



THE HEALTH-ENERGY-WATER-AGRICULTURE NEXUS: THE SOLUTION FOR IMPROVING AFRICAN LIVELIHOODS?

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Summary

In Africa, the increasing complexity to satisfy health and livelihood needs of human beings requires innovative approaches that are interlinked for the better leveraging of resources. The Health-Energy-Water-Agriculture Nexus (HEWAN) is one realistic concept that has increasingly proved appropriate for livelihood improvement while ensuring sustainable development in Africa. It entails collective engagement of actors, and a designed intention to make more and new resources available for health, fuel, food, forage, and income, while considering the inextricable connectivity of different sectorial players, such as in water, agriculture, and energy, in the process of improving livelihoods. The concept is proven highly effective in resource-constrained regions, especially in Africa, that have limited access to health services and entirely depend on land for food, and in turn, for income. With the support of the energy and water resources, it is inevitable that energy security and sanitation are achievable, and therefore there are greater opportunities for healthy living and livelihood improvement. The nexus could be a panacea for livelihood empowerment when households understand the complete cycle of the benefits accrued from an increase in water harvesting, on-farm crops, product recycling, and animal and woodlot productivity. This productivity subsequently supports the supply of critical resources such as biogas, manure, mulch, compost, forage, food, fuel, timber, and herbal medicine. Achieving the connectivity of resources working in an integrated manner is necessary for the improvement of livelihoods in Africa. This makes the HEWAN concept a promising approach in policy and development in order to improve overall quality of life.



INTRODUCTION: THE PROBLEM

For millions of people in Africa, poor health remains the leading obstacle to effective work output in both the formal and informal sectors of the labor market.^{1,2} Poor health is primarily attributed to poor sanitation and hygiene, poor nutrition, and unclean sources of water and energy. Meanwhile, low income is another large obstacle that restricts the purchasing potential of individuals and thus their ability to access quality health services and other basic, critical life resources.^{3,4} The need for improved access to quality health services has become a social-economic-environmental issue throughout Africa and impedes African development considerably.

Income

Limited capacity to access quality health services can be overcome by addressing the fundamental issue of low-income labor, more specifically within the agricultural sector – which remains the backbone of the economy in Africa, and also the primary source of income for millions of people living in rural communities. A majority of rural households depend on the productivity of farms to achieve sufficient quantity of affordable, nutritious food as well as on financial returns from livestock and crop sales to access health services and education.⁵

Energy

Equally important is the energy needed for daily support of household activities. The majority of rural households depend on fuel-wood from woodlots to satisfy their energy needs. Burning charcoal is prevalent in Africa, affecting health and fueling deforestation and environmental degradation.⁶ Such an energy source affects air quality and trigger adverse effects on health, including an increase in cancer and respiratory diseases (pneumonia, asthma, etc.) Over 10% of patients die of such diseases in Africa, while another half million die due air pollution in SSA.^{7,8,9} Subsequently, the rise in these diseases has affected household functioning and thus livelihood mobility.

Interventions that trigger capacity development but also encourage the use of energy alternatives such as liquefied petroleum, innovative green technologies such as solar energy, efficient and clean energy saving stoves, and locally generated biogas, could be instrumental to averting illness and sustaining livelihoods.^{10,11} One solution, such as clean and efficient energy saving stoves have been proven to reduce health risks, however, very few households have adopted them. The majority of rural households use old traditional stoves, which are considered ‘affordable’, and many are unaware of the serious health risks they pose. In fact, it is estimated that more than half a million people die from health related complications associated to indoor household air pollution.¹²



Photo: Efficient and clean burning Stoves slowly being adopted in selected rural homestead in Uganda.



Photo: One of the livestock watering points near stream with evidences of water pollution due to sedimentation in southwestern Uganda

Water Access and Sanitation

Access to clean water for the domestic and production sectors has also been threatened significantly by incidences of mass water source pollution.^{13,14,15} This human-driven pollution is a byproduct of damaging land-use activities such as over cultivation and deforestation, resulting in soil disturbance, soil erosion and sedimentation of low lying water resources. The poor water quality has affected livestock and thus supply for domestic use. In urban areas, the water is polluted as a result of industrial and anthropogenic-related leachates from waste depositions. What's more, uncontrolled storms and surface run-off from the highly tarmacked upper landscapes often carry highly toxic waste and effluents causing pollution further downstream, creating poor health conditions for communities.¹⁴

A more elusive influencer of water security is climate change. An increase in climate change – related events has drastically impacted water security and human productivity. It has led to prolonged drought, water stress, food insecurity, and human displacement. Water stress can have dire consequences on the ability for communities to respond to major sanitation needs and to adopt hygienic practices.¹⁶ Other direct negative effects of water stress are evident in the reducing rates of crop and livestock productivity, affecting biomass regeneration, and producing an intermittent water supply for domestic activities.

Water excess has also posed challenges in some areas in Africa.¹⁷ Flash Floods have left thousands of vulnerable people displaced, leading to an increase in health complications, and threatening their way of life.¹⁸ The direct and indirect health risks are even greater when flooding causes physical damage to water infrastructure leading to increased contact with polluted waters that cause waterborne infections such as cholera, and psychosocial disturbances due to the forced displacement of entire communities. Recent floods in countries like in Uganda have led to human death and displaced of more than 7,000 in 2013, and over 1500 people in 2017 in western Uganda^{19,20}



Photo: Urban based waste disposal points where leachate is the primary sources of water pollution in Mbarara district, Western Uganda



HEWAN-APPLIED INTERVENTIONS



Photo. Example of improved farming practices using high and low phosphorous fields. One approach critical for boosting on-farm productivity and economic returns (Kiboga, Central Uganda)

The model homestead

Achieving a healthy household with access to nutritious foods and better income requires that the Health-Energy-Water-Agriculture Nexus be considered when developing durable, holistically solutions. Adopting advanced modern farming practices and water management technologies can improve energy access and water optimization, and can minimizing the negative effects of drought and flood. Such benefits minimize health risks and boost productivity.

Some features of successful programs that have applied the nexus include the optimization of available resources through intensified production via sustainable land use: using clean water, organic and inorganic fertilizers, correcting soil pH by liming, applying natural pesticides, planting high yield and disease resistant varieties, practicing correct agronomy, and managing post-harvest losses.^{21,22,23}

A typical, well-resourced, rural homestead in Africa is endowed with enterprises that may

include crops (annual and perennial), livestock, fish, water tanks, biofuel, and woodlots. Such homesteads tend to have greater health services because resources are better optimized: livestock manure is used for biofuel generation (biogas) and soil fertility is improved at household level. A significant amount of water is harvested from the roof in tanks to respond to adverse conditions posed by climate change. Most of these homesteads follow a farm plan, and tend to have high adoption rates of technology such as the use of conservation agriculture. Conservation agriculture practices conserve soil and water: using soil covers, mulch or cover crops, reducing soil disturbance by using minimum and zero tillage practices; using rotation and mixed cropping. At the same time, breaking the pest cycle, building organic matter in soil, improving soil health, and maximizing harvest yield, are all important tenets for adapting to climate change.

In communities that have a significant number of homesteads, the formation of social groups that collectively market products as a community has boosted access to local and international markets. Such homesteads have sustainable and cooperative organizations, with stronger social safety networks that allow access of funds at affordable interest and social capitalization.^{24,25} These homesteads qualify as 'model homesteads' in most peri-urban and rural settings in Africa. They tend to have defined standards that can alleviate poverty.

Visionary farming methods that focus on efficiently optimizing the use of resources have a massive potential. By linking renewable and non-renewable energy sources, capitalizing on market-led production, harnessing social capital and financial discipline and embracing value addition, communities are stronger at their core and are thus more resilient.



These model homesteads boost clean energy, clean water, nutritious food and milk, resiliency to health risks, social capital, savings, and high net returns. They demonstrate the importance of the Health-Energy-Water-Agriculture Nexus and how its integrated approach to life is vital for healthy living, growth household income, and livelihoods improvement. However, the challenge is that few farmers or households in Africa have adopted this nexus approach.

There are different categories of homesteads at which the HEWAN principle can be measured, ranging from high, medium, low to very low.

Less endowed homesteads

In Africa, many homesteads are resource-constrained and have not fully applied the concept of the Health-Energy-Water-Agriculture Nexus. The households are endowed differently with resources.^{26, 27, 28} The variations arise from various factors, including the relative access to basic drivers of homestead development such as water, energy, land, and capital; to challenges related to social-cultural and economic factors such as family structures, attitude, mindset, low education, disease burden, or limited access to technical support.

Classifying homesteads ranging from high/rich, medium to low/poor resource-endowed homesteads across a community could help guide intervention efforts.^{29, 30, 31} In urban – peri-urban settings, a similar approach would apply, with highly innovative, high-value enterprises established based on land usage and resources-endowment status. These strategic interventions would enable the Health -Energy-Water-Agriculture Nexus to be applied at varying intensity for the benefit of all land users, for both urban and rural homesteads.

Current Efforts

There are efforts across the African continent under the direction of different governments to alleviate poverty and ensure sustainable development. The programs target the same households but with various sectors or ministries providing disjointed services. These disjointed approaches have not provided solutions to the complex household development challenges. As such, there is a need for new coordination and players, those with one common vision for household livelihood improvement, to construct the approach together. This is where HEWAN can be applied. There is an immense need for evidence-based mechanisms to measure the impact of current health and household finance programming. The tenets of HEWAN directly address both shortcomings of existing efforts.

Some programs in Africa have started to work in accordance with the nexus approach such as the *Operation Wealth Creation in Uganda*, which is providing seed funding to households; the *Africa Rising Program*, which is targeting pathways to overcome hunger and poverty for smallholder families with affordable and sustainable agricultural practices; Makerere University outreach programs through students-staff interfaces with communities; as well as many Non Governmental Organizations aimed at household income improvement.

Other networks have advanced measures to improve resilience of households with deliberate efforts to overcome poverty and hunger, such as the *Resilient Africa Network*. Given the magnitude and interconnected needs of low-resource households and the call for a joint approach, HEWAN remains most fitting framework for responding to the African challenge.



Photo: Permanent planting basins as one of the innovative and promising farm productivity enhancement measures.³⁸

Example Approaches

Some of the programs being promoted in resource-constrained homesteads include measures that emphasize affordable innovations to maximize the effective use of water, nutrients, energy and seeds.

Recent innovations in countries like Uganda have adopted the use of the permanent Planting Basins (PPB) as a soil and water conservation measure, among others. This innovation has registered amazing results for crop yield without relying heavily on investments in irrigation or mechanization.³² Other instruments such as fertilizer optimization tools (a fertilizer calculator) have been implemented to guide the use of the best types, amounts, placement, and timing of fertilizer in order to regulate its use in resource constrained homesteads.

Other approaches have been geared towards the development of drought-tolerant and disease-resistant crop varieties, targeting homesteads so they can respond to climate change challenges. Some universities in Africa such as Makerere University are at the forefront of agronomy and climate research and have developed soil testing kits,³³ are formulating plant clinics, fabricating rain gauges to monitor rainfall variability, supporting seasonal climate forecasts, making solar powered water pumps,

and developing simple tools for mechanization such as the affordable multipurpose tractors.³⁴

With increasing use of information technology, Makerere University has partnered with the private sector to explore the utilization of digital applications to bring services closer to land users. Mobile phone Apps have been developed to diagnose field issues regarding soil fertility, plant nutrition, diseases, and pests. Solutions can be shared after analysis of the collected data in quality laboratories. Other partners have been developing innovations that integrate fish rearing, poultry and horticultural crops with a recycling approach.³⁶ All of these innovations are important and can be applied after visionary planning on the land with a business mentality.

Other innovations that are contributing to HEWAN include finance-saving schemes,³⁷ comprehensive credit and agricultural insurance schemes, and social learning approaches that provide a platform for farmers to save, lend and borrow money, and insure their investments. Most importantly, these programs encourage farmers to continue their education and learn from one another in farmer field schools, progressive homesteads, and market-led production training centers.



Fig 1. Artistic impression of a homestead in Africa under four acres with perennials, livestock, orchards, and housing facility. (Photo credit- Dr Patrick Musinguzi)



Community-based adaptation approaches are central in responding to livelihood and health challenges: they promote wealth creation at the local level and address sanitation issues. At the recent *GLACAM Conference*, partnerships between Government and Universities were emphasized as important for guiding communities to develop their visions for growth. Improved water capture, storage, and management were also re-emphasized as key components for a development revolution in Africa, and advancing the HEWAN approach. With Africa, enriched with water from precipitation and various watershed/catchment units, community based engagement was fronted as an ultimate solution for managing common pool resources including water and energy. This type of engagement promotes

ownership of the development process, and leads to higher bargaining power to achieve the vision of healthy living and greater income, all the while protecting the environment.

The African communities Livelihoods program (ACLIIP), designed with the HEWAN approach at its core, is in its formalization stage. This program is aimed at promoting community revolutions, quality multi-sector partnerships, community resiliency to environmental and economic shocks and stresses, homestead visionary farming, water and energy planning, and better access to health services. Such strengthening reinforces the HEWAN concept itself by improving overall financial and product returns for farms, and increasing a community's ability to respond to health challenges.

CONCLUSION

It is evidently clear that the disjointed efforts have affected efforts for household economic empowerment in Africa. The integrated approaches must be fully harnessed, placing the communities in the driving seat, with support of Governments and Universities, to lead the revolution of visionary development. Such an approach can confront poverty, overcome health challenges, and improve livelihoods. However, all bio-physical, social-economic and cultural factors must be taken into account, in the community, with supportive policies and regulations, market information, technical support, infrastructure support services; all these boosted by financial discipline. Investment decisions must be targeted to support the Health-Energy-Water-Agriculture Nexus in order to catalyze transformation for a prosperous, healthy and economically empowered Africa.



Photo: African children will achieve success based on a sound health-energy-water-agriculture plan. (Kiboga District, Central Uganda)



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Education

- B.S in Agricultural Land Use and Management - Makerere University
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Dr. Musinguzi has been involved in intensive local and international research and consultancies in different sectors related to natural resource management both with Government and Non-Government Organizations. He commands vast experiences in conducting objective-based rural development activities, field related experiments, research and publications. He has gone through several local and international training in the areas of natural resource management in soils, land use, climate change, crop management, models/simulations, geo-statistics, GIS, watershed management and food-water-energy-ecosystem nexus. He has also successfully executed some duties in Kenya, Somalia, Djibouti, Tanzania, Rwanda, Morocco and Ethiopia. He has conducted integrated assessments related to the water-food-energy and ecosystem nexus. Currently, Dr. Musinguzi is analyzing how the nexus is linked to the health of millions of people on the continent since healthy living is critical for sustainable development. He believes that rural development can only be tackled with an integrated approach. This zeal to promote the integrated approach started after his PhD studies, and later during his work with communities. He believes that overcoming poverty in Africa demands an integral model that considers a holistic packaging of information, support services, technology, and innovations within established time frames.

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