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OPPORTUNITIES FOR TRANSITIONING TO CIRCULAR FOOD SYSTEMS IN TANZANIA

KEY MESSAGES

Circular Food Systems (CFS) present an opportunity to transform Tanzania's agricultural sector by enhancing land and water resource efficiency, improving productivity, and reducing environmental impacts.

Existing agricultural and environmental policies in Tanzania do not fully integrate CFS principles, creating barriers to sustainable development.

Revising and aligning existing policies, such as the National Agricultural Policy and National Irrigation Policy, to integrate Circular Food Systems (CFS) principles, coupled with strengthened policy frameworks and cross-sector collaboration, is essential to advance CFS adoption and ensure long-term sustainability. platforms that bring together agriculture, waste management, and food production sectors to align strategies, reduce inefficiencies, and create integrated waste-to-resource systems.

BACKGROUND

In Tanzania, agriculture faces significant challenges due to inefficient water use, substantial post-harvest losses, and inadequate infrastructure jeopardizing food security, economic stability, and environmental sustainability. The agricultural sector in Tanzania is predominantly composed of smallholder farmers who contend with persistent obstacles such as poorly operated and maintained irrigation systems, high post-harvest loss, poor access to output markets and lack of capital. The National Agricultural Policy (2013) and Agriculture Sector Development Programme (ASDP II) promote practices such as nutrient recycling, composting, and integrated crop-livestock systems, which align with Circular Food Systems (CFS) principles by enhancing resource efficiency and reducing agricultural waste. However, there remains a crucial gap in fully integrating CFS principles into agricultural policies, development programs, and resource management strategies to enhance sustainability across the agricultural value chain. This shortfall hampers the efficient use of water and nutrient resources across the agricultural value chain, thereby limiting broader socio-economic and environmental benefits. As Tanzania's population grows and climate variability intensifies, adopting Circular Food Systems (CFS) approaches is essential to optimize irrigation systems. By improving water use efficiency, integrating nutrient cycling, and recycling wastewater, CFS can enhance agricultural productivity, reduce greenhouse gas emissions, and strengthen resilience to climate impacts in irrigation-dependent farming systems.

This policy brief highlights opportunities for transitioning to Circular Food Systems (CFS) in Tanzania. Insights are drawn

from the Circular Food Systems in Africa project, which is testing how Small, Medium, and Micro Enterprises (SMMEs) and inclusive value chains can reduce post-harvest losses and enhance rural livelihoods in pilot localities. The project is being implemented by the Australian National University (ANU), Ardhi University, the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), University of Eduardo Mondlane (UEM) and the National Institute of Irrigation in Mozambique. The CFS project operates across five localities in Mozambique, Tanzania, and Zimbabwe, and employs agricultural innovation platforms to foster a shared understanding of Circular Food Systems (CFS) principles. With a focus to creating local jobs, particularly for women and youth groups, through localized value addition, the project facilitates the co-design of SMMEs and the development of inclusive value chains, promoting sustainable livelihood opportunities and reducing migration to urban areas by creating employment in rural areas (Velasco-Muñoz et al., 2021).

CIRCULAR FOOD SYSTEMS – THE CONCEPT

The global food system faces an immense challenge: producing enough food to sustain nearly 10 billion people within the earth's ecological limits. With limited land and water resources, agriculture must adapt to climate change, reduce greenhouse gas emissions, and lift millions out of poverty. Sustainable Intensification (SI) offers one potential pathway, aiming to increase food production without further depleting natural resources (Pretty, 2018).

Building on SI and inspired by circular economy principles, the concept of CFS has garnered interest from global research, philanthropic, and policy communities (Velasco-Muñoz et al., 2021). CFS focuses on improving agricultural productivity by reducing reliance on synthetic inputs, localizing food processing to reduce food miles, and recycling agricultural by-products for use as inputs for local agro enterprises. This approach emphasizes integrating crop and livestock systems to foster sustainable, efficient, and resilient food production cycles (van Rooyen et al., 2024).

CFS seeks to decouple natural resource use from increased food production, thus improving resilience to climate impacts while contributing to climate mitigation through resource efficiency, local processing, and soil carbon sequestration. In essence, CFS aims to enhance socio-economic benefits, particularly for women and youth, by creating more diverse livelihood opportunities and ensuring access to nutritious food through efficient resource management and enhanced nutrient, water, and energy cycles (Matshe, 2022).

Circular Food System Practices and Initiatives in Tanzania

Practice/Initiative	Description and Circularity Elements	Impact
Integrated CSA Practices	Techniques like crop rotation, composting, and drought-resistant varieties enhance nutrient cycling and resource efficiency.	Farmers in Dodoma and Mbeya report improved soil health and higher yields.
Renewable Energy Practices	Biogas digesters and solar-powered irrigation reduce waste and emissions while supporting sustainable food production.	In Rungwe, biogas reduces firewood dependency; in Kilimanjaro, solar cold storage reduces food loss.
Community-Led Waste Valorization	Recycling food and crop waste into organic fertilizers and biochar supports soil health and reduces disposal costs.	Farmers in Arusha save on fertilizers; Eco-Circular in Dar es Salaam creates urban farming income.
Rikolto Initiative	Converts organic waste into animal feed and fertilizers, promoting resource efficiency and inclusivity in food systems.	Strengthens local food systems and engages youth and small businesses in Arusha.
TAREA Biogas and Solar Projects	Biogas and solar technologies support energy efficiency and sustainable farming practices.	Improves food preservation and curbs deforestation in rural areas.

OPPORTUNITIES TO ADVANCE THE CIRCULAR FOOD SYSTEMS AGENDA

Tanzania's agricultural policies exhibit both alignment with and divergence from Circular Food System (CFS) principles, which advocate for a sustainable, closed-loop approach to food production, consumption, and waste management. Several policies, such as the National Agricultural Policy (NAP), National Irrigation Policy (NIP), and National Post-Harvest Management Strategy (NPHMS), provide a foundation for sustainable agricultural practices. Existing initiatives, like the Climate-Smart Agriculture (CSA) Program, demonstrate the potential to reduce economic losses—currently estimated at USD 200 million annually—through resilience-building and greenhouse gas mitigation. Similarly, Eco-Circular projects, such as plastic waste management by PREYO Co. Ltd. in Dar es Salaam, showcase how circular principles can minimize waste and close resource loops. In Kiwere village, farmers have adopted a circular approach by integrating irrigation with dairy farming and manure management, where fodder crops cultivated with irrigation systems feed dairy cattle, and the resulting manure is composted and applied as organic fertilizer, reducing synthetic fertilizer use and enhancing soil fertility. However, significant gaps remain, particularly in:

The **National Agricultural Policy (NAP)** of 2013 aims to promote sustainable agricultural development and inclusive growth, which aligns with the broad goals of CFS, particularly in terms of improving food security and reducing rural poverty (United Republic of Tanzania, 2013). However, while the policy predates the formal emergence of Circular Economy (CE) and Circular Food Systems (CFS) concepts, which gained prominence in global discourse in the mid-2010s, it lacks explicit integration with practices now associated with these frameworks, such as water recycling and waste valorization. Specifically, the policy does not incorporate strategies for the reuse of water at household, farm, or irrigation scheme levels or promote nutrient cycling through community-led waste valorization initiatives. These elements are fundamental to contemporary CFS principles, which advocate for maximizing resource efficiency and reducing waste by ensuring that all agricultural outputs, including water and nutrients, are continually recycled within the system (FAO, 2014). As such, updating the policy to reflect these principles presents an opportunity to align it with current sustainability priorities.

The National Irrigation Policy (2009) focuses on expanding irrigation infrastructure and improving water use efficiency (United Republic of Tanzania, 2009). While this is critical for enhancing agricultural productivity, the policy predates the global prominence of Circular Food Systems (CFS) concepts, which emerged in the mid-2010s. As a result, it does not explicitly address broader circular practices such as nutrient recycling or the reuse of agricultural waste. Circular Food Systems emphasize nutrient cycling, where agricultural by-products, such as crop residues and animal waste, are repurposed to enhance soil fertility and reduce reliance on chemical fertilizers. This focus is not explicitly integrated into the Irrigation Policy, which primarily prioritizes water management (FAO, 2014). Revisiting and updating the policy to include nutrient reuse and waste valorization could enhance its alignment with contemporary CFS principles.

The **Agricultural Sector Development Program (ASDP II) (2017/2018–2027/2028)** aims to increase agricultural productivity and commercialization through sustainable land and water management (United Republic of Tanzania, 2017). While it aligns with CFS principles in its emphasis on sustainable land management, it does not adequately address key aspects of CFS, particularly nutrient cycling and waste management. The program focuses on water

and land management but fails to promote closed-loop agricultural systems where nutrients are recycled through organic matter (e.g., composting or using agricultural by-products as fertilizers) (FAO, 2014). The program would benefit from integrating circular practices, such as the reuse of food waste and crop residues, to enhance soil health to align more closely with CFS.

The **National Postharvest Management Strategy (NPHMS) 2019–2029** aims to reduce food waste, which is a significant element of CFS (United Republic of Tanzania, 2019). However, it faces challenges in scaling up its impact due to inadequate infrastructure for food waste management. Effective waste management systems, such as composting facilities or biogas plants, are essential for closing the food production loop and ensuring that waste is recycled into useful resources. The NPHMS would benefit from strengthening its focus on circular practices by improving infrastructure for the valorization of food waste and agricultural by-products, which could help reduce waste and improve resource use efficiency (FAO, 2014).

The National Environment Policy (2021), emphasizes sustainable resource management, a key principle of Circular Food Systems (CFS). However, it does not explicitly promote circular agricultural practices such as waste valorization, nutrient cycling, or water reuse in agriculture (United Republic of Tanzania, 2021). While the policy addresses broader environmental issues, such as conservation and climate change mitigation, it lacks clear guidelines or frameworks for integrating circular food practices into agricultural systems. Opportunities for integration could be pursued through policy reviews to incorporate circular principles or through the development and implementation of projects aligned with the policy's objectives. These projects could focus on piloting circular initiatives at the community or sector level to demonstrate feasibility and scalability, ultimately enhancing the policy's ability to promote a fully circular agricultural economy.

POLICY RECOMMENDATIONS

Tanzania's agricultural policies lay a strong foundation for sustainable development but fall short of fully embracing CFS principles, which aim to create a closed-loop system where resources are continually reused and recycled. Key policy gaps include limited integration of nutrient cycling, water reuse, and waste valorization. To better align Tanzania's agricultural sector with CFS principles, the following policy improvements are recommended:

1. **Revise the National Agricultural Policy (NAP) of 2013** – Integrate funding streams and incentives for nutrient cycling initiatives, such as composting and organic fertilizer production. Provide subsidies for farmers adopting these practices to promote resource efficiency and reduce dependency on chemical inputs.
2. **Amend the National Irrigation Policy (NIP)** - Introduce guidelines for wastewater recycling and nutrient recovery in irrigation systems. Establish pilot projects to demonstrate the feasibility of integrating circular water management practices into existing schemes.
3. **Strengthen Water Management strategies**- Emphasize water reuse and recycling within agricultural systems. Sustainable irrigation techniques, efficient water use, and conservation efforts to minimize loss and ensure water availability for future agricultural needs should be prioritized in irrigation development projects and programmes (FAO, 2014).
4. **Promote Cross-Sector Collaboration** – Establish a multi-stakeholder task force to align efforts across policies like NAP, NIP, and NPHMS. This task force would coordinate the implementation of circular principles, ensuring synergy between nutrient cycling, water reuse, and waste valorization strategies.
5. **Strengthen the National Post-Harvest Management Strategy (NPHMS)** - Leverage public-private partnerships to establish composting facilities and biogas infrastructure at regional agricultural hubs. This approach would minimize post-harvest waste while creating value-added products for farmers.
6. **Amend the Environmental Management Act of 2004** - Update the Act to incorporate specific measures for managing agricultural waste and converting it into bioenergy. This adjustment would facilitate the adoption of sustainable waste-to-energy solutions, contributing to renewable energy generation while managing agricultural waste effectively.
7. **Provide Financial and Technical Assistance to Smallholder Farmers and SMMEs:** Introduce targeted support programs to equip farmers with knowledge on water and nutrient dynamics, enabling improved irrigation decisions and productivity. Additionally, establish grants or credit facilities tailored to women- and youth-led SMMEs, focusing on nutrient recycling, renewable energy, and agro-processing initiatives. These interventions will promote the widespread adoption of Circular Food Systems (CFS) and enhance sustainability in agriculture.

CONCLUSION

Advancing Circular Food Systems (CFS) in Tanzania presents an opportunity to address critical challenges in agriculture, including inefficient water use, post-harvest losses, and inadequate infrastructure. While existing policies provide a foundation for sustainable development, targeted enhancements—such as revising policies to incorporate nutrient recycling, waste valorization, and water reuse—are necessary to fully align with CFS principles. Investments in post-harvest infrastructure, capacity-building programs, and pilot projects to demonstrate CFS practices will be crucial. Strengthened public-private partnerships can also accelerate adoption. By taking these steps, Tanzania can reduce agriculture's environmental footprint, create economic opportunities for rural communities, and build resilience to climate variability, securing its food supply and the well-being of its people.

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Authors

FANRPAN Tanzania Node – Economic Social Research Foundation - Teresia Mruma, John Shilinde, Richard Ngilangwa, Vivian Kazi and Essenam Hannah Ama Dorkenu

FANRPAN Regional Secretariat - Sithembile Mwamakamba, Suwilanji Sinyangwe

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The Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN) is an autonomous, multistakeholder policy network with a mandate to coordinate agriculture policy research, analysis and dialogue, promote the dissemination of policyrelevant research results across Africa, and act as a platform for dialogue of all food systems stakeholders. FANRPAN was established in 1997 in response to a call by Ministers of Agriculture from Eastern and Southern Africa (ESA) for the formation of a regional agricultural policy analysis and research network to enhance indigenous capacity for policy formulation and analysis and to reduce dependence on foreign experts when countries develop comprehensive agricultural policies and food security strategies (COMESA Gazette, 1994, volume 201, number 1, clause 23). FANRPAN is mandated to work in all African countries and currently has activities in 17 countries, namely Angola, Benin, Botswana, Democratic Republic of Congo, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe.

141 Cresswell Road, Weavind Park 0184, Private Bag X2087, Silverton 014, Pretoria, South Africa.
Telephone: +27 12 804 2966. Facsimile: +27 12 804 0600. Email: policy@fanrpan.org. Website: www.fanrpan.org