet and know each other or to know about opportunities and programs that are available to them. During one of the thematic meetings on communication, advocacy and outreach, it became clear from interactions with different key players and stakeholders that not many are conversant with ASRIC’s mandate and functions.

Under such a scenario, it is difficult to deliver the council’s object of mobilizing Africa’s scientific human and financial capital to tackle the challenges. This calls for speedy development of a communication, advocacy and outreach campaigns program aimed at increasing ASRIC’s visibility. Therefore, the communications committee, chaired by Prof. Driss Ouazar, has its work cut out for it. The committee whose membership was expanded during the congress, must move with speed. New members of the team included, among others, ScienceAfrica’s Deputy Executive Director, Daniel Otunge, who joined the advocacy sub-committee.

The congress identified several priority areas from which ASRIC flagship projects will be fashioned in the near future. The thematic areas include climate change, agriculture, health, environment, communication, economy and governance.

To accelerate implementation of ASRIC priorities, the African Union Network of Sciences (AUNS) has been set up in collaboration with African Union Scientific and Research Commission. AUNS is a virtual platform where African scholars, scientists, engineers, technology developers, innovators and inventors within Africa and in the diaspora, will be able to interact, cooperate, exchange information/knowledge and complement one another in research, development and entrepreneurship.

It is hoped that the AUNS will lead to better coordination and management of scarce resources to avoid wastage. Success will require aggressive awareness program aimed at bringing the scientists to the same level of knowledge of the tools and opportunities available to them through the AU’s scientific research and innovation agenda. It is one thing to create a network and it is another thing to make it work effectively and efficiently.



# TECHNOLOGICAL PROGRESS AND THE FUTURE OF WORK: SOME FOOD FOR THOUGHT

By Prof Leopold P. Mureithi

## Introduction

Humans have increasingly called upon capital tools to ease their work burden. In a sense, capital has served as what Bruce Mazlish has labelled “extra-corporeal limbs.”<sup>1</sup> The result is that capital and labour broadly complement each other in production of goods and services, a mathematically positive relationship for the data thus far, as demonstrated by David Autor.<sup>2</sup> However, there is increasingly declining labour-capital ratio over time.<sup>3</sup> This reflects replacement – at the margin – of capital for labour in the production process incentivised by significant marginal elasticity of substitution between the two;<sup>4</sup> and “the combination of falling prices of robots and the rising cost of human labor.”<sup>5</sup>

## Labour-Technology Response Function

The implication of the two observations above is that the relationship between labour and capital is mutually increasing in tandem over time, not *pari passu*, but at a relational decreasing rate. Conceivably, the labour-capital ratio could reach a pinnacle and then decline. This high point could – analogous to oil<sup>6</sup> – be termed “peak labour”. As such, labour-capital ratio *could* be zero ( $L/K = 0$ ) at some future point in time, suggesting an elongated inverted U-curve. This would be a state of *full unemployment*, a phrase coined by Jim Dator.<sup>7</sup> It conjures up the end of work scenario. Jeremy Rifkin<sup>8</sup> envisioned a “workless world” where “millions will be permanently displaced from the economic labor process due to entire segments of the labor force being shrunk, restructured, or eliminated.”<sup>9</sup> Similarly, Gerd Leonhard points out the tendency “to make an algorithm out of everything,”<sup>10</sup> such that, businesses are evolving towards “algorithm-only zero-employee companies.”<sup>11</sup> Thus, systemic structural technological full unemployment is a rising tendency and the prospect of full unemployment a distinct eventuality.





## Work in the Era of Unemployment

From macro-history, we learn that work started as an own-account arrangement: people worked the land to produce their own output for their own consumption; and, latter, some was exchanged with similarly-placed people who produced dissimilar goods. At that time, cultural attitude imprinted in people's *psyche* that working is needed to make one whole.<sup>12</sup> But, when *modus operandi* changed from own-account to mechanical to semiautomatic and further headed to full automation, work will get inadvertently relegated to a periphery from which it is unlikely to come. Job-killer machines will be ubiquitous.

This feeling of alienation or redundancy of labour is a psychological feeling brought about by the tendency of "omitting unpaid labor."<sup>13</sup> We need "a reframed vision of work."<sup>14</sup> "There would be a need for people to have an alternative identity beyond work."<sup>15</sup> This would be given impetus by giving value to non-income personal leisure time and the "work" of the *unemployed*. Indeed, the tome by Joseph Stiglitz *et al* is a giant step in this perspective.<sup>16</sup> We may see, not an end to work as such. But only of what Adam Schaff calls "work-merchandise...commodified work."<sup>17</sup>

"So it then becomes a question of imagining new forms of social relations and new occupations where social wealth does not identify with labour-time, with development in productivity functional to profit, but with free time, with development of the single individual's personality, with development of the human person."<sup>18</sup> What is required is "a bit of sound human reason that can guide the transition from the civilization of work to the civilization of occupations."<sup>19</sup>

But, it should be appreciated that full unemployment, just like full employment, does not mean 100% of that achievement. In the case of full employment, there will always be persons in transit from one job to another; and frictional, seasonal, and voluntary unemployment. This sets a minimum or natural unemployment level - say 5% - even in the face of full employment. Similarly, with full unemployment, there will always be people to do conventional work, since artificial intelligence (AI) is capital that requires people to produce, programme, maintain and reproduce. That minimal human touch is a given. Jim Dator estimates it at 10 percent of the population.<sup>20</sup> But, even then, Dator admits that people will do things that they did not previously have the time to do because of being "employed", ranging from arts and crafts to zigzag dancing. His list is instructive.<sup>21</sup>

Jerome Glenn envisions a scenario of self-actualization activities, *a la* Abram Maslow.<sup>22</sup> He tabulates the following:<sup>23</sup>

- Collaborate with whom you want (rather than those you have to in a job), work-at-home, tele-work. More energy efficient.
- Create your own sharing economy –Peer-to-Peer (P2P): what would you like to share?
- Free to pursue what you think gives meaning to life, self-actualization, not forced to compete for same status; hence, less social conflict (which wastes energy).
- What environmental/other caucuses do you want to pursue?
- DIY products from community sharing 3D Printers, design and build your on environment, shoes, etc.

A comprehensive catalogue of post-work engagements, which education and training should promote, is given by Michael Peters in what he calls "*creative policy work, viz.*"<sup>24</sup>

- The expansion of the 'third sector' based on corporate-government-community partnerships;
- The revival of DIY job cultures;
- The growth of small businesses and self-employment in food, hospitality and other industries;
- Education for design, media and creative arts that encourage a raft of new platform initiatives;
- Intensification of all competitive talent programmes in sport, fashion and entertainment;
- Large-scale sponsored survivalist and cooperative living programmes;
- The cultivation of traditional arts and crafts;
- Increasing development of second-hand markets and waste management industries;

- An environmental education that monitors resource depletion and water and air quality at the local level;
- And, perhaps, the revival of the liberal arts education with an emphasis on collective processes that aid citizenship and imaginative citizenship projects.

Andy Hines has his list of ten things we could do if we didn't have to work, namely:<sup>25</sup>

- Learn for the sake of learning.
- Parenting, more time raising children.
- Participating in political and civic affairs.
- Helping the less fortunate.
- Exercising in light of the growing obesity epidemic.
- Connecting to family and friends outside of social media.
- Reinvigorating our interest in space exploration.
- Restoring and enhancing the environment.
- Travelling to experience other cultures.
- Hobbying, reading, music, cooking, surfing, etc.

A keen reader will observe that many of these activities are productive because they result in output of real goods or services that satisfy human wants, can lead to one earning an income by exchange, and are otherwise recognized as worthwhile -- thus satisfying Amartya Sen's three criteria for what employment is.<sup>26</sup> An example is self-actualization, metier-based production with P2P transactions.

## New Economic Arrangements

By the time a country reaches the full unemployment point, there will be high levels of production and income. The sharing of the benefits will depend, as always, on the power structure and how that power is exercised. In a particular society, that will be an outcome of the interactions between economic, social, political, environmental, cultural and technological (ESPECT) forces. If business as usual prevails, skewed income distribution and inequality will persist and, most likely, increase. Herein lies a risk of social disintegration, counter-actable by reskilling, work sharing, freelancing, and labour market information.

A "new remuneration system"<sup>27</sup> would be needed to provide unemployment and other forms of social insurance, education and health care. Ultimately, unconditional "universal basic income"<sup>28</sup> (UBI) may be needed for all, so that no one is left behind. A low lying fruit approach is a comprehensive social security system for sustainability and creativity.

## Conclusion

To the question: will work die? The answer is no. Its form will alter, though; thus undergoing a structural change. Human creativity is such that for every window that closes, others open; and people will always find things to occupy themselves, in search of that which makes them human. If work is completely unavailable, income support measures can be set up from the overall prosperity arising from technological revolution so as to make everyone have a fulfilling life. Human ingenuity is implicated: to anticipate, be flexible, and be futures literate.



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## The World Futures Study Federation (WFSF) in Brief

WFSF is a UNESCO and UN consultative partner and global NGO with members in over 60 countries. It brings together academics, researchers, practitioners, students and futures-focused institutions. WFSF offers a forum for stimulation, exploration and exchange of ideas, visions, and plans for alternative futures, through long-term, big-picture thinking and radical change. It was established as a legal entity in Paris, France, in 1973. The President is now based in Oslo, Norway.

One can join The **WFSF** as an individual member or as an institution through web page <https://www.wfsf.org/membership/apply-to-join-wfsf>. Individual active members and current institutional members are listed at <https://www.wfsf.org/membership/member-profiles/individual-members-alphabetical> and <https://www.wfsf.org/membership/member-profiles/wfsf-institutional-members>

**WFSF** frequently organizes conferences across the globe and publishes the **Human Futures** periodical.

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# USING SCIENCE, TECHNOLOGY AND INNOVATION AS A MEANS FOR ACHIEVING SUSTAINABLE DEVELOPMENT GOALS IN AFRICA: THE ROLE OF THE AFRICAN TECHNOLOGY POLICY STUDIES NETWORK (ATPS)

By Dr. Nicholas Ozor, Executive Director, ATPS



## BACKGROUND AND RATIONALE

The development of and attention to science and technology in Africa took center stage in the 1980s with African governments making commitments through their Heads of States to allocate at least 1% of their gross domestic products (GDPs) to research and development (R&D) as well as scientific and technological capabilities in what is popularly known as the Lagos Plan of Action for the economic development of Africa 1980-2000. This was against the backdrop that Africa at that time was unable to point to any significant growth rate or satisfactory index of general well-being for almost two decades. Faced with this situation, and determined to undertake measures for the basic restructuring of the economic base of the continent, the African leaders resolved to adopt a far-reaching regional approach based primarily on collective self-reliance which included putting science and technology in the service of development by reinforcing the autonomous capacity of our countries in this sector.

They noted that the role of science and technology in integrated rural development requires among other things the generation of financial resources and political will and courage on the part of policy and decision-makers to induce a profound change with far-reaching effects on the use of science and technology as the basis of socio-economic development. A well-developed science and technology base and its appropriate application will lead to developments in other sectors such as agriculture; transport and communications;

industry, including agro-allied industries; health and sanitation; energy; education and manpower development; housing, urban development and environment among others. Countries were urged to develop appropriate policies and programmes that will utilize the power of science and technology to sustain growth and development. Among the early adopters in the development of science and technology policies that was to drive development since the Lagos Plan of Action were Ethiopia (1992), Tanzania (1996), Zambia (1996), Botswana (1998), Nigeria (1998) and Ghana (2000). Other countries followed later.

One very remarkable outcome of the Plan of Action was the support and strengthening of regional and sub-regional science and technology organizations in Africa with a call to Member States and international agencies to provide resources to enable them attain full operational levels. It was during this period that two distinct networks emerged in Africa: the Eastern and Southern Africa Technology Policy Studies (EATPS) and the Western Africa Technology Policy Studies (WATPS). These networks promoted and advocated for the use of science and technology as a means for achieving socioeconomic development in the regions. They facilitated the development of most of the science and technology policies in most of the African countries earlier mentioned. However, in 1994, the EATPS and WATPS came together under one platform that led to the birth of the African Technology Policy Studies Network (ATPS) with its Secretariat in Nairobi, Kenya, under the East and Southern Africa Regional Office of the International Development Research Centre (IDRC).

The ATPS has since then grown in leaps and bounds. In 2001 ATPS became an autonomous international organization with diplomatic status in Kenya and working on trans-disciplinary science, technology and innovation (STI) themes for African development. Whilst retaining the STI focus, ATPS has moved towards a "knowledge for development" network of researchers, policymakers, private sector and civil society actors that promote the generation, dissemination, use and mastery of science, technology and innovation for Africa's development, environmental sustainability and global inclusion. We implement our programs through members in National Chapters established in 30 countries (27 in Africa and 3 Diaspora Chapters in Australia, United States of America and the United Kingdom) with partnerships across the entire 54 African countries.

The ATPS is unique in many ways: It is not only the premier STI institution in Africa; it is unique in the composition of its membership, institutional structures and implementation activities. Today ATPS is made up of over 1500 members spread across 51 countries in 5 continents. As the premier STI institution in Africa, it has successfully mainstreamed STI in African development policy dialogues and assisted many African countries to formulate STI policies as well as develop strategies for their implementation.

The ATPS work is guided by the needs and aspirations of its stakeholders across Africa, which is usually put together in consultation with these stakeholders as a Strategic Plan over five yearly periods. During the current ATPS Phase VIII Strategic Plan (2017-2022), we have identified four thematic namely: Agriculture, food and nutrition; Energy; Climate change and environment; and Health innovations; and five programmatic priorities of action namely: STI policy research, policymaking and advocacy; Training, sensitization and capacity building; Youth and gender empowerment; Knowledge brokerage, management and commercialization; and Intra-Africa and global collaboration and partnerships. These priorities are briefly discussed below:



## ATPS THEMATIC PRIORITIES

### 1. Agriculture, food and nutrition:

ATPS plans to identify and promote appropriate technologies and innovations for improving productivity and resilience, reducing waste and improving value addition along the agricultural value chain from farm to table. This is in line with STISA priorities 1, 4 and 6 and will also aid in achieving SDGs 1, 2, 3 and 12. The focus of attention will include innovations in the fields of farming systems and technologies, biotechnology (i.e. seed and livestock technology/genetics), yield enhancement and loss control (i.e. fertilizers and pest control), as well as social innovations such as farm information management systems and the use of Information and Communication Technologies (ICTs) such as smart mobile telephones and satellite data, Geographical Information Systems (GIS), etc. Already, the ATPS is out-scaling an award winning *LandPKS* mobile app technology developed in partnership with partners under the leadership of the USDA-ARS. The app enables farmers determine the potential of any given piece of soil through the climatic and soil information that the app provides instantly. In the new strategic plan, ATPS hopes to continue its work in out-scaling the *LandPKS* mobile app across Africa by building the capacity of extension agents and farmers on the use of the technology to support farm decision-making on productivity, land-use management and resilience.

**2. Energy:** ATPS plans to promote renewable energy access and development on the continent. Lack of access to modern energy services (e.g. electricity and clean cooking facilities) and massive dependence on fossil fuels have hampered sustainable socioeconomic development even as the access to modern and reliable energy services is a critical human development priority. These plans are in line with the SDGs 3, 7, 11 and 13. Incidentally, the resource potentials of hydro,

solar, wind and geothermal energy resources in Africa present huge supply side market opportunities for low carbon technology development and technology transfer.

### 3. Climate change and environment:

ATPS plans to strengthen its longstanding efforts in building climate change resilient capacities at individual, institutional and systemic levels on the continent as expressed in SDGs 11, 12, 13, 14 and 15 and as strategized by the AU in STISA's priority goal 4. We will continue to promote our Climate Sense Program (CSP) launched in 2008 in partnership with the United Nations Environment Program (UNEP). CSP aims to:

- Make Sense of Climate Science through effective science communication;
- Make Sense of Climate Economics through policy analyses and translation of complex climate economics in ways that promote dialogue at all levels of African society;
- Make Sense of Climate Innovation through investment portfolio analyses and supporting the development of technologies and innovations for climate change adaptation, mitigation and resilience; and
- Make Sense of Climate Change Politics and Policymaking through scenario analyses, training and policies that support the development of sustainable technologies and innovations for adaptation such as the renewable energy carriers and efficient stoves.

**4. Health innovations:** Under the health sector, ATPS plans to integrate research programs on innovations and policies for sustainable health delivery and health risk prevention, including health technology policy studies, and social innovations for advancing health and wellbeing in communities. SDGs 3 and 6 clearly cover these while SDG 9 emphasizes on the use of technology

to make the realization of the targets of this sector. ATPS will pay specific attention on the use of Information and Communication Technologies (ICTs) and social innovations for health delivery, risk prevention and mitigation. Potential projects include: Telemedicine, e-medicine using mobile telephone platforms and social networking sites, indigenous approaches to nutrition for health and wellness; mobile health diagnostics systems, etc. We intend to support research and development on emerging diseases on the continent. The organization will advocate for regulatory harmonization of registration of pharmaceuticals and vaccines across regional blocs on the continent to ensure easy access and free trade across borders.

## ATPS PROGRAMMATIC PRIORITIES

### 1. STI policy research, policymaking and advocacy:

Under this strategic objective, we plan to build capabilities, structures, and conditions for the co-production of scientific knowledge, technologies, innovations, and policies across the identified priority sectors for sustainable development in Africa. The concept of co-production of knowledge (transdisciplinary) is strongly emphasized in the work of the ATPS to ensure proper contextualization and socialization of STI in the society for effective development, deployment, diffusion, commercialization and up-scaling of innovations. We recognize that an STI-led development is a political endeavour and hence will work closely with the political class and policymakers to attract their goodwill towards STI issues on the continent.

### 2. Training, sensitization and capacity building:

Under this strategic objective, we plan to enhance the skills and capacities of individuals and organizations in STI policy research, policymaking and policy implementation for sustainable development on the continent. Themes for training and

capacity building/strengthening have been identified with the stakeholders comprising of researchers, policymakers, private sectors, civil society and the media. These themes will be continuously reviewed according to evolving needs and demands by the stakeholders. Such themes may include but not limited to STI policymaking/policy formulation processes, STI policy research methodologies, STI indicators and policy instruments, effective research-policy-practice linkages, effective science communication skills, entrepreneurship development, intellectual property issue, business development, green growth concepts and best practices, etc. ATPS has also developed standard manuals for conducting its capacity building trainings for its stakeholders on demand basis.

### 3. Youth and gender empowerment:

Under this strategic objective, we plan to nurture and harness the innovative potentials of African youth and women, since they constitute the largest segment of the African population. Investing in African youth and women (SDG 5) will definitely create wealth and ensure socio-political stability on the continent. In recognition of the powerful potentials of youth and women in the society, the ATPS has created platforms to empower the youth and women to attain their aspirations and potentials. These platforms include the African Youth Forum for Science and Technology (AYFST) and the African Women Forum for Science and Technology (AWFST).

### 4. Knowledge management, brokerage, and commercialization:

Under this strategic objective, we plan to broker the adoption, commercialization and sharing of locally developed scientific knowledge, technologies and innovations that could transform African society into innovation-led, knowledge-based economy. Scientific knowledge will only be useful if it is translated into technologies and innovations useful for addressing societal needs. These are captured in SDGs 9, 10 and 11 as well as in STISA's priority 3. We will act as independent knowledge brokers to foster effective policies and incentives for technology cooperation between and among institutions and countries for socio-economic development. We will recognize both modern and indigenous

technologies and innovations and promote its acceptability, deployment and use.

### 5. Intra-Africa and global collaboration and partnerships:

Under this strategic objective, we plan to develop new forms of intra-Africa and global partnerships within and amongst stakeholders interested in achieving the continental STI Agenda (AU's Agenda 2063) and the SDGs especially SDG 17. We will facilitate the culture of networking and mutual collaborations amongst STI stakeholders in Africa and internationally so as to foster rapid deployment of technologies and technology transfer systems. We will support the harmonization of policies across regional blocs in Africa so as to foster integration and free trade within the blocs and the entire continent at large. To achieve this objective, we will work closely with like-minded institutions, develop MOUs and PAs that will build trusts and achieve enduring results.

More details about these themes and programmes are available online at: [https://atpsnet.org/wp-content/uploads/2017/12/ATPS-Phase-VIII-Strategic-Plan-2017-2022\\_Final.pdf](https://atpsnet.org/wp-content/uploads/2017/12/ATPS-Phase-VIII-Strategic-Plan-2017-2022_Final.pdf). These strategic priorities (thematic and programmatic) align very well with most of the development agenda in Africa, including the Sustainable Development Goals (SDGs), the Africa's Agenda 2063, the African Development Bank (AfDB)'s Hi Five Priorities, and the national development agenda and visions in most of the African countries. We aim to seek for supports and collaborations from different institutions and organizations charged with the implementation of these development agenda especially in Africa. The ATPS has benefitted and continues to enjoy the support from many development partners, donors and governments at various levels in the achievement of our mandate.

## ATPS ACHIEVEMENTS SO FAR

Since the official establishment of the ATPS in 1994 as the premier STI policy research and policymaking network in Africa, the ATPS has continually impacted on Africa's STI development in many fronts.

### 1. Facilitated the development of STI policies of regional and national governments in Africa:

Through series of policy research and advocacy actions, the ATPS has facilitated the development of STI policies and strategies in many African countries including Nigeria, Ghana, Kenya, Benin Republic, Lesotho, Uganda, Tanzania, Malawi, Ethiopia, Cameroon, Liberia, Swaziland, and Zimbabwe among many others. The ATPS made inputs to the Consolidated Plan of Action (CPA) of the African Union that metamorphosed into the Science, Technology and Innovation Strategy (STISA 2024) for Africa. As an accredited institutional Partner of the African Union Commission (AUC) the ATPS provides inputs to the Specialized Technical Committee on Education, Science and Technology (STC-EST) of the AUC. The ATPS also developed the first ever *African Manifesto for Science, Technology and Innovation* ([http://www.atpsnet.org/Files/the\\_african\\_manifesto\\_for\\_st&i.pdf](http://www.atpsnet.org/Files/the_african_manifesto_for_st&i.pdf)) that provided a roadmap for attaining socio-economic development in African through investments in science, technology and innovation.

### 2. STI Policy research, capacity building and outreach:

The ATPS has supported the conduct of policy research endeavours in over **30 countries** in Africa in the areas of agriculture, energy, climate change and environment, health, intellectual property rights, entrepreneurship, etc. These research interventions have generated tremendous knowledge products for decision-making in Africa. The ATPS

capacity building program has trained researchers, policymakers, private sector actors, the civil society, extension agents, farmers, the media and many more and enabled them to accomplish desired goals and objectives for sustainable development in Africa. We have commissioned and completed over **150** STI research projects; published over **500** research papers, policy briefs and reports including some global and regional reports; developed **4** training manuals on different areas of STI including STI policy manual, entrepreneurship training manual and Intellectual Property training manual; facilitated the development of STI policies in about **17** African countries; trained over **8000** different stakeholders of the ATPS; engaged over **5000** ATPS stakeholders in various events in Africa and beyond; conducted over **75** training workshops; signed over **30** MOUs; developed new project partnerships with other like-minded institutions across Africa and beyond; and launched **2** youth and gender programs - The Youth Innovation Challenge (Y I CAN) and Women Innovation Challenge (WE CAN) programs with **24** innovation challenge grants awarded among many others. Through one of our programmes, we and our partners have facilitated the commercialization of over **110** technologies, created over **12,000** jobs and working with over **50,000** farmers, established **350** SMEs, supported over **280** new businesses across Africa and created linkages with over 20 incubators and mini-incubators across Africa.

**3. Development of practical technologies to help the poor:** ATPS in collaboration with the United States Department of Agriculture, Agriculture and Research Service (USDA-ARS) among other global partners developed an is out-scaling an award winning **LandPKS mobile app technology** that enable users instantly access climatic and soil information at any point given location and use the

information generated to make informed decisions on their farm enterprises including production, processing, marketing and utilization. ATPS has won two awards: **Wazo Prize** and **Tekeleza Prize** for promoting the adoption and out-scaling of the technology in Kenya and continues to receive supports from development partners, donors and governments to out-scale the technology across Africa.

**4. Ranked as the Best Think Tank in Africa:** For six consecutive years now, the ATPS has consistently been ranked by the Global Go To Think Tank Index Report as the best think tank in Africa (getting the highest number of rankings as well as ranking first in more categories). The 2019 Report released in January 2020 ranks the ATPS as the **1<sup>st</sup> Top Science and Technology Policy Think Tank in Africa and 10<sup>th</sup> globally**. The ATPS also ranked tops in many other categories that were used to assess Think Tanks across the world. Notable among these categories where the ATPS ranked tops are: Best Think Tank Network; Best Managed Think Tank; Think Tank with the Most Innovative Policy Ideas/Proposals; Think Tank with the Most Significant Impact on Public Policy; Best Trans-disciplinary Research Think Tank; Best Advocacy Campaign Think Tank; Think Tank with the Best Use of the Internet; and Think Tank with the Best institutional collaboration involving two or more Think Tanks among many others. Details of the ranking can be found in the report at:

[https://repository.upenn.edu/cgi/viewcontent.cgi?article=1018&context=think\\_tanks](https://repository.upenn.edu/cgi/viewcontent.cgi?article=1018&context=think_tanks)

**5. Positive Evaluation Assessments:** The latest external evaluation assessment of core funding support to the ATPS by the Ministry of Foreign Affairs, the Netherlands scored the ATPS an "AAA Grade" on the average. The score was based on ATPS's effectiveness, efficiency and

value for money in all its activities and program implementation. Responses were received from ATPS stakeholders in Africa and globally. Our annual audits have shown positive financial responsibility and continuous ability of the ATPS to meet its financial obligations.

## CONCLUSION

The ATPS remains focused in their mandate to strengthen Africa's capabilities in science, technology and innovation for sustainable development. We strongly believe that no country can develop without STI and those who are already developed also adopted and mainstreamed STI in their development agenda. To continually achieve this mandate and to remain relevant in meeting the needs and aspirations of Africans we developed a new strategy that is aligned with key developmental goals including the SDGs, Africa's Agenda 2063 (STISA 2024), AfDB's Hi Five Agenda and other national and regional priorities.

ATPS seeks through our strategic thematic and programmatic priorities to contribute to poverty alleviation through science, technology and innovation research, policy and practice. The centre piece of the mission is the strong belief that in Africa's current predicament, bridging the knowledge, technological and innovation capacity gaps between Africa and the rest of the world is the foundation for inclusive growth and sustained economic prosperity.

We recognize that achieving the desired outcomes from the ATPS strategy will require significant investments in terms of Overseas Development Assistance (ODA), government supports, and private sector investments. We invite both traditional and new partners to support the new ATPS Phase VIII Strategic Plan 2017-2022 through core grants, thematic/programmatic grants, and consultancies to enable us achieve our stated objectives aimed at using science, technology and innovation in achieving sustainable development in Africa.

# KMFRI: CENTRE OF EXCELLENCE IN MARINE RESEARCH, CLEARING HOUSE ON INFORMATION, DATA ON BLUE ECONOMY

By Professor James Njiru- Director KMFRI



The *blue economy* is the “sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem.”

European Commission defines it as «All economic activities related to oceans, seas and coasts. It covers a wide range of interlinked established and emerging sectors.»

The Commonwealth of Nations considers it «an emerging concept which encourages better stewardship of our ocean or <blue> resources.»

Conservation International adds that «blue economy also includes economic benefits that may not be marketed, such as carbon storage, coastal protection, cultural values and biodiversity.

Kenya Marine and Fisheries Research Institute (KMFRI) is a regional centre of excellence in marine research. The institute is the mandated *Information and Data Clearing House for Blue Economy*. The blue economy is the “sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem.”

Within our *National Research Mandate*, we undertake Innovative Research in

Fisheries, Physico-chemical and Geological Oceanography; Aquatic Biology, Ecology and Environment; Bioprospecting; Applied Technologies in Aquaculture (including Mariculture); and Socio Economics for the Development and growth of the Blue Economy.

Among these Research areas, and of crucial interest is our coverage of the Coastal Area / Zone, mostly directed to rehabilitating and improving utilization of Critical Ecosystems and Habitats (Which have in the past been faced with heavy or wanton degradation). These include among others: Mangrove wetlands/Areas, Sea Grass Beds, and Coral Reefs.

Our mangrove research is shaping the world in areas of blue economy, integrated coastal area management, mariculture, sustainable management of mangrove forests, ocean- based climate actions, and of course development of carbon offset projects, involving mangroves.

**Mikoko Pamoja** – Based in Gazi Bay, is the first community project in the world to restore and protect mangroves through sale of carbon credits. Success of Mikoko Pamoja made us win the coveted UN's Equator Prize in 2017 as a blue solution to climate change challenges.

At the regional level, KMFRI has partnered with UNEP in developing ‘regional guidelines for ecological mangrove restoration’. The guidelines will serve as a cookbook on how, when and where to restore mangroves for sustainable coastal development.

Climate change remains a major threat to society. We have been able to map areas vulnerable to climate change impacts, such as rising sea levels. Low lying areas of our coasts, including Tana Delta, that are at risk. We have witnessed losses of mangroves due to climate change in Dodori, Pate, and Mkunumbi in Lamu.

KMFRI played a coordinating role in efforts leading to the of The Intergovernmental Panel on Climate Change (IPCC) Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) that was approved in Monaco on 25th of September 2019.

The overarching message of the report is that negative impacts of human activities are responsible for global warming that is affecting our oceans, leading to: decline in fish stocks, death of coral reefs, and rising sea levels that could displace millions of people. Global warming has already reached 1°C above the pre-industrial level, due to past and current greenhouse gas emissions. There is overwhelming evidence that this is resulting in profound consequences for ecosystems and people.

The ocean is now warmer, more acidic and less productive than before. Melting glaciers and ice sheets are causing sea level rise, and extreme coastal events are becoming more frequent and severe. Meanwhile, ocean acidification is dissolving calcifying organisms such as corals and oysters.

But it is not all doom. Oceans are highly resilient. They have solutions for recovery. Especially when we restore the degraded areas ecosystems (e.g. Mangroves wetlands, seagrasses beds and salt marshes, which are important carbon sinks).

Carbon storage in Kenya's mangrove forests has been estimated at 1500 tC/ha. This is 10 times higher than carbon stored in most terrestrial ecosystems. When degraded, coastal wetlands release the stored carbon leading to global warming.

# LOW AFLATOXIN IN CROPS GROWN USING PUSH-PULL TECH

By Duncan Mboyah

**A**flatoxin, a type of toxin produced by fungi or mould and clings onto crops, especially maize, when the crops are not dried and stored properly, is a major problem in Kenya and other developing countries. It is a major source of food insecurity that is still overlooked.

Even more aflatoxin is linked to mutation and cancers especially cancer of the liver in humans. It is found in various crops and not just maize. These include even rice, sorghum, millet cassava, beans, groundnuts and others.

In Kenya, where people rely on maize flour, there is need for a quicker solution to the problem given that most maize is increasingly reportedly contaminated. But according to a scientist at the global insect research institute, there are low incidences of aflatoxin in maize grown using push and pull technology in Western Kenya.

Nancy Njeru, a researcher at the International Centre for Insect Physiology and Ecology (Icipe) says that there is low ear rots and levels of aflatoxins in maize grown under the push and pull technology.

“Higher proportion of non push and pull samples had aflatoxin and fumonisin levels far above acceptable Kenyan regulatory

threshold,” Njeru says during an interview in her laboratory at ICIPE’s Thomas Odhiambo Campus in Mbita, Western Kenya.

Njeru notes that the study that was done in 116 Push and Pull and 139 non Push and Pull farms in Vihiga, Kisumu, Kakamega, Migori and Siaya Counties in 2017 – 2019 revealed that aflatoxin levels were also positively associated with stem borer damage.

She says that the levels of aflatoxin and fumonisin in maize in Western Kenya were influenced both by pre – harvest agronomic practices and by the cropping system adopted. “20 percent of maize samples were contaminated with both aflatoxin and fumonisin, with proportion of maize samples without aflatoxins contamination being significantly higher from push and pull farms,” she says.

She reveals that across the five counties, there were less than 10 percent of push and pull maize samples contaminated with aflatoxin, except Siaya where the proportion was 12 percent.

The survey found out that a great proportion of the farming population in the region though fairly literate, have no knowledge of maize ear roots and aflatoxin. The knowledge gap stands as a great threat to acquisition and utilization of safe food for human and feed for animals.



# ICIPE TURNS 50



**On 7<sup>th</sup> April 1970, the International Centre of Insect Physiology and Ecology (icipe), Africa's only institution dedicated to the study of insects and other arthropods, was officially registered by the Government of Kenya, its host country.**

Icipe was founded by the late internationally renowned Kenyan scientist, Prof. Thomas Odhiambo. This was at a time when the very notion that insect science – or indeed, the then woefully small indigenous African scientific communities – could contribute to a prosperous future for Africa, must have seemed audacious to say the least.

And yet, icipe has progressed and thrived as envisioned.

Today, the Centre prevails as a model of scientific excellence, uniquely combining generation of world-class knowledge, and the translation of such insights into innovative technologies, transforming the lives of numerous communities across Africa. The Centre is also distinct in its holistic approach, working across Human Health, Animal Health, Plant Health and Environmental Health.

With its headquarters and field stations in Kenya; country offices in Ethiopia and Uganda; operations in more than 41 African countries; 79 donors; and over 300 partnerships with a diverse range of organisations including academic, research, public and private institutions across the world, *icipe* is truly African, and remarkably global.

## Unique from the start

Right from its founding, *icipe* stood out in several ways; first as an idea conceived by an individual scientist. And then, in an era when most African countries were aiming to establish national institutions, *icipe* was conceived as an international organisation, with a mandate for Africa and the tropical regions.

Moreover, the Centre's overall vision was to push the frontiers of science, not just for the sake of it, but because of the direct relevance to significant challenges affecting the continent. This foresight of undertaking advanced mission-oriented

research and technology development was in contrast to traditional approaches to science in Africa over the eras, which accorded exclusive emphasis to one aspect – either basic or applied research – at the expense of the other.

*icipe* may be described as an experiment that worked – a study in the intellectual communion of Africa's scientific communities and research institutions across the world to solve the continent's priority problems.

## Selected examples of success\*

**Human Health Theme:** *icipe*'s most significant contribution is in malaria control, where the Centre's extensive and ongoing studies on mosquitoes and the malaria-causing *Plasmodium* parasites have led to the development of a range of tools and strategies. *icipe* continues to employ these solutions with commendable success, through an integrated vector management (IVM) approach. Indeed, the Centre is noted for its leadership in IVM; a process that seeks to improve the efficiency, cost-effectiveness, ecological soundness and sustainability in the control of insect transmitted diseases.

**Animal Health Theme:** The tsetse repellent collars stand out as a fascinating centrepiece. This technology is based on chemical cues identified by *icipe* researchers from waterbuck (an animal that is common in tsetse habitats but is not fed upon by the insects). A blend of these chemicals has been packaged in innovative dispensers which, when worn as collars around the neck of cattle, essentially make the animals unattractive to tsetse flies. The tsetse repellent collar technology has undergone intense trials and has now reached a stage of full-scale commercialisation.

**Plant Health Theme:** The *icipe* push-pull technology is another fascinating example of success, due to its ability to provide a platform to address a complex set of issues. Push-pull, an innovative companion cropping technology developed over the past 25 years by *icipe* in close collaboration with national partners in eastern Africa, and Rothamsted Research, United Kingdom, is modelled along the African smallholder farming system of multiple cropping. Push-pull was originally created for the control of stemborers, the key pests of cereal crops in Africa. The technology involves intercropping cereal crops with insect repellent legumes in the *Desmodium* genus; and planting an attractive forage plant as a border around this intercrop. The intercrop emits a blend of compounds that repel ('push') away stemborer moths, while the border plants release semiochemicals that are attractive ('pull') to the pests. In addition, push-pull has also been found to control the parasitic *Striga* weeds, aflatoxins and other mycotoxins, while improving soil health and providing high quality fodder, since the companion crops are superior forages. The technology therefore facilitates crop-livestock integration, thus expanding farmers' income streams. Most recently, push-pull has been found to be effective in controlling the invasive and highly devastating fall armyworm, whose arrival into the continent in 2016 spelt potential doom for production of cereals (and many other crops) in Africa. A climate-smart push-pull has recently been developed and disseminated, in view of increasingly dry conditions in many parts of Africa.

**Environmental Health Theme:** *icipe* activities in the sustainable exploitation of commercial and beneficial insects have enabled the establishment of beekeeping and silk farming value chains in several parts of Africa. These initiatives have become lifelines for rural communities, especially those living in fragile or natural resource-rich ecosystems. Moreover, such ventures have provided a basis to create dignified jobs for young people, specifically through initiatives in Ethiopia.

**Insects for food, feed and other uses:** The Centre is a leader in this globally emerging research area, originating knowledge on aspects such as: diversity, host plants and abundance of various edible insects; their nutritional profiles; rearing protocols; and developing simple methods to extract insect oils that could be used as food ingredients and in skincare products. In addition, *icipe* has been involved in determining aspects that will enable insect-based enterprises, for example through training of researchers and potential entrepreneurs; and preparation of policies and industry standards.

**Capacity building:** The longstanding focus on strengthening skills and leadership capabilities in insect science across Africa is one of *icipe*'s most sustained achievements. While the Centre has impacted thousands of researchers and stakeholders, the African Regional Postgraduate Program in Insect Science (ARPPIS) remains paramount as a continental effort to nurture and retain young African talent. Between 1983 and 2019, 723 postgraduates (PhDs and MScs) from 33 African countries (plus 67 postgraduates from 15 countries outside of Africa) completed their training, including 242 through ARPPIS. Many of the ARPPIS graduates (about 75%) are today contributing to Africa's future via their research, development or higher education roles across Africa. The African alumni (377 MSc, 346 PhD students, and more than 50 postdoctoral fellows) represent an outstanding community of researchers in relevant fields who are well-positioned to advance research for development and higher education on the continent. This is evidenced, for example, by four *icipe* alumni members, all women, having taken the position of Vice Chancellor at public universities in Kenya in the past 10 years.

**Innovation and bioeconomy for socio-economic transformation:**

In recent years, *icipe* has re-examined its contribution to Africa's concerted goals of achieving inclusive and sustainable development. One way is by creating much needed technical and scientific capacity, to enable incorporation of bioscience research into developmental agendas. This vision, backed by the Centre's demonstrable institutional strengths, has resulted in *icipe* being mandated to host and manage two novel and landmark initiatives: the Regional Scholarship and Innovation Fund (RSIF – <https://www.rsif-paset.org>) of the Africa-led Partnership for skills in Applied Sciences, Engineering and Technology (PASET); and BioInnovate Africa Programme (<https://bioinnovate-africa.org>), one of Africa's largest regional innovation-driven science initiatives.

\*A special report providing the first comprehensive narrative of *icipe*, from inception to present day and the Centre's future forecast, will be available soon.

The **International Centre of Insect Physiology and Ecology** ([www.icipe.org](http://www.icipe.org)): Our mission is to help alleviate poverty, ensure food security, and improve the overall health status of peoples of the tropics, by developing and disseminating management tools and strategies for harmful and useful arthropods, while preserving the natural resource base through research and capacity building. *icipe* gratefully acknowledges the financial support of the following core donors: Swiss Agency for Development and Cooperation (SDC); Swedish International Development Cooperation Agency (Sida); UK Aid, from the government of the United Kingdom; the Ministry of Higher Education, Science and Technology, Kenya; and the Government of the Federal Democratic Republic of Ethiopia. In addition, *icipe* receives restricted project funding from a range of institutions from across the world, among them, governments, private foundations and United Nations agencies. *icipe* also benefits from extensive partnerships with research collaborators (including universities and research institutes in Africa and beyond), private sector partners, and communities across Africa. A comprehensive list of *icipe* donors and partners is available at: <http://www.icipe.org/donors-and-partners>. For further information on *icipe* visit: [www.icipe.org](http://www.icipe.org)



UGANDA TECHNOLOGY AND MANAGEMENT UNIVERSITY

UTAMU

The International Journal of Technology and Management (IJOTM) calls for academic papers for a publication in July 2020, in the areas of technology and management. IJOTM is an international, peer-reviewed open access journal at <https://ijotm.utamu.ac.ug> (ISSN 2518-8623). The Journal aims at publishing critically written articles of research, surveys, reviews from the different disciplines of technology and management.

CLICK HERE TO SUBMIT YOUR MANUSCRIPT ONLINE or use this URL in your browser  
<https://ijotm.utamu.ac.ug/index.php/ijotm/about/submissions>.

Alternatively, send your manuscript directly to the Editorial Assistant at [ijotm@utamu.ac.ug](mailto:ijotm@utamu.ac.ug).

Check the deadlines at the journal website.

**The East African Science and Technology Commission (EASTECO) recently published the second issue of the East African Journal of Science, Technology and Innovation (EAJSTI) online at [www.eajsti.org](http://www.eajsti.org).**

The following papers were published in this issue Vol. 1 No. 2 (2020)

DOI: <https://doi.org/10.37425/eajsti.1.2> **Published:** 2020-03-20

## ARTICLES

**SYNTHESIS, CHARACTERISATION AND APPLICATION OF CHROMIC OXIDE-LOPHIRA ALATA CARBONIZED SAWDUST NANOCOMPOSITE (COLACSN) IN REMOVING CD<sup>2+</sup> AND PB<sup>2+</sup> IONS FROM AQUEOUS SOLUTION.**

Okponmwense Moses, James Majebi Okuo

DOI <https://doi.org/10.37425/eajsti.1.2.131>

**Analysis of gender parity in climate change adaptation actions within Kajiado and Kiambu counties, Kenya**

Abdimajid Nunow, Nzioka John Muthama, Josiah Mwivandi Kinama

DOI <https://doi.org/10.37425/eajsti.1.2.138>

**Chemical composition of *Azadirachta indica* A. Juss and *Ricinus communis* Linn. seed oils growing in Marigat, Baringo County, Kenya**

Ann Kiplagat Jepkorir, Dr.Charles I. Maina, Dr.Philip K. Bett

DOI <https://doi.org/10.37425/eajsti.1.2.88>

**The interplay between traders, products, and customers in fresh produce business establishment and operation in Nairobi City Park market, Kenya**

Mwamburi Mcharo, Fuchaka Waswa

DOI <https://doi.org/10.37425/eajsti.1.2.17>

**An Adoption model for a big data analytics system for improving healthcare services in Burundi's public hospitals**

Yves Habimana, Irene Moseti-Morara , Damaris Odero

DOI <https://doi.org/10.37425/eajsti.1.2.90>





## BioInnovate Africa Fellowship for Women Scientists (BA-FWS)



### Call for Applications

Nomination and application deadline: Monday 25 May 2020, 23:59 hours East Africa Time

#### 1. Context

BioInnovate Africa (BA) is the largest regional innovation-driven bioeconomy platform in Africa, comprising over 300 scientists and innovators based in more than 90 organisations. It currently operates in six countries: Burundi, Ethiopia, Kenya, Rwanda, Tanzania and Uganda, and collaborates also with partners in South Sudan. BA was established in 2010 with support from the Swedish International Development Cooperation Agency (Sida) and is based at the International Centre of Insect Physiology and Ecology (*icipe*) in Nairobi, Kenya.

The mission of BA is to enable scientists, industry partners and policy makers to co-create and translate innovative bioscience research ideas, inventions and technologies into practical use for societal benefit. As such, BA supports scientists and innovators to create sustainable bio enterprises and works with institutional leaders and policy makers to build productive biobased innovation ecosystems.

The BA Fellowship for Women Scientists (BA-FWS) is a strategy to increase women's participation in bio-entrepreneurship and bio-innovation in eastern Africa. The Fellowship provides opportunities for early and mid-career women scientists to work with and learn from the diverse BA bioeconomy projects and networks in the region. The Fellows are hosted in BA organisations outside their home countries for a period of four to six months, where they gain experience and establish networks to advance their skills, innovation capacity and overall career progression.

#### 2. Themes, projects and topics

Prospective applicants to the 2020 Fellowship call should select up to two topics from any of the following themes of BA projects:

- a. Phytomedicine/biopharmaceuticals
- b. Food and nutrition
- c. Biofuels
- d. Biopesticides
- e. Biofertilizers
- f. Industrial enzymes
- g. Insect-based proteins
- h. Bioeconomy policies

Placement of a Fellow in a project is guided by the applicant's choice of a theme of interest and an independent assessment by the BA of their capacity to work in the project based on academic qualifications and/or career interests.

#### 3. What the Fellowship provides

The Fellowship package includes a round trip air ticket (from home country to country of host organisation), one-off relocation allowance of US\$ 500, modest monthly stipend of US\$ 1,000 and health insurance for the Fellows.

#### 4. Benefits of becoming a BA Fellow

- a. Practical experience: Each Fellow is placed in a BA supported project, working alongside peers in biological based research and innovation. This hands-on opportunity provides an all-rounded experience in developing, testing, producing and commercializing impactful innovative biological based ideas and technologies.
- b. Career development: This fully supported Fellowship includes one-on-one mentorship by leading research scientists and bio-innovators, as well as access to entrepreneurs and leaders in bio-innovation in eastern Africa and around the world.
- c. Knowledge and skills improvement: The Fellowship ensures access to advanced training opportunities to nurture practical skills in applying scientific knowledge for beneficial societal use, as well as leadership skills in managing innovation projects.
- d. Networking: Fellows are assured of interaction with other Fellows, project teams and researchers/scientists in the host organizations. This widens their network and creates opportunities for scientific collaboration.

## 5. Expected outcomes of the BA Fellowship

BA Fellows will continue to interact with each other and the teams they have worked or networked with and be able to develop their ideas into bankable bio innovation projects in the region. Beyond the Fellowship, and upon return to their respective organizations, Fellows are expected to contribute to innovation ecosystem building, and serve as role models for other female scientists.

## 6. Eligibility

- a. Female national or resident of Burundi, Ethiopia, Kenya, Rwanda, South Sudan, Tanzania, Uganda.
- b. Master's degree holder in any of the following fields: biological, chemical or environmental sciences, medicine, ICT, agriculture, engineering or any other closely related field.
- c. Early and mid-career female scientist affiliated to a university, research institute or relevant legally registered private firm, which is currently participating in a BA project.
- d. Readiness to take up the Fellowship on a full-time basis, and in a BA partner country other than their own.
- e. Not a previous Fellow.

## 7. Application requirements

All applications **MUST** be accompanied by:

- a. A motivational essay of between 500 and 700 words detailing interest in the BA Fellowship, and how the Fellowship will contribute to career advancement. Applicants should **clearly** indicate the BA theme to which their idea applies. The idea will be evaluated for its potential to develop into a possible bio-innovation project on completing the Fellowship.
- b. An up-to-date Curriculum Vitae, which includes at least two referees with knowledge of the applicant's educational and professional qualifications and capabilities.
- c. A signed letter of support from the applicant's head of organisation or department, written on official letterhead. The letter should briefly describe an applicant's suitability for the Fellowship and commitment by the organisation to grant sufficient leave to participate in the Fellowship.

## 8. Application and selection process

- a. Each BA project co-Leader in the organisation, in consultation with the head of the organisation, will nominate a maximum of three (3) individuals, and ensure that the nominees apply for the Fellowship on or before the deadline, which is **Monday 25 May 2020, 23:59 hours East Africa Time**. Nominees who do not fulfil the eligibility and application requirements listed above will be rejected.
- b. The nominees shall apply through the online system [http://grants.bioinnovate-africa.org/forms/womens\\_fellowship\\_2020.php](http://grants.bioinnovate-africa.org/forms/womens_fellowship_2020.php). Only applicants nominated by BA project co-leaders and heads of respective partner organisations will be considered.
- c. The deadline for application is **Monday 25 May 2020, 23:59 hours East Africa Time**. Late applications will not be considered. Applications sent through email or post will not be accepted.
- d. After the application deadline, BA Programme Management Office (PMO) will screen the applications received through the online system for completeness and eligibility. Incomplete applications will be rejected. Qualifying applications will be evaluated by an independent panel of experts set up by the PMO. The panel will select up to 15 applicants in this round of the call.

## 9. Award of the BA Fellowship

Successful applicants will be notified by the end of June 2020 and the Fellows will start working with host project teams anytime from July 2020 and complete their Fellowship by June 2021.

For more information about **BA-FWS**, please contact:

*The Programme Manager, BioInnovate Africa*

*International Centre of Insect Physiology and Ecology, icipe, Duduville Campus, Kasarani*

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*Nairobi, Kenya.*

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### About ScienceAfrica

ScienceAfrica (SA) is a science communications consultancy firm that is keen on popularization of various aspects of STI as the driving force for sustainable socio-economic development in Africa. Since 1994, SA has been providing specialized strategic communications, research, capacity building, media and editorial advisory and hands-on support to various partner organizations in both private and public sectors at national, regional and international levels. SA has a wide network of highly skilled partners spread all over sub-Saharan Africa that are capable of meeting the needs of the most demanding and networked organization. At ScienceAfrica, we believe that no society, country or region can develop without mainstreaming STIs into its core development agenda. We have therefore designed the following menu of products and services to provide support to our partners and clients to realize their strategic goals and objectives in the most sustainable way.

## What we do

### Publishing and Editorial Services (PES)

Whether it is book, booklet, report, annual report, newsletter, journal or magazine, among others, ScienceAfrica has a team of expert writers and editors that will meet all your editorial and publishing needs. Our writers, editors and creative designers will work with you to your most demanding expectations. For instance, we edited and designed Kenya's *Malaria Eradication Strategy 2009-2018* for WHO. One of our flagship products is *ScienceAfrica Quarterly Journal* and *ScienceAfrica Weekly Newsletter*.

### Strategic and Corporate Communications (SCC)

In the age of information super highway that facilitates swift global communications, the world has suddenly become a small global village where it's extremely difficult to contain information flow. Everyone with a smart phone is a media house unto him/herself. Thus, control and management of both corporate and individual reputations has become quite challenging. At Science Africa, we understand these challenges and that is why our approach to corporate communications are uniquely strategic, pre-emptive and data-driven.

### Capacity Building and Mentorship (CBM)

ScienceAfrica runs perhaps the most effective communication and media training and mentorship program in Africa. We have developed unique capacity building and mentorship curriculums to suit the needs of various professionals and organizations. We are the pioneer solution journalism trainers in Africa. We have partnered with governments, county governments, international organizations, UN agencies, regional bodies and companies to train and mentor journalist, scientists and communication specialists on effective communication. For more than a decade, we have offered hands-on training and internship program to upcoming and practicing journalists needed in effective reporting mostly on science, technology and related innovations for Africa's socio-economic development. Some of the outstanding trainings planned and executed by ScienceAfrica have been done in partnership with UNDP, Kenya Meteorological Services, Drugs Neglected Diseases Initiative (DNDi) and World Federation of Science Journalists (WFSJ), among others.

### Media Relations and News Service (MRNs):

We have a network of well trained and experienced journalists across Anglophone, Francophone, Lusophone African countries that support our clients' national campaign to launch a new product/project or service, raise public awareness on a social issue and support conferences. Besides the external journalists working with mainstream media in Africa and globally, Science Africa have in-house team of reporters, science writers and media planners ready to plan and execute your media relation needs that deliver results. We are particularly skilled in providing the creative insight needed to effectively communicate intricate scientific, technical and development issues.

### Public Engagement and Participation (PEP)

The need to involve the public in decision making on any project plan, design, implementation and evaluation needs no emphasis. Public knowledge and acceptance of any development initiative are the keys to a project's success and sustainability. ScienceAfrica has designed arrange of effective Public Engagement strategies and tools to help our partners meet their needs.

### Research, Monitoring, Evaluation and Learning (RMEL)

Research is the basis of good project design and implementation as it produces necessary input data. ScienceAfrica undertakes audience research, opinion surveys, content analysis, among others. We believe that good planning, monitoring and evaluation enhance learning and the contribution of the project or organization by establishing clear links between past, present and future initiatives and development results. Our team of experts will work with you cover your wholistic research needs.

### Policy and Regulatory Support (PRS)

It takes experience, expertise, in-depth knowledge to navigate the regulatory minefield of the science, technology and innovation. ScienceAfrica team have accumulated years of helping organization to open up policy and regulatory environments through well-thought out policy advocacy in very tricky areas like agriculture, biotechnology and health. We provide support leading to adoption, review or implementation of better policies by leveraging our good standing with high-level policy makers and science, technology and innovation councils in Africa. We have experience running STI and development policy advocacy and communications campaign programs. Our high-level and community dynamic approach is backed up with solid research to inform the process.

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