The End of Famine in Africa

By Dr. Vincent Kitio

Recent images shown on Kenyan television could not fail to move even the stone hearted among us to tears. It was heart wrenching to see women hopelessly cuddling the lifeless bodies of their children, victims of merciless famine that swept across the country. Many appeals were made both by government, churches and even the corporate world to help mitigate against the disaster.

Across the continent and to my home country of Cameroon, a similar event recurs almost every two years and appeals are usually made by those in authority seeking food to help the victims. As an African professional, these are some the issues that leave me pondering on how my fellow learned Africans and I can contribute to alleviate the suffering which our people have been undergoing.

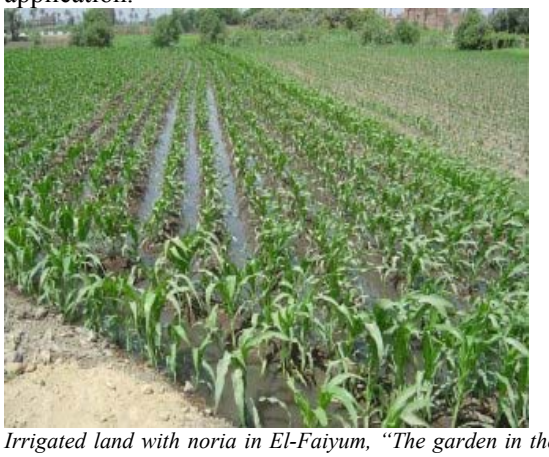
The problem of recurring famine goes deeper than the often touted reason of lack of water to help grow food or for animal use. The water levels available in Kenya are enough to sustain a hunger-free nation. In some parts of Cameroon, people suffer famine despite that country having the distinction of being home to the wettest climate on earth.

Examples abound of how others have managed to overcome.

Despite the scarcity of water in semi-desert and arid lands of North Africa, the Arab World, the Mediterranean countries and part of the South East Asia, farmers there enjoy better food security, compare to Sub Saharan Africa. This is not because their economies are better off to enable them to easily pump water for irrigation. Long before the discovery of fossil fuel, most of these countries already enjoyed food security. In fact, in order to cope with the harsh climatic conditions with little rains, inhabitant of these dry lands developed traditional knowledge of water lifting techniques to exploit streams, rivers and underground water for irrigation to increase food production. As a result, farmers are able to harness available water to grow crops and harvest up to three times a year. In this process, all available forms of energy are put into use, such as human power, animal power, water power and wind power, to lift water for irrigation.

Children scooping sand to fetch water in the dry land of Kitui, Kenya

These ancient water lifting knowledge that have been in used in Europe, Arab World and part of Asia for centuries are still ignored in Sub-Saharan Africa. Farming in Africa depends heavily on rainfall and human labour and therefore, agriculture is vulnerable to the weather. As part of a long lasting solution to the recurrent drought and famine, there is a pressing need to document, adapt and transfer these technologies to areas suitable for their application.



Irrigated land with noria in El-Faiyum, "The garden in the middle of the Egyptian desert" with 3 days of rains a year. This irrigated field yields as many as four harvests yearly.

Famine in Africa has reached unprecedented and disproportion levels. Images of malnourished children, weak adults and carcasses of livestock's are portrayed in the mass media every day. All Sub-Saharan Africa countries are affected by this drought, which many people argue that it could have been prevented or minimized.

Effect of draught on African livestock 2006

Many attribute the origin of this preventable situation to poor governance, corruption, over population, climate change, dependency syndrome on food aid from foreign assistance and so on. The main root causes of famine remains the dependency of African agriculture on the weather, particularly the rain. This heavy dependence, not only reduces the number of harvest per year, but also gives little freedom to the farmer for proper planning. Several years ago, rain fed agriculture was not an issue in Africa, since entire community could migrate from drought areas to greener pastures. This is no longer the case as no free land is available any more.

Symbol of food globalisation

Globalisation is also contributing to the burden of famine: cheap crops import dominate some local markets to the detriment of local crops. This situation is worsened by the fact that agriculture in Sub-Saharan Africa depends heavily on human labour as opposed to mechanisation. As a result, farmers need to provide more and more effort for little output. The application of irrigation methods in African agriculture remains very limited due to the water drudgery associated to it. The percentage of land irrigated in Africa is the lowest of the world.

Despite the advance of technology, this typical drudgery of water remains frequent across Sub-Saharan Africa

It is therefore time to seriously explore other alternatives and affordable ways of improving traditional farming systems. Africa is endowed with permanent rivers that flow undisturbed to the sea, passing through hectares of idle lands suitable for agriculture. Using some of these rivers and streams to irrigate lands will be very beneficial to present and future food security in Africa.

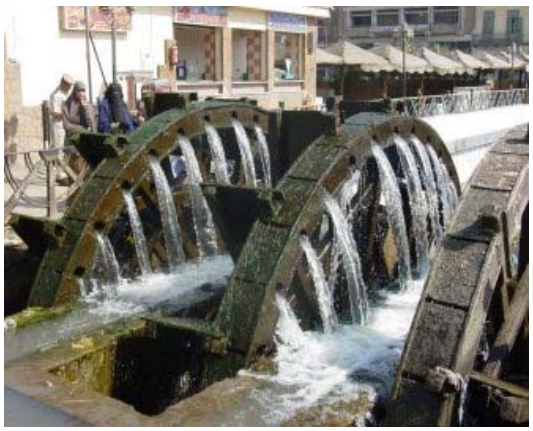
The high operational cost of motor pumps to increase productivity through irrigation is simply not affordable to the majority of African farmers, leave alone the high cost of the pump itself that is prohibitive. Drilling borehole is another solution but again very expensive and costly. It is common knowledge that people living in arid land have developed irrigation techniques that have ensured them food security for centuries. This is the case of Egypt, Syria, Iraq, Jordan and many other Arab States, India, China, Israel, just to mention a few. Fortunately, despite the advance of modern technology, some of this traditional or indigenous knowledge are still in use today after thousands years of operation.

NORIA

In the city of Medinet El Faiyum, also known as the Garden of Eden, situated 100 km south of Cairo, over 40 waterwheels known as *Noria* are used to lift water from the river Nile for irrigation. In this ancient city known as a garden in the middle of the desert, farmers are able to harvest three times a year despite the fact that the region receives only three days of rain a year. In addition to that, El Faiyum Governorate is considered as the main granary of Cairo. Ef Faiyum waterwheels were introduced several centuries ago by Ptolemic engineers. They are still working today side by side with electric water pumps to grow olives, vegetables, fruits, nuts, sugar cane, rice, wheat etc.

Self operating device pumping water continuously using the running water to rotate the wheel

The Noria, is a simple wooden waterwheel with buckets which use the flow of the river to lift water to an irrigation aqueduct above the river: water by gravity is directed to several farms.



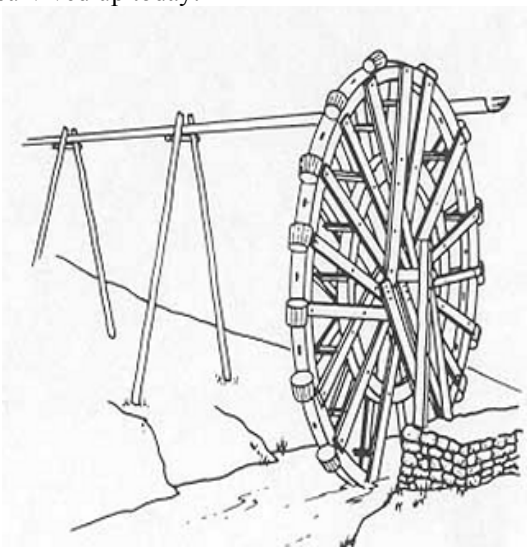
Waterwheels of Medinet El-Faiyum. Since the Nile River is vital to Egypt's survival, over the centuries, Egyptians have used several techniques to irrigate their field and ensure food security to their people.

The noria works round the clock, 7 days, all year round, provided that there is a flow of water. This time tested technology, invented more than two thousand years ago, must probably by the Romans, has survived up to today because of their efficiency and effectiveness on food security. Thousands of them are still in operation in Spain, Portugal, Syria, Iraq, Mexico, China (in China, they are made out of bamboo tree) etc. The city of Hama in Syria

is very famous for its different norias, built along the Orontes River, some of which are still used to irrigate urban agriculture while others, national heritages, attract thousands of tourists every year.

One of the over 200 noria in Hama. This tool was invented to reduce the physical effort of farmers in their daily tasks and to make their life easier and more efficient.

The Romans relied on irrigation systems to ensure food security in the empire. Roman architects and engineers developed different techniques as described by Vitruvius in 1 BC in his "Ten Books on Architecture" to support their agriculture. Some of these irrigation systems have survived up today.

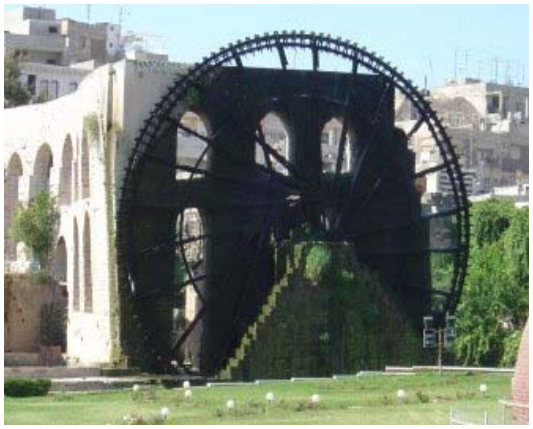


In 1913, Webster's Revised Unabridged Dictionary gave this definition: **"***Noria- a large water wheel, turned by the action of a stream against its floats, and carrying at its circumference buckets, by which water is raised and discharged into a trough; used in Arabia, China, and elsewhere for irrigating land".*

The Norias found in Spain were introduced during the Islamic domination and have double sets of buckets on each side of their rims, other have two wheels on the same shaft. This allowed the system to increase the amount of water lifted. Spanish priests introduced Norias in Mexico during the colonial period. Some of them are still in operation in farms located in the northern part of the county. Their buckets are made of plastic material as oppose to clay pots or wooden buckets.

Noria in Spain, Unesco. In the Spanish city of Cordoba, there were over 5000 norias on the Guadalquivir River, in the 13th century. Some are still in use today.

Another living testimony of this magnificent time tested technology is the largest noria (over 20 meters) known as Al-Mohammediyyah in Hama, Syria. It was the subject in one of the famous American television programme called Ripley's Believe it or Not! With the following title, "*A water wheel on the Ornotes River in Syria is still working, although it was built in the year 1000."*



Al-Mohammediyyah: the biggest and oldest Noria in the world. A superb example of a simple technology totally self sufficient in energy, that has raised water for over a thousand years.

Some farmers in Hama use Noria in urban agriculture, and occasionally when the water flow is not enough to turn the waterwheel, up to 5 motor pumps are needed to lift water to the aqueduct.This age-old technology is very much appropriate to the African rural lifestyle, especially with the fuel price increase that is already impacting negatively on the economic growth.

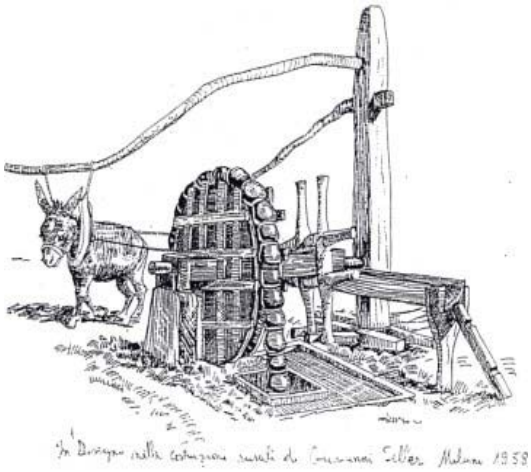
Details of a self operated waterwheel of 8 m diameter, Hama, 2005

PERSIAN WHEEL

The Persian wheel, also known as *Saqiya*, is a water-lifting device made of two gear wheels and an endless chain of pots or buckets, capable of lifting water from both shallow and deep well. The system is powered by one or two animals (donkey, horse, camel, bullock, buffalo etc.). Person wheels have been used since time immoral to supply water for irrigation in Egypt, the Mediterranean's countries, India, China, etc.

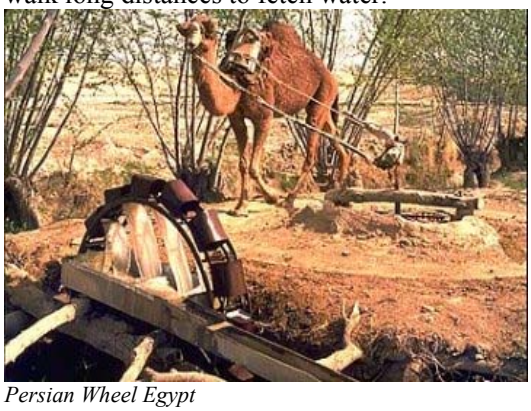
Persian Wheel Egypt

Animal revolves around the first wheel and generates horizontal rotations, which are transferred into vertical rotations through gears and, bring up the chain of pots (buckets)that carry water from the well and empty into a conduct. Since animals don't like the boring revolution walk, they are blindfold. This technology has been in use for over 2,000 years. An American geographer, who visited Egypt in 1727, estimated that there were over 200,000 Persian wheels in operation driven by oxen for agriculture purposes.



Persian wheel in Sardine, Italy

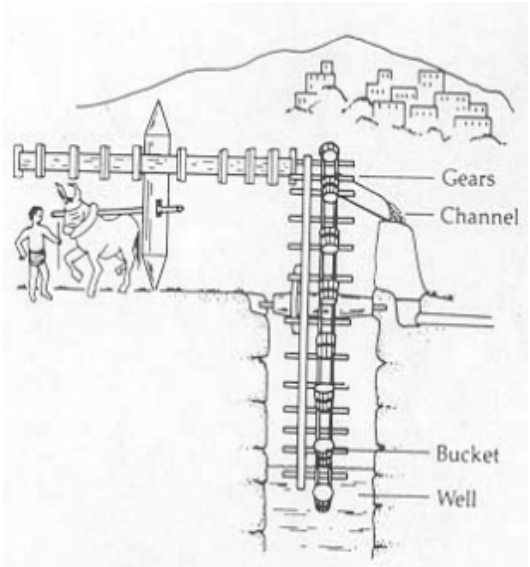
In the region between India and Pakistan, Persian wheels, known as Rahat in Urdu, are traditional tools used for irrigation. Before their introduction in the region, irrigation was a very tedious and inefficient activity, as it is today in rural African countries, where people have to walk long distances to fetch water.



Persian Wheel Egypt

The introduction of this technology improved agricultural productivity substantially in medieval India. As a result of a successful rural electrification programme across India, electric pumps are gradually replacing this time tested device.

Despite the availability of modern energy, Persian wheels remain popular in the Indian region of Rajasthan. It is estimated that one Persian wheel can irrigate up to one hectare of land.



Persian Wheel Egypt

SAKIA

Another water raising device that is worth to mention here is the *Sakia*. *Sakia* is an ancient water-lifting technology that has been in used intensively in Egypt, where it originated, from time immemorial.

Sakia in Egypt

The device is efficient and effective widely used in the Nile Valley and Delta. Sakia is made of a large hollow wheel with scoops around its periphery, and water discharges at its centre. The diameters of the Sakia range from 2m to 5m; and they lift water from 0.8m to 1.8m respectively.

Sakia in Egypt

Sakias originally made of wood, are now made from galvanized sheet steel with gears system that convert the horizontal rotation into vertical rotation. There are mainly powered by animal, but recently some are using electric or gasoline motors. According to the Egyptian Hydraulic Research and Experimental Station, more than 300,000 Sakias are in use in the Nile Valley and Delta mostly driven by animals. A Sakia of 5 m diameter will lift around 36 m^3/h of water, while a 2 m diameter model will lift 114 m^3/h.

Sakia in Egypt

WIND PUMP

Simple wind pumps as opposed to the sophisticated and costly one that are occasionally seen in some African rural areas are another appropriate solution for the irrigation. In the mountain plateau of Lassithi in Crete, Greece, simple wind pumps have being used for over 400 years to irrigate land that produces crops mainly vegetables, fruits and wheat. These wind pumps, manufactured locally by village craftsmen, were originally made of wood and cloth. Wood was later on replaced by metal steel in order to extend the lifespan.

Details of a windmill in Crete, Greece

A decade ago, over 10 000 windmills could be found in the plateau, each farmer owning at least one of them to supply water for irrigation. Today less than 2000 are in operation, as a result of European Union's agricultural subsidy policies to purchase farmer's implements. Traditional windmills are gradually replaced with electric pumps. Model windmills are sold to tourists as souvenir.

Wind pump in Crete, Greece

When there is wind, each windmill pumps water from a well to a tank, and the water is later used by the farmer to irrigate their gardens by gravity.

African coastal areas and hilly regions with permanent winds are ideal place for the application of this technology.

Wind pump in Crete, Greece, 2005

CONCLUSION

This clean and affordable technology for water lifting remains unknown to Sub-Sahara African farmers.

If thousands of them are introduced in the continent along its many rivers and streams to irrigate idle lands, food will be soon in abundance on the local markets, in just three months: the average time to grow and harvest vegetables badly needed to stop the spread of malnutrition.

Food aid should not be seen as a long-term solution, people should be empowered with affordable technologies that can help them to overcome present and future period of food shortages.

All the above-mentioned traditional knowledge of water lifting techniques can be domestically manufactured with local material: no imported part is required, no fossil fuel is needed, and humanpower is saved.

This technology may seem very old but its efficiency surpasses those of the imported motor pumps. It is regrettable to note that despite the 21th century's high-tech society, one person in six has no access to clean water. Therefore any affordable solution that can bring water closer to people should be considered as an innovation rather than an attempt to bring development back.

To make famine history in Africa we need to introduce these affordable, tangible, proven, and traditional knowledge from the arid world to African farmers. The creativity of African informal sector will innovate and adapt the technology to different local social and economic conditions, aiming at ensuring long lasting food security.

While exploring modern technology to address the famine situation in Africa, it will be wise to consider this know how which is in the public domain and does not required any copyright to be negotiated.

Since the technologies described here are in operation, as we speak, in Egypt and Syria, it would be highly appreciated if stakeholders in the fight against hunger in Africa visit Medina El Faiyum in Egypt and Hama in Syria to witness how these simple traditional technologies can turn arid land into forest. This will be the beginning of the end of famine in Africa.

Symbol of the Governorate of El Faiyum

A Cameroonian national, Vincent Kitio (PhD) is an architect and expert in renewable energy and appropriate technologies for sustainable development working at the Nairobi headquarters of UN-HABITAT.
Email: *Vincent.kitio@unhabitat.org*