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Africa Digest

Trends and Issues in Macro Environment

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1. Developments in Agriculture

Food security is often an issue in emerging countries. Africa faces a challenge, as its food production is far lower than its potential. The root causes are the lack of technology and finance and archaic farming practices. Although these factors are understood and widely discussed, lack of funding limits progress in modernising agriculture in Africa. Observers see increasing diversification in the products produced in Africa. This month's report addresses some of the latest developments in the field of agriculture.

THE NEED FOR MODERN IRRIGATION SYSTEMS IN AFRICA

Although the agricultural sector in Sub-Saharan Africa employs about 60% of the population and is responsible for 23% of the GDP, its productivity lags the rest of the world. The agriculture sector mostly relies on rainwater or manual irrigation. In Sub-Saharan Africa, only 4% of agricultural land is irrigated. In North Africa, this figure is 28%. Viewing Africa as an entity, more than 67% of the agricultural areas equipped with irrigation systems are in the five countries of Egypt, Madagascar, Morocco, South Africa, and Sudan.

As stated above, most African farmers rely on rainwater or existing water sources that often contain polluted water. Pollution may cause serious damage to the field and crops, and later to the consumers of the crops.

Regularly irrigated land yields about twice or more crop than land irrigated by rain and manual irrigation. The absence of irrigation systems in 96% of agricultural lands in Sub-Saharan Africa is therefore the primary reason why the sector's productivity is considered to be the lowest in the world.

Encouraging smart and calculated investments in irrigation systems would significantly increase productivity. Higher crop yields will benefit the whole of Africa: higher economic growth, job creation, increased exports and decreased imports, and lower food prices.

This is an achievable goal. Irrigation systems are increasingly more accessible and affordable, with advanced technology systems facilitating the use of extremely affordable energy sources.¹

IMPROVING RICE PRODUCTION

Tanzania's Expanding Rice Production Project (ERPP) launched in March 2015. The ERPP seeks to boost rice production, increase food security and strengthen the country's agricultural sector. The programme specifically focuses on improving agricultural practices for smallholder farmers and farms run by women. It has achieved improved rice productivity, better irrigation systems, linked small farmers to markets to sell their produce, and enabled increases in revenue.

The success of the ERPP can be ascribed to the implementation of sustainable seed systems and the improvements in production technology. Farmers learned a new farming technique called System of Rice Intensification (SRI). The SRI technique tripled rice productivity through changes in the management of plants, soil, water and nutrients. The programme led to an increase in the average number of farmers producing rice paddies from 1.8% in January 2014 to 5.4% in May 2019. It also increased rice production in the country, improving food security in the process.

The ERPP is expected to help 165,345 people by the end of the program in late April 2020.²

FLORICULTURE IN AFRICA

Russian food retailer X5 will import flower supplies directly from Ethiopia through RVI, its subsidiary responsible for direct imports. The company will import roses grown by Afriflora Sher Company, the operator of the largest rose farm in the world. The flowers will be on sale in Moscow, the Moscow region and St. Petersburg. X5 will be Russia's first food retailer to deliver fresh flowers directly from Africa. Cultivating roses in Ethiopia reduces the production carbon footprint as this uses fewer natural resources than producers based in areas with colder and drier climates.³



The flower industry in Ethiopia is the second largest flower sector in Africa, after Kenya. The country earned US\$261 million from the export of flowers in the past fiscal year, ending July 2019.

The export of Ethiopia's horticulture products (flowers, fruit, vegetables and herbs) has been increasing steadily over time. The flower sector has been the main generator of export revenues. To date, the Netherlands, Saudi Arabia, UK, USA, Japan, Norway, Germany, UAE, Belgium and Italy are the main export destinations of Ethiopian horticulture products.

More than 100 companies in Ethiopia cultivate horticulture products. These firms have origins in a variety of countries, e.g. Netherlands, India, USA, Israel, Saudi Arabia, German, UK, France, Ecuador, and Belgium. Floriculture created over 100,000 employment opportunities in the sector.⁴

In October 2019, five foreign companies from the Netherlands showed interest in Ethiopia's floriculture sector. They will engage in floriculture development on 500 hectares of land in Amhara regional state. Dutch ambassador Bengt van Loosdrecht pledged to provide €20 million support to improve the livelihoods of residents of the area.⁵

NEEDS TO ADOPT NEW FARMING PRACTICES

In Nigeria, most food systems are supplied by rain-fed agriculture. Hence, variations in rainfall have the potential to disrupt food security in the country.

One solution to the challenge of food security in Nigeria is the adoption of "no-till" farming - the practice of growing crops without disturbing the soil through tillage. Scaling up the practice of no-till in Nigeria requires addressing and overcoming three fundamental barriers:

- First, Nigerian farmers must adopt agroecology practices, which are farming practices designed to make the most of nature's resources whilst limiting negative effects on the soil.
- Second, few farmers have the funding and finance necessary to implement these new techniques. Farmers should therefore be encouraged to share resources.
- Third, the specialised planting machinery required for the new farming practices in Nigeria is often expensive or ill-suited to the country's soils.

Patience Koku, owner of the company 1Hectare1Family, is addressing this by working in collaboration with a number of partners from abroad (as far away as New Zealand) to find cheaper and more efficient tools to use in Nigeria.⁶

DEVELOPING AGRI VALUE CHAINS TO ENHANCE FOOD EXPORTS

Rwanda's Ministry of Trade and Industry is prioritising agri-processing for six products: sugar, aquaculture, edible oils, rice, fertilizer and maize. This is part of its policy to recapture the domestic market and lower imports. The initiative is part of a Made-in-Rwanda policy adopted in 2017. The strategy provides for government intervention in certain clusters and value chains, in which Rwanda may feasibly achieve global competitiveness. Optimizing production of the target products could save Rwanda US\$112 million annually.

There are also efforts to add value to other agricultural products, including leather, dairy, Irish potato, wood, ceramics and honey. Quality standards are viewed as a key driver in promoting the exports.

According to the Ministry, they target value chains through sector-specific strategies. They are currently working on the development of rice, cassava and maize value chains. The entire value chain must be addressed. This includes agricultural production, the installation of machinery and the setting up of factories, transportation, and market development. For example, facilitating development of these value chains requires ensuring access to transport infrastructure (e.g. feeder roads to connect farmers, markets and agro-processing industries).

The value chain approach coordinates the work of farmers, the factory, and the market. This ensures the factory has sufficient levels of raw materials and thus raises overall productivity.



The same principle applies to the adoption of new and improved technologies to increase productivity on small plots. To boost agricultural productivity, it is also necessary to develop new high yielding and tolerant crop varieties.⁷

ENCOURAGING BIOFUELS AS ALTERNATIVE TO FOSSIL FUEL

Zimbabwe faces severe fuel shortages, with many motorists leaving their cars at home and using public transport to save money on fuel as prices keep rising. The adoption of bio-fuels can help ease the fuel shortages the country is facing, saving millions of dollars.

Bio-fuels are a special type of fuel made from living things or their waste. In Africa, sugarcane, jatropha and castor bean are some of the crops that have attracted a number of investors in the bio-fuel market.

Zimbabwe recently approved its National Bio-fuels Policy, which seeks to improve the long-term growth, viability and sustainability of the bio-fuels sector. This will reduce the county's dependence on imported petroleum products and the stabilisation of fuel prices.

Zimbabwean farmers have been urged to grow bio-fuel crops such as castor bean due to its diverse properties that can be used in the fuel and pharmaceuticals sectors.

The advantages of bio-fuel crops are that most are drought resistant, require no irrigation and tillage, and are profitable.⁸

POINTS OF INTEREST

- Modern irrigation systems have long been touted as an important contributor to enhancing the productivity of Africa's agriculture sector. An additional benefit of these systems is that it optimises the use of water, an even scarcer resource in a continent that is frequently suffering from the ravages of drought. With water becoming scarcer, the battle for water between society, industry and agriculture will intensify. Optimising the use of water is therefore an imperative. For many smallholder farmers, however, funding remains a challenge.
- Tanzania's initiative to increase rice production in the country is an example of what can be done to increase food security. The basic message: "it can be done." What is needed is a strong political will and resolute policy implementation. The latter requirement, however, frequently goes begging. There should be no excuses for this weakness, and political leaders must act decisively against those that fail to deliver.
- Funding remains a challenge for many farmers in Africa (and globally, for that matter). The • vicious cycle referred to above must be broken in order for all the stakeholders to benefit and for food security to become a non-issue. Former Nigerian president Olusegun Obasanjo is quite vocal about the need to create value by diversifying his country's economy away from an overdependence on oil production and exports and instead to focus on agriculture. In an interview I had with him in 2016 in Singapore, he raised this as a remedy for the economic challenge Nigeria was facing due to the oil price slump of 2014/2015. Should governments take this call seriously, they would not only reduce the risk their economies face due to price volatility in the global market, but also benefit from import substitution and raise the living standards of their population. Nigeria is again facing a massive oil price slump. While the country had developed a national budget based on an oil price of close to US\$60 per barrel, we are now looking at half that. Again the country's currency is under pressure due to its focus on oil as the mainstay of its economy. We will probably again hear calls for a diversification of its economy and for a focus on agriculture. This is not just the case for Nigeria, but a number of other countries are facing the same challenge. There is an old saying that history repeats itself. Others have responded by saying that historians repeat each other. It seems that politicians repeat each other as well.
- It is refreshing to see Rwanda focusing on increasing both the scope and scale of its agricultural production for export. They seem serious about not falling into the trap others like Nigeria have



fallen into, with eyes shut wide, one might add. They view agriculture, and its various value chains, as an ecosystem that must be addressed as an integrated and interrelated system. This is an important point of departure for those who want to create value for all and avoid the trap of unintended consequences. The ecosystem approach highlights the need for appropriate transport infrastructure to help farmers get their products to market and to get input materials to their farms. Food security will remain a threat in the absence of feeder roads.

- Floriculture has become an important sector in East Africa, with the sectors in Kenya, Ethiopia and Rwanda growing strongly. The diversification of the markets these countries are serving is an important strategy. Until recently, the primary market (if not only market) has been the EU. Over the past few years other regions have also been targeted. These include China, the USA, the Middle East and now Russia. Many companies from Europe clearly recognise the potential value of the sector in East Africa. They are increasing their footprint in countries such as Ethiopia. This investment is good for those countries, its people and its industry at large, and helps overcome the funding challenge experienced by locals.
- Zimbabwe's decision to produce biofuels from castor beans has the potential to contribute to alleviation of its fuel problems. The challenge when using food for non-food products is the unintended consequence of food insecurity. When many people go hungry, whether in Africa or globally, the ethical dimension of such a policy stance must be addressed.



2. Developments in Digital Technology

Technology is an essential enabler. The Fourth Industrial Revolution promises digital solutions to many of mankind's challenges. The digital services sector greatly increased levels of financial inclusion in Africa. The same technology now disrupts the business models of established players in banking and financial services. Digital technology enables small investors to contribute to the funding and productivity of the agriculture sector. However, its solutions are not available to all. A phenomenon sociologists call the digital divide prevents many Africans from accessing the advantages of digital technology. This report addresses recent developments in this emerging sector.

DIGITAL DEVELOPMENTS IN HEALTH

Uganda has some of the highest maternal and perinatal mortality rates in the world. In 42% of cases, women delayed seeking healthcare, 9% of which were due to a lack of transport. 49% of cases involved delay in receiving appropriate medical intervention, even when women did try to seek it. This situation led to Asha Namugambe developing a community programme, dubbed "Uber for nurses." The programme works via a mobile app called Taheca and offers pregnant women home check-ups. First-time mothers are also taught how to properly take care of their newborn babies.

According to co-founder Danny Ruyonga, the best way to promote maternal and child health in Uganda is through technology and innovation. Digitalization is becoming the main concept everywhere. The future of healthcare provision is therefore digitally driven.

The Taheca app offers the kind of information women would receive at antenatal services at health centres on a one-on-one service basis. It is aimed at directly addressing maternal challenges.⁹

GROWTH OF DIGITAL LOANS

In Kenya (and elsewhere), mobile phones and increased Internet penetration has led to the movement of loans from traditional channels to electronic channels. Financial institutions started digitizing their services and took advantage of the digital economy. Amongst others, they made financial transactions faster and lending more efficient. Currently there are over 50 digital lending apps in Kenya that provide borrowers with millions of shillings every day.

These apps can determine the creditworthiness of borrowers with great accuracy using social information and various AI tools. The factors the address include mobile phone airtime usage, the amount of money transacted every month, location, Facebook friends, etc. The credit checks are a potential reason for the much lower default levels of mobile money loans compared to loans from shopkeepers, banks, friends and family.

With the high penetration of mobile money in Kenya, it is now easier and faster than ever to get a credit facility and have the money sent directly to one's phone. The number of people who use these apps keeps growing.

The negative side of mobile-based loans is that the effective 'interest' charged by these apps comes to about 90% per annum for the conservative ones like M-Shwari and KCB-MPESA, and up to 180% per annum for Tala and Branch. In comparison, SACCO (Savings and Credit Cooperatives Societies) loans charge an average of 12% per annum, while banks until recently were limited to not more than 4% above Central Bank of Kenya lending rate, which translates to 13% per annum.¹⁰

FINTECH EXPANSION

Jumo, a South African fintech start-up recently closed a US\$55 million investment round from a diverse group of investors. Jumo offers a technology platform for partners to build savings, lending, and insurance products for customers in emerging markets. In 2018 it raised US\$52 million to expand to Asia. The company has now in total raised US\$146 million in capital. Jumo will use the latest funds to expand into new markets and launch new products in Asia and Africa.



So far its products have disbursed over US\$1 billion in loans, and served over 15 million people and small businesses. Jumo is currently active in six markets, and intends to expand to Nigeria and Cote d'Ivoire in Africa and Bangladesh and India on the sub-continent.

Jumo joins a growing list of African digital-finance start-ups raising big money from outside investors and expanding abroad. Others include Interswitch, Miga and Paga.¹¹

JUMIA INNOVATING ITS BUSINESS MODEL

Jumia, Africa's foremost e-commerce company, has experienced a rather difficult time in recent times. At the end of February 2020, it reported a 34% increase in operating losses to US\$248 million, up from US\$184.2 million posted in 2018. Jumia attributed the loss to an increase in general and administrative expenses.

This was despite a 33% increase in gross merchandise value (GMV) — the total amount of goods sold over the period — to US\$1.1 billion from US\$899.3 million in 2018. While Jumia recorded a GMV growth of 20 to 50% in most product categories, its phones and consumer electronics segment contracted by approximately 20%.

Jumia now intends to reorganise its business to focus on fast-moving consumer goods (FMCG), fashion, beauty and personal care, as well as digital services. According to Jumia co-chief executive Sacha Poignonnec, these categories provide affordable entry points into the Jumia ecosystem, while driving repeat purchase and consumer lifetime value.

Jumia anticipates the coronavirus outbreak will affect its cross-border business and create procurement problems for sellers. In addition, Jumia's challenges include vendors selling counterfeit products, consumer cyber fraud and robberies.¹²

In addition to the added categories, Jumia also decided to offer small, digital, personal loans. In Nigeria, Jumia is now offering fast loans of up to NGN 100,000 (~US\$ 260) via its lifestyle app, Jumia One. The lending option is currently only available to Android users, although the Jumia One app is available to both Android and iOS users.

Jumia One provides easy access to instant micro-loans without collateral and at competitive interest rates and repayment plans, much like regular payday lenders. Jumia One is not new. The app was launched in 2018 as the go-to app for everything. It enables consumers to buy airtime, pay bills, order food, book hotels, arrange flights, book cab rides, gamble, and access all Jumia services in one place.

Following its recent announcement of increasing losses despite increased revenues and users, Jumia is expected to pursue other growth channels. Jumia is likely to scale back its e-commerce activity. Its new digital lending platform is its latest move targeted at the active digital lending space in Africa.¹³

FINTECH & AGRI-TECH SUPPORTING GROWTH IN AGRICULTURE SECTOR

Complete Farmer CEO Desmond Koney stated that the lack of access to funding for smallholder farmers and other stakeholders in the agriculture sector is a major factor that leads to dependence on food imports. Importing food that can be grown on the continent limits economic growth in Africa.

Africa hosts 25% of the world's farmland, but generates only 10% of global crops. A vicious cycle is suppressing the productivity of Africa's farmers, with most smallholder farmers operating at just 40% of their potential capacity due to a lack of access to funding. This, in turn, is due to low crop yields, thereby denying them the collateral for loans at financial institutions. However, tech start-ups are contributing towards the growth of Africa's agriculture potential.

Nigeria's Farmcrowdy pioneered the phenomenon of crowdfunding for the agri-sector in Africa. A number of other start-ups including Complete Farmer soon followed, all contributing (some quite significantly) to link potential investors with famers in need of funding. Integrating the fintech and agri-tech sectors, these platforms are increasingly popular with investors.



According to Farmcrowdy CEO Onyeka Akumah, while crowdfunding can also impact positively on other sectors, such as transportation, the agriculture sector itself has a lot more untapped potential.

According to Koney, Complete Farmer's platform doubles also as a commodity-sourcing platform, where global commodity buyers source agriculture products directly from the farms. This is in addition to expanding access to finance for Africa's smallholder farmers.

Koney observes that while demand for smallholder agriculture finance in Sub-Saharan Africa is estimated to be as high as US\$11 billion, less than 3% of this demand is currently met. The good news is that agribusinesses, financial institutions and government schemes are addressing these issues.¹⁴

COVID-19 BOOSTING ADOPTION OF CRYPTO-CURRENCY?

Egypt's Central Bank very recently imposed limitations on daily cash withdrawals (EGP10,000 for individuals; EGP50,000 for companies; individuals can draw a maximum of EGP5,000 from ATMs). This is a response to the serious cash shortage amid the growing fears of the coronavirus pandemic. Experts are exploring the potential for a massive boost in the adoption of crypto-currency in Egypt.

The adoption of crypto-currency in Egypt witnessed a surge when the government lifted the ban on crypto-currencies in May 2019. The disruption caused by Covid-19 puts the Central Bank under serious pressure, as the local public is withdrawing large sums of cash.

Should the situation deteriorate further, people may seek alternative investment options, such as gold or Bitcoin.¹⁵

POINTS OF INTEREST

- As reported in recent editions of African Digest, digital technology is increasing its contribution to the provision of health services in a continent where doctors and nurses are few and far between. Digital health not only responds to an urgent need for medical care, but also does so at a much lower cost. Accessibility and lower costs are two major benefits resulting from the use of digital technology. Many people in Africa are dying from causes that would not have the same outcome in more developed countries. With the growth of digital health, we should see an increase in health expectancy and a reduction in mortality rates for Africa's population. It remains to be seen whether the policy environment in some countries will keep up with developments in IT and transform their policies to enable the technological dimension of medical services delivery.
- Financial institutions price for the risk profile of their clients by means of the interest rates they charge. Higher rates for higher risk, and lower rates for lower risk. However, the extremely high rates the poor of Africa get charged is morally wrong. Rates of between 990% and 180% are extortionist and governments should step in to limit this scandalous exploitation. The fact that the poor do use these loans is by no means a sign they approve; it is merely indicative that they have no choice!
- The growth of digital technology in Africa's financial sector is not slowing. As indicated in the introduction to this report, fintech threatens the existence of many established retail banks and forces them to innovate and transform their business models. Some have partnered with existing fintechs, while others have developed their own offerings. As fintechs increase the range of their products, they will become more popular, and threaten the establishment. Given their scale, it is increasingly important for central banks to regulate and license these fintechs (many are linked to mobile telephony institutions) to ensure proper supervision. Should a large fintech with millions of users, such as M-Pesa or Paga, go belly-up, it would put the entire sector under serious pressure.
- Jumia, Africa's largest e-commerce company and one-time darling of investors, is again adjusting its business model in an attempt to address the loss-making situation it has been in since its establishment a few years ago. Whether the focus on FMCG and loans will have the



required impact, remains to be seen. Some reports suggest that there is a loss of trust amongst users and investors in Jumia. It is uncertain whether a streamlined focus on the FMCG sector and a new financial product can heal this breach. For loans, Jumia will compete with both the established banks and fintech players that have been around for quite a while and who have developed a loyal segment of users.

- In the report on developments in the agriculture sector, reference was made to the funding challenge many farmers are experiencing. A number of fintech start-up companies have seen the light to address specifically this problem. This number is constantly increasing, linking investors to farmers, and farmers to markets. They play a crucial role in this crowd-sourcing initiative, allowing small-time investors to get involved in agriculture from the comfort of their living rooms. Some, like Farmcrowdy in Nigeria, have expanded the scope of their involvement quite considerably. We should see more of them as the need in the agri-sector is great.
- It will be interesting to see whether the crypto-currency sub-sector will receive an impetus from Covid-19 as central banks place restrictions on cash withdrawals. Whilst protecting its cash flow position, I doubt whether central banks would appreciate a move towards crypto-currencies such as Bitcoin, as this trend reduces the control central banks can exert over the movement of digital money. A focus on the price of digital currencies will be an indication as to whether the market in general thinks that there will be a move towards Bitcoin, etc. Interestingly, the price of one Bitcoin on 12 March was US\$4857. This has now risen on 9 April to US\$7293, a 50% increase. One must bear in mind, however, that correlation does not equal causality.
- Another question that goes with the previous point, is whether Covid-19 will lead to much greater adoption of digital technology. This does seem to be the case. Sagaci Research has found in its investigation of retail in Africa that digital content has skyrocketed. Spending on entertainment, online gym and training and online classes have grown substantially. Mobile transactions have also become the preferred mode of payment and consumers are avoiding cash and card transaction. In Kenya, according to Sagaci Research, most of the transactions are done online, and consumers are moving from cards to M-Pesa. (Note: source of Sagaci Research: webinar on African retail hosted on Thursday, 9 April 2020).



3. Energy Developments

Energy will always be an important issue in Africa. The continent's leaders constantly pursue affordable sources of energy. Approximately 620 million Africans are without access to electricity. However, discovery of gas and oil reserves in new areas will provide new sources both for energy and revenue. This report addresses recent developments in the sector.

FUTURE SCENARIO FOR ENERGY IN AFRICA FAVOURS RENEWABLES

Only half of Africa's population has access to electricity, according to Africa Energy Outlook 2019 (AEO 2019). A large proportion of Africans who do have access suffer from bad and costly service. This is true both for households and businesses. In 2018, about 80% of sub-Saharan African companies reported that they suffered frequent electricity disruptions leading to economic losses.

The International Energy Agency (IEA) identified challenges brought about by the lack of electricity IEA reports that only 30% of the population in sub-Saharan Africa has access to clean cooking facilities. The consequences for public health amongst women and children, for forest degradation, and from rising temperatures are disastrous.

The AEO 2019 identified alternative sources of electricity that would address the challenges African populations are experiencing in the energy field.

- The wide distribution and use of LPG and improved cookstoves.
- Half of the new energy connections will come in the form of mini-grids and stand-alone systems.

This multi-source approach offers several benefits: a lower carbon footprint, less deforestation, and improved health for women and children.

The AEO 2019 also viewed Africa emerging as a major player in natural gas markets as a producer, consumer and exporter. Gas production will more than double by 2040, and the share of gas in Africa's energy mix will rise to 24% by 2040. Africa, led by Mozambique and Egypt, will become a major exporter of natural gas to other parts of the world.

According to the AEO 2019, Africa invests a lot more in renewables and much less in fossil fuel (coal). The high increase in investments in renewables will require reforms from both national governments and the large number of national and multilateral development banks currently active in the green energy investment space across the continent. Should these reforms take place, deployment of solar PV, wind and other renewables like geothermal will accelerate from less than 5 GW today to more than 230 GW by 2040. More than 70% of this capacity will come from solar PV.

Hydropower will continue to play an important role in Africa, but recurring droughts attributed to climate change reinforces the need for many countries to reduce their dependence on hydropower in the total energy-mix.

Despite the growth of investment in renewables, coal- and oil-fired power is also expected to grow.¹⁶

NUCLEAR REMAINS ATTRACTIVE

Rwanda entered into an agreement with Russia to advance the use of nuclear energy for "peaceful purposes." In addition to increasing Russia's influence in East Africa, the agreement will improve the relationship between the two countries.

Russian scientists are to set up a Centre for Nuclear Science and Technology in Kigali. The Russian government nuclear parastatal, Rosatom Global, will set up a nuclear plant by 2024. According to the Rwandan government, the nuclear plant will help in the advancement of technology in agriculture, energy production and environment protection. Rosatom has concluded similar agreements with Kenya, Uganda and Tanzania despite questions regarding the appropriateness of the technology.¹⁷



Ethiopia has also concluded an agreement with Russia (Rosatom as the construction partner) for construction of a nuclear power station (3 GW capacity) within the next ten years. Russia will help to develop the "foundations for an Ethiopian nuclear industry, including the writing of safety regulations and establishing storage facilities for nuclear fuel and waste." The projects will include reactors to create radioactive isotopes for medical, agriculture and research purposes.

This agreement may lead to the construction of an Ethiopian Centre for Nuclear Science and Technology.¹⁸

Rosatom has also concluded an agreement with Uganda to work together in the field of nuclear energy. Uganda is reportedly keen to use its uranium deposits to develop nuclear power.

While the deal "lays the foundation for specific cooperation between Russia and Uganda" in the field of nuclear energy, it also opens up avenues for collaboration in "the creation of nuclear energy infrastructure, the production of radioisotopes for industry, medicine, agriculture, as well as the training of personnel".

Russia first signed an MoU with Uganda in the nuclear energy area in 2017, ahead of China, which signed a similar agreement in 2018.¹⁹

LACK OF PRODUCTIVITY IN NIGERIA'S STATE REFINERIES

Nigeria's state refineries under the management of the Nigerian National Petroleum Corporation (NNPC) processed no crude oil for the months of July, August and September 2019. These three facilities consistently posted losses for 13 consecutive months. In June 2019, the facilities lost N17.4 billion (US\$44.8 million), the highest loss for the 13-month period. In September 2019, while the three refineries processed no crude, they did produce 967 metric tons of finished products.

According to the NNPC, the "declining operational performance recorded is attributable to ongoing revamping of the refineries, which is expected to further enhance capacity utilisation once completed."²⁰

GAS FINDS ON AFRICA'S WEST COAST

Currently the energy world is focused on discoveries along the African east coast and in Mozambique. This part of Africa could soon be sharing the limelight with Senegal on Africa's west coast, as this country has made some substantial deep-water finds. Senegal is therefore a potential hot spot during the next decade for relatively low-cost LNG clusters. These offshore projects are expected to come online between 2022 and 2026. The size of the gas reserves found (apparently in cooperation with Mauritania) is about 40 trillion cubic feet and 1 billion barrels of oil.

The exploitation of the gas reserves will support Senegal's "Plan Emergent Senegal", a project launched by the President of Senegal in 2014.

West Africa has reportedly evolved from a frontier to an emerging hydrocarbon opportunity, attracting the attention of the global industry. The project should deliver social economic benefits to Senegal, including energy security and revenues, employment, development of an infrastructure and social investment.²¹

SETTING UP FOR OIL EXPORTS

In October 2019, Kenya's President Kenyatta announced that Kenya would use Lamu Port to export crude oil, thereby dashing plans to build a refinery for value addition. According to assessments, Kenya's crude oil deposits were insufficient to justify the construction of a refinery. According to research, a refinery would only be economically viable when it has a refining capacity of at least 400,000 barrels a day.

However, the Kenyan government signed agreements with Total, Tullow Oil and Africa Oil Corp to develop a 60,000 - 80,000 barrels per day crude processing facility in June 2019. In addition to the



processing facility, a crude oil export pipeline from Lokichar in Turkana County to Lamu was also part of the deal.

The president stated that Lamu will begin its operations initially as a transhipment hub for global shipping lines. The country's vision was to link Lamu Port to the LAPSSET transport corridor through a road infrastructure, with the aim of using Lamu to export Kenya's crude oil.

Commercial production of Kenya's oil reserves is scheduled to begin in the second half of 2023.22

BAN ON THE IMPORTATION OF GENERATORS

In early March 2020, the Nigerian Senate started the process to criminalise the importation, selling and usage of generators in Nigeria. The bill prescribes a 10-year jail term for importers and sellers of generators. This move comes despite an energy crisis that finds most parts of Nigeria experiencing erratic power supplies.

The sponsor of the bill says the intent was to curb environmental pollution and to facilitate the development of the power sector. The bill excludes importers and sellers of generators meant to power essential services such as hospitals, nursing homes and other healthcare facilities. Airports, railway stations, elevators, escalators, research institutions, and facilities that require 24-hours electric power supply are also exempted.

The Lagos Chamber of Commerce and Industry described the bill as unrealistic as it did not take the reality of the power situation in the country into consideration. The heavy dependence by Nigerians on generators for electricity is a direct consequence of the failure of its electrical power sector.²³

POINTS OF INTEREST

- A few years ago, only a brave person (or a renewable energy fanatic) would make the case for renewable energy (RE) as a viable energy business model for Africa. RE utilisation now grows in leaps and bounds. Wind, solar, hydro, geothermal and biomass are embraced as sources of electricity. In the process, the manufacturing industry is getting a jumpstart, and the living conditions of Africa's population improved, without adding to the challenges of global warming. Two decades ago, high costs were a challenge for the adherents of RE. This is no longer the case. RE also has the benefit of increased efficiencies, ease of deployment, speed of implementation and the ability to serve small and micro villages. Africa is the beneficiary of these developments. It is therefore good to see countries such as Kenya with more than 90% of their energy mix coming from RE sources. Strangely, there are still some who deny the benefits of RE, seeing it as insignificant and too expensive to scale.
- To make matters worse, in my humble opinion, we have countries in Africa embracing nuclear energy. In the same region that we have Kenya with 90%+ of its energy mix from RE, we find the likes of Ethiopia, Rwanda and Uganda who have signed agreements with Rosatom to implement nuclear energy.
- Nigeria's oil refinery problems are hopefully nearing resolution. In addition to refurbishment of its existing state refineries, long operating at extremely low production levels, we also have the Dangote refinery with a capacity of 650,000 bpd. State refineries have a total capacity of approximately 447,000 bpd. Other small private refineries have a capacity of 157,000 bpd. Hopefully the refurbished refineries and the Dangote refinery will eventually enable Nigeria to add value locally before exports. It does not make sense to export crude oil just to import the refined product later on at a much higher price. As it is, given the low oil price, Nigeria must do something to reduce its vulnerability to low oil prices. As mentioned in another report of this Digest, the severe drop in the oil price has again put the Nigerian economy in harm's way. In 2015 much was said about diversifying the Nigeria economy to reduce its risks should oil prices fall. Unfortunately, this did not take place. Kenya should learn from Nigeria and adopt policies to prevent becoming another victim to the same vulnerability.



- Those countries that have discovered new gas and oil reserves should all learn from Nigeria and Angola as victims (self-inflicted) of the resource curse. History, however, does not really give one much hope. In addition to Senegal and Mozambique, Tanzania also has vast gas reserves that could make a significant contribution to the country's wealth.
- A bit of bizarre news was the ban on the importation of generators in Nigeria. The generators are in demand precisely because of the inability of the authorities to provide electricity. Most, if not all, hotels and corporates have their own back-up generators. These generators are expensive to run, and the solution is far from ideal. Without providing an alternative, the Nigerian Senate now wants to jail those that do import generators, except for use in essential services. With all respect due to this august body, one must ask "what were you thinking?" Maybe they should put the same energy and focus into developing a system of energy provision that meets the needs of the Nigerian people. The more cynical amongst us would say someone somewhere (most probably definitely?) is waiting to benefit from this ban. Unfortunately, corruption in politics is always a spectre waiting to raise its ugly head. When such a puzzling policy decision is made, one must therefore ask about the potential of corruption. And the loser, as always, remains the society at large, both citizens and corporates.



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4. Developments in Renewable Energy

Africa has a huge renewable energy (RE) potential, across all sources of RE: sun, wind, hydro, biomass and geothermal. The business model for the future of electricity in Africa is focused on RE. Some projects would pursue solar energy, others wind. Whichever resource is selected, it is undeniable that RE can alleviate Africa's immense energy problems.

WIND FARM DEVELOPMENT

Egypt's Ras Ghareb wind farm began operating in October 2019. The 262.5 MW wind park, built at a cost of US\$380 million, is the country's first private and its largest wind farm. Ras Ghareb is the first wind farm developed on a Build-Own-Operate (BOO) scheme in the country. It forms part of the Egyptian government's strategy to increase the share of renewables in the energy mix with a target wind generation capacity of 7 GW by 2022.

The project company, Ras Ghareb Wind Energy SAE, is owned as follows:

- Engie: 40%
- Toyota Tsusho Corporation / Eurus Energy Holdings Corporation: 40%
- Orascom Construction: 20%

ENGIE Africa CEO Yoven Moorooven believes Africa has a huge potential for low-cost renewable energy. The consortium partners also secured a 20-year power purchase agreement (PPA) for the project, for power supplied to the Egyptian Electricity Transmission Company (EETC).²⁴

In Senegal, the Parc Eolien Taiba N'Diaye (PETN) wind farm recently started transmitting power to Senegal's national electricity grid. The wind farm has a capacity of 158.7 MW. PETN has been described as West Africa's "first ever utility-scale wind farm", and will produce electricity for Senegal for a period of 20 years.

Construction work is still ongoing and due to finish in 2020. Once it is fully built, PETN will use 46 wind turbines supplied by Danish firm Vestas.²⁵

In Guinea, a start-up company, Eol-Guinée, aims to improve access to electricity by offering households mini-wind turbines. These turbines will be made with local materials, enabling Eol-Guinée to offer access to electricity at a lower cost. The essential materials for the quite simple and robust structure include wood, a disc, magnets and conducting wires. The turbine utilises winds at very low speeds and requires virtually no maintenance. Eol-Guinée turbine capacity varies from 1 to 3 kV.

Eol-Guinée is offering its services to hospitals, mosques, churches, schools, households, etc. They also offer the turbines for rent for a specific period of time. Eol-Guinée also market their products in Cameroon, Togo and Madagascar.²⁶

Namibia has approved the construction of four wind power plants in the Tsau Khaeb National Park in the town of Luderitz. The power plants are expected to generate 100 MW of electricity and will allow Namibia to have most of its energy generated from renewable energy sources.

The authorities have put measures in place to ensure that the biodiversity in the park remains intact.

Namibia has formulated an objective to increase the share of renewable energy to about 70% of its energy mix by 2030. Currently, Luderitz only has a 5 MW wind farm.²⁷

MANUFACTURING SOLAR EQUIPMENT

Milltech, a telecoms and renewable energy company in Algeria, intends to start production of solar panels in the country from April 2020. While these panels will mainly target the local Algerian market, Milltech is hoping to export in the future. The factory will have a 100 MW annual capacity, with the intention to double its capacity within a year.



The company will invest around €6 million in the facility, which will produce PV panels with 60 and 72 cells. This will enable Milltech to provide all viable technologies currently in the market. Products will include double-glass, glass and backsheet and mono and polycrystalline PERC products, and will meet the module certification standards of German inspection company TÜV Rheinland. The production line itself is supplied by Mondragon from Spain.

This factory joins two existing plants to become Algeria's third solar panel manufacturing facility.²⁸

HYBRID SOLAR PLANTS FOR RURAL AREAS

Gabon will be the beneficiary of eight hybrid solar power plants, thanks to Engie Africa and its subsidiary Ausar Energy. The purpose of the Ndjole hybrid project is to provide energy access to isolated villages (1600 homes) in the northwest of the country. The plants will save one million litres of fuel oil per year, or 2600 tonnes of CO₂, reduce production costs by 30%, and allow the country to transform its energy mix, currently based on fossil fuels. Gabon will also now for the first time develop skills in solar PV power.

The plants will consist of 1440 panels and is the first application of fuel saving technology in Gabon. The lifespan of the main photovoltaic equipment (panels and installation structures) is 25 years. The project will create 26 direct full-time jobs in Gabon.²⁹

SOLAR INCREASES RENEWABLE ENERGY MIX IN KENYA

Kenya's Garissa Solar Plant (50 MWp) increased the share of renewable energy delivered to Kenya's main grid to 93%. This creates an opportunity for cheaper electricity in the country. The project is the first plant commissioned to harness its solar energy resource. The China Jiangxi Corporation for International Economic and Technical Co-operation (CJIC) completed the project at a cost of US\$128.5 million.

The plant consists of 200,200 solar panels feeding power to inverters, installed on an area of 85 hectares. It is expected to supply 70,000 households (~350,000 people) in Garissa, which is almost 50% of the county's population.

Under the contract, Kenya Power will purchase a kWh of electricity at US\$0.12, which is currently US\$0.07 less than electricity generated from diesel, the main source of power in Garissa County.³⁰

NEW HYDROPOWER SOURCES

Nigeria will soon construct Africa's third-largest hydropower plant. The Mambilla facility on the Donga River in the eastern Taraba state will produce 3,050 MW. This equals 25% of Nigeria's current installed capacity.

A consortium including China Energy Engineering Corp. and Sinohydro Corp. Ltd will build the facility, which is expected to cost US\$4.8 billion. Construction will start this year.

Ethiopia's 6,000 MW Grand Ethiopian Renaissance Dam is the second largest hydropower facility in Africa. Construction of this project began in 2011. Unfortunately it is now more than five years behind schedule.

The DRC seeks partners to construct Africa's largest hydropower facility dam with an initial capacity of 11,000 MW.³¹ When completed, the Grand Inga project could have up to eight separate dams, with a power output of 43,500 MW (4.35 GW). The estimated cost of US\$80 billion includes transmission lines.

BIOMASS AS SOURCE OF RENEWABLE ENERGY

GE Steam Power Sub-Saharan Africa CEO Lee Dawes believes biomass has high potential to add to the renewable energy capacity of the African continent. Industrial scale biomass and waste-to-energy plants are currently under study across the continent. Potential sites include Angola, Tanzania, Cote



D'Ivoire, Kenya, Malawi, Mauritius, Nigeria and Ethiopia. Biomass systems have far lower carbon emissions. This will be a determining factor in the transition from coal to biomass, especially in South Africa. The sustainability of biomass as a source of renewable energy requires a continuous supply from the sources of biomass to ensure a carbon neutral state.³²

MINI-GRID ADOPTION AS ANSWER TO LOAD SHEDDING

Barry Bredenkamp, general manager for energy efficiency at The South African National Energy Development Institute, believes that mini and micro grids will be the future energy business model for South Africa. He stated that generation of electricity in the northeast of South Africa for transmission to the southeast, thousands of kilometres away, was impractical and too costly. The decentralisation of power generation was therefore a priority.

Uncertainty about when load shedding in the country will stop remains a troubling issue. Bredenkamp believes mini-grids will provide one of the solutions. This would reduce dependence on an inefficient national grid system and provide more control to local users.

He notes that widespread adoption of mini-grids will require adjustments to the regulatory environment. Existing policies do not provide for the adoption of mini-grids on a countrywide basis.³³

POINTS OF INTEREST

- Wind farms are becoming more popular as a source of RE. It has, in fact, allowed Namibia to follow in Kenya's footsteps in the sense that both now source the majority of their electricity from renewable sources.
- The levels of innovation in Africa are another refreshing story. The mini wind farms in Guinea provide access to "mini-solar" plants for individual households, using a business model similar to M-Kopa in Kenya. We have already seen mini-biogas models where households use their own refuse to generate methane gas for cooking and heating purposes. Close to the town of Stellenbosch in South Africa a "Sustainability Village", linked to the Sustainability Institute of the University of Stellenbosch, uses methane from their own refuse as energy source, in addition to solar panels. Necessity is, as it often is, again the mother of invention.
- The Waste-to-Energy potential in Africa is vast. This form of energy, derived from biomass and waste, will hopefully increase its footprint on the continent. Given the challenges of waste disposal on the one hand, and the lack of electricity on the other, it makes great sense to use waste to generate electricity. Addis Ababa in Ethiopia offers a good example with its Reppie plant, as does the use of waste in Cape Town in South Africa to develop gas.
- Until now mini-grids in South Africa have not gained much traction, despite their obvious benefits for rural communities. This seems to be changing, given the trend referenced above. The inability of Eskom, the country's state-owned enterprise tasked with provision of electricity, to do its job has led to frequent load shedding episodes, and escalating costs. Given its poor financial situation, rural areas currently not served by Eskom will likely wait for a very long time for the supply of electricity from the main grid. Mini-grids are thus an excellent strategy to meet the energy needs of South Africa's rural population.
- The hydropower sources of the DRC, Ethiopia, and Nigeria will make a significant contribution, not only to their home countries, but also to their neighbours. For example, the DRC's Grand Inga dam complex has long been punted as an additional source of electricity for South Africa, which is quite far for the DRC. The integration of Africa by means of the AfCFTA will hopefully play a role in the distribution of electricity on the continent from high potential generation areas to areas with much less capacity. This will require transmission lines, which is a scarce infrastructure in Africa. This gap points again to the attraction of mini-grids, be they powered by solar or wind.



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5. Developments in Sustainability

Sustainability in Africa, as elsewhere in the world, is an important collective goal. Phenomena such as global warming, waste disposal (especially plastic) and deforestation all contribute towards a planet whose capacity to sustain the global population is increasingly under severe stress. Governments play a crucial role in achieving sustainability. This report addresses recent developments in this field.

PHASING OUT PETROL MOTORCYCLE TAXIS

President Paul Kagame of Rwanda announced in August 2019 that his country would eliminate petrol motorcycles in its taxi sector in favour of e-motos. He urged taxi-moto operators to assist government during the phasing-out process. This was part of a of a national e-mobility plan developed by Rwanda to move Rwanda's entire mobility space to electric. The country will start with public transit operators, such as moto-taxis, then move to buses and automobiles.

There are reportedly 30,000 motorcycle taxis in Kigali that provide a convenient mode of transit.

This initiative comes after various instances of tech investment and expansion, including the likes of Uber and Bolt that moved into the motorcycle taxi business in Africa in 2018.

Ampersand is a start-up involved in the early stages of this revolution. This Kigali-based venture has already begun to pilot EVs and charging systems in Rwanda. Ampersand developed its own e-motorcycle model, and imports new motorcycle chassis from Asia. To keep the taxi-moto riders consistently moving, the company developed its battery-swapping and station system.³⁴

WASTE TO ENERGY GAINING MOMENTUM

Egypt produces 95 million tons of waste annually. The Egyptian government favours incineration to produce electricity from this waste. In order to attract more investors to improve waste management, the government recently increased the purchase price of electricity produced from waste.

Egypt loses on average 1.5% of its GDP each year (US\$5.7 billion) to its waste recovery deficit. A further negative impact originates from environmental pollution caused by ineffectively treated waste.

Several companies took advantage of the opportunity to develop electricity from waste (Waste to Energy – WtE) and obtained concessions. One concessionaire is the Swiss gasification firm Thermo-Chemical Gasification and Alternativ Energy Applications GmbH (TCG Alena), which will build several waste incinerators in Egypt in collaboration with the National Authority for Military Production.³⁵

PROTECTING AFRICA'S FORESTS

The International Bamboo and Rattan Organization (INBAR) intends to help protect the forest of the Congo Basin through development of the bamboo and rattan industry. These two non-timber products have environmental and economic benefits. To drive this initiative, INBAR inaugurated a regional office in early December 2019 in Yaoundé, Cameroon. They aim to reduce human activity in forests, particularly in the Congo Basin forest, by cultivating and exploiting bamboo and rattan as an approach to combat forest degradation.

Bamboo has the advantages of very fast growth, reaching maturity after only three or four years, and also has a high carbon sequestration capacity. These attributes make it very competitive with wood.

In 2018, bamboo and rattan had a turnover of US\$60 billion. This created many jobs in the value chain. Nearly 10,000 products are derived from these renewable materials, including furniture, pulp and paper, textiles, beverages, etc.³⁶



BAMBOO AS RAW MATERIAL FOR BICYCLE PRODUCTION

Social entrepreneurs in Ghana from the engineering industry, under the guidance of cycling enthusiast Bernice Dapaah, created a social enterprise to make bicycle frames from bamboo. Bamboo has the following advantages:

- It is fast-growing
- It produces as much as 35% more oxygen than other trees
- It helps prevent soil erosion, a serious issue for Ghanaian farmers
- Bamboo is abundant in Ghana

The characteristics of the production process are:

- It takes only one or two bamboo trees to make one of the bicycle frames
- Production is far less energy intensive than the process for making steel bikes
- The process creates employment and is environmentally friendly
- Wheels, gears, brakes and handlebars are recycled from second-hand steel bikes and refurbished
- Only a few components are imported, such as the tyres
- The epoxy used in the manufacturing process is derived from tree fibres

While the organisation (Ghana Bamboo Bikes Initiative) currently employs 26 full-time staff, its goal is to eventually employ 200 people in the community in southern Ghana.

EcoRide bicycles currently retail between US\$200 and US\$400, and a number of charities have made bulk purchases for Ghanaian schoolchildren.³⁷

CACTUS AS SOURCE OF BIOGAS

Madagascar intends to use cactus to produce energy. An important advantage of cactus is that the speed of its fermentation enables faster production of biogas in greater quantities. The country will implement a project to plant cactus on 1,000 hectares in the coming years.

The biogas yield of cactus is double that of the main energy crops or waste streams. Cactus grows very fast and has a high rate of decomposition into organic matter. One hectare of cactus can produce up to 400 tons of biomass. The rapid fermentation of this biomass will produce methane, which can be used in cooking. Households will no longer have to clear the forest in search of wood. Cactus also protects the soil against wind and water erosion when planted in strips in fields.³⁸

FROM PEST TO ANIMAL FEED: WATER HYACINTH

Kenyan dairy farmer Jack Oyugi came upon the idea to use water hyacinth as a source of protein for livestock feed. After watching livestock graze on the leaves of water hyacinth during droughts, he realised they would graze on the leaves and then move on. He then thought about how to process the leaves. His first hyacinth cake had about 20% protein – equivalent to the sunflower cake sold in Kenyan markets as animal feed. He subsequently created a patented fermentation process using a fungus to increase the protein levels to 50%, comparable to soya.

The water hyacinth is steam boiled, dried, crushed and fermented to make a powder, which is then mixed with minerals and energy-rich materials to make an affordable feed sold at a fraction of the price of soya feed. In a pilot study, Kenyan farmers experienced a 20% increase in milk production and 30% decrease in feed costs after using the hyacinth-based animal feed.

By-products from processing the feed can be sold as fertilisers. Fishermen are employed as hyacinth harvesters, as they can no longer fish due to the high levels of hyacinth growing in the water.³⁹

ORGANIC FASHION FROM THE SEYCHELLES



Seychelles entrepreneur Mariette Dine of M.eco–fabrics started a fashion business that uses organic thread. She weaves with organic thread made from the fibres from banana and Raphia (raffia) palm trees, and pineapple plants. According to Dine, the fashion industry is the second biggest polluter in the world. She believes that through her business, Seychelles will be able to join the global sustainable fashion movement that is currently taking place in the fashion industry.

Dine positioned M.eco-fabrics as an alternative type of organic and eco-friendly textile products, for sale to her immediate customers. She explained that processing the fibres is challenging and requires a lot of patience. However, she believes it is a worthwhile exercise.⁴⁰

INSURANCE AND FOOD FINANCED BY WASTE

Nigeria produces more than 34 million tons of waste per year. For example, 20 billion PET (polyethylene terephthalate) bottles cause huge sanitation and health problems. These issues are opportunities for creative entrepreneurs. Nigerian micro-insurance start-up Soso Care recently launched a health micro-insurance platform in the country. It allows Nigerian slum dwellers to obtain low-cost health insurance, and either pay their premiums in cash or by delivering recyclable waste to Soso Care's agents every month.

This waste includes bottles, glass bags and plastic bags. Through this approach, poor uninsured people (pregnant women, children, etc.) can access insurance and earn points that can be converted into food vouchers. Soso Care partnered with Hygeia HMO, a health and medical aid insurer in Nigeria, to gain access to the insurance product. It also partnered with Nigeria's supermarkets to obtain food vouchers.

Soso Care resell the waste to recycling companies as raw materials. The funds are converted into health funds to finance the premiums. Soso Care subscribed 550 users in the first month and aims to reach their target of three million users by 2021.

While Soso Care has been self-financing since its launch in October 2019, it now seeks investments to support and promote its growth and development. The firm aims to expand into the rest of Africa and Asia, including the South Asian subcontinent.⁴¹

POINTS OF INTEREST

- Few of the points raised above are in principle new. We have discussed using waste to generate electricity (through WTE plants) and their dual benefits. What is a bit puzzling is the lack of governmental response in this area. Africa generates massive amounts of waste on a daily basis, and frequently complains about the lack of landfill sites. They also complain about a lack of electricity. As stated elsewhere, WTE addresses both situations. Yet we currently have only two such plants in the whole of Africa. This should not be rocket science. In 2015, the Singapore government awarded a contract for the building of its 6th WTE plant. Why do some governments find it relative easy to identify the problem and its solution, while others stare the situation in the eyes without understanding what needs to be done, and why?
- Helping societies to gain value from waste is a business model that is growing in popularity. In
 addition to buying insurance and food by means of collecting waste, some communities are
 using plastic waste to build schools using bricks made from plastic waste, and even building tar
 roads with plastic as an ingredient.
- As an input to clothing, an earlier edition of this digest reported the use of plastic waste as an ingredient in the manufacturing of men's shorts, etc.
- Water hyacinth is becoming a versatile resource. In addition to serving as an ingredient in livestock feed and fertiliser, it has also been used in Kenya as a source of heating, with much better properties than wood. It is far healthier, reduces deforestation and addresses the problem of water hyacinth taking over dams, lakes and rivers.
- The benefits of reforestation are well known and self-evident. Using bamboo as a fast-growing alternative to wood is a solution that has been in use for a number of years. Although not an



entirely new idea, the use of bamboo as an ingredient for manufacturing bicycle frames is an innovation in Africa.

 Africa is a wonderful hotbed of innovation. Innovators in Togo and Tanzania, amongst others, have in the past five years used recycled e-waste to build 3D-printers that are producing commercially viable products. The venture in Togo builds medical prostheses. In Kenya, the African Centre for Technology Studies and Kenyatta University partnered to create a centre of 3D printing excellence. When entrepreneurs tap into the opportunities to address waste and deforestation issues through recycling, they also create jobs for many of their fellow citizens.

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