

Tanzania's Agricultural and Food Systems: A Scenarios Analysis

SUMMARY

The evolution of Tanzania's agricultural and food system is critical to the country's development prospects over the coming decades. The population remains predominantly rural, rates of malnutrition are high and the agricultural sector provides a critical source of employment, income and export revenue.

However considerable uncertainty surrounds the agricultural and food system's future. Trends including demographics, climate change, environmental degradation, the development trajectories for domestic and international markets, rates of technological development and adoption, dietary patterns and social developments including the integration of a growing youth population into the job market and access to education and resources for women, all have important implications.

Taken together, these trends present huge uncertainty surrounding how Tanzania's food system will evolve between now and 2050. Any central estimate forecast of such a complex system over such a long time frame will certainly be wrong, and planning purely on the basis that 'expected' outcomes will materialize is likely to result in poor decisions. Instead, plans to develop Tanzania's agricultural and food systems should explicitly recognize this uncertainty.

Decision-makers should explore how choices and events might shape different futures and identify strategies that are resilient to uncertainty, i.e. 'no regret' options that should pay off in a range of possible futures, rather than the one we hope for or expect. To help do so, a scenario exercise for Tanzania's agricultural and food systems was

conducted in September 2018 with a selected group of stakeholders from government, academia, civil society and the agriculture sector. Through discussion, two critical driving forces, with high uncertainty regarding their outcomes, were selected from a shortlist of pertinent trends affecting the agricultural and food system. These two critical uncertainties were used to create axes for a 2x2 matrix that frames four potential futures—one in each quadrant—reflecting more and less progressive outcomes for each critical uncertainty. Each one of these futures was then explored, allowing participants to consider the inherent uncertainty the future holds, and understand how choices, decisions and extraneous factors might contribute to very different outcomes

POLICY IMPLICATIONS

- The extent and nature of private sector investment will be fundamental to the evolution of Tanzania's food system
- Public support for the agricultural sector and climate change adaptation is critical
- The evolution of the agricultural sector and agricultural markets could hold important implications for Tanzania's nutrition transition
- The speed at which climate change affects Tanzania and the extent of disruption to weather patterns will affect not only the ability of Tanzanian farmers and pastoralists to adapt, but it will also influence private investment decision

KEY SOCIO ECONOMIC AND ENVIRONMENTAL DRIVERS OF TANZANIA'S AGRI-FOOD SECTOR

A country's agricultural and food system encompasses the totality of the actors, processes and outcomes arising from supplying food to its citizens. This obviously involves agriculture and supply chains, but also the food system's impacts on nutrition, health, well-being and the environment. The evolution of Tanzania's agricultural and food system over the coming decades is critical to the country's development prospects, including realizing Vision 2025 and the targets set out in national five-year development plans and the second phase of the Agricultural Sector Development Plan¹ (ASDP II), as well as Tanzania's contribution to the Sustainable Development Goals (SDGs). Over two thirds of the population live in rural areas where livelihoods are heavily dependent on agriculture. Agriculture is estimated to employ 59% of the economically active population and constitutes approximately one-third of economic activity and export earnings². Farms are predominantly small scale, with women constituting around half of the workforce but only 20% of landowners³.

Agricultural growth has been slow compared to the industrial and services sectors, with productivity hampered by a familiar litany of challenges for developing country agriculture including low access to finance, technologies and inputs; rudimentary and often unsustainable farming practices; unproductive livestock; insecure land tenure; high rates of post-harvest loss; weak extension systems; and low-levels of investment and market development⁴. These challenges, and a high dependence on rainfed agriculture, make the sector particularly vulnerable to climate change.

As well as providing livelihoods and being an important driver of economic performance, the food system provides nutrition to a rapidly-growing population. Recent survey data indicate that undernutrition is widespread, and about one third of children under five are stunted⁵. This has implications for Tanzania's wider growth prospects, as undernutrition and stunting impair physical and cognitive development and suppress GDP growth.

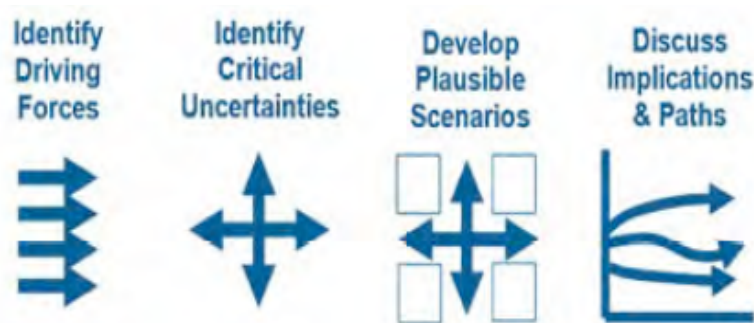
FUTURE SCENARIOS: A PARTICIPATORY APPROACH

Figure 1: The Steps in a Scenario Exercise

There is considerable uncertainty surrounding how Tanzania's food system will evolve between now and 2050. Accordingly, plans to develop Tanzania's agricultural and food system should recognize this uncertainty. Decision-makers should explore how choices and events might shape different futures and identify strategies that are resilient to uncertainty, i.e. 'no-regret' options which should pay off in a range of possible futures, rather than the one we hope for or expect.

A scenario exercise can help with planning for uncertainty by exploring the range of possibilities that the future may hold. In such a process, a group of participants identifies a set of driving forces that will shape future outcomes over the period in question. Through discussion, two impactful trends (or critical uncertainties) are selected over which there is high uncertainty, thus maximizing the range of possible future outcomes. Ideally these should also be as independent as possible in order

to maximize the extent of future possibilities. These are used to create a 2x2 matrix that frames four



potential futures—one in each quadrant (see figure 2). Each one of these futures is then explored, creating a rich, narrative-driven scenario into which the other (discarded) driving forces can be integrated. Exploring these four scenarios through discussion allows participants to better embrace the inherent uncertainty the future holds, and understand how choices, decisions and extraneous factors might contribute to very different outcomes.

A scenario exercise for Tanzania's agricultural and food system was conducted in September 2018 with a selected group of stakeholders from government, academia, civil society and the agriculture sector. Core questions addressed by the Tanzania scenario exercise included the following:

- What will Tanzania's agri-food systems be like in 2050?

- What crops, grown where, how?
- What relationship with trade?
- Does food provide nutrition? Equitably?
- Adaptation and mitigation to climate change?
- Sustainability?

IDENTIFYING THE MOST CRITICAL UNCERTAINTIES

Participants identified and discussed the following shortlist of important uncertainties for Tanzania:

Table 1: Driving forces, critical uncertainties and ranking importance in shaping TZ agri-food system

Uncertain trends	Key Questions	Ranking
Diets and Nutrition	How will the nutrition transition play out in Tanzania? Will traditional diets and foods be preserved, or will western diets and processed foods be adopted? Will diets be diverse and nutritional? How will food safety evolve? How will the nature of malnutrition evolve among different sections of society?	
Human Capital	How will education affect food system outcomes? Will efforts to address gender inequality be successful? What will a more equal society mean for human capital and food security? How will a growing youth population be accommodated and employed? How will urbanization affect farming, human capital and social inclusion?	
Information and Technology	Will information, training and extension services be appropriate and sufficient? What will be the impacts of future technologies? Will they be affordable and accessible? Will farmers want to adopt them? Will technologies help farmers adapt to and/or mitigate climate change? How will they effect farm size and agricultural employment?	1
Gender and Youth	Will agricultural development, finance, technology and food markets be inclusive? How could more inclusive markets affect food security outcomes and the development of the agriculture sector?	
Market Development	Will physical infrastructure (e.g. storage, roads and transport) be developed at sufficient speed and scale? Will soft infrastructure (information, regulations, transparency) be developed effectively? How will supply chains organize for export, transit and domestic supply? Will opportunities for value-addition and agro-processing be realized? How will international commodity markets evolve and what will be the implications for imports and exports? How will markets facilitate or limit fair prices for farmers, and the dissemination of new technologies and improved practices? What will the role of the private sector be, who will investors be (urban elite / international citizens), and what will they invest in (production, processing, trade)?	3
Climate Risk	How will climate change affect different regions of Tanzania? How will precipitation patterns and extremes change? Will adaptation efforts be effective in the face of such uncertainty? Will international efforts to address climate change be successful? Will different sections of society be more/less vulnerable to climate change?	2
Environmental Change	How will climate change affect soils, forests and water availability? How will use of land and natural resources change and what are the implications of this? How will land use, natural resource degradation, water scarcity be governed and managed? Will people move to climatically less sensitive/more favourable areas, what will be the impacts? Will farming practices become more sustainable? Will the risks from pests and diseases change?	

Whilst all of the trends considered above are clearly important in determining whether or not Tanzania's food system in 2050 will be sustainable, productive and climate smart, they vary in terms of their uncertainty. For example, whilst temperature and rainfall changes due to climate change are both important, there is

considerably more uncertainty about the latter. And whilst there may be some uncertainty about the extent of population growth and urbanization that will occur, there is little doubt that both will increase significantly and that plans should be made on this basis.

CONSTRUCTION OF THE SCENARIOS AND KEY CONSIDERATIONS FOR THE NARRATIVES

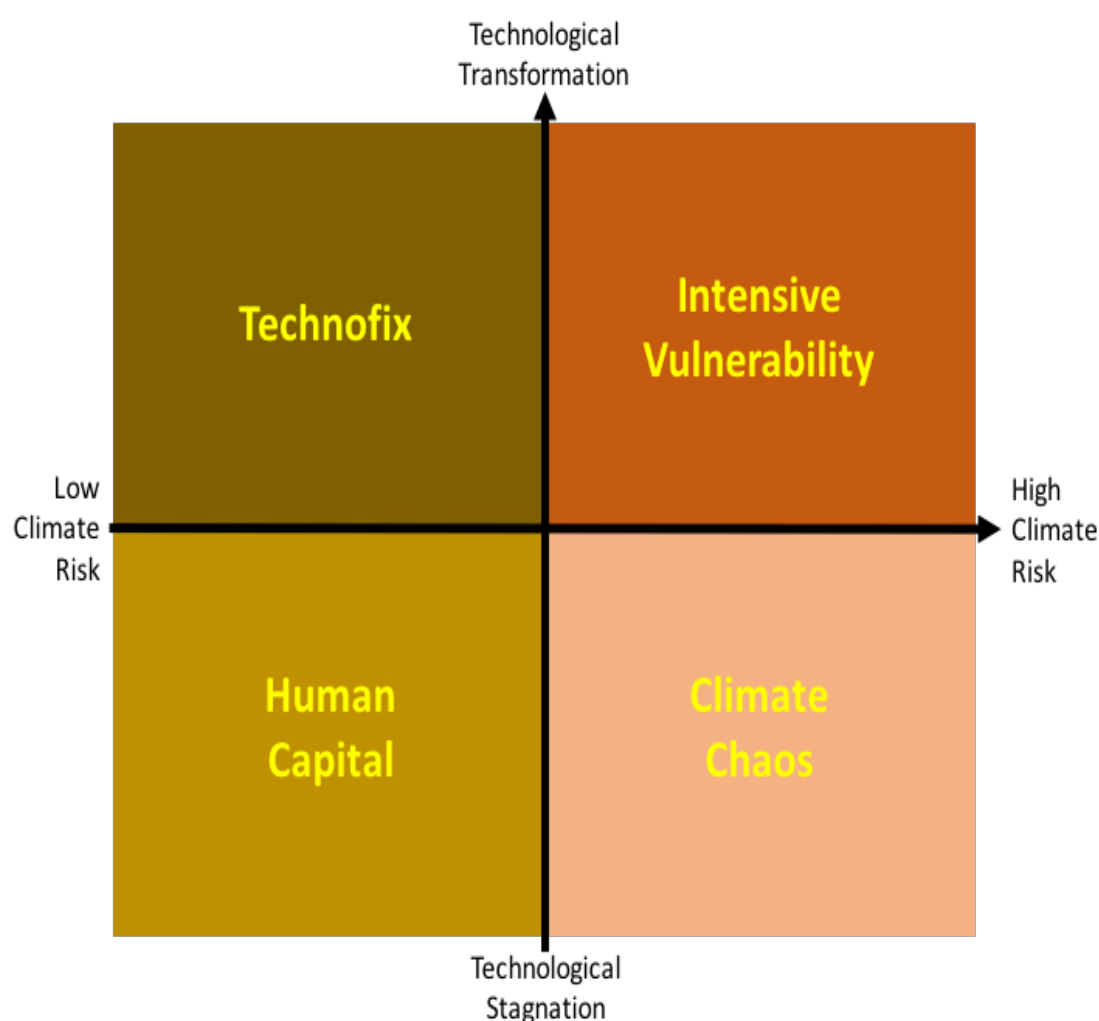
The assembled experts chose the following critical uncertainties to construct the scenarios matrix:

1. Technological Impact relating to the extent to which technological change shapes the Tanzania's agricultural and food system, through the development and adoption of new technologies and the impacts they have on agriculture, food, processing, employment, markets and so forth.
2. Climate Risk relating not only to the severity and frequency of climate change impacts, but also the exposure and vulnerability of agriculture and other food system actors and infrastructure.

Market development was a close third. This resulted in the scenario matrix below:

Figure 2: Tanzania's Agricultural and Food System Scenario Matrix

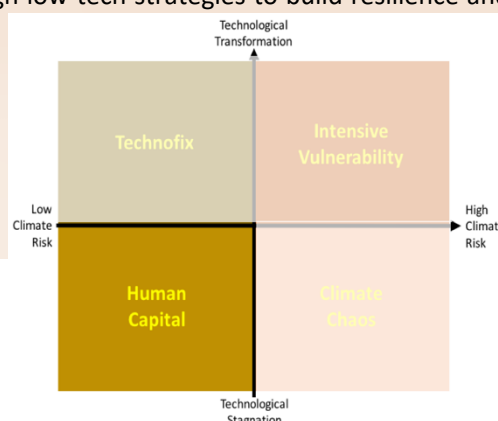
The four scenarios are explored below, starting in the bottom left quadrant.



SCENARIO 1: HUMAN CAPITAL (TECHNOLOGICAL STAGNATION AND LOW CLIMATE RISK)

This scenario describes a future in which the technological situation in Tanzania has remained much like today, with Tanzanians responding to climate change through low-tech strategies to build resilience and human capital. In this scenario the following is taking place:

- Effects of climate change are noticeable but the impacts on crops and livestock productivity are not as bad as feared
- Agricultural technology remains low; post-harvest losses are considerable impacting food availability, low investment in crop breeding, low productivity, minimal to no adoption of new crop varieties
- Farming is labour intensive, and the agricultural workforce has remained large; rural-urban migration is less than predicted
- Crop area has expanded to counteract low yields, with subsequent forest loss as land is converted to agriculture
- Farmers are supported to adapt using traditional knowledge and low-tech solutions; human capital built through improved knowledge and skills, focus on women, community networks and co-operative structures
- Increase in cultivation of traditional drought resistant crops such as millet and sorghum



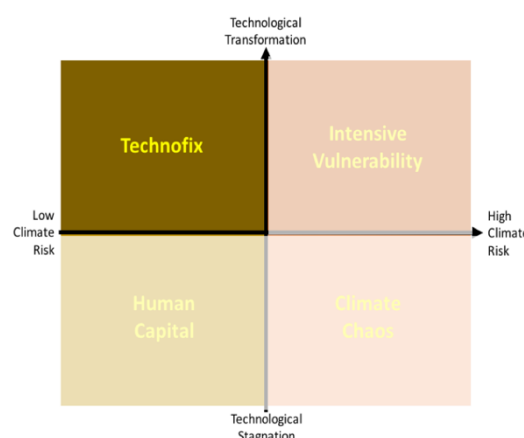
Winners: Crop and livestock farmers benefiting from government support in resilience strategies

Losers: Consumers/population at large, country (less agriculture based economic growth)

SCENARIO 2: TECHNO FIX (TECHNOLOGICAL TRANSFORMATION AND LOW CLIMATE RISK)

In contrast, this scenario sees Tanzania's agriculture transformed by the development and adoption of pro-poor technologies, underpinned by substantial public Research and Development (R&D) and investment. In this scenario the following is taking place:

- Climate risks and impacts on the agricultural and food system have not been as pronounced as feared
- There have been significant advances in food system technologies and innovations, e.g. improved irrigation, crop breeding, agro-industry/food processing, post-harvest technologies
- Crop diversity has increased with new crops selected to increase resilience to climate change
- Increased productivity has enhanced food exports and improved domestic food security
- Less labour intensive farming due to enhanced mechanization has contributed to faster and higher rural to urban migration; unskilled workers struggle to find work



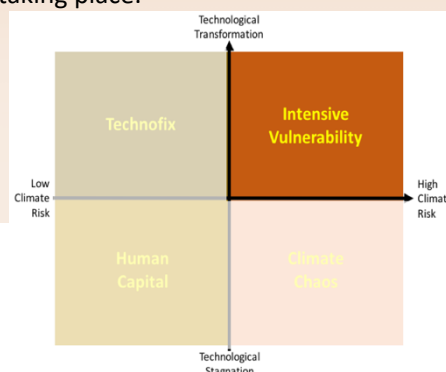
Winners: Technology developers, consumers, economy at large

Losers: Unskilled rural labourers, small holder farmers (in the event they can't access new technologies despite government support)

SCENARIO 3: INTENSIVE VULNERABILITY (TECHNOLOGICAL TRANSFORMATION AND HIGH CLIMATE RISK)

In this scenario, rapid climate change has overwhelmed the pace of technological transformation, which has failed to reduce vulnerability. In this scenario the following is taking place:

- High climate risks with more frequent shocks in terms of floods, long drought spells, frequent outbreaks of pests and diseases, soil/land degradation
- Significant advances in development and adoption of improved agri-food systems technologies more targeted to increased yields, post-harvest and food storage, food processing; but this technology fails to reduce vulnerability of agriculture to rapid climate change
- Private sector develops and deploy new technologies through the markets, but these are inaccessible to smallholder farmers
- Expansion of irrigation has led to maladaptation because of intense competition with urban and industrial users and unsustainable water withdrawals
- High rates of rural to urban migration by pastoralists (as land is appropriated for crop farming) and smallholder farmers who leave the rural sector in increasing numbers
- Focus on crop production for export and subsistence means food demands from urban dwellers have to be met by imports, with diets dominated by processed foods and consequent increases in obesity



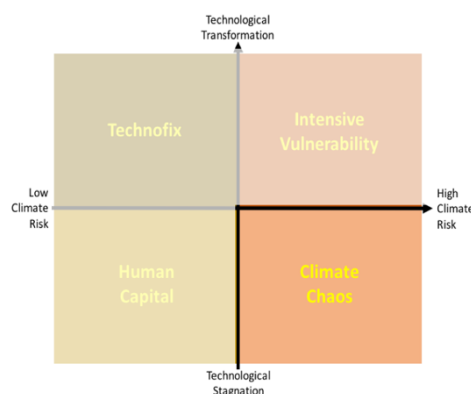
Winners: Large scale commercial farmers, private sector, technology developers

Losers: Smallholders and subsistence farmers and pastoralist, unskilled labourers

SCENARIO 4: CLIMATE CHAOS (TECHNOLOGICAL STAGNATION AND HIGH CLIMATE RISK)

This is arguably the most troubling scenario, in which climate change has a devastating impact on Tanzania's farmers who lack the requisite technologies and practices to build resilience. In this scenario the following is taking place:

- Severe climate risks with devastating impacts on Tanzania's agricultural and food system e.g. frequent droughts cause repeated food crises and the loss of livestock; outbreaks of pests and diseases affecting crops and livestock, land degradation, etc.
- Agri-food system technologies and innovations stagnate, slow technological advances and low adoption of limited technologies that are unable to address the severity of climate impacts; low investment because of high climate risks
- Agriculture expands into forested lands, highly dependent on heavy use of fertilizers and pesticides, which are costly and exacerbate soil depletion and broader environmental degradation
- Rural economies in freefall, not attractive for anyone, especially vulnerable farmers, to make a living due to collapse of the agriculture sector; very high migration of smallholder farmers and pastoralists to urban areas where there is high unemployment and social tensions
- Collapse of the agriculture sector impacts national revenues and foreign exchange earnings



Winners: Private sector with ability to access limited adaptation technology, food importers

Losers: Everyone is a loser in this scenario

IMPLICATIONS OF THE SCENARIOS

None of these scenarios are impossible. Many of the early signals that presage them can be observed today. Public resources for investment in agriculture and adaptation are currently insufficient to meet needs in developing countries.

The effects of climate change appear to be occurring faster and more powerfully than predicted. Although global progress to reduce greenhouse gas emissions is increasing, there is little sign that the international community will achieve the kinds of reductions needed to avoid the worst climate impacts. In Tanzania, there are already tensions over access to land and water and early data indicate that rainfall variability is increasing.

Looking across the scenarios, the following insights emerge:

(1) The extent and nature of private sector investment will be fundamental to the evolution of Tanzania's agricultural and food system.

Private sector investment has implications for technology diffusion, and the types of technologies that are accessible. It may also influence the mix of crops grown and the markets they are grown for, and the livelihood opportunities for farmers and agricultural labourers.

Tanzanian farmers are also part of the private sector, and their ability to invest and the choices they make about what to invest in are equally important. Outcomes will be dependent on the answers to a number of critical questions about the nature of investment: Which financial support mechanisms? Which technologies and crops? What farming systems and practices? Which markets?

(2) Public support for the agricultural sector and climate change adaptation is critical.

The Tanzanian government has significant agency in shaping private investment decisions, for example through the use of public finance and by supporting R&D for adaptation and pro-poor technologies. The provision of donor assistance and climate finance can provide additional resources for government strategies, but these typically come with conditions and will not be sufficient alone.

(3) The evolution of the agricultural sector and agricultural markets could hold important implications for Tanzania's nutrition transition.

If agriculture provides a diverse food supply to domestic markets, then this can help ensure nutritional diversity and reduce the need for imports. If agriculture evolves to supply export markets, or fails to keep pace with domestic demand, then food imports, potentially of processed foods for urban consumers, will increase. How climate change affects Tanzania will also play a role here. For example, under certain climate scenarios, it may make sense for Tanzania to stop producing certain crops and maintain nutritional diversity through trade: by importing these crops from regions with more suitable climates whilst focusing domestic production on more resilient varieties.

(4) The speed at which climate change affects Tanzania and the extent of disruption to weather patterns will influence private investment decisions.

Faced with increasing risk, farmers and businesses may choose not to invest. In the absence of effective adaptation, farmers may also be forced into unsustainable coping strategies that could deplete soils and increase tensions over land and water resources. Early adaptation, informed by sound research and evidence, will be key.



REFERENCES

- ¹ The United Republic of Tanzania (2016) 'Agricultural Sector Development Programme Phase Two (ASDPII).'
² CIAT; World Bank (2017) 'Climate-Smart Agriculture in Tanzania', CSA Country Profiles for Africa Series.
³ Ibid.
⁴ The United Republic of Tanzania (2016) and CIAT; World Bank (2017).
⁵ URT (2016) 'Tanzania Demographic and Health Survey 2015-16'.

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About the Agricultural and Food-system Resilience: Increasing Capacity and Advising Policy (AFRICAP) Programme

The Agricultural and Food-system Resilience: Increasing Capacity and Advising Policy (AFRICAP) programme is a four-year research programme focused on improving evidence-based policy making to develop sustainable, productive, agricultural systems, resilient to climate change. The programme is being implemented in Malawi, South Africa, Tanzania, Zambia, and the UK led by the University of Leeds, a leading Russell Group university in the north of England, in partnership with the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), a pan-African multi-stakeholder policy network. The programme is funded by the UK Government from the Global Challenges Research Fund (GCRF), which aims to support research that addresses critical problems in developing countries across the world. It is administered by the UK's Biotechnology and Biological Sciences Research Council (BBSRC) - UK Research and Innovation (UKRI).

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