CALL FOR SUBMISSIONS:

From Foresight to Field: Exploring regional and multistakeholder perspectives to implement a foresight on emerging technologies and innovations in agrifood systems

In 2023, FAO published the report “Harvesting change: Harnessing emerging technologies and innovations for agrifood system transformation”. The report explores the critical role of technology and innovation in transforming agrifood systems to address future challenges in the attempt to shorten the time lag between research and investment innovation phases and the uptake of technology and innovation, thus creating preparedness an ensuring inclusive, resilient, and sustainable agrifood systems transformation.

Since the global foresight synthesis report is published only in English, the OIN team has prepared the background document that is available in the six UN languages (Arabic, Chinese, English, French, Russian and Spanish). This document can serve as a reference for completing the template for submissions.

Please use this submission template to share your experience and views on the potential pathways of the agrifood system transformation at regional level.

The call for submissions is open until 03 June 2024.
From Foresight to Field: Exploring regional and multistakeholder perspectives to implement a foresight on emerging technologies and innovations in agrifood systems

For the necessary background and guidance, please refer to the topic note and the background document available at this call webpage. You can upload the completed form upon login to your account with the FSN Forum or, alternatively, send it to fsn-moderator@fao.org.

**Template for submissions**

| Contact person | Name: Jose Luis Fernandez Filgueiras  
|                | Organization: FAO  
|                | Country: Mozambique  
|                | Email address: joseluis.fernandez@fao.org |

| What region are you from? | ☐ Europe and Central Asia  
|                          | ☐ Latin America  
|                          | ☐ North Africa and Near East  
|                          | ☒ Sub-Saharan Africa  
|                          | ☐ Asia and Pacific  
|                          | ☐ North America |

| Affiliation | ☐ Farmers and producer organizations  
|            | ☐ Research and academia  
|            | ☐ Government  
|            | ☐ Private Sector  
|            | ☒ Civil Society Organization  
|            | ☒ International Organization  
|            | ☐ Other (please specify) |

1. In the foresight synthesis report “Harvesting change: Harnessing emerging technologies and innovations for agrifood system transformation” (FAO and CIRAD, 2023), 20 emerging or pre-emerging technologies and innovations have been identified with highest potential to impact the agrifood systems from now to 2100. From those 20 innovations, select the three key technologies and innovations that have the potential to accelerate each of the following: a) inclusion; b) sustainability; and c) resilience.

**Sustainability: Carbon credits in agriculture and aquaculture**

Carbon credits have the potential to facilitate environmental sustainability by contributing to Mozambique’s climate targets and promoting sustainable practices and financial sustainability for smallholder producers, particularly women, through sale of carbon credits.

Global Forum on Food Security and Nutrition  
[www.fao.org/fsnforum](http://www.fao.org/fsnforum)
Inclusion: Territorial or landscape value chain and food-to-consumer economy policies

Territorial value chains and food-to-consumer policies have the ability to enhance inclusivity in agrifood systems by strengthening the livelihoods of all actors in the chain, especially for smaller producers. This is also an innovation that supports inclusion of women and youth in markets and agribusiness.

Resilience: Social impact bonds

Social impact bonds promote resilience by providing public and private investment in smallholder producers and agrifood systems that will enhance livelihood and economic opportunities.

In addition, legal frameworks for agroforestry models evolving from food security to food systems in the context of the voluntary market of carbon trade would enhance the benefits to the above innovations and are a further consideration when applying carbon credit schemes.

Sustainability: Carbon credits in agriculture and aquaculture

The trade-offs are medium for this innovation. There are several ways that the benefits of carbon credits can be maximized.

First, ensuring that smallholders in agrifood systems can easily understand and utilize carbon credits and that these schemes are accessible to local communities. FAO in Mozambique is promoting agroforestry systems as an action to reduce pressure on natural forests and increase carbon storage, thus contributing to NDC strategic actions in agriculture and fisheries, namely: 4.6.1.3.1 Increasing the resilience of agriculture and livestock; 4.6.2.3.1 Development of low carbon agricultural practices; and 4.6.2.3.2 Reducing the rate of deforestation and uncontrolled burning. This allows smallholders to participate in an agroforestry scheme for better management of natural resources such as soil while obtaining additional gains through carbon credits. Digitalization is also used to determine the boundary of smallholder farms, allowing satellite images and therefore estimating Carbon Removal Units. So far, FAO has engaged 245 Farmer Field School (FFS) facilitators in training on agroforestry to enhance smallholder participation in carbon credit schemes.

In addition, legal frameworks for agroforestry models evolving from food security to food systems in the context of the voluntary market of carbon trade would enhance the benefits to the above innovations and are a further consideration when applying carbon credit schemes.

Inclusion: Territorial or landscape value chain and food-to-consumer economy policies

The trade-offs are low for this innovation yet several ways to maximize benefits exist.

First, the inclusion of local actors beyond government is essential for value chain policies to positively affect all stakeholders. Inclusion of all members of a value chain, including smallholder producers and producer associations must be consulted. Easily accessible ways to coordinate stakeholders must be explored. For example, FAO Mozambique, together with public and private stakeholders, organized an agribusiness forum to dynamize agribusinesses and facilitate effective market linkages between input and output value chain actors. A forum such as this provides an opportunity to engage actors in policy dialogue to maximize benefits for all stakeholders involved.

Second, truly understanding the challenges in value chains is essential to develop strong policy. For example, Mozambique faces a permanent shortage of good quality seeds. Understanding how this affects local value chains and why this could hinder the success of food-to-consumer policies is essential to develop strong value chain frameworks. FAO participated in developing the National Seed Regulatory Framework that offers guidelines for the use, production, purchase and sale of seeds in Mozambique. Through the Association for the Promotion of the Seed Sector (APROSE) and FAO, a study on the impact of fake seed in the seed sector in Mozambique was conducted, aiming at identifying and quantifying fake seed circulating in the market, areas sown, main routes and
schemes for introduction and dissemination, among other issues. Regulation and studies such as these are important first steps to develop and implement broader local value chain policy.

Third, technology can also be used to improve the local agribusiness environment. FAO Mozambique developed and successfully piloted an Agricultural Market Information System (AMIS), which provides relevant market information to value chain actors and links supply and demand of agricultural commodities and services. The system can be accessed through Unstructured Supplementary Service Data (USSD) and digital technology. The USSD component allows users in remote areas with low mobile connectivity to improve agribusiness decision-making and diversify marketing channels. This digital portal allows economic agents to develop dedicated trading profiles and is especially useful for aggregated farmers, off-takers, agrodealers, aggregation infrastructure and transporting services. Through the web version, agents can search and interact with new clients. The digital and USSD - SMS component are fully integrated. For example, through the digital portal, off-takers of specific commodities can request dedicated volumes - consistency and quality of agricultural inputs from the registered aggregated farmers and send an SMS to the latter. The system hence facilitates the effective operationalization of aggregation or geo-cluster schemes while optimizing the supply chain model of off-takers, resulting in lower marketing transaction costs. Technologies such as these can be used on both localized/regional scales and more broadly. However, this technology offers massive potential to better link smallholder producers with local markets and to reach more consumers and grow their livelihoods while staying in regional value chains.

Finally, farmer networks that aggregate smallholders to sell their production in a "co-op" method allows more producers to engage in regional markets and value chains. FAO Mozambique initiated ten farmer networks, covering a total of 200 farmer group for commercial purposes. The networks provide a platform for market aggregation and structuring by clustering independent farmers with relatively low market volumes that are in geographical proximity. As the groups receive capacity training on agribusiness management and design, the establishment of geo-clusters is facilitated, ensuring that the groups organize their farms as businesses – resulting in steady, consistent supply of quality production in the volumes required to successfully enter markets. This enhances market access and inclusion in commercially driven off-taker supply chains. Effective geoclustering is further facilitated and supported through the Agricultural Market Information System (SIMA), which was created with FAO support.

**Resilience: Social impact bonds**

The trade-offs for social impact financing are low. Impacts of this innovation can be maximized through several methods.

First, strong partnerships — especially South-South Cooperation can be leveraged to develop agricultural financing models that will inform and strengthen the implementation of impact bonds. For example, FAO Mozambique engaged in high-level policy discussions with public and private stakeholders and with representatives from the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL) to identify de-risking and risk-sharing mechanisms to enhance the flow of affordable financing in agricultural value chains. This in turn has informed FAO Mozambique's work in agri-finance and agri-investment in Mozambique with a focus on reengineering value chain financing and making impactful blended finance work for agribusinesses. FAO Mozambique is working on blended finance schemes and impact investment structures to be established and adopted by the Mozambican agricultural sector and will address the lack of affordable finance for both working and investment capital. South to South exchange with Nigeria was essential to develop this model and will be an important asset as FAO’s work progresses.
Second, benefits can be maximized through partnership and dialogue with private and public investors to include these parties in high-level technical and policy discussions. Policy related to social impact financing, including impact bonds must also include dialogue with (non)-development finance institutions and regulatory actors such as the Central Bank on attracting affordable finance to the agricultural sector. FAO Mozambique has led such discussions and has successfully brought various actors together. FAO now plans to conduct a study tour of Mozambican key decision makers to generate positive changes in the agricultural sector’s financial environment.

Third, the benefits of social financing can be maximized by using geospatial data and analysis to map where investment will have the greatest impact. This goes beyond looking only at the need for investment but also considers variables such as infrastructure, water resources and socioeconomic factors. FAO Mozambique conducted such a study on investment for rice value chains and green processing.

Finally, a strong investment strategy is important to clearly define how and where bonds will be targeted and what the goals of the investment are, ensuring that investments are targeted. After broad consultations with public and private stakeholders, FAO Mozambique updated its agribusiness and agri-invest strategy, with a focus on catalyzing inclusive investments and trade in agribusiness development and aligning and strengthening de-risking and risk-sharing mechanisms among public-private initiatives. In this strategy, four key investment areas are sequenced and prioritized to achieve the highest impact on private mobilization and the initiating of systems or schemes relevant to developing a commercial-driven ecosystem in the country: i) financial strengthening with a focus on bridging the gap between market actors (input, production and output) and financiers, making it easier and more efficient to assess the potentiality, profitability and effective financing of new business proposals; ii) private sector development with a focus on enterprise development (organizational, financial and managerial) and services and sourcing schemes for agribusinesses; iii) promoting investment policy by adopting policies and regulatory frameworks that enhance investments that are responsible, impactful and inclusive in agriculture and food systems based on a level playing field; iv) and market development with a focus on facilitating commercial farming in stable quantity and quality production, meeting market requirements and formal and informal market regulations that foster a level playing field.

3. What are the capacities needed, including at enabling environment level, and related gaps in generating, adopting and transferring new technologies and knowledge in the low and low middle income countries (LMICs)? What should be the role of organizations like FAO?

Policy and government engagement are needed to promote the adoption and generation of new technologies. This must be done at different levels and frequency. For example, at the central level, FAO Mozambique engages ministers of key sectors (agriculture and rural development, fisheries, land and environment, industry and commerce) while FAO Mozambique technical teams have direct and day to day contact with national directors and government technicians. At provincial and district levels, the collaboration is even closer as FAO Mozambique’s preferred modality is to establish Letters of Agreement (LoAs) for implementation and monitoring of field activities. This is to show that engagement of government actors at all levels will be needed to promote adoption through both policy and coordination with communities on the ground.

Capacity must also be built through important working groups covering agriculture, the blue economy, nutrition and the Food Security Cluster, for example. These groups have widespread influence across many sectors and have the ability to engage with and influence government actors, public and private sector, policy agendas, and communities.

Currently, gaps to both generate and adopt new technologies are related to limited access to resources (such as the resources needed to use technologies and the technologies themselves) and
limited knowledge or distrust of new methods in agrifood systems. Strong policies and training will play an important role in filling these gaps.

In Mozambique, FAO’s role is to support both government and agricultural producers to create an environment where technology is accessible to those who need it, yet is well regulated and sustainable for both people and the planet. Assisting with policy development and providing capacity-building training to government counterparts is an important component. FAO is also training counterparts on data collection, analysis and monitoring of agricultural and food security data that will better inform innovation.

FAO’s Farmer Field Schools, Farmer Business Schools and Pastoralist Field Schools are also important methods of transferring knowledge of new technologies and innovations directly to smallholders. Currently, FAO in Mozambique is training community facilitators on sustainable agriculture and agroforestry systems in different areas of the country. FAO Mozambique is also supporting knowledge and technology transfer regarding circular waste valorization (use of agriculture waste for animal feeding), biodegradable materials, biofertilizers, biopesticides (locally produced for agricultural production) and biotechnologies (use of pheromones and natural enemies to control Fall Armyworm). Finally, FAO’s role should not only be to directly train smallholders but should also be to work with farmers’ associations to introduce new technology.

<table>
<thead>
<tr>
<th><strong>4.</strong> In what area of application do you see major breakthroughs in the next 10-20 years in your region/country? (Production systems; Energy and transportation; Value chains and services; One health and nutrition; Governance and trade; New materials, proteins and circular economy; and Inclusion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major change can be foreseen in all the sectors mentioned above in the next 10-20 years in Mozambique. FAO Mozambique is particularly working on, and is expecting change to continue to occur in the below sectors:</td>
</tr>
<tr>
<td><strong>Production systems:</strong> The vast majority of Mozambique’s producers are smallholders who produce using little technology. As climate change continues and new technology becomes available in Mozambique, production systems are expected to become more automated and rely increasingly on data, such as that collected via the Participatory Information of Climate Services for Agriculture (PICSA) supported by FAO. Production systems will also need to become more resilient to extreme weather events as drought, floods, and cyclones worsen. FAO is currently improving national capacity by providing quality agriculture extension services to increase production and productivity through sustainable and climate-smart agricultural practices and to improve knowledge of sustainable production, including agroforestry. Climate smart agriculture must continue to be adopted in greater numbers throughout the country, leading to a breakthrough in production systems on a national level.</td>
</tr>
<tr>
<td>Seed systems are also expected to improve, further enhancing the nutritional quality and climate adaptability of crops and the ability of producers to sell in markets. Mozambique is currently facing an influx of “fake” seeds in the market. To date, FAO has established 111 demonstration plots of seed varieties and selected seven wheat genotypes for Mozambique’s agro-ecological zones and two of the varieties have been released for registration in the seed varieties system. Additionally, 12 cassava clones were selected as tolerant and/or resistant to Cassava Brown Streak (CBS) and Cassava Mosaic Disease (CMD) and have been planted in Nampula and Zambezia provinces. These advances in seed systems are expected to grow throughout the country, drastically improving production systems.</td>
</tr>
</tbody>
</table>
Energy and transportation and value chains: As advances in energy and transportation are made in Mozambique, FAO Mozambique is expecting the transportation of fresh agricultural goods through the cold chain for fish and other fresh products to increase. To date, FAO has supported both fisheries and agricultural value chains in Mozambique by assisting producers, processing hubs, aggregators, and agribusiness to connect along value chains and efficiently reach consumers. Through continued interventions and technological advancements, the number of products sold, especially through the cold chain, is expected to increase with fresh products able to be transported farther and to have a longer shelf-life.

One health and nutrition: One health and nutrition are expected to improve through continued veterinary, vaccination, reducing Antimicrobial Resistance (AMR) and biosecurity practices. FAO is currently working with veterinarians and government laboratories to improve these systems. As access to vaccinations reach more communities, the health of both livestock and people is expected to improve in the coming decades. Nutrition is also expected to improve as FAO will continue to strengthen the capacity of stakeholders on nutrition and healthy diets in coming years.

Circular economy: Agroforestry and forestry more broadly have the potential to be a major breakthrough for the circular economy in Mozambique in the coming years. Forest-based value chains are emerging in Mozambique as population increases and demand for land and housing materials grow. Promotion of traditional and sustainable methods of forestry are imperative to shape the future of Mozambique’s forest sector and will greatly impact the sector in the next few decades.

FAO conducted an agroforestry feasibility study in May 2023 in Zambézia and Nampula provinces, to understand local community necessities and preferences related to production, to assess the ecological contexts of different districts and to verify environmental and social conditions to determine the feasibility of agroforestry in Mozambique. The data collected was used to design plantation schemes for agroforestry systems through an analysis of environmental conditions of community priorities and of the necessity to collect wood and non-wood products from forest systems. FAO also analyzed the cost to conduct the project, including the production of seedlings and the implementation and maintenance of the agroforestry systems. FAO Mozambique plans to continue work in the agroforestry and forestry sector to shape sustainable forestry in country.

5. What are the 3 most important triggers of change (hypothetical future events, positive or negative), which could potentially enable rapid development of emerging technologies and innovations in your region? Please consider the following:

- Advancement of other technologies. Which ones?
- Societal consensus and higher ethical standards
- Removed barriers for adoption
- Governance and business environment
- Rapid acquiring of skills/human capital
- Open and trustworthy communication
- Other

Enhancing digital infrastructure and advancement of digital technologies to enable the collection, processing and dissemination of agriculture and food security data will better inform stakeholders and increase engagement of farmers/producers. This would improve monitoring and evaluation and impact assessments and facilitate the dissemination of information to government institutions to drive evidence-based policy decisions and allocation of public investments.
Removing barriers to adoption will be essential to trigger widespread use of technologies in Mozambique. These barriers include lack of access to financial mechanisms/financing, lack of access to technologies, lack of knowledge on technologies and their use and how they can benefit stakeholders, and distrust of new technologies or methods of production.

Rapidly acquiring human skills/capital would also significantly change the agrifood landscape in Mozambique. This would likely accelerate the adoption of technologies/innovations and might push use into more rural areas of the country. In particular, enhanced skills of government extension workers/technicians would spread use of technology/innovations beyond the current scope of organizations such as FAO.

6. From the five global scenarios, identified in the report, which future scenario is the most plausible in your region/country and why? Please, mention the name of the country in your response.

FAO Mozambique’s work aims to foster Scenario C: sustainable prosperity of technologies and innovation. With a focus on technology and innovations that foster circular economies, sustainability and one health — this scenario is what FAO envisions for the future of Mozambique and what we believe is possible if stakeholders work together to ensure that technology is well regulated, yet inclusive and accessible to everyone, while also benefitting and fostering resilience of the most vulnerable communities.

However, Scenario A: struggling between technology illusions and sustainability could also be possible if work isn’t done to strengthen policy and sustainability, including the sustainable use of technology in the agriculture sector. Stakeholders must also be willing to coordinate and engage with other groups, and this scenario is possible if adequate coordination does not occur.

7. What does this foresight synthesis report and its recommendations mean for your country and your region? How to implement them? What actions diverse stakeholder groups have to take (policy makers, farmers, researchers, private sector, civil society etc.)?

This synthesis report is timely for Mozambique as new technologies become available at the same time as the population grows and the effects of climate change worsen. Mozambique is also grappling with conflict in the northern areas of the country. As these changes occur, the synthesis report’s focus on resilience, inclusivity and sustainability are topics that must be considered and promoted as the landscape shifts over the coming decades.

While some of the technologies/innovations are not yet a major presence in Mozambique’s agrifood systems, such as AI, others (especially those mentioned above) are emerging in Mozambique’s agricultural landscape. FAO in Mozambique is working to promote these innovations to promote resilience for vulnerable people and communities in a sustainable manner that protects natural resources while also ensuring that no one is left behind and that all producers, including women and youth are including in emerging innovations.

Over the coming years, various stakeholder groups will play different roles in the implementation of these emerging innovations. Policy makers and government must ensure that technologies are safe to use and follow regulations to ensure the health and safety of both people and the environment. Through extension, the government also plays a major role in enabling access to technologies and ensuring that users are properly trained. Researchers will not only refine existing technologies but will also develop new ones, and test how technologies on a global scale act in the Mozambique landscape. Civil society play important roles in ensuring that innovations reach the communities that need them the most and assist government counter parts to facilitate training and share
knowledge with the public on the uses and potential of these innovations. The private sector will play a role in commercializing innovations for widespread use and in the financing and spread of new technologies. Finally, farmers, fishers, and herders play the fundamental role of adopting new technologies and innovations in their livelihoods to ensure resilience and sustainability of their production. Farmers, fishers and herders must also be vocal about how technology impacts them and where they see these practices deviating from being resilient, sustainable and inclusive.

8. What will be the technologies and innovations the most likely to bring about gender equality in the agrifood systems? Can social norms be tackled to merge the gender divide and how?

Financial innovations, such as FAO’s e-voucher and other financial mechanisms through social impact bonds have massive potential to promote gender equality in Mozambique’s agrifood systems. Enabling women to access to capital and financing mechanisms, which have typically been more challenging for women to access than men in Mozambique, will not only improve women’s livelihoods and business opportunities but will increase their presence throughout the food system. These types of innovations are essential not only for women’s inclusive, but also to engage and foster opportunities for youth.

Coupling financial mechanisms with specified training, such as through Farmer Field School and/or Farmer Business Schools is also important to ensure that women and youth have both the opportunity and the skills to succeed. Currently, FAO Mozambique is engaging women and youth through the e-voucher system and related seed agribusiness activities for young entrepreneurs. These young agrodealers have been growing and expanding their businesses and acting as role models and transformation agents in targeted rural areas, fostering social change.

9. How do you envision the role of women in innovation in the next 10, 20 and 50 years?

In Mozambique, women are active players in farming and are present in fishery and livestock production. FAO Mozambique envisions the role of women growing in both the agriculture sector and in wider innovations across the country. In FAO Mozambique’s current work, gender balance is prioritized and is seen as essential for sustainable and resilient agricultural development and emergency response throughout the country. This balance is essential as the country continues to grow and new innovations are introduced. We envision this gender balance at all stages and in all stakeholder groups mentioned above — with women present at the innovation and research stage, included in policy dialogue to ensure inclusive and comprehensive policies and agendas, and at the producer stage at all levels in agricultural value chains.

<table>
<thead>
<tr>
<th>Link(s) to specific references</th>
<th>Please include attachment(s) or add here link(s) to documents with specific references.</th>
</tr>
</thead>
</table>