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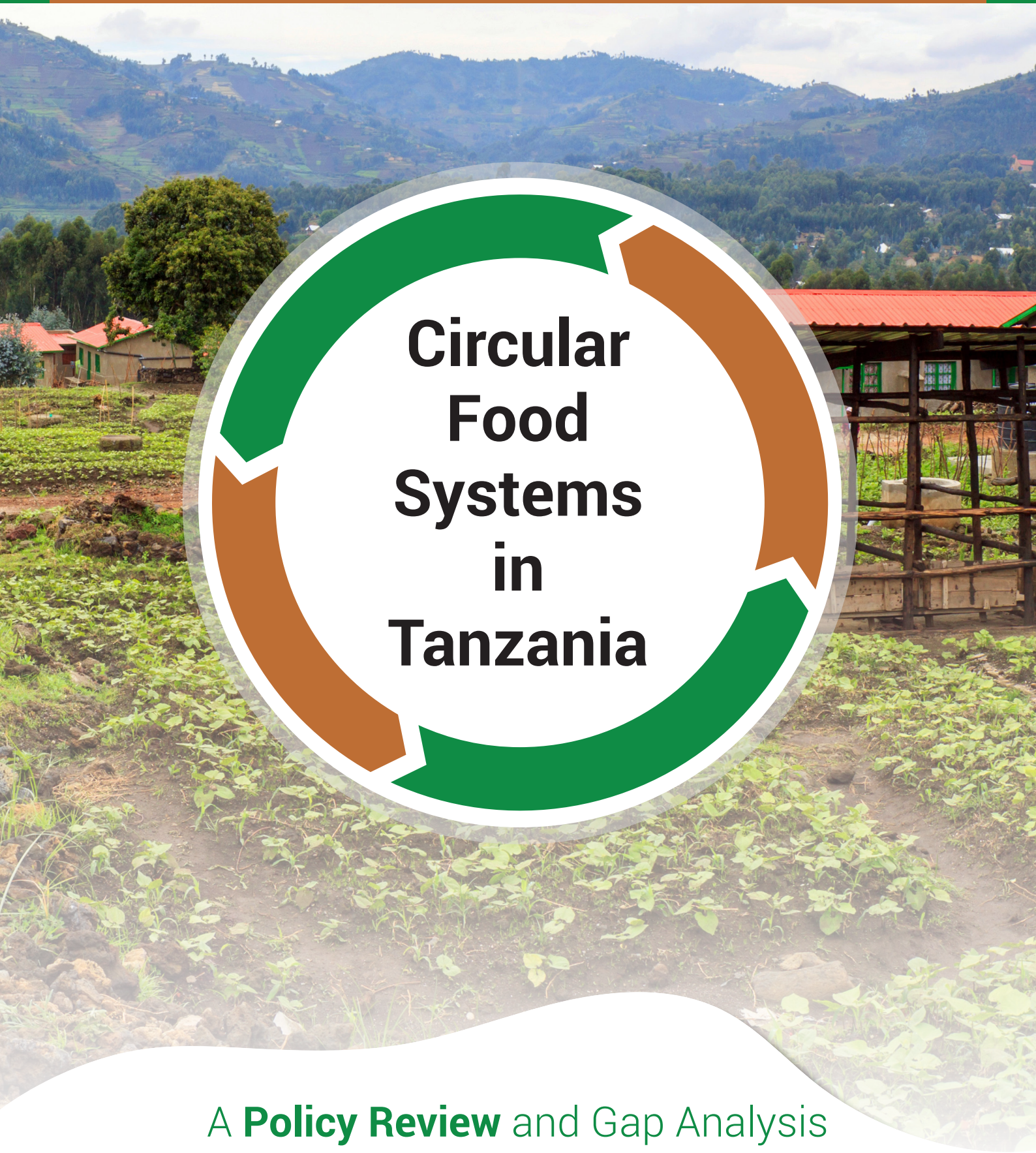

Circular Food Systems in Tanzania

A **Policy Review** and Gap Analysis

Acknowledgement

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About FANRPAN

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 policy-relevant 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.

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Executive Summary

Tanzania's food systems face significant challenges, including inadequate policy frameworks, limited infrastructure for waste management, and insufficient collaboration among stakeholders. These issues hinder the transition toward sustainable and inclusive agricultural practices, such as Circular Food Systems (CFS).

The Circular Food Systems (CFS) project in Eastern and Southern Africa (ESA), funded by the Austrian Centre for Agriculture Research (ACIAR) and led by the Australian National University (ANU), seeks to promote sustainable agricultural practices across Tanzania, Mozambique, Zimbabwe, and South Africa. It involves collaboration with regional institutions like ARDHI University, Eduardo Mondlane University, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), building on initiatives such as the Transforming Smallholder Irrigation in Southern Africa (TISA) project. By integrating irrigation, livestock, and dryland farming, the project aims to enhance agricultural resilience and inclusivity through co-designed innovations and systems transformation.

This report provides a comprehensive analysis of Circular Food Systems (CFS) in Tanzania, drawing from an extensive literature review and stakeholder consultations. It identifies significant opportunities for CFS to transform Tanzania's food systems by enhancing sustainability, resilience, and equity. However, key challenges, such as insufficient policy frameworks and inadequate infrastructure for waste management, hinder the widespread adoption of CFS.

The report highlights Tanzania's potential to improve sustainability, resilience, and equity in food systems. However, challenges such as weak policy frameworks, limited waste management infrastructure, early-stage CFS initiatives, inadequate stakeholder collaboration, and low consumer awareness impede progress. Limited integration of microfinance with circular economy principles further constrains scaling efforts.

To overcome these obstacles, the report recommends:

1. Establishment of specific frameworks supporting CFS, especially in irrigation schemes and dryland farming.
2. Building waste management systems through public-private partnerships.
3. Strengthening coordination between policymakers, businesses, researchers, and communities.
4. Developing financial products aligned with CFS through targeted research.
5. Advocacy and awareness campaigns and incentives to drive consumer adoption of CFS practices.

List of Acronyms

ACIAR	Australian Centre for International Agricultural Research
AIPs	Agricultural innovation platforms
ASDP	Agricultural Sector Development Program
BBT-YIA	Building a Better Tomorrow: Youth Initiative for Agribusiness
CAADP	Comprehensive Africa Agriculture Development Programme
CE	Circular Economy
CFS	Circular Food Systems
CSA	Climate-Smart Agriculture
ESA	Eastern and Southern Africa
FANRPAN	Food, Agriculture and Natural Resources Policy Analysis Network
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
MLF	Ministry of Livestock and Fisheries
MOA	Ministry of Agriculture
NAP	National Agricultural Policy
NGO	Non-Government Organisation
NSA	Nutrition-Sensitive Agriculture
PPP	Public-Private Partnership
SMMEs	Small and Medium-sized Enterprises
TAFSIP	Tanzania Agriculture and Food Security Investment Plan
TISA	Transforming Irrigation in Southern Africa
URT	United Republic of Tanzania
VCA	Value Chain Analysis

Table of Contents

List of Tables

List of Figures

1. Introduction

The Challenge

Tanzania's food systems are vital for the country's socio-economic development, supporting the livelihoods of millions while playing a central role in national food security. However, they face a range of persistent challenges that undermine their sustainability, inclusivity, and resilience. One significant issue is the lack of adequate policy frameworks to support modern agricultural practices and sustainable food systems. Current policies often fail to comprehensively address essential components such as waste management, resource recycling, and the integration of renewable resources into agricultural practices. This policy gap creates barriers to the adoption of transformative approaches like Circular Food Systems (CFS), which emphasize resource efficiency and sustainability (FAO, 2021).

In addition to policy gaps, Tanzania's food systems suffer from limited infrastructure, particularly for food and agricultural waste management. The absence of proper infrastructure significantly hampers efforts to recycle and repurpose resources, which are key to operationalizing circular economy principles. Smallholder farmers, who constitute most agricultural producers in Tanzania, are disproportionately affected by these limitations, as they often lack access to basic waste management facilities and technologies (World Bank, 2020).

Furthermore, the lack of collaboration among key stakeholders—such as policymakers, private sector actors, researchers, and local communities—exacerbates these challenges. Circular Food Systems require coordinated efforts and partnerships to co-design and implement context-specific solutions. However, in Tanzania, siloed approaches and fragmented initiatives reduce the potential to achieve large-scale, impactful results (UNEP, 2022).

Compounding these issues is the low level of awareness about circular economy principles among producers and consumers alike. Many stakeholders are unaware of the potential economic, social, and environmental benefits of transitioning to CFS. This lack of awareness creates resistance to change and hinders the behavioral shifts necessary for widespread adoption (IFPRI, 2019).

Addressing these challenges is critical to transforming Tanzania's food systems into models of sustainability, resilience, and equity. Circular Food Systems offer a promising pathway to achieve these goals by promoting efficient resource use, reducing waste, and fostering agricultural innovation. However, the successful implementation and scaling of CFS depend on tackling foundational issues in policy, infrastructure, collaboration, and public awareness. This report provides a detailed analysis of these challenges and outlines actionable recommendations to create an enabling environment for the adoption of Circular Food Systems in Tanzania.

The Circular Food Systems Concept

Circular Food Systems (CFS) offer a transformative approach to food production, distribution, and consumption by promoting sustainability, resource efficiency, and economic resilience. This innovative concept prioritizes minimizing waste, optimizing the use of resources, and closing the loop within the agri-food system. By adopting circular principles, CFS aims to reduce environmental footprints, enhance food security, and mitigate greenhouse gas emissions. Through a closed-loop system, resources such as water, nutrients, and energy are recycled and reused, ensuring that the food system remains both environmentally and economically sustainable (FAO, 2021).

CFS holds profound relevance for Tanzania, addressing pressing issues such as food insecurity, climate change, and the need for sustainable agricultural development. Tanzania faces considerable challenges related to resource inefficiencies and environmental degradation, which exacerbate food insecurity and rural poverty. By promoting resource efficiency, CFS can help farmers optimize their use of water, land, and nutrients, leading to improved agricultural productivity and reduced environmental degradation. Furthermore, CFS emphasizes value addition through the local processing of agricultural products, creating jobs and income opportunities, particularly for women and youth in rural areas. This aligns with Tanzania's goals of empowering vulnerable groups and fostering rural economic growth (World Bank, 2020).

One of the critical contributions of CFS is its potential to enhance climate resilience. By adopting practices that minimize greenhouse gas emissions and improve adaptation to climate variability, CFS supports Tanzania's broader climate goals. For instance, integrating sustainable irrigation, livestock management, and dryland agriculture within the CFS framework can reduce the environmental impact of food production while boosting resilience to climate-induced shocks. Practices such as crop diversification, composting, and regenerative agriculture can reduce reliance on chemical inputs, conserve water, and improve soil health, further enhancing system sustainability (UNEP, 2022).

Dryland agriculture is particularly significant in Tanzania, where much of the population depends on rain-fed farming systems. However, these systems are often constrained

by erratic rainfall and poor soil fertility, limiting their productivity. Small-scale irrigation has emerged as a promising solution to improve agricultural productivity in dryland areas. Despite challenges, the successful implementation of irrigation projects in Tanzania has demonstrated the potential to enhance food security, improve household incomes, and reduce poverty (IFPRI, 2019). Integrating irrigation into CFS not only addresses water scarcity but also creates opportunities to use wastewater and agricultural byproducts, aligning with circular economy principles.

Public investments and supportive policies are indispensable for achieving sustainable food systems in Tanzania. Policies that promote sustainable agricultural intensification, irrigation development, and resource-efficient farming practices can deliver significant benefits. These include increased crop yields, higher incomes for farmers, improved food availability, and lower food prices. Moreover, public and private sector collaboration can facilitate market access, crop diversification, and year-round food supply, ensuring that even marginalized communities have access to diverse and nutritious diets (FAO, 2021). Evidence from sub-Saharan Africa underscores the positive impact of irrigation and circular agricultural practices on food security, poverty alleviation, and nutrition outcomes (World Bank, 2020).

The Circular Food Systems Project

The Australian National University (ANU), in collaboration with the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), ARDHI University, Eduardo Mondlane University (UEM), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and other regional partners, is leading an innovative project to enhance Circular Food Systems (CFS) in Eastern and Southern Africa (ESA) by testing how the global concept of circular food systems can be applied in the region. This initiative is funded by the Australian Centre for International Agricultural Research (ACIAR).

The project's genesis lies in transforming irrigation schemes from dysfunctional to profitable systems under the Transforming Irrigation in Southern Africa TISA research. The TISA initiative laid the groundwork by enhancing irrigation scheme functionality and community collaboration. The benefits included improved crop scheduling, joint purchasing, and better market access. However, the potential to integrate these advances with broader agricultural sectors remained largely untapped.
The CFS project now seeks to extend these benefits to dryland cropping and livestock sectors by promoting sustainable agricultural practices across Tanzania, Mozambique and Zimbabwe. It explores how integrating irrigation, livestock and dryland agricultural production based on existing water and land use can accelerate rural development and circularity through tighter water, carbon, and nutrient cycling without increasing greenhouse gas emissions. The project's goal is to bridge this gap, by integrating irrigation with dryland farming and livestock, improving supply chains, and establishing Small and Medium-sized Enterprises (SMMEs) to foster local value addition. The project uses Agricultural innovation platforms (AIPs), to build a mutual understanding of the basics of circularity-including creating jobs for the youth and women in value-adding locally—and facilitate the integration and inclusive co-design of local SMMEs and associated value chains.

The CFS project is important for local development in Tanzania for several reasons. By improving agricultural productivity and efficiency, the project can help enhance food security in Tanzania, ensuring that local communities have access to an adequate and nutritious food supply. Also, sustainable agricultural practices and resource efficiency will mitigate the impact of climate change and reduce environmental degradation, ensuring the long-term sustainability of Tanzania's food system. Incorporating Small and Medium-sized Enterprises (SMMEs) and value-added agricultural activities will provide economic opportunities for local communities, particularly women and youth, thereby contributing to poverty reduction and economic growth.

Study Approach

This study employed a mixed-methods approach that combined secondary and primary data collection techniques to assess policies related to agriculture, food security, climate change, and sustainable development. Secondary data included literature reviews of research reports, government publications, academic works, and policy documents, with selection criteria emphasizing relevance to the CFS concept, credibility, geographical applicability, and timeliness. Primary data collection involved engaging stakeholders through a virtual validation workshop to gather insights, identify policy gaps, and propose interventions for advancing CFS. The policy mapping and content analysis focused on evaluating existing frameworks, highlighting challenges, and aligning policies to enhance the support provided to smallholder farmers for sustainable productivity.

The analytical framework used a threefold approach: content analysis of policy documents, thematic analysis of literature, and synthesis of stakeholder feedback. Content analysis identified key themes and strategies related to water resource management and circular food systems, while thematic analysis highlighted patterns in topics such as waste valorization and market access. Stakeholder feedback from the validation workshop provided additional perspectives on policy gaps and actionable recommendations. Despite limitations such as restricted data availability, potential biases, and resource constraints, the study mitigated these challenges through triangulation of data sources and stakeholder validation. The findings underscore the need for targeted policy enhancements to address gaps and create an enabling environment for CFS implementation in Tanzania.

2. **Tanzania Policy** Landscape and Alignment with Circular Food Systems (CFS) Principles

The policy landscape and current state of Circular Food Systems (CFS) implementation in Tanzania reflects a multidimensional approach to agricultural development, food security, and economic empowerment. However, the degree of alignment with CFS principles, addressing sustainable practices, inclusivity, water management, and environmental protection varies across existing policies and programs.

a) Policy Frameworks Supporting Sustainable Practices

The National Agricultural Policy (NAP) 2013 and the National Multisectoral Nutrition Action Plan (NMNAP II) (2021-2026) prioritize sustainable agricultural practices, efficient resource utilization, and food security. The NAP 2013 underscores the need for agricultural modernization while promoting environmentally sustainable practices such as soil conservation, crop diversification, and agroforestry. NMNAP II complements these efforts by addressing nutrition security and encouraging resilience in food systems. Furthermore, flagship programs like the Comprehensive Africa Agriculture Development Programme (CAADP) and the Tanzania Agriculture and Food Security Investment Plan (TAFSIP) emphasize sustainable land and water management, improved market access, and strengthening food supply chains. These initiatives align with key CFS principles, such as minimizing waste, enhancing resource efficiency, and supporting equitable food systems (FAO, 2020; URT, 2017).

b) Policy Frameworks Supporting Inclusivity and Community Involvement

Tanzania has placed significant emphasis on inclusivity and community engagement in its policy framework. The "Building a Better Tomorrow: Youth Initiative for Agribusiness" (BBT-YIA) seeks to involve youth in agriculture, addressing employment challenges while fostering innovation and entrepreneurship in agribusiness. The Public Procurement Act (2016) promotes opportunities for women and marginalized groups, requiring that a portion of public procurement be allocated to women and youth-owned enterprises. Similarly, the National Microfinance Policy (2017) facilitates access to finance for smallholder farmers and agripreneurs, encouraging broader participation in agricultural activities. The Agricultural Sector Development Program (ASDP), implemented in two phases, emphasizes community-driven development. ASDP I (2007–2014) focused on improving smallholder production and irrigation development, while ASDP II (2017–2028) builds on these successes by accelerating agricultural GDP growth, improving food security, and enhancing smallholder incomes. These efforts reinforce the importance of inclusivity and resilience, which are integral to CFS principles (URT, 2009; URT, 2017).

c) Policy Frameworks Supporting Water Management and Irrigation

Efficient water management is critical for sustainable agricultural productivity and is strongly emphasized in Tanzania's policy framework. The National Irrigation Policy (2009) promotes the development and use of irrigation technologies to increase agricultural yields while minimizing water wastage. Similarly, the National Water Policy (2002) underscores the need for integrated water resource management to optimize water use across competing demands, including agriculture. These policies align with CFS principles by advocating for resource optimization and supporting practices that ensure the sustainable use of water in food production systems (FAO, 2020).

d) Policy Frameworks Supporting Environmental Protection and Sustainable Land Management

Tanzania's commitment to environmental protection and sustainable land management is evident in policies like the National Environmental Policy (2021) and the Tanzania Land Policy (1997). The National Environmental Policy prioritizes the protection of ecosystems, climate resilience, and sustainable utilization of natural resources. The Tanzania Land Policy promotes sustainable land use planning, aiming to reduce land degradation and ensure equitable access to land for productive purposes. These policies indirectly align with CFS objectives by supporting practices that minimize environmental impacts, preserve biodiversity, and enhance the resilience of food systems to climate change (URT, 2021; URT, 1997).

Table 1: Summary of how each policy aligns with or diverges from CFS principles

Policy Name	Focus	Alignment with CFS Principles	Divergence from CFS Principles
National Agricultural Policy (NAP) 2013	Sustainable agricultural development, inclusive growth, empowering smallholder farmers, climate resilience	• Emphasizes sustainable agricultural development	• Lacks specific mention of Circular Food Systems (CFS)
		• Promotes inclusive growth and climate resilience	• Doesn't integrate CFS with irrigation schemes
		• Empowering smallholder farmers	• Limited integration with irrigation schemes
National Irrigation Policy (2009)	Developing and managing irrigation infrastructure to reduce reliance on rainfed agriculture	• Focuses on improving agricultural productivity	• Doesn't explicitly address broader circular practices
		• Promotes water efficiency and land use optimization	• Needs revision to integrate CFS principles explicitly
National Multisectoral Nutrition Action Plan (NMNAP II)	Sustainable food systems, dietary diversity, nutrient adequacy	• Highlights importance of sustainable food systems	• Doesn't specifically address Circular Food Systems
		• Promotes dietary diversity and nutrient adequacy	• Lacks a specific emphasis on circular food systems integration
Agricultural Sector Development Program (ASDP I (2007/2008-2013/2014)	Enhance smallholder production, irrigation, GDP growth, incomes, food security	• Promotes economic sustainability for smallholders	• Economic growth focus overlooks broader environmental and circularity impacts
ASDP II (2017/2018-2027/2028)	ASDP II (2017/2018-2027/2028): Broader productivity and commercialization	• Emphasizes sustainable land, water management, productivity, market access, sustainable practices, and rural livelihoods and value addition	• Lacks explicit integration of circular food system principles such as nutrient cycling and waste reuse
	Transforming the agricultural sector, productivity, market access	• Focus on productivity	• Lacks specific emphasis on circular food systems integration
Livestock Policy (2005)	Improve livestock productivity and marketing	• Aims to improve livestock productivity and marketing	• Lacks specific strategies for promoting circularity in livestock production, particularly in dryland areas
Tanzania Land Policy (1997)	Sustainable land management practices	• Promotes sustainable land management practices	• Doesn't directly address irrigation development in drylands
National Water Policy (2002)	Ensure the efficient, reliable, and fair development and utilization of water resources in a sustainable and cost-effective manner.	• Recognizes importance of irrigation farming and livestock	• Doesn't sufficiently address interconnection for increased productivity in both sectors
		• Advocates for integrated water planning	
National Microfinance Policy (2017)	Financial inclusion for low-income individuals, households, and enterprises, thereby promoting economic growth, employment opportunities, and poverty reduction.	• Emphasizes financial inclusion and sustainability	• Needs more explicit integration of circular economy principles into microfinance strategies
		• Promotes collaboration and innovation	• Requires increased focus on research and innovation specific to circular food systems

Policy Name	Focus	Alignment with CFS Principles	Divergence from CFS Principles
Food and Nutrition Policy (1992)	food production, improving access to food, and enhancing the stability of food supplies, especially during times of crisis	• Fosters agricultural innovations such as irrigation • Promotes environmental protection and women's inclusion	• Doesn't mention CFS directly
National Environment Policy (2021)	Sustainable management and conservation of the environment and natural resources to ensure their availability and equitable distribution for present and future generations.	• Emphasizes environmental protection and poverty alleviation • Aims to strengthen coordination across sectors	• Doesn't explicitly promote circularity
Agriculture Marketing Policy (2008)	Addressing significant challenges in agricultural marketing, such as institutional, legal, and regulatory shortcomings, insufficiently developed marketing infrastructure, and limited agro-processing capabilities.	• Addresses optimization of resource use, post-harvest management to reduce food losses, enhancement of value addition, improve market access, and foster entrepreneurship in the agricultural sector.	• Limited focus on integrating circular economy principles and processing practices • Focus on market infrastructure without emphasizing circular food systems • Lack of policies encouraging circularity • Absence of a holistic system approach
National Forest Policy (2018)	Sustainable forest management, conservation, and reforestation.	• Promotes food security by safeguarding ecosystems crucial for agriculture and water resources.	• Does not explicitly promote circular practices • Lacks measures to integrate forestry with agricultural systems • Limited emphasis on reusing forest products within agriculture • Does not address interconnectedness with agriculture in a circular economy context
Comprehensive Africa Agriculture Development Programme (CAAP)/ Tanzania Agriculture and Food security Investment Plan (TAFSIP)	Boost agricultural GDP growth, mobilize financial resources, and allocate them to various agricultural activities	• Focus on sustainable land and water management, market access, and food supply	• Not addressing Circular Food Systems directly • Lacks integration of irrigation, dryland farming, and livestock for shared benefits

3. Circular Food Systems (CFS) Practices in Tanzania

Circular Food Systems (CFS) practices in Tanzania are increasingly gaining recognition as essential components for sustainable agricultural development, food security, and environmental conservation. These practices focus on resource efficiency, waste minimization, and enhancing the resilience of food systems, which are integral to addressing the challenges of climate change, land degradation, and food insecurity in the country.

a) Organic Waste Recycling and Composting

The recycling of organic waste into compost is a growing practice among smallholder farmers in Tanzania. Organic compost derived from crop residues, manure, and other biodegradable materials is used as an alternative to chemical fertilizers, improving soil fertility while reducing waste. For example, initiatives by organizations like Sustainable Agriculture Tanzania (SAT) have promoted composting and biofertilizer production, contributing to sustainable soil management and reduced reliance on synthetic inputs (SAT, 2020).

b) Integrated Crop-Livestock Systems

Integrated crop-livestock systems, a key aspect of circular agriculture, are widely practiced in Tanzania. Farmers use crop residues as animal feed while utilizing manure as fertilizer, creating a closed-loop system that enhances resource efficiency. These systems reduce waste, improve soil health, and provide diversified income streams for farmers. Studies have shown that integrating crops and livestock can increase farm productivity and resilience to climate variability (Mkamilo et al., 2021).

c) Agroforestry Practices

Agroforestry is a prominent CFS-aligned practice in Tanzania, involving the integration of trees and shrubs with crops and livestock systems. This approach provides multiple benefits, such as improved soil fertility, erosion control, carbon sequestration, and diversified farm outputs. Projects like the Africa Forest Landscape Restoration Initiative (AFR100) have supported the adoption of agroforestry practices, aiming to restore degraded lands and enhance livelihoods (WRI, 2021).

d) Water Resource Management

Efficient water use is critical for circular food systems, and Tanzania has adopted various practices to optimize water management. Rainwater harvesting and small-scale irrigation systems have been implemented to ensure the availability of water for agriculture, especially in arid and semi-arid regions. The adoption of drip irrigation technology, promoted by initiatives like the Kilimo Endelevu Program, has further improved water use efficiency and crop productivity (FAO, 2020).

e) Renewable Energy Integration

The use of renewable energy, particularly biogas, in agricultural systems is an emerging practice in Tanzania. Biogas is produced from agricultural waste and livestock manure, providing a sustainable energy source for cooking and electricity. This practice not only reduces reliance on traditional wood-based fuel but also supports waste-to-energy initiatives, reducing greenhouse gas emissions (URT, 2021).

f) Value Addition and Food Waste Reduction

Value addition and the reduction of post-harvest losses are integral components of circular food systems. Efforts to establish agro-processing facilities and improve storage infrastructure have helped farmers minimize food waste and increase the shelf life of agricultural products. The Tanzania Post-Harvest Management Strategy (2019–2029) emphasizes the importance of adopting efficient processing and storage technologies to reduce losses and enhance market opportunities (URT, 2019).

Several initiatives are implementing CFS principles led by the Government of Tanzania, research institutions and other partners (see Table 2).

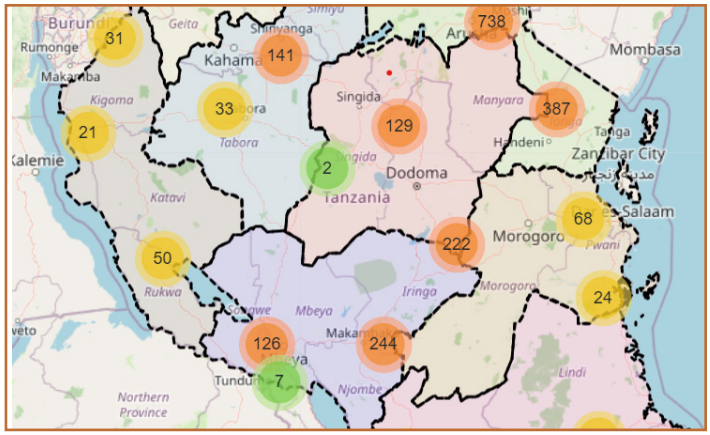
Table 2: Examples of projects implementing CFS Principles

Projects	Location	Implementers	Description
Transforming Irrigation in Southern Africa	Iringa Rural, Iringa	FANRPAN	Enhanced irrigation scheme management, Improved community collaboration among farmers, better crop scheduling, joint purchasing, and market access
Ruvuma Basin Irrigation Project	Ruvuma	Government	Five large reservoirs, rehabilitating existing irrigation schemes, and promoting water efficiency practices
Five large reservoirs, rehabilitating existing irrigation schemes, and promoting water efficiency practices	Mvomero, Morogoro	Government	Aims to improve water management, upgrade infrastructure, and enhance agricultural productivity in the schemes.
East Africa Youth Inclusion Program	Iringa, Njombe, Mbeya and Songwe	Heifer International	Has initiatives to promote raising chickens alongside crops, providing additional income, and utilizing household waste for chicken feed. The program also promotes improved manure management by training farmers on composting manure to create organic fertilizer, reducing waste and improving soil fertility.
Netherlands East African Dairy Partnership (NEADAP)	Tanzania	Netherlands Food Partnership	Offers a platform for exchange of knowledge and experience to tackle current challenges and leverage further development in East African dairy
Fufu (vegetables)	Chamwino, Dodoma	Virtual Irrigation Academy	Aims to improve water management, upgrade infrastructure, and enhance agricultural productivity in the schemes.
Luganga (vegetables) & Mangalali (vegetables)	Iringa Rural, Iringa	Virtual Irrigation Academy	Aims to improve water management, upgrade infrastructure, and enhance agricultural productivity in the schemes.
Mkula (Rice) & Njage (Rice)	Kilombero, Morogoro	Virtual Irrigation Academy	Aims to improve water management, upgrade infrastructure, and enhance agricultural productivity in the schemes.

Tanzania has implemented several Circular Food Systems (CFS) practices, particularly in irrigation schemes aimed at enhancing water management and agricultural productivity, alongside integrated livestock and crop management systems. While there have been efforts to combine livestock production with crop farming for improved resource efficiency, these practices remain fragmented and lack integration with dryland farming systems, presenting a significant opportunity for improvement. Data on irrigation schemes across the country, illustrated in Figure 2, highlights their potential for scaling up CFS practices. The Arusha region stands out with the highest number of registered irrigation schemes (738). In Ruvuma region, for example, Figure 3 showcases the spread of micro-irrigation schemes, illustrating how such initiatives can be adapted to support sustainable practices at the community level. Expanding these approaches and addressing existing gaps in integration with dryland farming could significantly strengthen the implementation of CFS principles across Tanzania.

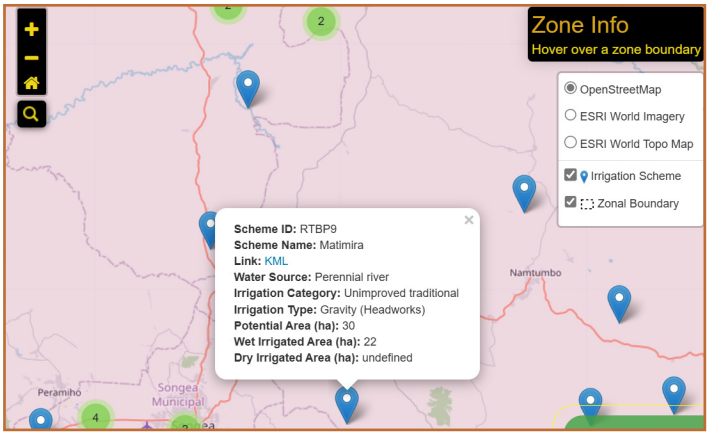
The policy landscape and status in Tanzania provide a strong foundation for sustainable agricultural practices, with various policies indirectly supporting CFS principles. Despite this, explicit integration and promotion of CFS within these policies and frameworks are limited. There is a need to develop specific policies and strategies that incorporate circular food systems, especially focusing on irrigation schemes, dryland areas, and integrating livestock production. Continued research, innovation, and targeted interventions will be crucial for advancing CFS practices in Tanzania. Recent research by Makombe, et al. (2023) underscores the necessity for policy revisions to explicitly integrate CFS principles and provide clearer guidelines for water management within irrigation schemes.

Figure 1: Map showing the concentration of different irrigation schemes.



Source: National Irrigation Commission
https://www.nirc.go.tz/webmap

Figure 2: Example of detailed Information showing concentration of schemes in Ruvuma based on Figure 1.



Source: Ramani | NIRC - Tume ya Taifa ya Umwagiliaji

4. Gaps, Barriers and Opportunities

Tanzania, like many other nations, is striving to transition toward more sustainable agricultural systems that balance economic growth with environmental stewardship. Circular Food Systems (CFS) offer a promising pathway to achieve this balance by integrating resource efficiency, waste reduction, and sustainable land management into food systems. However, despite existing policies that address some components of CFS, significant gaps remain that hinder their effective implementation.

This section identifies the key gaps, barriers, and opportunities for implementing Circular Food Systems in Tanzania. It provides an analysis of policy areas where shortcomings exist, explores the potential impacts of these gaps on achieving CFS goals, and suggests targeted interventions to address the challenges. Furthermore, it outlines barriers and opportunities in policy, finance, technology, market awareness, and capacity building, offering actionable recommendations to accelerate the adoption and scaling of CFS practices in Tanzania.

Policy Gaps and Impact on Implementation of CFS Principles

While Tanzania possesses various policies touching upon aspects of Circular Food Systems, significant gaps hinder their effective implementation. The following table summarizes these identified gaps and their potential impacts. This gap analysis highlights the need for comprehensive policies and targeted interventions to address barriers and leverage opportunities for the successful implementation of CFS in Tanzania.

Table 3 :Gap analysis and potential impact on CFS implementation

Policy Area	Identified Gaps	Description
Water Management	Lack of integrated water management policies that consider the entire water cycle and prioritize efficient water use across different sectors.	Reduced efficiency in water use, hindering the integration of CFS with irrigation schemes and limiting the potential for water reuse within the food system.
Land Use Planning	Absence of land use policies that explicitly promote CFS principles, such as encouraging mixed farming systems, integrating livestock into crop production cycles, and facilitating the creation of closed-loop nutrient cycles.	Limited ability to optimize land use for circular practices, potentially leading to inefficiencies and hindering the adoption of sustainable land management approaches within CFS.
Waste Management	Inadequate policies and infrastructure for waste valorisation (converting waste into valuable products) and recycling organic waste within the food system.	Missed opportunities for resource recovery and waste reduction, hindering the closure of nutrient loops and the potential for generating additional income streams from waste resources.
Market Access	Limited policies supporting the development of local markets and value chains for products and by-products generated within CFS initiatives, particularly for small and medium-sized enterprises (SMMEs).	Hindered development of SMMEs and local value addition initiatives, potentially limiting economic opportunities and incentives for farmers to engage in CFS practices.
Financial Support	Insufficient financial mechanisms dedicated to supporting the development and scaling up of CFS interventions, including access to loans, grants, and risk mitigation instruments for farmers and businesses.	Difficulty in funding and scaling CFS interventions, hindering their widespread adoption and limiting their potential impact on food security, resource efficiency, and economic development.
Capacity Building	Lack of policies and programmes specifically focused on building the skills and knowledge of farmers, extension workers, and other stakeholders in implementing circular practices within the food system.	Limited ability for communities to effectively engage in and benefit from CFS, potentially hindering their long-term sustainability and impact

Targeted Interventions for Addressing Identified Gaps

To bridge these gaps, targeted interventions are necessary, which include adjustments to policy frameworks, the implementation of pilot projects, and fostering collaborations among key stakeholders. The table below outlines recommended actions.

Table 4: Targeted Interventions for Addressing Identified Gaps in the Implementation of CFS Principles in Tanzania

Policy Area	Policy adjustments	Pilot Projects/training initiatives	Stakeholder engagements
Water Management	Develop integrated water management policies considering the entire water cycle and efficient water use	Implement projects demonstrating the integration of CFS with irrigation schemes	Engage with water resource authorities and communities to prioritize water efficiency in CFS
Land Use Planning	Establish land use policies promoting CFS principles like mixed farming and closed-loop nutrient cycles such as organic farming	Initiate pilots showcasing sustainable land management practices within CFS	Collaborate with agricultural stakeholders such as MoA, MoLF and other stakeholders for land optimization under CFS principles
Waste Management	Develop policies and infrastructure for waste valorisation and organic waste recycling	Launch initiatives demonstrating resource recovery from waste within the food system	Partner with waste management agencies and communities to implement waste reduction strategies
Market Access	Formulate policies supporting local markets and value chains for CFS products	Implement pilots enhancing market access for CFS products, especially for SMMEs	Collaborate with local governments and market associations to facilitate market linkages for CFS products

Policy Area	Policy adjustments	Pilot Projects/training initiatives	Stakeholder engagements
Financial Support	Design financial mechanisms supporting CFS interventions	Initiate financing programmes (such as grants and subsidies for sustainable agriculture, community support agriculture (CSA), Public-private partnerships) demonstrating the viability of CFS initiatives	Engage with financial institutions and investors to advocate for dedicated funding for CFS
Capacity Building	Develop policies and programmes for building skills in circular practices within the food system	Establish training programmes for farmers and stakeholders in CFS principles	Collaborate with agricultural institutes and NGOs for capacity-building initiatives in CFS

Barriers and Opportunities

To effectively implement Circular Food Systems in Tanzania, it is essential to understand the systemic barriers that impede progress and identify opportunities that can catalyze action. The table below summarizes key barriers and opportunities across critical themes.

Table 5: Barriers and opportunities for CFS implementation.

Theme	Barriers	Opportunities
Policy & Regulation	Lack of specific circular food systems (CFS) focused policies	Advocacy for CFS policy development with policy actors
	Limited inter-ministerial coordination	Collaboration with policymakers for mainstreaming circularity principles
	Weak enforcement of existing regulations related to resource use and waste management	Engaging relevant stakeholders in policy dialogues at all levels, national, regional and local levels.
Finance & Investment	Limited access to finance for CFS ventures, especially for SMMEs and women/youth-led businesses	Exploring innovative financing models (e.g., green bonds, impact investing)
	Lack of risk-sharing mechanisms for innovative circular projects	Developing targeted financial support programmes for CFS initiatives
		Building partnerships with financial institutions to facilitate access to credit
Technology & Infrastructure	Inadequate infrastructure for resource recovery and waste management	Investing in research and development of circular technologies
	Limited access to advanced technologies for circular production and processing	Promoting knowledge exchange and technology transfer among stakeholders
	Maintenance of irrigation schemes	Leveraging existing infrastructure and adapting it for circular practices
Market & Consumer Awareness	Access to markets	Raising awareness about the environmental and social benefits of circularity
	Limited consumer understanding of the benefits of CFS	Engaging with retailers and distributors to promote circular products
		Launching consumer education campaigns and initiatives
Capacity Building & Knowledge Sharing	Lack of knowledge and skills among stakeholders on implementing CFS practices	Providing training programmes on circular food systems for farmers, entrepreneurs, and policymakers
	Limited capacity for collaborative approaches and co-creation	Facilitating knowledge sharing platforms and forums for stakeholder interaction
		Building capacity for co-designing and implementing circular business models

By addressing these gaps, barriers, and opportunities, Tanzania can create a more enabling environment for Circular Food Systems, unlocking their potential to contribute to food security, sustainable livelihoods, and environmental resilience.

5. **Circular Food Systems:** Best Practices and Lessons for Tanzania

The lack of policies promoting Circular Food Systems (CFS) in Africa, coupled with insufficient scientific evidence, has hampered the adoption of CFS across the continent. This section explores three case studies and their lessons, with a focus on their applicability to Tanzania.

Case Study One: Circular Bioeconomy Practices in Rwanda, DRC, and Ethiopia

A study conducted in Rwanda, the Democratic Republic of Congo (DRC), and Ethiopia examined Circular Bioeconomy (CBE) practices among approximately 2,100 farmers and consumers in key food value chains. The findings revealed widespread adoption of composting and a general willingness among consumers to purchase food grown using CBE fertilizers. Factors influencing the adoption of CBE practices included education level, mobile phone usage, agricultural income, and proximity to urban centers. However, challenges such as the absence of policies to stimulate CBE investments and limited scientific evidence hindered broader adoption (Schut et al., 2022).

For Tanzania, this case study underscores the need for public awareness campaigns tailored to educate communities on the benefits of CBE practices. Leveraging technology and targeting educated, tech-savvy agricultural households can accelerate adoption. In addition, building consumer trust through education about the safety and benefits of CBE-grown products is essential. To address policy gaps, Tanzania should prioritize establishing evidence-based frameworks to guide investments in CBE initiatives. Financial incentives, such as subsidies or grants, can make these practices economically viable for farmers, fostering broader acceptance and implementation.

Case Study Two: Barriers to Circular Food Systems in Rwanda

A study in Rwanda explored the challenges hindering CFS adoption in both formal and informal agricultural sectors. The study identified six key barriers: limited technical support, lack of awareness about recycling and circular economy concepts, financial constraints, weak policy frameworks, institutional obstacles, and seasonal challenges. The formal agricultural sector benefited more from existing policies and technical support compared to the informal sector (Bihonegn et al., 2022).

For Tanzania, this case study highlights the importance of strengthening institutional frameworks to address these barriers. Raising awareness and providing targeted technical support can bridge knowledge gaps around CFS practices. Financial constraints can be alleviated through microloans or grants, enabling small-scale farmers to adopt these systems. Tanzania can also benefit from tailoring support to informal sectors, which play a critical role in its agricultural economy.

Case Study Three: The Need for an African Food Policy Framework

A study commissioned by the Alliance for Food Sovereignty in Africa (AFSA), the African Union (AU), and partners emphasized the lack of a unified food policy to guide sustainable food systems like CFS across the continent. The study proposed an African Food Policy Framework to address this gap. Such a framework would integrate the voices of small-scale farmers, tackle poverty, and create an enabling environment for innovative agricultural approaches, including circularity. It would also foster cross-sectoral linkages, promote SME growth in agriculture, and enhance resilience to climate change and other shocks (AFSA et al., 2022).

For Tanzania, the development of a national food policy aligned with the proposed African Food Policy Framework is critical. This approach would promote public-private partnerships to mobilize resources for infrastructure, capacity building, and market access for small-scale farmers. Government incentives to encourage innovation in circular practices could further enhance sustainability and resilience in food systems. Technical advancements, supported by evidence-based policies, can drive economic growth and poverty reduction.

Conclusion

The case studies underline the transformative potential of Circular Food Systems in addressing the challenges of food security, environmental degradation, and economic sustainability. For Tanzania, key lessons include the importance of building robust policies supported by scientific research, engaging communities in the design and implementation of circular practices, and addressing barriers such as financial constraints and awareness gaps. With targeted strategies and strong stakeholder collaboration, Tanzania can lead the way in creating sustainable, inclusive, and resilient food systems.

6. Policy Recommendations

To overcome the challenges identified and harness the full potential of Circular Food Systems (CFS) in Tanzania, this report provides actionable recommendations. These include promoting awareness and capacity building, facilitating access to land for small-scale farmers, implementing comprehensive land use policies, and enhancing research and knowledge sharing. The proposed timelines and responsible stakeholders are outlined to ensure effective implementation and monitoring of these initiatives, fostering a sustainable, resilient, and equitable food system in Tanzania.

a. Promoting awareness and capacity building is crucial for the successful implementation of Circular Food System (CFS) principles. This can be achieved through educational programmes aimed at farmers, policymakers, and other stakeholders, designed to enhance understanding of CFS practices and their benefits. Stakeholders responsible for the implementation of this initiative should include farmers, agricultural extension services, cooperatives, Ministry of Agriculture officials, policymakers, NGOs, and government agencies focused on agricultural development.

   The proposed timeline for implementation is six months. This includes the launch of awareness campaigns and training programmes, with ongoing capacity-building initiatives thereafter. The timeline was determined based on the urgency of raising awareness and the feasibility of organizing capacity-building programmes, as well as considerations such as program development, stakeholder coordination, and resource mobilization.

b. Facilitating access to land for small-scale farmers is essential for promoting inclusivity in CFS initiatives. This recommendation involves exploring and implementing strategies, potentially through land use planning mechanisms, to ensure equitable access to land for small-scale farmers. Stakeholders responsible for implementation can include government agencies responsible for land management, small-scale farmers, community leaders, Ministry of Lands officials, land tenure experts, and representatives from farmer associations.

   The proposed timeline for implementation is 12 months, which includes a series of activities such as pilot programmes or policy implementations. This timeline considers the complexity of land tenure issues, the need for policy formulation or adjustment, and the time required for community consultations. Additionally, it allows for piloting strategies before broader implementation.

c. Implementing land use policies for CFS activities is essential to establish comprehensive regulations. These regulations should focus on facilitating equitable access to land, securing land rights, establishing zoning regulations, and considering land consolidation to enable large-scale CFS initiatives. The stakeholders responsible in this process can include government agencies responsible for land management, small-scale farmers, community leaders, the Ministry of Agriculture, the Ministry of Land, local government authorities, landowners, and agricultural investors.

   The proposed timeline for developing and implementing these policies is 18-24 months. This timeframe allows for thorough stakeholder consultations, legal review, and the drafting of regulations. Additionally, it provides sufficient time for coordination among multiple government agencies and the monitoring of policy implementation. Throughout this process, ongoing adjustments will be made as necessary to ensure the effectiveness of the policies in promoting sustainable land use practices within the context of CFS initiatives.

d. Integration of CFS principles into village land use plans is imperative to encourage their stronger integration. This will involve improving land allocation for irrigation, waste management, and other crucial components essential for sustainable food production. Key stakeholders responsible for this process will include local government authorities, village councils, urban planners, and community development committees. Their collaborative efforts are pivotal in ensuring the effective integration of CFS principles into land use planning.

   The proposed timeline for reviewing and updating land use plans is 12-18 months. This timeframe allows for thorough reviews of existing plans and the incorporation of CFS considerations. Additionally, ongoing revisions will be conducted as CFS initiatives evolve, ensuring that village land use plans remain aligned with broader development agendas and responsive to community needs. Criteria for setting the timeline include consideration of the frequency of land use planning cycles, the availability of resources for plan revisions, and the importance of community engagement in the process. Moreover, it accounts for the capacity of local institutions to implement and adapt to changes in land use planning practices.

e. Promoting research and knowledge sharing by establishing industry and collaboration platforms facilitating knowledge exchange and research partnerships. Key stakeholders to be involved in these platforms include universities, research institutions, government agencies responsible for agricultural development, financial institutions and the

private sector. Public-private partnerships between universities, knowledge institutions, and government can support research questions of the private sector. Research conducted to explore the intersection of microfinance strategies and circular economy principles will aid develop innovations, policy recommendations, and financial products tailored to support CFS. Additionally, agricultural extension services and private sector representatives will play crucial roles in contributing to knowledge-sharing and research initiatives.

- The proposed timeline for establishing these platforms is 6-12 months, with ongoing research and knowledge-sharing activities thereafter. This timeline takes into consideration the time required to establish collaborative platforms, organize research initiatives, and disseminate findings effectively. Furthermore, it accounts for funding cycles, institutional capacity, and the availability of expertise to ensure the success and sustainability of these knowledge-sharing efforts.

f. Researching CFS integration within irrigation schemes Reflecting the pivotal role of CFS, conducting research to determine the optimal integration of CFS principles within irrigation schemes, and sharing findings with policymakers and stakeholders to guide future adjustments would be a plausible approach. Stakeholders responsible for implementation can include research institutions, irrigation scheme managers, and government agencies responsible for agriculture and water management.

- The suggested timeline is to initiate research projects within 12 months, with the dissemination of findings within 24-36 months. The criteria used to set the timeline consider the duration of research projects, including data collection, analysis, and reporting. Additionally, it accounts for stakeholder involvement, ethical considerations, and the potential for iterative research cycles.

g. Improving waste collection and separation infrastructure calls for the support of circular business models, ultimately leading to waste reduction and increased value in resource recovery efforts. Stakeholders responsible for implementation can include waste management authorities, private waste management companies, and local communities. For example, municipal waste management authorities, private waste collection companies, and community-based organizations.

h. The proposed timeline for upgrading infrastructure is within 12-18 months, with ongoing maintenance and optimization efforts thereafter. This timeline was determined based on several criteria, including the urgency of addressing waste management challenges, the availability of funding for infrastructure upgrades, and the feasibility of implementing new waste management practices. Additionally, it considers regulatory approvals, procurement processes, and community engagement efforts.

7. Conclusion

Advancing Circular Food Systems (CFS) in Tanzania offers a promising pathway to address pressing challenges within the agricultural sector, including inefficient water use, post-harvest losses, and inadequate infrastructure. While Tanzania's existing agricultural policies and programs lay a strong foundation for sustainable development, they require targeted enhancements to fully integrate CFS principles. Through strengthened policies and investments, Tanzania has the potential to become a leader in the Circular Food Systems approach in Africa. Embracing this model will not only reduce the agricultural sector's environmental impact but also create new economic opportunities, particularly for rural communities, women, and youth. As Tanzania's population grows and climate variability intensifies, advancing CFS principles will be essential to foster a regenerative agricultural system that secures both the country's future food supply and the well-being of its people.

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