



# Role of Latent Local Technologies and Innovations to Catapult Development in Kenya

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**Abstract** The domination of “colonization shadow” may have reduced the manifestation of young indigenous technologies and innovations that with minimal value addition could help local communities overcome many challenges. Rediscovery of these technologies can bring about wealth and well-being to the local people who are also the inventors. Some of these technologies have either been suppressed or picked up by colonizers to the disadvantage of local inventors. This chapter discusses the useful, locally found technological resources that have not helped local communities but sometimes fetch millions of dollars elsewhere. This knowledge is expected to bring about rediscovery and decolonization so as to use the technologies to improve local lives. In this aspect decolonization is necessary in many sectors of the economy such as medicine which failed to take off from herbal- to industrial-based

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pharmaceutics. For instance, Kenya is the home of over 1100 species, many have medicinal value. While such herds are condemned at “home” as illegal herbal concoctions, they are glorified in other countries as medicine and food supplements. Today, many Kenyans import such medicine and food supplements at unaffordable prices as disease continues to bite. The conclusion is that there are a number of unexploited indigenous technologies and wealth that have remained dormant due to colonized minds and with little decolonization they can earn wealth that can increase wellness and improve livelihoods for the growing population in Kenya.

**Keywords** Decolonization · Indigenous technology · Wealth · Wellness

## INTRODUCTION

Colonization came with western culture that greatly affected technological advancement. It stifled local technologies and cultures. Intrusion of colonization brought about a paradigm shift including foods, medicine, housing and all types of western inclination. Colonized nations were forced to drop their cultures in favour of those colonizers. In this regard, the colonized will mainly refer to Kenya. The result of colonization is that various traditional technologies were abounded but became stunted. History tells us that the aim of colonization was to obtain raw materials for the growing industries in Europe but never to enrich the culture or technology of the colonized. Many technologies that had evolved around industrial revolution and thereafter were strongly entrenched in Kenya.

Since the earliest days, human kind survived through some research that led to innovation that enabled them to improve their living style. Some of the earliest known technologies were for acquiring of basic survival skills like acquisition of food and shelter. In the early days, means to procure food was basically obtained through cultivation and hunting. Therefore, technologies to enable cultivation and hunting were developed while shelters were dependent mainly, on local architectural designs.

Technological development can be demarcated into timelines such as; ancient, civilization, the modern and super modern civilization.

Ancient technologies seem to have been geared for basic, crude and simple weaponry. The regional (e.g. Europe or Africa) disparity was not very conspicuous. However, later development brought bigger differences among regions. This depended on how nations exploited their indigenous knowledge, opportunities and wealth. Civilization followed a pattern of technological development. For example, Egypt and irrigation, Greece and the literary advancement, Babylon and farming, Ghana and gold mining among others. A shift in paradigm was realized with the coming of the Industrial and Agrarian revolutions that led to economic transformation in Europe and America. There followed scramble for resources around the world, including Kenya, and this is what led to “colonize the people and reap off the resources”. Some regions prospered, however, some were left behind like Africa. Many technological leaps were seen in the eighteenth century that included the discovery of the steam-powered engine in 1712, inventory of Power Loom machine for weaving cloth in 1765 by Hargreaves 1812 while in 1876, Alexander Graham Bell invented the telephone (*New-York Tribune*, 1877). As Europe was undergoing technological change, local technologies in Kenya and rest of Africa were subjugated by colonization.

### CONSUMER OF TECHNOLOGY

During colonization and after independence, many colonized countries continued to import technologies under the program of technology transfer. Mainly linear model (Bradley et al. 2013) of technological transfers has been used to get technology from colonizers to colonized. This is a situation whereby technology is transferred the way it was invented from the university scientist to the end user (Siegel et al. 2004). This is a traditional model of the technology transfer process that was adopted by colonialist. During colonization the western nations came with their ready-to-use technologies and later transferred them to local people. A kind of Europe in Kenya was established. The effects of this are that the new technologies were forced on the local people. The transfer may have been done but they were never completely adopted. This could be the reason why some technologies died with leaving of the colonialist. A double loss was realized, local technologies were suppressed and the western ones started failing after colonizers left. Even if they were to

work there was a cost tied to it especially where patents were involved, such as in books printing and pharmaceuticals among others.

### TECHNOLOGICAL SUPPRESSION

Intrusion of western-based technologies into African continent suppressed non-competitive (often times “superior”) African technologies. The result was that many useful African technologies became latent and little or no research was put into them. These technologies included; medical and surgery, mining, pharmacy, engineering, food processing, weaponry, industrial chemistry among others. Speed of local technological latency or decay was increased by the fact that many of the African technologies were never documented but the knowledge was passed from generation to generation by verbal communication. For example, the Kamba people of Kenya used poisoned arrows during war where a chemical, locally called “*uvai*”, was put on the arrow head (Kieti and Coughlin 1990). These were and are biological weapons, which could have been developed to a weaponry industry. Unfortunately, the chemical formula and product itself have never been locally documented as an innovation. In apiary, Kenyans used to make bee hives by tunneling a log of tree which was good to create a natural roof to prevent water from entering inside it in rainy times (Affognon et al. 2015). However, this was abandoned in favour of western box-like beehives. The Kenyan blacksmiths never transformed themselves to modern manufacturing. Local building materials, architecture, engineering, agriculture, medicine, literature and many other technologies went into limbo. Development of medical field seems to have been more affected and for this reason, medical industry will be singled out for a bit more exploration.

### MEDICAL ADVANCEMENT

All cultures worldwide have long history of medicine practices. By 2003, about 3.5 million people depended on herbal medicine and 80% were in Africa (WHO 2003). Herbal medicine has a very important role in healthcare, and in remote areas it is the major source of medication (Dery et al. 1999; UNESCO 1998) such that some Governments have encouraged their use (Marshall 1998). Besides, the original standardization of scientific medicine, a process known as Pharmacopoeias was first based on herbal products (Farnsworth et al. 1985).

## HERBAL MEDICINE OR WITCHCRAFT

Herbalists are found in all parts of the globe including America, Europe, Asia and Africa (Kung'u et al. 2006). However, wheresoever the West transformed their herbal into pharmaceutical industries that in Kenya stagnated. When the western culture infiltrated, African medicine was viewed with a lot of suspicion, and it was associated either with witchcraft or something close to it. However, if any item was proven to be valuable to the west it was referred to as herbal medicine. African-based natural products were disregarded at the discretion of the western recipients. In situations where the herb served the colonialist well, they promoted and referred it as a natural product or raw material for drugs making. Things like propolis, *Prunus africana* products and artemisinin are some of herbs used to produce medicine at industrial level (WHO 2009). Chances are that penicillin and quinine, all herbal products could have been rejected if the discovery came from an African. It is worth noting that at one time quinine and artemisinin (Codd et al. 2011) were major drugs to treat malaria. Other plants like neem oil have been used as mosquito repellents for a long time (Liu et al. 2009).

## CHANGING PARADIGM IN HERBAL MEDICINE

In Kenya, the value of herbal medicine has continued to dwindle due to human activities. On the other hand, in the Western and Eastern worlds, plants are being developed to be natural synthesizers of vital herb like products such monoclonal antibodies (Murphy 1907) that are used in vaccines, alternatively plants are put into use as biofactories of biopharmaceuticals (Horn et al. 2004). Some of the plants used in biopharming are tobacco (*Nicotiana* spp) to glasshouse-grown Arabidopsis, lotus and moss among others. In the tropics, Kenya included, there is a lot of exploited "natural capital". The western countries have turned to Africa to bio-prospect with a hope of getting new products. Indeed, they have often been discovered and sometime they are pirated. An example is where some bacterial materials that generated millions of dollars were pirated from Kenya (*The Guardian* 2004). Colonization may have added value to some of the local products but the benefit may not have been felt by the indigenous population. For example, Neem and Aloe Vera are widely used to make products like toothpaste and soaps but by large colonial multinational companies like Unilever. The paradox is that now the major suppressors of the indigenous

knowledge are not the westerners but the local people with the western education. Today a number of plants around the globe are highly regarded for medicinal value, among them are; Mayapple or American mandrake, or mandrake (*Podophyllum peltatum* Linnaeus) (Maqbool 2011) found in American, Cape bush-willow (*Combretum caffrum*) found in South African and Pacific Yew or Canadian Yew (*Taxus brevifolia*) found in Canada have anticancer properties and some research may be going on to make medicine from them (Srivastava et al. 2005). However, very little is going on in Kenya to value add herbs like Red Stinkwood (*Prunus africana*) that is also reputed to have anticancer properties.

### THE NATURAL CAPITAL

Herbal market is undergoing a global transformation, turning it to be quite a profitable natural capital business. Local practitioners will need education so as to benefit from this growing trade. The market for herbal products was estimated to be US\$62 billion by 2006 and it is expected to be US\$5 trillion by the year 2050 (Singh 2006). There are about 7,227,130 species in the world out of which 374,000 are plants. About 10,000 species are listed as valuable medicinal plants in Africa (Christenhusz and Byng 2016). Kenya houses over 1100 species (Teel 1985). Demand of some of the herbs in both local and international markets has been in the increase, like in Kenya harvesting of East African Sandal wood was put under presidential ban in 2007 to prevent over exploitation (Taylor 2010). Sandalwood is exploited for its essential oils used in perfumery. The heartwood of the trunk, main branches and roots contain an essential oil.

### LATENT INDUSTRY IN AFRICA; EFFECT OF COLONIZATION

Many latent technologies in Africa have adversely affected industrialization. For instance, increasing the value of medicinal and aromatic plants has not attracted commensurate research and business attention locally. There is a bit of publication on value of medicinal and aromatic plants including the works of John Kokwaro in his book Medicinal Plants of East Africa (Kokwaro 2009). However, a lot of knowledge has not locally been transformed to commercial products. Some of the major herbs of commercial interest include; anti-malarial such as African Wormwood (*Artemisia afra*), Quinine, and quinidine. Others include

*Aloe vera*, Red Stinkwood in English (*Prunus africana* or in Kieambu in Kenya it is called *Mwiria*) (Komakech et al. 2017).

Colonization has had a negative impact on indigenous industries in general but health and pharmaceutical growth suffered most because any of its products were labelled as African medicine or witchcraft. This was worsened by the fact that many of the industries had no formal documentation. Medical education was called traditional knowledge and it was never given a chance to advance. This made scholars and users shun herbal medicine for a long time. Thus, colonialist succeeded in making Africans believe that local healers were infective and inferior and thus reducing competition with their medicine. This stifled research in African medicine and pharmaceutical studies. A lot of knowledge has been lost because subscription was by word of mouth and as knowledgeable people die so too does the knowledge. So far about 7000 single compounds that are used in modern medicine have been extracted from medicinal plants. This development happened in the west but not in Africa. This could have been some of the dark ages in African studies. The major compounds that have made impact are sweet from wormwood (*Artemisia annua*) leaves for anti-malaria parasites, Aspirin from the Willow tree and Quinine from Cinchona bark. *Artemisia annua* shrub has been used for traditional treatment in China and now it is a major raw material for medicinal-based industry (Dharani et al. 2010). Also, the Neem tree in Swahili, known as *Mwarubaini*, has a number of uses including anti-plasmodial properties (Bashir et al. 2015).

At present, about 25% of the prescribed medical drugs in the developed countries are plant based, but it is as high as 75% in the developing countries (Sanjoy and Yogeshwer 2003). However, herbal and aromatic products industry has been growing steadily in Asia and India. For many years, many drugs have been extracted from plants. Africa can follow the example of China and India in the commercialization of various food and herbal products. For example, *Aloe vera* is today grown from tissue culture at Jomo Kenyatta university of Agriculture and Technology (Kenya) because there are many products made from it.

## TECHNOLOGY OF FOOD PROCESSING

In food, there are many technologies that have not captured the eye of the modern researcher. A good example is brewing industry where alcoholic drinks from the west are over celebrated while sometimes tastier

drinks, like beer made from honey, sugar cane, banana, sorghum, maize, rice among others have been neglected. Modern breweries over concentrated in the use of barley but today the brewers have discovered the power of sorghum in brewing, and it is gradually replacing barley. In fact, it is being called a “discovery” despite being used in Kenya for many years. In spite of this, local brewers who use it to make beer are arrested and their product destroyed and labelled an illicit drink. This is a suffocation of innovations and entrepreneurship, instead the brewers need to be assisted to properly obtain the requisite standards of their products.

Colonization opened doors to big multinationals to compete with smaller African economies. Although it brought a healthy competition, which is good for a business it suffocated small non-conventional African industries. Many times, the multinational demanded protection from competition and this stunted the growth of small local companies. For example, coffee board placed a law to prevent traditional roasting of coffee beans, however, the same law does not persecute companies like Dolman coffee or Java Coffee groups. Traditional foods like the potato, when roasted on fire is “poor man’s” food and when grilled in an oven it is considered high value food or when fried it becomes French fries that is worth millions of dollars. African technology never developed from fire to oven grilling and thus the value of end product and technology itself has remained archived. Researchers and innovators need to de-archive the indigenous technologies and enhance their competition with colonially introduced technologies. If not done well, the same colonial master will pick it, modify it (technology) and patent it. A good example is the patenting of traditional Kenyan bag called *Kiondo* by the Japanese. In horticultural production, when a flower is planted in the precincts of a house it becomes an indigenous ornament or wild plant and when a western company picks it and plants it in a farm it then becomes a cash crop.

Education industry was not spared by the effects of colonization. In Kenya there was a lot of knowledge in Biology, Physics, Chemistry, Astrology, Agriculture, Medicine, Languages among others but no detailed research and development was recorded before colonization. The consequence is that people migrate from Kenya to Europe to study African History or Geography that could have better been studied locally. There are many situations, when students leave African to European nations to study tropical diseases, African culture, Tropical Botany, Tropical soils among others while real samples are in the land



they are leaving. This is not because they want diversified views, but because study opportunities are not available in Africa. Where is the missing link? What happened? The African performing art is dying and left only for tourists who just pay a token to the performers. This is why you hear of Russian Ball dance, Jazz music but you never hear of “Masai Performing Arts” despite being a major tourist attraction. Colonialist relegated African entertainment industry as traditional and backward. The result is that good performances and music have disappeared as composers perish.

### DECOLONIZING RESEARCH AND TECHNOLOGICAL DEVELOPMENT

Technological innovations bring about development and advancement. This can only come through local research and innovation. However, over reliance on technological transfer brings about technology enslavement. Colonization succeeded in technological enslavement. There is a need to rediscover the technologies that can bring about more knowledge and wealth to indigenous Kenyans. This will enhance exploitation of wealth that has gone unused or undiscovered due to colonization of mind. The objective of this script is to identify useful resources that have not been exploited locally to help indigenous people but quite often they have been used to earn millions of dollars outside Kenya. Ultimately, it is expected that this will bring about rediscovery and decolonization so as to research and use technologies to improve local lives. For example, many medicinal herbs can be developed into herbal farming and eventually biopharming and also local brewers can be converted to standardized beer manufacturers.

### CONCLUSION

Technological latency and development in Africa was significantly worsened by colonization. Quite often the colonizers picked and developed some technologies for their own use. Ultimately, the indigenous Africans’ technology was subjugated hence innovations and any final product and the benefits that accrued from them. For example, in herbal medicine, the pharmaceuticals have been picking up local herbal product and synthesizing a chemical version of the plant compounds and overtime, the use of herbal medicines declined in favour of the synthetics ones. However, interests on African indigenous knowledge are

rekindling. Africa content contains a lot of unutilized indigenous knowledge and resources such as many unstudied flora and fauna that can be used to develop products to create wealth for the indigenous people. For instance, pharmaceuticals are bio-prospecting to find new drugs while local fabrics and textile like *kiondo* and *kikoi* are targeted by industrialists with an intention to patent them. Documentation of indigenous knowledge is needed to enable its transmission, improvement and its use in production of goods and services for people of Africa. This will rekindle African science, technology, innovation and knowledge management using modern technology. Developed countries may have technology but with limited unexplored knowledge. However, Africa has got indigenous knowledge that can be catalogued and coded into public database for research and development.

## REFERENCES

- Affognon, D., Kingori, W. S., Omondi, A. I., Diiro, M. G., Muriithi, B. W., Makau, S., & Rainam, S. K. (2015). Adoption of Modern Beekeeping and Its Impact on Honey Production in the Former Mwingi District of Kenya: Assessment Using Theory-Based Impact Evaluation Approach. *International Journal of Tropical Insect Science*, 35(2), 96–102. <https://doi.org/10.1017/s1742758415000156>.
- Bashir, L., Oluwatosin, K. S., Adamu, Y. K., Ali, A. J., Maimuna, B. U., Eustace, B. B., & Blessing, U. A. (2015). Potential Antimalarials from African Natural Products: A Review Horn, ME, Woodard, SL. *Journal of Intercultural Ethnopharmacology*, 4(4), 318–443. <https://doi.org/10.5455/jjice.20150928102856>. [www.jjicep.com](http://www.jjicep.com).
- Bradley, S. R., Hayter, S., & Link, A. N. (2013). *Models and Methods of University Technology Transfer Department of Economics* (Working Paper Series). University of North Carolina, Greensboro, 13-10.
- Christenhusz, M. J. M., & Byng, J. W. (2016). The Number of Known Plants Species in the World and Its Annual Increase. *Phytotaxa*, 261(3), 201–217. Magnolia Press.
- Codd, A., Teuscher, F., Kyle, D. E., Cheng, Q., & Gatton, M. L. (2011). Artemisinin-Induced Parasite Dormancy: A Plausible Mechanism for Treatment Failure. *Malaria Journal*, 10, 56. Open Access. <http://www.malariajournal.com/content/10/1/56>.
- Dery, B. B., Otsyina, R., & Ng'atigwa, C. (1999). *Indigenous Knowledge of Medicinal Trees and Setting Priorities for Their Domestication in Shinyanga Region, Tanzania*. Nairobi: ICRAF.

- Dharani, N., Rukunga, G., Yenesew, A., Mbora, A., Mwaura, L., Dawson, I., & Jamnadass, R. (2010). *Common Antimalarial Trees and Shrubs of East Africa, A, Description of Species and a Guide to Cultivation and Conservation Through Use* (pp. 1–100). The World Agroforestry Centre. ISBN: 978-92-9059-238-9. <http://www.worldagroforestry.org/downloads/Publications/PDFS/B16781.pdf>.
- Farnsworth, R. N., Akerele, O., & Bingel, A. S. (1985). Medicinal Plants in Therapy. *Bulletin of the World Health Organization*, 63, 965–981.
- Horn, M. E., Howard, J. A., & Howard, J. A. (2004). Plant Molecular Farming: Systems and Products. *Plant Cell Reports*, 22, 711–720. <https://doi.org/10.1007/s00299-004-0767-1>.
- Kieti, M., & Coughlin, P. (1990). *Musyimi the Hunter Kamba—Fables and Legends a Traditional Kamba Story, The Wisdom of Kamba Oral Literature*. Nairobi: Phoenix Publishers.
- Kokwaro, J. O. (2009). *Medicinal Plants of East Africa* (3rd ed.). Nairobi: University of Nairobi Press.
- Komakech, R., Kang, Y., Lee, J. H., & Omuja, F. (2017). *A Review of the Potential of Phytochemicals from Prunus africana (Hook f.) Kalkman Stem Bark for Chemoprevention and Chemotherapy of Prostate Cancer*. Hindawi Evidence-Based Complementary and Alternative Medicine Volume 2017, Article ID. 3014019, 10 Pages. <https://doi.org/10.1155/2017/3014019>.
- Kung'u, J. B., Kiviyatu, B., & Mbugua, P. K. (2006). Some Medicinal Trees and Shrubs of Eastern Africa for Sustainable Utilization and Commercialization. In B. O. Awour, D. Kamoga, J. Kungu, & G. N. Njoroge (Eds.), *Challenges to Utilization and Conservation of Medicinal Tree and Shrubs in Eastern Africa* (pp. 13–25). <http://www.worldagroforestry.org/downloads/Publications/PDFS/B14816.pdf>.
- Liu, N. Q., Van der Kooy, F., & Verpoorte, R. (2009). *Artemisia afra*: A Potential Flagship for African Medicinal Plants? *South African Journal of Botany*, 75, 185–195.
- Maqbool, M. (2011). Mayapple: A Review of the Literature from a Horticultural Perspective. *Journal of Medicinal Plants Research*, 5(7), 1037–1045. <http://www.academicjournals.org>.
- Marshall, N. T. (1998). *Searching for a Cure; Conservation of Medicinal Wildlife Resource in East and Southern Africa* (p. 12). Cambridge, UK: Traffic International.
- Murphy, D. J. (1907). Improving Containment Strategies in Biopharming. *Plant Biotechnology Journal* (2007), 5, 555–569. <https://doi.org/10.1111/j.1467-7652.2007.00278.x>, <http://onlinelibrary.wiley.com/doi/10.1111/j.1467-7652.2007.00278.x/epdf>.
- Sanjoy, K. P., & Yogeshwer, S. (2003). Herbal Medicine: Current Status and the Future Asian Pacific. *Journal of Cancer Prevention*, 4, 281–288.

- Siegel, D. S., Waldman, D. A., Atwater, L. E., & Link, A. N. (2004). Toward a Model of the Effective Transfer of Scientific Knowledge from Academicians to Practitioners: Qualitative Evidence from the Commercialization of University Technologies. *Journal of Engineering and Technology Management*, 21(1–2), 115–142.
- Singh, H. (2006). Prospects and Challenges for Harnessing Opportunities in Medicinal Plants Sector in India. *Law, Environment and Development Journal*, 2(2), 196, 198–210. <http://www.lead-journal.org/content/06196.pdf>.
- Srivastava, V., Negi, A. S., Kumar, J. K., Gupta, M. M., & Khanuja, S. P. S. (2005). Plant-Based Anticancer Molecules: A Chemical and Biological Profile of Some Important Leads. *Bioorganic & Medicinal Chemistry*, 13, 5892–5908. Elsevier.
- Taylor, G. (2010). Indian Sandalwood Plantations in Australia. In *Head of Plantations, Tropical Forestry Services Limited, Australian Forest Growers Conference 2010, Australia Forest Growers*, 107–109.
- Teel, W. (1985). *Tree Seed Training and Extension Resources; A Pocket Directory of Trees and Seeds in Kenya* (151 pp.). Illustrated by Terry Hirst. Kengo, Nairobi. <http://agroforesttrees.cisat.jmu.edu/>.
- The Guardian*. (2004, September 5). The Multi-Billion Bio-Piracy Law Suit Over Faded Jeans and African Lakes (Antony Barnett, Public Affairs Editor, Sunday). <https://www.theguardian.com/uk/2004/sep/05/highereducation.science>.
- UNESCO. (1998). *FIT/504-RAF48 Terminal Report: Promotion of Ethnobotany and the Sustainable Use of Plants Resources in Africa* (p. 60). Paris: UNECSO.
- WHO. (2003). *Traditional Medicine* (Fact Sheet No. 134) (Revised May 2003). WHO: Switzerland. [http://apps.who.int/gb/archive/pdf\\_files/WHA56/ea5618.pdf](http://apps.who.int/gb/archive/pdf_files/WHA56/ea5618.pdf).
- WHO. (2009). *Monograph on Selected Medicinal Plant* Vol. 4, (p. 1–456). Salerno Paestum, Italy: WHO Consultancy of Selected Medicinal Plants. ISBN 9789241547055.