Food Security In Africa:

How Innovation And Science Can Build A Future Free From Hunger

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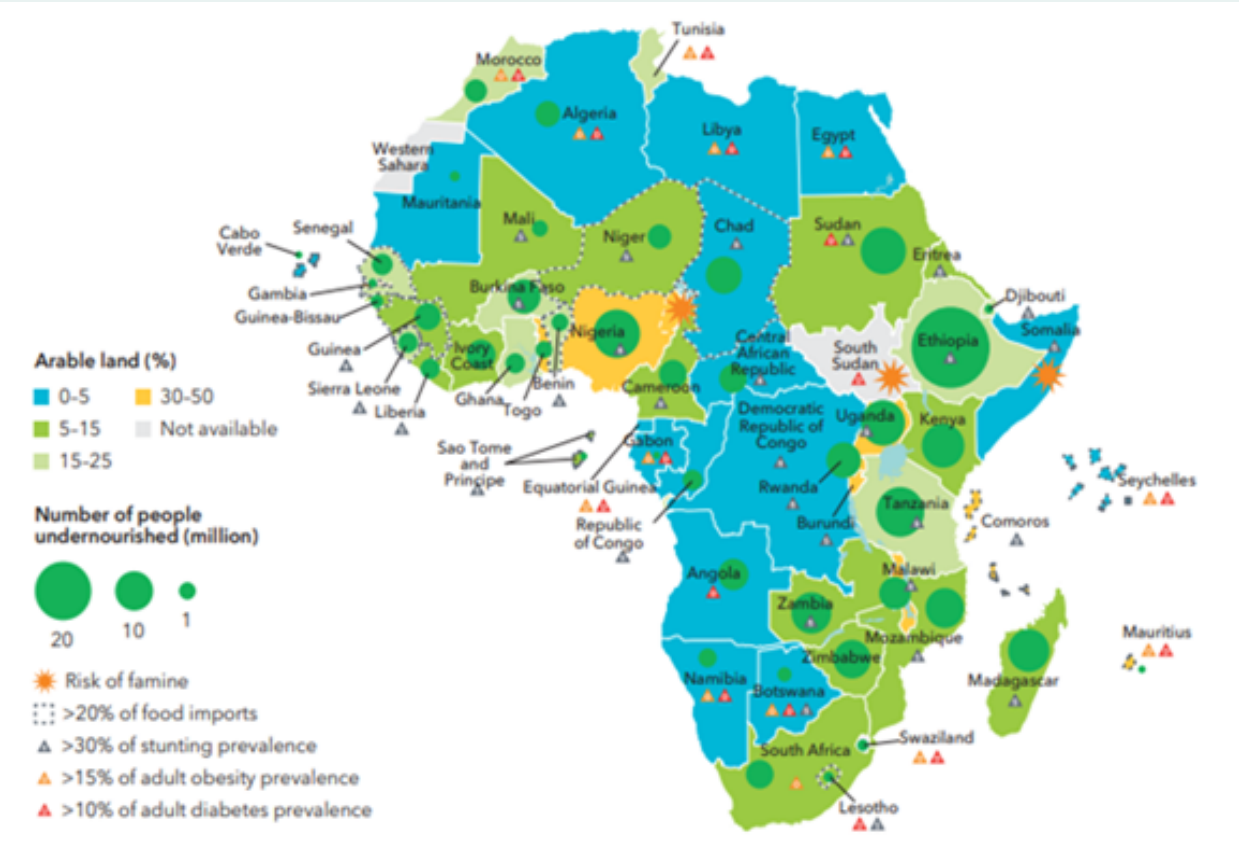
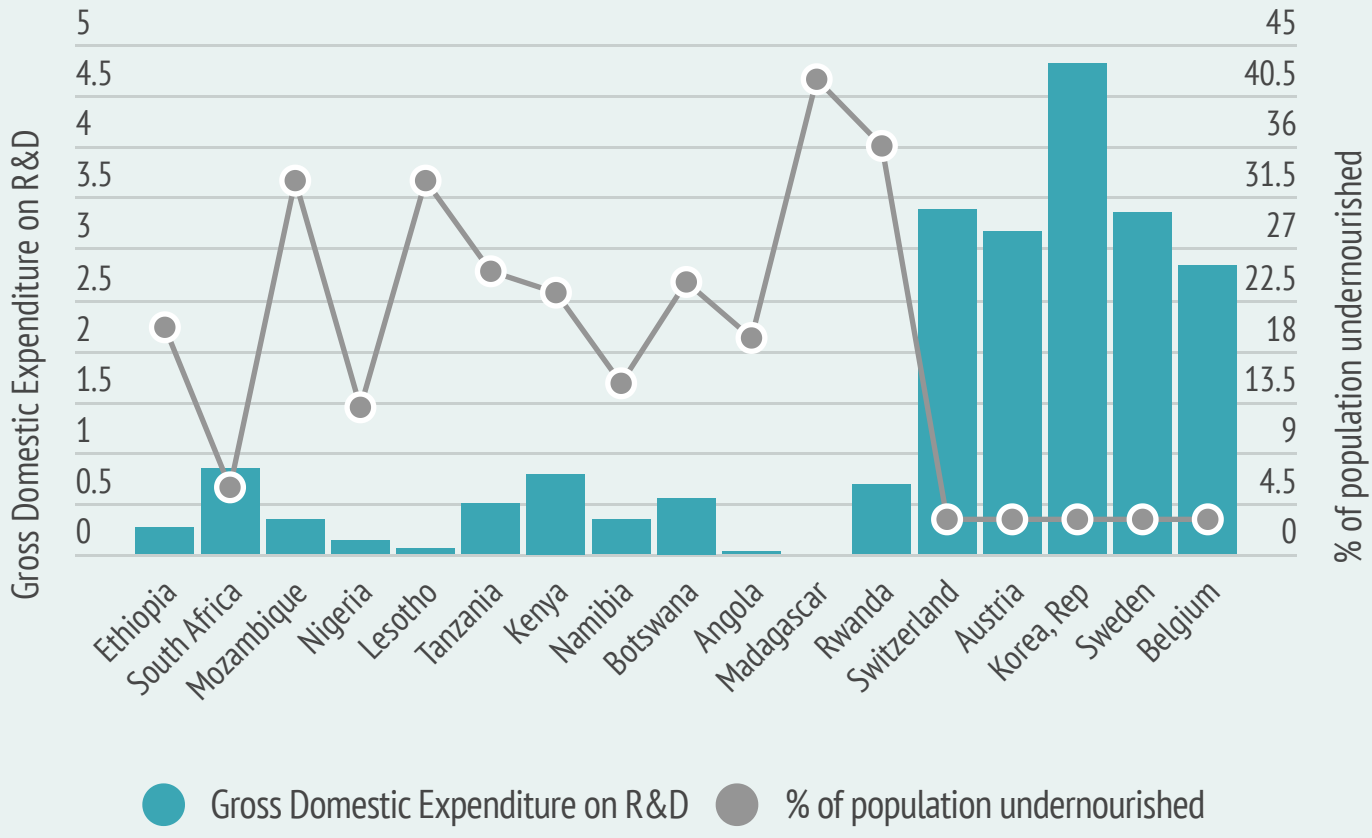
Hunger and famine in Africa continue to increase at an alarming rate with more than 257 million people experiencing hunger (Reid, 2019). Figure 1.1 (below) from Malabo Montpellier Panel (2017) provides an overview of the state of nutrition in Africa. The Food and Agriculture Organisation (FAO) projected that a 60% increase in food production will be required for the global population in 2050. Food insecurity in Africa is a multidimensional challenge as it has direct links to a number of factors such as conflict, climate change, pests, pandemics, population growth, trade policies and agricultural production.

It is evident that Africa requires an accelerated approach to achieve food security. This is supported by the African Union (AU) Agenda 2063 as it aspires to transform Africa's agriculture using science and innovation. In addition, the AU has partnered with the UN FAO to create a new framework that will boost trade and improve food security. This initiative was launched on 15 April 2021 and promotes the AfCFTA agreement that began at the beginning of 2021. The framework aims to improve Africa's industrial transformation policies through improved trade policy and facilitation, infrastructure and finance, productive capacity and market integration (UN News, 2021).



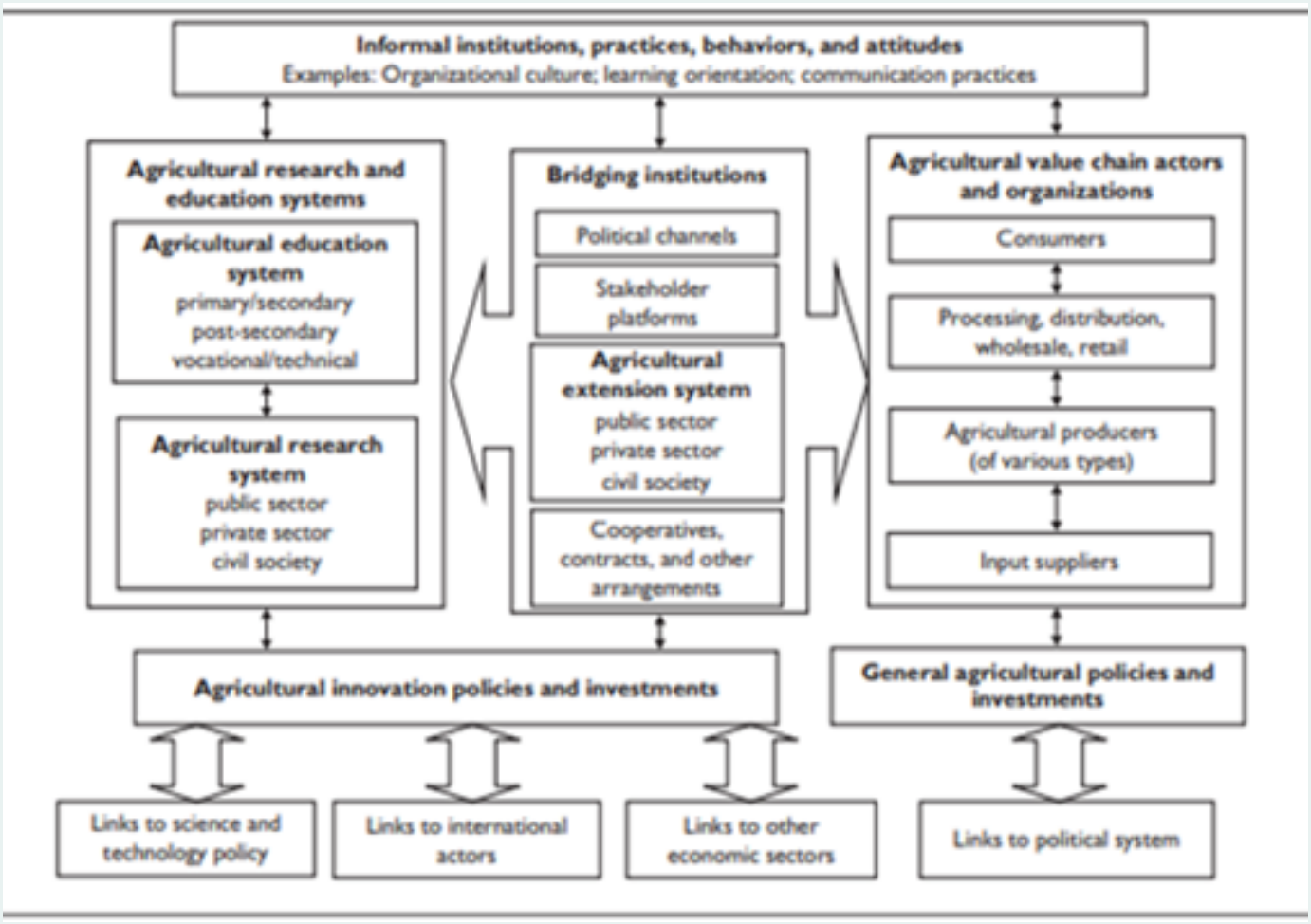
The Figure 1.1 (above) demonstrates the seriousness and urgency of transforming the food system in Africa. A profound change is required in Africa's agricultural system as the world is not on track to achieving the SDG of No Hunger by 2030. In contrast, with the toll of Covid-19 and without countries enhancing its innovative capabilities, the world could have more than 840 million people experiencing hunger by 2030.

Although investment in agricultural R&D has been proven as a prime driver of agricultural productivity with high returns, it still lacks financial and political support in Africa. This is evident as data from The World Bank in the (Figure 1.2 below)shows the inverse relationship between Gross Domestic Expenditure of R&D and the percentage of the population undernourished. While South Africa leads African countries with a 0.82% expenditure, it is still distinctly lower than developed countries which contribute an average of 2-3%. As a result, these countries have approximately 3% of the population undernourished while Madagascar and Lesotho have 41% and 38% respectively.



For countries to improve their innovative capabilities and apply scientific, technical and innovative systems, African countries require a framework that facilitates agricultural innovation (Figure 1.3 below) as well as R&D that focuses on smallholder farmers, building capacity and enabling policies and infrastructure. The use of innovation in agriculture should also account for smallholder farmer participation, local and traditional knowledge use and recognition and promote gender-responsive systems.

The funding directed towards agricultural R&D should be increased, consistent and co-ordinated as the returns from R&D take numerous years to develop. The public sector should also ensure that smallholder farmers are in a position to adopt new technologies by rehabilitating neglected infrastructure and equipment. Agricultural R&D also has the potential to promote agricultural development and economic growth, improve nutrition and reduce poverty and drive capacity building.



Technology Innovation Systems

The framework above allows for Technology Innovation Systems (TIS) to address some of the greatest threats to food security such as vulnerable crops, inadequate storage facilities, pests and diseases, poor soil quality, water availability and nutritive value. Listed below are examples of these systems and the manner in which they address food insecurity.

a. Combating diseases: Eastern Africa relies heavily on cassava, sweet potato and potato as they are a source of food, animal feed and an agro-processing income. While these crops have a high nutritive value and the potential to alleviate malnutrition, its productivity is greatly limited by viral diseases which can result in the loss of more than 90% of total yields. The TIS developed to address this challenge uses micro-propagation techniques, which is the rapid multiplication of plant materials and surface contaminants removal, to screen and develop disease-free crops. The improved tuber crops have increased climate resilience and have greater yields in shorter periods of time (Ecuru, et al., 2016).

b. Food wastage is one of the greatest reasons that Africa is food insecure. More than one third of food produced is wasted, mainly due to inadequate storage facilities. Solar Freeze, a TIS launched in Kenya, provides mobile solar-powered cold rooms for smallholder farmers. These portable cold rooms significantly reduce postharvest losses and promote food security.

Technology Innovation Systems

c. A contributing factor to food insecurity is low productivity and low yield output due to the vulnerability of crops. Genetic modification of these crops assists in increasing its resilience to drought, pests, diseases and enhances its nutritive value. This cross-breeding TIS has encountered great success in Ethiopia and launched the Nutritious Maize for Ethiopia project. This initiative aims to alleviate household food insecurity by promoting the adoption of quality protein maize (QPM) among growers and consumers due to its higher nutritive value and productivity. Some genetically modified crops are also supported by biotechnology to increase its climatic and environmental resilience (UNCTAD, 2017).

d. Another method used to increase a crop's resilience to biotic and abiotic stresses is transgenic modification. Transgenic modification involves the insertion of genetic organisms from foreign DNA. An example of successful transgenic modification are the rice varieties produced by New Rice for Africa (NERICA). These varieties are hybrid combinations of African and Asian rice species and have a higher tolerance with early maturity.

e. Fertile soils play a vital role in agricultural productivity and food security. Healthier soils have the potential to produce healthier plants and higher yields. N2Africa uses a science-based TIS that focuses on nitrogen fixation for smallholder farmers to increase yields as it enhances the water-holding capacity and infiltration rate of soils. Nigeria's National Research Institute for Chemical Technology (NARICT) has also directed its research towards organic neem-based and Moringa oliefera fertilizers.

Technology Innovation Systems

f. Water availability is another critical input that threatens food security in Africa. Africa experiences low, unpredictable and unevenly distributed rainfall. A TIS called Groasis Waterboxx, collects, stores and gradually distributes water particles to the surrounding plant while preventing the evaporation of groundwater. Other water related science and innovations include water desalination plants, fungal seed and plant treatments to reduce crop water requirements and easily accessible climate and soil data.

g. Biofortification, which is the breeding of micronutrients and vitamins into staple crops, have proven to be increasingly effective in alleviating malnutrition. Successful examples include zinc-fortified rice and vitamin A enriched cassava. Once these crops are produced, nanotechnology can be used to prolong its lifespan. A nanotechnology packaging system has been developed with hexanal (a naturally occurring compound that slows down the ripening process) along with a hexanal spray, to keep fruits and vegetables fresher for longer (UNCTAD, 2017).

Policy Recommendations

The new culture of science and innovation in agriculture requires the government to play a critical facilitating role. Government has the ability to diversify its funding sources (tax, excise and FDI) and provide incentives, business idea incubators and research funding. Africa requires policies that are conducive with an enabling framework that are consistent across African regions.

Organizations like SADC and COMESA will need to be aligned on its bioscience innovation structure for all of its member states. Intuitions should also provide support for building human capacity, providing farmer-scientist interface, increasing investments in R&D and strengthening the physical environment for agricultural production, storage and distribution. The development and application of science, innovation and technology should be encouraged on all four dimensions of food security, namely; food availability, food access, food stability and food utilization.

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