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Breaking the Traditional Trap: Improving Food and Nutrition Security through Science Technology and Innovation in Zimbabwe

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Abstract: *There is a growing realisation on the importance science, technology and innovation (STI) in improving agriculture and ultimately food and nutrition security. Nevertheless, in spite of the recognition that STImatters, current literature onits contribution to improved food and nutrition security in developing countries is relatively scant. With most developing countries at various levels of socio-economic fragility, STI offers some options to realise the untapped potential of agriculturethat is essential in enhancing food and nutrition security, ending hunger and malnutrition and ultimatelyattain socioeconomic transformation. Improving of food and nutrition security through STI is being ushered as a better approach and it strives to deliver innovation, boost agriculture production and action needed to achieve sustainable development. STI are key drivers of economic and social development.Inherently, if STI policies are well integrated into national development strategies combined with institutional and organizational changes can help raise agriculture productivity, improve the country competitiveness, support faster growth and create jobs.This article analyses how to improve food and nutrition security thoughScience,Technology and Innovation in Zimbabwe.*

Keywords: Food and nutrition security, science and technology policy, biotechnology, Zimbabwe

Introduction and background of the study

The world is under intense pressure to fight food and nutrition insecurity. In fact, an estimated number of the undernourished people increased to 815 million in 2016, up from 777 million in 2015 (FAO, 2017: 1). In essence, world is facing the greatest test of how to feed the projected 10 billion by 2050 (AfDB, 2016:2).Despite the commitments by world governments to achieve zero hunger by 2030 under the ambitious Sustainable Development Goals, hungerproves to be a major challenge.Bain et al, (2013:4) argues that developing countries including Sub-Saharan Africa host the majority of the hungry people.

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Zimbabwe continues to face food and nutrition security challenges, which, if left unchecked will have negative impact on national development (FNC, 2013: ix).Food and nutrition security is a complex condition thus calling for concerted effort to address it. Profoundly, for the world to achieve food and nutrition security, Science Technology and Innovation (STIs) must be given a top priority UNCTAD (2017:8).Inherently, STIs hostsa lot of opportunities capable for improving food and nutrition security hence leading to socioeconomic transformation (ACBF 2017: viii).Science Technology and Innovation (STI) has entered the policy domain of many institutions and has the potential to increase agricultural productivity, reducing poverty, and improving food and nutrition security(UNESCO 2015:8). Many countries and institutions strive for STI-led development in recent years and it is regarded as an enabler for socioeconomic transformation.

Zimbabwe is confronted by multiple food and nutritioninsecurity that could threaten human survival if not addressed. The country needs to increase food production and move away from subsistence production and weak productivity. Global experiences suggest that the attainment of food and nutrition security requires high and sustained growth, underpinned by enhanced agriculture productivity (AfDB, 2016:3).Inherently, a comprehensive transformation of the agriculture sector in Zimbabwe towards high food production requires investments in science technology and innovation in order to improve the productivity of land and especially labour (e.g. new tools, improved seed, water control, fertilizers) including innovation in the commercialization of agriculture products (AEC, 2016:4).It is imperative for farmers to be given incentives to adopt new technologies by making them affordable in order to raise food production andeventually improve food and nutrition security. If properly embraced, science technology and innovation would raise food production in Zimbabwe and ultimately improve food and nutrition security which will result in socioeconomic transformation.

In Zimbabwe the impacts of climate change and variability are becoming more evident with increased incidences of droughts, floods, hailstorms, more hot days and heat waves. Ideally, climate change is one of the biggest threats to food and nutrition security with the developing countries being more vulnerable due to their low adaptive capacity (ACBF, 2012). Climate change has been widely recognized and accepted as a reality and that it poses seriousproblems with far reaching social, political, economic and environmental consequences, particularly in vulnerable (GoZ, 2014:3). The impacts of Climate Change in Zimbabwe are likely to stall the country's development, pose a serious risk to food and nutrition security thus calling for measures to mitigate and arrest the situation. STI provides a window of opportunities through climate-smart solutions including the use of precision agricu lture and early warning systems (UNCTAD 2017:3).

Application of STI strategies such as genetic modification, methods for improving soil fertility, and irrigation technologies has the potential to improve food and nutrition security (UNCTAD 2017:3). In fact, post-harvest and agro-processing technologies can address food accessibility while bio-fortification can make food more nutritious. Moreover, STI approaches such asartificial biology, synthetic intelligence and tissue engineering may have potential implications for the future of crop and livestock agriculture thereby improving food and

nutrition security. Nonetheless, the potential of STI for food and nutrition security transformation entailsinvestments in research and development, human capital, infrastructure and knowledge flows.

The analysis in this article is based on the case study of Zimbabwe to understand how food and nutrition security is realised through the use of science, technology and innovation. The next section of the articlecovers the objectives while section III covers the literature review, the methodology and conceptual framework to identify and study the STI mechanisms for achieving food and nutrition security. The articleconcludes with a discussion on the results the policy implications as well as the concluding remarks respectively.

Literature Review

According to ACBF (2017:1) the term STI encompasses all systematic activities that are closely concerned with the generation, advancement, dissemination and application of scientific and technical knowledge in all fields of science and technology- the natural sciences, engineering, medical and agricultural sciences, and the social sciences and humanities. On the other hand FAO (2016:1) argues that, 'Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'. Food and nutrition security is when all people at all times have physical, social and economic access to food, which is consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life (FAO 2017:3).There is in fact a mutual relationship between food and nutrition security and science technology and technology in ensuring socioeconomic transformation as the later can increase the former.

Historical Development of Science, Technology and Innovation in Zimbabwe

Science, Technology and Innovation footprints can be traced back to the period before country's 1980 independence. Hove and Zinyama (2012:10) argues that the Zimbabwean government set the STI policy proposals in the Growth with Equity policy pronouncement of 1981.It is in this blue print where the government announced its intention to come up with a clear national STI policy (UNESCO 2014:89).Zimbabwe launched its first Science and Technology policy in 2002 with the main objective of providing a comprehensive framework that could promote STI and harness it to economic development. The policy also sought to co-ordinate and direct research and development activities in the country. Moreover, in the same year the government of Zimbabwe established a Department of Science and Technology in the Office of the President and Cabinet with the main objective of enhancing national economic growth and development through systematic application of STI (UNESCO 2014:90). The functions of the Science and Technology Department were to co-ordinate the formulation of STI

development policies, assist the establishment of innovation centres among others promotion of STI and information, communication and technology (ICT) literacy.

In the year 2005 the government established a stand-alone Ministry of Science and Technology Development and it strived to make STI an integral part of both individual and national development. The Ministry had the following STI related departments: Science, Technology and Innovation, Research, Development and Innovation and Commercialisation of Research, Development and Innovation. This development led to the creation of the Cabinet Committee on Scientific Research, Technology Development and Application and it comprised several government ministries. The Ministry of Science and Technology Development launched the Innovation and Commercialisation Fund to promote research and innovation. In a bid to address the emerging national challenges, the government launched the second STI policy in 2012.This was also in line with the new technological developments in the world. However, after the 2013 harmonised elections, the Ministry of Science and Technology Development was abolished and merged as a department in the Ministryof Higher and Tertiary Education, Science and Technology Development and remains there to date.

Key Legislative Architecture of the Science, Technology and Innovation in Zimbabwe

Zimbabwe's overall Science, Technology and Innovation (STI) regulatory framework is outlined in a number of key policy documents that include the Agenda 2063, Research Act of 1986 and its subsequent amendments, the Science, Technology and Innovation Policy of 2002 and its upgraded policy of 2012, the Biotechnology Policy of 2005, the Biotechnology Act of 2006 and the ICT Policy Framework of 2006.

Agenda 2063

In an endeavour to achieve region's vision, Africa have emphasised STI as a vital pillar to realise socioeconomic transformation. African leaders including Zimbabwe have adopted the Science, Technology and Innovation Strategy for Africa (STISA-2024) at the 23rd Ordinary Session of the African Union Heads of State and Government in 2014.This 10-year strategic frameworks for Agenda 2063 seeks to transform African governments an innovation- led, knowledge-driven economy.AUAC 2014 in ACBF (2017:4) argues that STISA-2014 strives to provide a focus on improving Africa's STI status in human capital, technical competence, infrastructure, the enabling environment, innovation, and entrepreneurial mind-sets.

Research Act 1986

The Research Act was first signed in 1986 and amended six times to date in line with the developments in the area of research and development. This Act is crucial because it led to the establishment of the Research Council of Zimbabwe. It confers on the Council the functions and powers relating to the promotion, direction, supervision and co-ordination of research. The Research Act also seeks to provide

for the establishment of research councils and research institutes and for the control of such research councils and research institutes .The Act also provide for the registration of foreign researchers; and also to provide for matters connected with or incidental to the foregoing.

Science, Technology and Innovation Policy

The enactment of the first Science, Technologyand Innovation Policy was done in 2002 and was later upgraded in 2012 by taking into account the new technological developments and also the emerging national challenges. The Science and Technology Policy underscore the need to mainstream science in all sectors of the economy and ensure that Zimbabweans benefit from acquisition and utilization of available technology in improving the quality of their lives. This policy also aims at developing a more effective innovative system of partnering all institutions involved in creating new knowledge, producing new innovations and diffusing them to the benefit of the people of Zimbabwe and our region at large. The Policy presents six primal goals through which all efforts should be channelled. These are:

- Strengthen capacity development in STI.
- Learn and utilize emergent technologies to acceleratedevelopment.
- Accelerate Commercialization of Research Results.
- Search for scientific solutions to global environmentalchallenges.
- Mobilize resources and Popularize science andtechnology.
- Foster international collaboration in STI.

The Biotechnology Policy Framework

Zimbabwe's regulatory framework on biosafety dates back to the early 1990s when the country's scientists approached thethen Scientific Liaison Office in the Office of the President and Cabinet requesting that Government put in place legal measures to manage breakthroughs in modern biotechnology.Government with support from donors developed a comprehensive national policy on biotechnology and its safe use was developed (2005) and a new Act of Parliament – theNational Biotechnology Authority Act passed into law in2006.The current national biotechnology regulatory regime(National Biotechnology Authority Act of 2006 and its supporting guidelines, regulations and standards) was developed as a means to implement the biotechnology and biosafety provisions contained in the National Biotechnology Policy and other national policy documents, and also to repeal earlier biosafety legal arrangements (The Research (Biosafety) Regulations of 2000). This Act transformed the Biosafety Board into the National Biotechnology Authority with the following functions:

- To regulate biotechnology research and development in Zimbabwe.
- To enforce standards and any regulations pertaining to biotechnology and its safe use.
- To champion all national efforts towards biotechnology research, development and management.
- To administer the Biotechnology Fund.
- To manage the National Biosafety Clearing House

The Information Communication Technology Policy Framework.

This Information and Communication Technology Policy is a culmination of a review of the 2005 National ICT Policy. The policy seeks to exploit the potential of ICTs in all sectors of the economy for sustainable socio-economic development in Zimbabwe. The National ICT Policy aims to develop an enabling environment for the creation of a knowledge based society that transgresses across all levels of the society. To this end the policy is guided by the following objectives:

a) Facilitate the provision and maintenance of infrastructural facilities necessary for ICT development;

b) Embark on extensive capacity building and training programmes to provide adequate supply of qualified ICT personnel and knowledge workers in all sectors;

c) Establish institutional mechanisms and procedures for determining sectoral application priorities;

d) Promote, support and enhance the development and use of ICTs, and ensure equitable access to benefits offered by ICTs across all sectors of society;

e) Promote the research and development of local ICTs to compete with international products;

f) Establish the necessary governance and regulatory structures that facilitate ICT development and adaptation across all sectors of society;

g) Protect consumers during the dispensation of the rapid adoption and diffusion of ICTs; and

h) Promote Regional Integration in the development and use of ICTs.

MappingKey Science Technology and Innovation Institutions in Zimbabwe

There are numerous policy-oriented organisations, both Zimbabwean and international, working on different programs that aim to enhance science, technology and innovation.

The Office of the President and Cabinet (OPC).

The OPC sits at the helm of science, technology and innovation system in Zimbabwe. In fact, the OPC is mandated to provide strategic policy direction, coordination, monitoring, advisory oversight to all government departments and ministries involved in science, technology and innovation. The OPC is responsible for planning and realisation of efficient delivery of science, technology and innovation inall government ministries and departments. However,there is often duplication of functions between the OPC and the Department of Science Technology and Innovation Development in the Ministry of Higher Education Science and Technology Development.

The Ministry of Higher Education Science and Technology

The Ministry of Higher Education Science and Technology is the custodian of science technology and innovation in Zimbabwe. The STI role within the ministry lies specifically with the Department of Science, Technology and Innovation. The department is mandated to provide leadership in research, science, technology and innovation in Zimbabwe. This is done through the provision of an enabling environment in terms of policy, legislation combined with co-ordination and monitoring. The functions of the department include the co-ordination of STI project implementation and promotion as well as facilitate technology transfer and strengthening of Intellectual Property Assets for effective knowledge translation. It is also the responsibility of the department to co-ordinate higher and tertiary education, science, technology and innovation policy planning, review, formulation, and implementation to meet the transformational agenda. The ministry also has the responsibility of developing policies and programme for human capital development through tertiary education for the country's transformational needs.Finally, the ministry also facilitate establishment of bilateral and multilateral collaborative researches and development programmes in the area of science, technology and innovation. Notwithstanding these responsibilities, the ministry suffers from limited funding from the government national purse hence limits the potential to discharge its duties.

The Research Council of Zimbabwe

The Research Council of Zimbabwe was established by the terms of the 1986 Research Act which succeeded the Scientific Liaison Office established in the Prime Minister's Office in 1967.The Research Council of Zimbabwe is mandated to promote, direct, supervise and co-ordinate research for sustainable development. The Council advises the government on matters related to research for the development of the country. In essence, the council provide an exceptional forum for the interaction and discussion of STI and other researches for the benefit of government, academia and industrialists. It is an established conduit for financial and administrative support for collaborative research among institutions.

Scientific and Industrial Research and Development Centre (SIRDC)

The SIRDC was established by the Government of Zimbabwe in 1993, under the provisions of the Research Act of 1986. The Centre provides technological expertise in the diverse areas in which Zimbabwe's industrial enterprises operate. SIRDC is Zimbabwe's Technology Centre whose responsibilities extend to technology development and transfer to Zimbabwe and regional stakeholders in diverse disciplines that include environment, energy, mining, agriculture, food and biomedical, biotechnology, engineering, informatics, electronics and communication, polymer science, metrology, Geographical Information

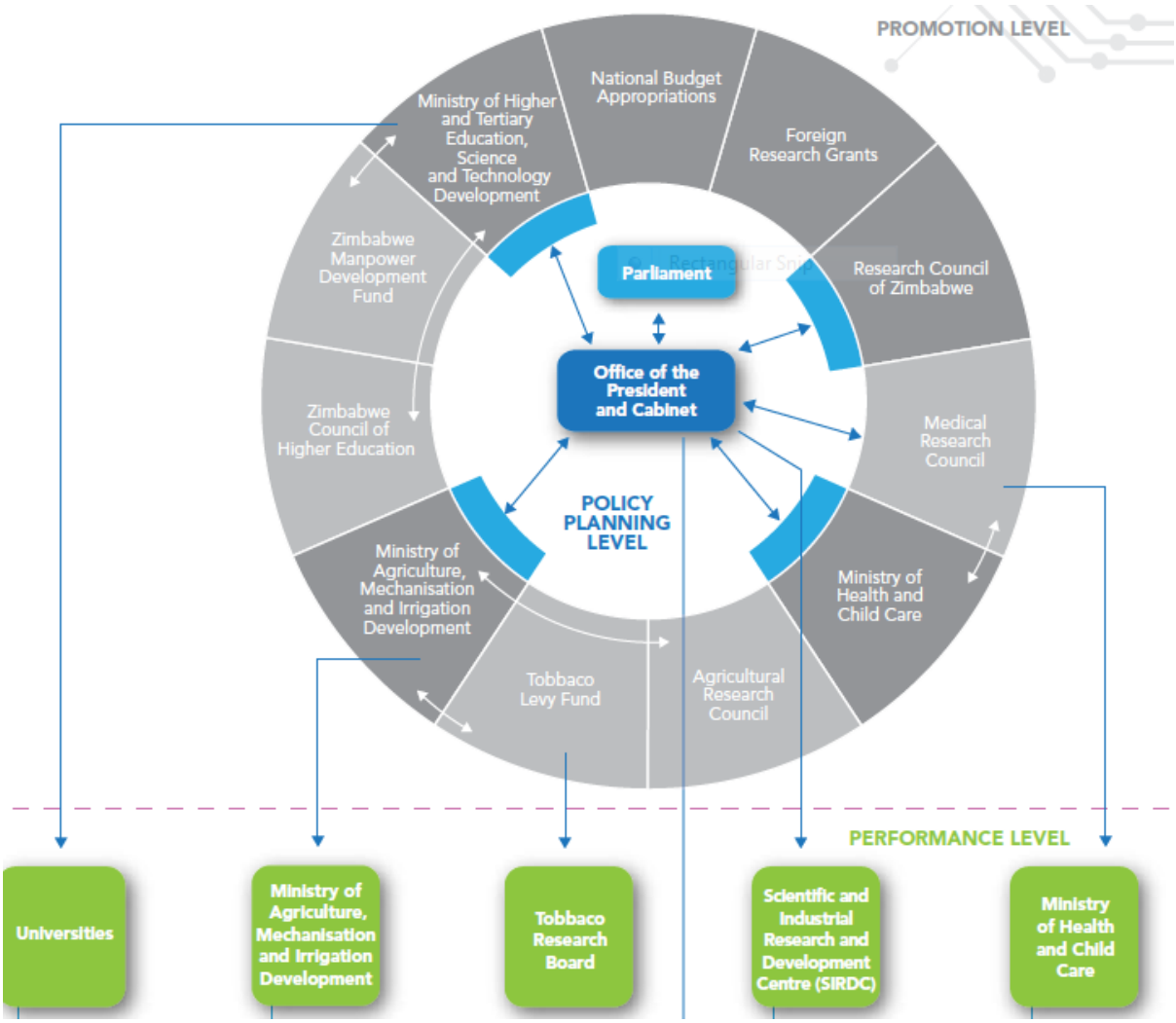

Figure 1: Zimbabwe's Science, Engineering, Technology and Innovation System

Source : UNESCO 2014

Systems (GIS) and remotesensing. In an endeavour to improve Zimbabwe's science, technology and innovation, SIRDC is responsible to carry out strategic research and development for the benefit of the industry, agriculture, health and mining sectors. The Centre also collaborates with other local and international institutions and universities in strengthening research and development capacity and its application to industrial processes. SIRDC also serve as a repository and disseminator of science, technology and innovation information. This is done by adapting imported technology and innovation into local needs. The Centre operates through eleven institutes which all deals with science, technology and innovation to enhance national development.

The Science, Technology and Innovation System on figure 1 above representa milestone of innovation in Zimbabwe. This system aims at developing a more effective innovative framework of partnering all institutions involved in creating new knowledge, producing new innovations and diffusing them to the benefit of the people of Zimbabwe and our region at large.

Success Stories of STI in Food and Nutrition Security

Zimbabwe has developed several STI initiatives, including research and development centres across the country. The country presents success stories of STI in food and nutrition security as indicated in Boxes 1,2 and 3.

Box 1: A new maize seed variety in Zimbabwe:The Sirdamaize Project

The Scientific Industrial Research and Development Corporation of Zimbabwe (SIRDC) invented a seed variety, Sirdamaize, which is a drought and disease tolerant, and offers higher yields than traditional strains. In 1997, SIRDC (with support from Biotechnology Trust Zimbabwe, Directorate General International Cooperation of the Netherlands, and International Maize and Wheat Improvement Centre) began work on the drought-tolerant maize varieties. This was a four year-phase project: capacity building "market-assisted selection" (a relatively new molecular biology technique at that time), selection of germplasm, development of inbred lines, and development of hybrids. Molecular biologists conducted tests in SIRDC's laboratories.

Using molecular biology and conventional breeding techniques, they identified 43 inbred lines as processing drought-tolerant genes. After the hybrid development stage, the variety "Sirdamaize 113" was registered in 2009.Farmers from Buhera Birchenough, and Hwedza assessed it, and found that it yielded well, even under tough environmental conditions. The main characteristic of Sirdamaize 113 is its drought tolerance, while its expected yield is up to 13 tons per hectare (although previous years' trials in communal areas from region two to region four had a yield of 1.5-9 tons per hectare). The variety has a low athesis-silking interval of about -1, taking 66 days to silking and 67 to anthesis, suggesting improved synchronization for pollination, and thereby guaranteeing yield even under water stressed conditions. Sirdamaize takes 136 days to reach maturity and has a tolerance to disease such as maize streak virus, gray leaf spot, rust, and phaeospharia leaf spot.

Source: Sovadye and Shiri 2012.

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Box 2: Sorghum miracle in Jambezi District Matabeleland North Province

Small-scale farmer Augustine Sibanda has grown resilient tradition sorghum varieties passed down through generations but has increased his yields after he adopted improved seed varieties developed through research.Sibanda, a farmer in the Jambezi District in semi-arid Matabeleland north province, is passionate about farming and is astute in seeking and applying new knowledge. Sorghum – a hardy but nutritious cereal – is suited to arid conditions such as the southern parts of Zimbabwe. Sibanda says improved sorghum varieties such as Marcia have helped triple his average harvests of 500kg of sorghum per hectare.Sibanda says improved sorghum varieties such as Marcia have helped triple his average harvests of 500kg of sorghum per hectare. Marcia is one of 12 improved sorghum seed varieties developed and released by the Zimbabwe station of the International Crops Research Institute for the Semi-Arid tropics (ICRISAT) through the research collaboration between scientists, public and private sector organisations. Fundamentally, investing in science, technology and innovation will help Zimbabwe meet the ambitious Sustainable Development Goals (SDGs) and improve food and nutrition security of its citizens.

Busani Bafana :January 2016

Box 3: The EcoFarmer ICT Project

EcoFarmer is a revolutionary way of farming using mobile technology throughout Zimbabwe offered by Econet Wireless Private Limited Company. Farmers using the mobile network receive daily weather information, farming tips and information on when and where to sell, and the best price for their produce. With EcoFarmer productivity is increased and food security improved. Therefore the mobile phone as an information and communication tool is extending agriculture extension services to underserved markets. Through the use of the mobile phone, access to technical and market information contributes to increased yields and income of smallholder farmers and other players in the agricultural value chains. Eco cash a payment instrument which is facilitated through the use of the mobile phone goes a long way in assisting smallholder farmers to make and receive payments.When fully registered and paid daily subscription the farmer gets:

Daily weather data from a weather station linked to your field.

Farming and market tips

Free daily rainfall advice

Free weekly best farming prices

Free weekly crop data

Free monthly market pricing requests

Crop information

Credit rating

Free adverts and marketing links

Financial linkages

Source : Econet Wireless (2017)

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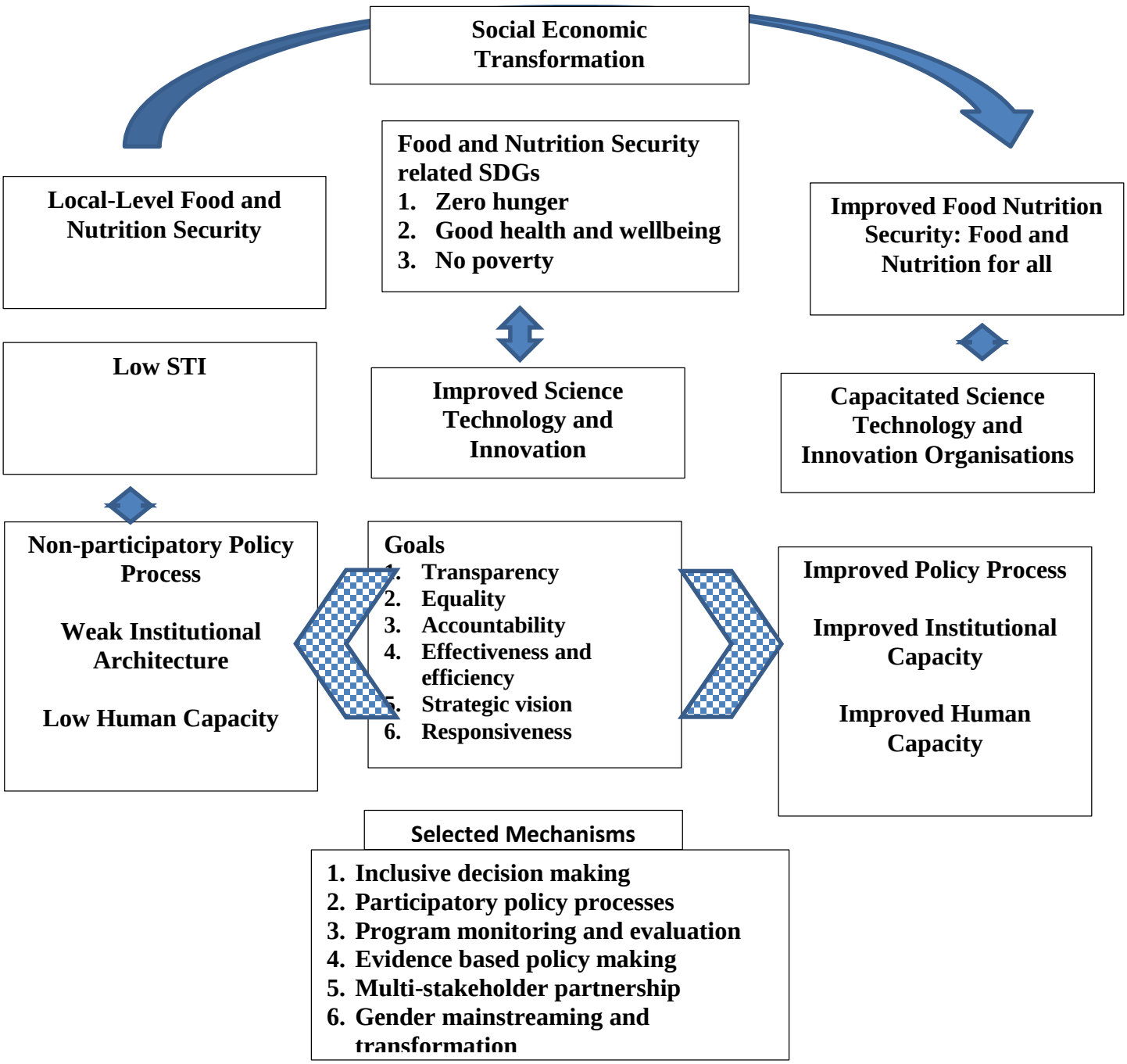

Figure 2: Transformation of Science Technology and Innovation for achieving Food and Nutrition Security

Source: Based on Babu and Blom (2014); Babu (2015)

The Methodological and Conceptual Framework

This article was developed based on a qualitative methodology in order to understand the contributions of science technology and innovation to enhanced food and nutrition security for socioeconomic transformation. The article attempts to trace STI as a critical enabler to unlock the potential of food and nutrition security for sustainable development and socioeconomic enhancement. The author understands that the subject of improved food and nutrition security through STI has entered the policy domain of many institutions and is now globally accepted to the extent that the methodological study of this body of knowledge is possible through systematic analysis and critique. This systematic analysis and critique principally take the form of document and literature as well as theoretical prostitution.Key informantsand focus group discussions with officials from the Office of the President and Cabinet, universities and Ministry of Higher and Tertiary Education Science and Technology Development we also done to get the practical realities of the matter under investigation.

Conceptual Framework

This section of the article offers a conceptual framework to explain the pathways of science technology and innovation to improve food and nutrition security. Figure 2 below shows the sequence needed to move from low-level science technology and innovation to high level science technology in order to achieve food and nutrition security critical for social and economic transformation. Concertedeffort by all the stakeholders is an essential step for enhancing STI capacity to improve food and nutrition security. Ideally, the role of government is to create an enabling environment by formulating the right policies, creating efficient institutions for implementation and follow-up, offering financial resources and improving investments in human resources.

Results of the article and lessons from the Zimbabwe Case study

The Zimbabwean case study provides several lessons for improving food and nutrition security through science, technology and innovation. The development of STI in Zimbabwe is supported by the high adult literacy rate of 90% in sub Saharan Africa thus providing a window of opportunities for the development of agriculture and ultimately improving food and nutrition security.Zimbabwe is also endowed with abundant arable land and good climatic conditions that give a comparative advantage over other countries and is projected to among those leading growth in sub-Saharan Africa by 2020 (UNESCO 2014:184).The establishment of the Innovation and Commercialisation Fund in 2005 shows commitment on the part of government towards STI. This is despite the limited funding from the national budget.

The development of STI in Zimbabwe is facing numerous challenges including poor co-ordination and harmonisation. The STI legal and institutional frameworks are fragmented resulting in duplication of functions by the various government ministries and departments. For example, the research priorities proposed by the Research Council of Zimbabwe differ from those articulatedby the Ministry of Higher and Tertiary Education and STI policies. The priorities are also different from the research and innovation policies proposed independently by the Ministries of Industry and Commerce; Agriculture; Environment, Water and Climate; Energy and Power Development. Since STI is a cross –cutting issue, it is imperative to have a specific national body with overall responsibility for co-ordinating the policy formulation, design, implementation, funding and assessment of all research and innovation in the country.

The STI system in Zimbabwe comprises of three pillars that is the funders, knowledge generation and users of research results, it remains complex. Through key informant interviews the Deputy Chief Secretary in the Office of the President and Cabinet argues that linking STI system pillars is highly complex. He further stressed that each pillar within the STI system has its own expectations and complications. In effect, is imperative for policy makers to foster collaborations and memorandum of understanding between industry and the academia for science, technology and innovation to thrive. Government should accelerate technology and innovation transfers and foster commercialisation of research and development. Focus Group Discussions with officials from the Ministry of Higher and Tertiary Education Science and Technology Development unanimously agree that the lack of effective coordination and linkage among ministries and agencies tend to limit innovation within the STI system. In Zimbabwe, the weak linkage is ubiquitous among public sector, research institutions and private sector. Building a capacitated STI system is a cross-cutting issue that requires effective public-private sector linkages and a coherent STI strategy at national level (ACBF 2017:49).

The Zimbabwean STI system is confronted with low funding to support institutions and also research and development programmes. Responses from one University lecturer at National University of Science and Technology key informant interview indicate that due to limited fiscal space most programs are supported by donors and private sector leaving STI isolated from the national agenda. Despite the government's commitment to invest 1 per cent of gross domestic product (GDP) in research and development, funding remains very low. Budgets for STI remains low across institutions making it difficult for government mobilise additional funding to follow up of donor funded STI programs after their withdrawal. Moreover,most institutions including agriculture research institutes and universities face critical shortage of technical staff and researchers. Zimbabwe is among the countries facing serious gaps in critical technical skills to implement the Science, Technology, and Innovation Strategy for Africa (STISA-2024).Ideally, lack of capacity building to develop critical technical staff and researchers means the country will continue to rely on imported skills this slowing down the development of STI (ACBF 2017:46).

The STI system in Zimbabwe is faced with weak monitoring and evaluation (M&E) due to lack of capacity, resources and missing framework. Monitoring and Evaluation of STI policies and programs is critical for policy makers to stay up to date with new scientific and technological transformations, to anticipate emerging developments , and to use these outcomes to prioritize areas for innovation and investment (ACBF 2017:50).Preferably, monitoring and evaluation was supposed to collect data on specified indicators to track progress as well as to determine the impact of the policy but unfortunately there is no framework for that within the STI policy. While the OPC and the Department of Science and Technology Development in the Ministry of Higher and Tertiary Education assumes the monitoring and evaluation role, it is not clear on duties and responsibilities. This has created a lot of problems as activities of multiple stakeholders are not monitored and directed.Ideally, the monitoring and evaluation is supposed to demonstrate cause and effect, but this is difficult without capacitating the institutions and staff on the M&E issues. The implementation of the STI policy is also confronted with lack of demand for monitoring and evaluation thus making it difficult to measure success.

Policy Recommendations

Zimbabwe has regarded STI a critical enabler for the achievement of both the Agenda 2063 of the African Union and also the Sustainable Development Goals. In fact, building STI is a driver in achieving socio economic transformation and development goals such as food and nutrition security and poverty eradication (ACBF 2017:72).The following suggestions are for the Zimbabwean policy makers to consider:

- Attaining socioeconomic transformation in Zimbabwe requires the country's commitment in bridging the STI investment gap. Ideally, countries with strong and effective STI invest up to 3.5 percent of their GDP in research and development(UNCTAD 2017:8). To close this gap Zimbabwe must strive to meet its 1 per cent of GDP STI target.

- The Zimbabwean government should curb brain drain by developing strategies to retain, monetizing and utilizing the STI capacity built in the country.The country have experienced mass exodus of skilled laborforce due to deteriorated socioeconomic and political environment for the past decade. The brain drain should not be viewed as a menace but as an opportunity to harness the skills and expertise skills from the diaspora. The Zimbabwean government should adapt a model where researchers and scientists are encouraged to return home for a period through a specifically designed program to contribute to its development of STI.

- Given that Zimbabwe is confronted with limited fiscal space, assistance from development partners and private sector is very important. The country must craft an enabling regulatory framework that is needed to foster public-private partnerships in all the sectors of the economy. Zimbabwe must enthusiastically pursue new and innovative funding ways involving bilateral and multilateral donors, governments, private sector.

- In order to transform Zimbabwe's food and nutrition security, the country should make staid commitments to develop human and institutional capacities by creating substantially in high quality universities, state of the art equipped laboratories, ICT infrastructure, and research funding mechanisms.

- Investing heavily in science,technology,engineering and mathematics (STEM) is important for Zimbabwe to achieve a critical mass educated human resources,to catalyzeinnovation, promote competitiveness, and to nature next generation of innovators, entrepreneurs, and scientists.

Concluding Remarks

In this research we used Zimbabwe as a case study to appreciate the importance of STI in improving food and nutrition security. Key informants were conducted to find out the opportunities for policy process that is well capacitated including sound and sustained investment in STI in order to boost agriculture production, ending hunger and malnutrition and reducing poverty. The Zimbabwean case study can assist in drawing importantlessons for other developing countries in improving food and nutrition security through the application of STI. Further studies are needed linking natural and social sciences to appreciate the factors that influence the uptake and sustained use of STI in food and nutrition security.The factors that affect the adoption of STI in improving food and nutrition security are complex thus further research may focus on understanding the local level, economic, and policy barriers.

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