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Sustainable food systems through diversification and indigenous vegetables

AN ANALYSIS OF THE IRINGA AND DODOMA AREAS IN TANZANIA

REPORT III

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Sustainable Agrifood Systems Strategies

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Acronyms

ASA	Agricultural Seed Agency
ASDP	Agricultural Sector Development Programme
CAADP	Comprehensive Africa Agriculture Development Programme
CBO	Community-based organisation
CCAFS	Climate Change, Agriculture and Food Security
CCM	Chama Cha Mapinduzi
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Centre for Tropical Agriculture
CSA	Climate Smart Agriculture
ECDPM	European Centre for Development Policy Management
FGD	Focus Group Discussion
GDP	Gross domestic product
ICT	Information Communication Technology
IGA	Income Generating Activity
IITA	International Institute of Tropical Agriculture
LGAs	Local Government Authorities
MGF	Matching Grant Fund
MIUR	Ministry of Education, Universities and Research

MTII	Ministry of Trade, Industries and Investment
MP	Members of Parliament
MVIWATA	The national network of farmers' groups
MWEKA	College of African Wildlife Management
NGO	Non-governmental Organisation
NMB	National Microfinance Bank
NMNAP	National Multisectoral Nutrition Action Plan
NUS	Neglected and Underutilised Species
PANITA	Partnership for Nutrition in Tanzania
PG-NFSCR	Parliamentary Group on Nutrition Food Security and Children's Rights
PO-RALG	President's Office of Regional Administration and Local Authorities
QDS	Quality-Declared Seeds
SACCOs	Savings and Credit Cooperatives
SAGCOT	Southern Agricultural Growth Corridor of Tanzania
SASS	Sustainable Agrifood Systems Strategies
SIDO	Small Industries Development Organisation
SILL	Sustainable Intensification Innovation Lab
SME	Small and Medium Enterprise
SUA	Sokoine University of Agriculture
SUGECO	Sokoine University Graduates Entrepreneurs Cooperative
SUN	Scaling Up Nutrition
TADB	Tanzania Agricultural Development Bank
TAFSIP	Tanzania Agriculture and Food Security Investment Plan
TAGRODE	Tanzania Grass Roots Oriented Development
TAHA	Tanzania Horticulture Association
TAHEA	Tanzania Home Economics Association
TARI	Tanzania Agricultural Research Institute
TASTA	Tanzania Seed Traders Association
TBS	Tanzania Bureau of Standards
TCCIA	Tanzania Chamber of Commerce, Industry and Agriculture
TFDA	Tanzania Food and Drugs Authority
TFNC	Tanzania Food and Nutrition Centre
TOSCI	Tanzania Official Seed Certification Institute
TPRI	Tropical Pesticides Research Institute
UNICATT	Catholic University of the Sacred Heart
UNICEF	United Nations Children's Fund
UNIMIB	University of Milano-Bicocca
UNISG	University of Gastronomic Sciences
UNIPV	University of Pavia
USAID	United States Agency for International Development
VBA	Village Based Agricultural Advisors
WASH	Water, Sanitation and Hygiene
WEF	World Economic Forum
WFP	World Food Programme

Executive Summary

This report analyses the economic, social and environmental sustainability of the food system in the areas around Iringa and Dodoma, in southern and central Tanzania, and studies the potential role of diversification and indigenous vegetables to advance its sustainability. It is the third output of the Sustainable Agrifood Systems Strategies (SASS) programme, a multidisciplinary consortium initiative that, between 2017 and 2020, conducted research and dialogue activities in Tanzania and Kenya.

This document was written by a team of anthropologists, economists and political scientists from different universities and knowledge centres in the Netherlands, Italy and Tanzania. **The first chapter introduces the SASS approach to sustainable food systems.** A 'food systems approach' is a way of thinking and acting that considers the whole food system. This includes the biophysical characteristics, activities and actors that characterise the food system, the way these interact and the outcomes of those interactions. We argue that **using a food systems approach can help practitioners and policymakers better understand the complex and interrelated drivers of food system sustainability and identify trade-offs between different policy objectives**. By providing a 'big picture' view, a food systems approach can thus inform more coherent, effective, and context-appropriate policies and interventions to support sustainability transitions. Recognising that food system transformation is inherently political, our approach combines an analysis of the food system under study and its unique sustainability challenges with an analysis of the system's **political economy dynamics** that investigates the power, interests and incentives different actors face in shifting or maintaining the status quo. This approach allows us to develop politically feasible 'transformation pathways', i.e., coherent mixes of policies and actions for improved food system sustainability.

In this report, we focus on the role of diversified agroecological systems and indigenous vegetables to advance food system's sustainability. Against the backdrop of the rapidly decreasing diversity in crop species and the homogenisation of diets worldwide, the diversification of agroecological systems – including through a better integration of highly nutritious and locally-adapted indigenous vegetables – can lead to more environmentally sustainable and food and nutrition secure food systems. However, the increased uptake of indigenous vegetables faces several challenges, including inefficiencies along the supply chain, negative perceptions as 'weeds' or 'food for the poor', and a general neglect from policy and research.

To contribute to a better understanding of the factors and actors currently supporting or hindering a shift towards more sustainable food systems and healthier diets in the Iringa region, **Chapter 2 maps the food system in Iringa and investigates its main policies and actors**. The research finds that the food system is central to Iringa's social, environmental, and economic sustainability, contributing to both positive and negative outcomes. Iringa is relatively well-endowed with water resources, rich in agrobiodiversity and displays a favourable climate. The majority of the population is rural and earns its livelihood from agriculture and informal trading activities. Smallholder and mid-scale farmers produce an array of food and cash crops and raise livestock for household consumption, selling their surpluses on the local and national markets. The food industry, located around the region's capital, Iringa town, is mostly small-scale but contributes to local employment. However, the region faces high levels of malnutrition, which are linked to low dietary diversity and gender biases. At the same time, unsustainable agricultural practices and pressure on land use contribute to the decline in soil fertility, while climate change is increasingly affecting small-scale producers.

The research shows that the policies governing the Iringa food system are often fragmented and sometimes incoherent. Some progress has been made towards adopting a more integrated approach to nutrition, which takes into account many different sectors and actors, but implementation remains weak. Moreover, the Iringa region was targeted by an ambitious public-private partnership to promote rapid and sustainable agricultural growth. But

investment plans have largely remained on paper, and those that have been realised have often favoured large-scale investments, marginalising smallholders and exacerbating land use conflicts. At the same time, the agricultural sector remains underfunded and prevailing policies are biased towards staples support, rarely promoting food system diversification.

Our analysis has led to the identification of three pathways that can improve Iringa's sustainability. First, **strengthening extension services**, building a stronger innovation system and expanding officers' knowledge on sustainable agricultural practices and nutritious crops, can enhance sustainable production and healthy diets. Secondly, **supporting the business of informal vegetable traders and food vendors**, for instance through targeted initiatives that strengthen income generating activities, can have trickle-down benefits for consumers and producers alike. Thirdly, **sustaining the demand for sustainable, safe and nutritious food**, for example by sensitising consumers on the nutritional value of indigenous foods and vegetables, could improve perceptions of these crops and contribute to healthier diets. For these pathways to be relevant, they should be further discussed, amended and validated with local stakeholders, and fed into existing projects and partnerships.

Chapter 3 deepens the analysis of the local food systems and leafy vegetable value chains through an anthropological study that puts local perspectives and practices at the centre. The research, carried out in an agro-pastoral area in the Dodoma region, investigates the economic, social and cultural aspects of *mboga*, a term that indicates a dressing of cooked green leafy vegetables that, together with *ugali* (a stiff, white porridge) accompanies the daily meals in rural households. The author finds that the use of dried leafy vegetables is part of a well-established and historical coping strategy of agro-pastoral populations of semi-arid areas characterised by recurrent droughts and frequent periods of food shortages. Increasingly, the commercialisation of fresh leafy vegetables is becoming popular and is characterised by a short-range trade network, with many exchanges taking place without established organisations of producers or traders. At the same time, ancient institutions of moral economy persist, giving sometimes life to hybrid exchanges between the monetary and trust forms. Unlike the sun-dried vegetables, fresh *mboga* are not available throughout the year, which means that the use of dried and fresh vegetables alternates or overlaps, depending on the season and market availability. Based on this analysis, the author suggests that, **while promoting a transition towards smallholder commercialisation, national and local food policies should not limit the extent of the moral economy and the knowledge of self-production and self-consumption of sun-dried *mboga* at the household and the village level**, acknowledging them as an important part of local resilience strategies.

These findings are complemented by an economic analysis of the leafy indigenous vegetables value chain in Iringa, presented in chapter 4. The authors find that, while Kilolo district is primarily known for tomato production, most small-scale farmers in this area also produce large quantities of indigenous vegetables. Due to the high perishability, these crops are mostly traded locally – as opposed to tomatoes and other exotic vegetables, which display longer trade routes – and are consumed daily by almost all social groups. Farmers enjoy access to irrigation systems or water streams and rely on local and commercial seeds to produce vegetables both for business and self-consumption, selling them mainly at farmgate. However, farmgate prices for these crops tend to be low due to the large post-harvest losses and seasonal oversupply. Processing is virtually non-existent in this area, besides some small-scale drying of vegetable leaves or powder, mostly done by migrants and migrants' descendants from arid areas of the country. As such, research and investment in simple processing or preservation technologies would increase products' shelf life. But existing horticultural businesses have displayed little interest for these crops so far, and focus mainly on exporting exotic vegetables. **Traders, and traders of leafy vegetables in particular, are identified as a critical and potentially neglected link within the value chain. Improving their businesses**, recognising the strategic role they play in linking producers with markets and as vehicles of information**, is expected to improve the welfare of other actors in the food system such as farmers and consumers**. Market managers and traders' associations, as well as urban and rural district councils, could play a role in this. In addition, consumer perceptions

and traders' businesses could greatly benefit from better market facilities and areas dedicated to the wholesale of indigenous vegetables. Finally, farmers are reported to use costly and potentially harmful commercial inputs inefficiently and information on the advantages and disadvantages of different varieties (traditional versus improved) is confused and inconsistent. Extension offices and agro-dealers could better train and inform producers on the appropriate input mix and procedures for indigenous vegetables production.

Lastly, **chapter 5 explores the dynamics of the catering and hospitality sector in the Iringa region, considering its potential role in contributing to the rediscovery of traditional foods and recipes**. In doing so, it investigates the role and diversity of traditional products and dishes as well as the key drivers of their offer and demand by restaurateurs and consumers. The research shows that traditional ingredients and recipes play a central role in the restaurant sector in Iringa, being one of the main pillars of the food offer in all three main categories of restaurants surveyed – serving respectively mostly local, low-income customers; local, middle-income customers; and local high-income, tourists and international customers. The authors highlight that this trend is linked both to a **gastronomic preference** for traditional ingredients and dishes as well as to a **growing health consciousness** that identifies them as safer and healthier than processed or international products. Moreover, while a greater presence of traditional foods and dishes is found in the restaurants targeting mostly local customers, the interest for traditional products is growing also in those restaurants that serve a wealthier clientele, as it answers the curiosity of national and international tourists. This opens **a promising niche for those local products more strongly associated with the specificities of the region and its people**.

As for the diversity of ingredients and dishes, this is linked mostly with the economic possibilities of the restaurants and the purchasing power of their clientele. Ingredients are bought daily in local markets, where price and freshness of the products are key drivers of purchase decisions. This choice responds to the need to cope with logistical and technical barriers, such as the lack of adequate preservation systems for the most perishable products. However, this means that the restaurateurs are largely exposed to price fluctuations in the local food market. The analysis thus points out possible lines of intervention to support the sector and sustain the production and consumption of traditional foods. These include public and private support of technological developments in the sector and the establishment of more stable commercial relationships between the actors of the food value chain, including by exploring alternatives to conventional market channels. On the marketing side, implementing consumer campaigns aimed at **promoting the nutritional and culinary potential of traditional foods, as well as celebrating their history**, is also recommended.

1. Introduction and objectives

By Cecilia D'Alessandro, Paulina Bizzotto Molina and Koen Dekeyser (ECDPM)

1.1. Objectives and structure of the report

Food systems around the world are changing rapidly and are confronted with unprecedented, interlinked sustainability challenges requiring responses at the local, national, and international levels. As such, there is a growing consensus on the need for a transformation in the way food is produced, processed, distributed and consumed (Willett et al., 2019). Action is needed across a range of policy areas, including agriculture, trade, health and the environment, and at multiple levels, from local to global. However, the complex interactions shaping our food systems, and the feedback loops these create, mean that actions in one area risk creating or worsening problems in others. Moreover, local factors (such as consumption patterns, input use and poverty), as well as resources, capacities and political will to reform and implement necessary policies, can vary immensely between countries and regions, making the transformation of food systems highly context-specific. Therefore, **efforts to improve the sustainability of a food system need to be based on a thorough understanding of the different elements, sustainability challenges and power dynamics in a given food system, and how these interact.**[1] This requires generating new knowledge through interdisciplinary research delivering context-specific programmes and policies in partnership with – or owned by – local actors.

This report analyses the economic, social and environmental sustainability of the food system in the areas around Iringa and Dodoma, in southern and central Tanzania, and studies the potential role of indigenous vegetables to advance its sustainability. It is the third output of the Sustainable Agrifood Systems Strategies (SASS) programme (see Box 1) and the result of a collaborative effort of a multidisciplinary team that brought together researchers in anthropology, economics, and political science from different universities and knowledge centres in the Netherlands, Italy and Tanzania, each contributing one or more chapters.

Box 1: Sustainable Agrifood Systems Strategies (SASS)

The SASS programme is a multidisciplinary consortium initiative funded by the Italian Ministry of Education, University and Research and comprised of the European Centre for Development Policy Management (ECDPM), the University of Milano-Bicocca (UNIMIB), the Catholic University of the Sacred Heart (UNICATT), the University of Pavia (UNIPV) and the University of Gastronomic Sciences (UNISG). Between 2017 and 2020, research and dialogue activities were carried out in three locations – the Arusha Region in northern Tanzania, the areas around Iringa and Dodoma in southern and central Tanzania, and the southern Nakuru County in Kenya. The objective of SASS was to improve the economic, social and environmental sustainability of the food system under study, with a focus on the opportunities and challenges of better integrating indigenous vegetables. The research was undertaken in close consultation with local stakeholders, such as universities, public and private sector representatives, and civil society. More information at https://ecdpm.org/sass

The report is structured as follows. This first chapter 1 discusses the SASS approach to sustainable food systems by unpacking the food system concept and the methodologies employed for the mapping and the governance research carried out by ECDPM. It also briefly reviews the existing evidence on the role of diversification and indigenous

[1] See https://ecdpm.org/wp-content/uploads/ECDPM-Sustainable-Food-Systems-Approach-Flyer-2021.pdf.

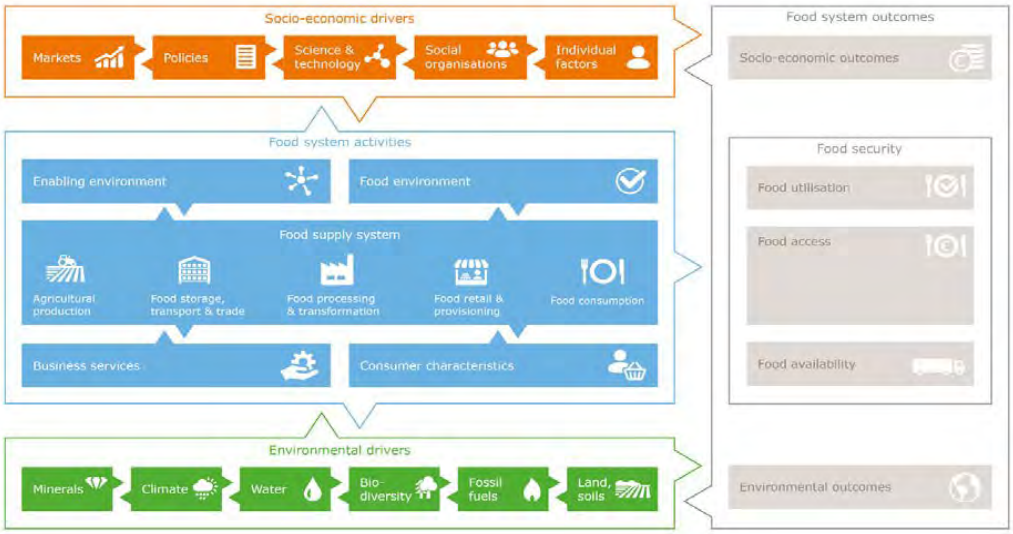
vegetables in promoting more sustainable food systems, and introduces the characteristics of the research area. Chapter 2 maps the Iringa's food system by studying its main activities, outcomes and drivers. It also provides an overview of the food system governance dynamics by studying the policies and actors that underpin Iringa's food system and charts pathways to improve Iringa's sustainability, with special attention to the role indigenous vegetables can play. Chapter 3 provides an anthropological study of the food systems and the leafy vegetable value chains in an agro-pastoral area in the Dodoma region. Then, an economic analysis of the value chain of leafy indigenous vegetables in Iringa is presented in chapter 4. This is complemented, in chapter 5, by a study on the drivers of the supply and demand of traditional products, with a specific focus on the dynamics of the catering and hospitality sector in the Iringa region. The last chapter 6 concludes this report.

1.2. Conceptual framework: the food systems approach

1.2.1. ECDPM's sustainable food systems approach[2]

A food systems approach is useful to analyse the complexity and interrelated drivers of food system sustainability. In essence, a 'food systems approach' is a way of thinking and acting that considers the whole food system, including the biophysical features, actors, activities and regulations that characterise the system, the way these 'elements' interact and the outcomes of these interactions. In this report, we build on the conceptualisation of food systems[3] developed by van Berkum (2018) and HLPE (2020). We look at both 'hard' (e.g., biophysical) and 'soft' (e.g., social, economic, and political) elements to study the relevant linkages, for instance, between the production of particular crops (hard) and social relations among middlemen (soft). In this framework, myriad **food system activities** generate several **food system outcomes**. All of these activities and outcomes are also influenced by interlinked socio-economic and environmental drivers (Figure 1). To these, we add 'demographic drivers', particularly population growth and urbanisation. We also broaden the 'policies' category to 'governance', as the latter better reflects the myriad informal and formal rules beyond the state that influence or affect food systems.

Figure 1: Food system framework



Source: van Berkum et al., 2018.

[2] Adapted from Dekeyser, K., Rampa, F., D'Alessandro, C., & Bizzotto Molina, P. (2020). *The food systems approach in practice: Our guide for sustainable transformation*. Maastricht: ECDPM.

[3] A food system is defined as '*[a]ll elements and activities that relate to production, processing, distribution, preparation, and consumption of food*' (Willett et al., 2019: 4). This includes the environment, people, inputs, processes, infrastructure, and institutions involved in taking food from farm to mouth (IFPRI, 2016).

At the core of food systems are the **food system activities**, which link food production and consumption through supply chains and are supported by an enabling environment and business services.[4] The food environment and consumer characteristics influence the retail and consumption side of the activities.[5] The **outcomes** are primarily food and nutrition security (including diets), socio-economic well-being (e.g., gender equality, livelihoods), and environmental quality (e.g., soil and water conditions). Each food system has a unique combination of drivers, activities, outcomes and governance arrangements (HLPE, 2017; van Berkum et al., 2018).

Using a food systems approach can help practitioners and policymakers identify and address trade-offs between different policy objectives, and capitalise on opportunities to accomplish multiple objectives simultaneously. By providing a 'big picture' view, a food systems approach can inform more coherent, effective, and context-appropriate policies and interventions and facilitate improved coordination and collaboration with food system stakeholders to support sustainability transitions (D'Alessandro et al., 2021).

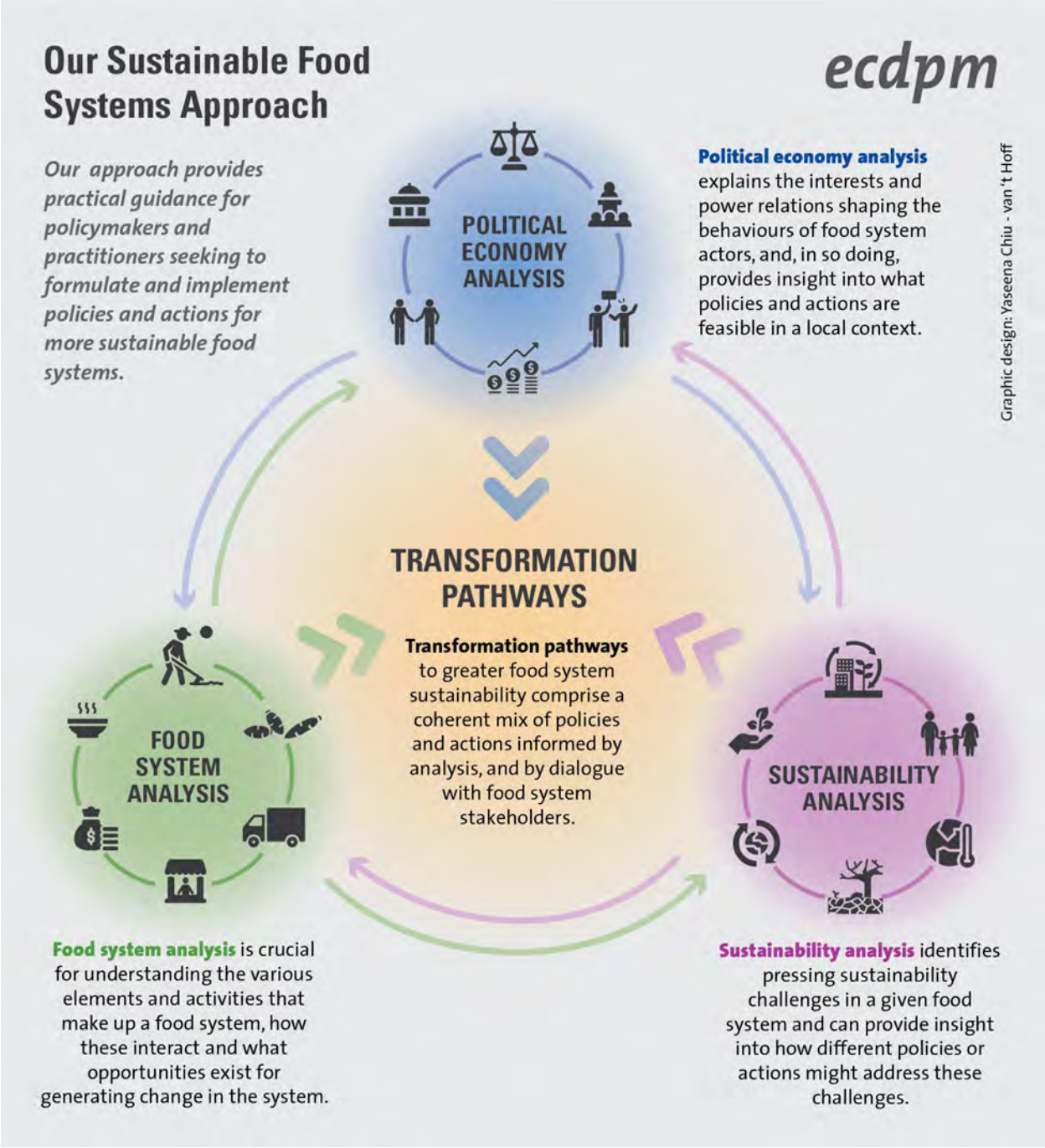
Food system transformation is inherently political, as powerful actors who benefit from the status quo will likely resist change. Thus, our food systems approach puts the spotlight on the analysis of power dynamics to understand what hinders or supports food systems transformation. It combines four components (or steps) as depicted in Figure 2: (i) a **food system analysis**, uncovering the key activities, drivers, and interactions in the food system under study; (ii) a **sustainability analysis**, exploring current and future sustainability challenges and dynamics; (iii) a **political economy analysis**, investigating the governance of the food system (the power, interests and incentives different actors have in shifting or maintaining the status quo); and (iv) the development of **transformation pathways** that present targeted and politically feasible options for increasing the sustainability of the food system or specific activities therein.[6]

[4] Such as regulations and research (van Berkum et al., 2018).

[5] A food environment "*refers to the physical, economic, political and socio-cultural context in which consumers engage with the food system to make their decisions about acquiring, preparing and consuming food*" (HLPE, 2017: 11).

[6] The feasibility of these pathways can improve if relevant stakeholders are engaged in pathway formulation and design.

Figure 2: ECDPM's sustainable food systems approach



The four components of this approach are all interlinked and are part of an iterative process. Every component informs and helps guide the others, without a strict chronology. Being intertwined, there may be overlaps between the components. Sustainability dimensions, for instance, might emerge from the general food system analysis, and the political economy insights may suggest diving deeper into a particular part of the food system. Transformation pathways can be refined by taking into account new insights emerging from the other components. Given the uncertainties involved in complex change processes, pathways also need to be adaptive to respond to unexpected changes in the food system.

1.2.2. Food system transformation through diversification: the role of indigenous vegetables[7]

The SASS project focused on the **diversification of agroecological systems as a potential transformation pathway** that can provide concurrent economic, environmental, and social benefits compared to more homogeneous systems (IPES-Food, 2016).

Against the backdrop of decreasing diversity in crop species worldwide and the increased reliance on a small set of crops, which contribute to the homogenisation of diets and pose a potential threat to food security (Khoury et al., 2014), the diversification pathway can be described as a strategy to improve diets that is '*based on widening the range of food produced by farmers and available to consumers, under the assumption that such widening can positively influence nutrition. It has both a qualitative component–for example, the number of crops grown and consumed in a particular location–and a quantitative one–for example, the balance of consumption across crops, with reference to total dietary intake and the nutritional compositions of foods*' (Dawson et al., 2018: 2).

Concretely, this entails the integration of **more crop diversity in farming systems**, for example through intercropping, crop rotation and the use of less uniform, locally-adapted varieties and breeds. Greater diversity in species can stimulate productivity, stability, ecosystem services, and resilience (Khoury et al., 2014). It can also positively impact nutrition by increasing home consumption of nutritious and diverse foods, as a source of income by selling surplus produce, and as a source of women's empowerment (Lang, 2010). However, higher yields do not automatically lead to higher incomes and food availability does not equate to food consumption. **Achieving advantages from diversification depends on local conditions and power relations.** For instance, to combat malnutrition, more gender equality is crucial to achieving beneficial nutritional outcomes (Ruben et al., 2018).

One way to diversify is to better integrate 'indigenous vegetables', which include both the vegetables native to Africa as well as those with a long history of cultivation and domestication to African conditions (Ambrose-Oji, 2009). An increasing body of literature provides evidence of the advantages offered by these crops. Indigenous vegetables are generally **highly nutritious and well-adapted to local conditions**, some are drought-resistant. They also have potentially lower natural resource requirements and a possible higher profit margin (Dawson et al., 2018; Padulosi & Rosado-May, 2019). They can be highly adaptable to agroecological niches and marginal lands, and resilient to climate change (Padulosi & Rosado-May, 2019). Leguminous indigenous vegetables enhance soil fertility through nitrogen fixture, which is especially beneficial to low input, rain-fed or dryland agriculture. As indigenous vegetables are mostly grown by small-scale farmers, promoting them can create important poverty-reducing effects (Rampa and Knaepen, 2019). In addition, as they are mostly grown by women (Padulosi & Rosado-May, 2019), increased market opportunities might result in more purchasing power for women, which is particularly beneficial for child nutrition (Kennedy and Peters, 1992). In sum, **promoting the production, distribution, processing, and consumption of indigenous vegetables can result in healthier diets and more sustainable food systems**.

However, indigenous vegetables are still often **neglected by policymakers** – who tend to focus on increasing staples production for food security – and several obstacles to their uptake exist, such as i) poor economic competitiveness compared to staple crops; ii) inefficiencies in producing, storing, and processing; iii) lack of nutritional information on different varieties; iv) disorganised or non-existing supply chains; and v) negative associations with poor rural lifestyle and low social status.[8] Their promotion thus requires a holistic approach to developing supportive structures, knowledge systems, cooperation and partnerships (Padulosi et al., 2019), as well as changes in policy and the policy environment which enable to promote less uniform and healthier diets and ecosystems (Mabhaudhi et al., 2018).

[7] Adapted from Bizzotto Molina et al. (2020).

[8] Furthermore, indigenous vegetables are often highly perishable, which is especially unfavourable in contexts where cold storages are absent (Baldermann et al., 2016). Other disadvantages include a lack of uniformity demanded by markets, limited seed availability, poor agronomic practices, low yields, laborious processing, lack of markets and information on consumer demands (Rampa and Knaepen, 2019; Padulosi & Rosado-May, 2019).

1.3. Introducing the Iringa and Dodoma food systems

The Iringa region is located in the **southern highlands of Tanzania**, bordering Singida and Dodoma in the north, Morogoro to the east, Mbeya to the west and Njombe towards the south. Occupying around 35,743 km^2, it comprises **three districts, namely Iringa, Kilolo and Mufindi**.[9] The region holds strategic importance in the country's economy, as it is one of the four major food-producing regions in the Tanzanian mainland. Two major national rivers (the Ruaha and the Rufiji) originate here, and the region is home to one of the largest national parks in Tanzania, the Ruaha National Park, which has an abundance of wildlife.

Iringa city is the region's capital. The town is located in the Udzungwa mountains, at an altitude of more than 2,700 metres above sea level (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019). It rises up to the hilltops above Little Ruaha River to the South and spreads along ridges and valleys to the north.

Picture 1: Aerial view of Iringa city

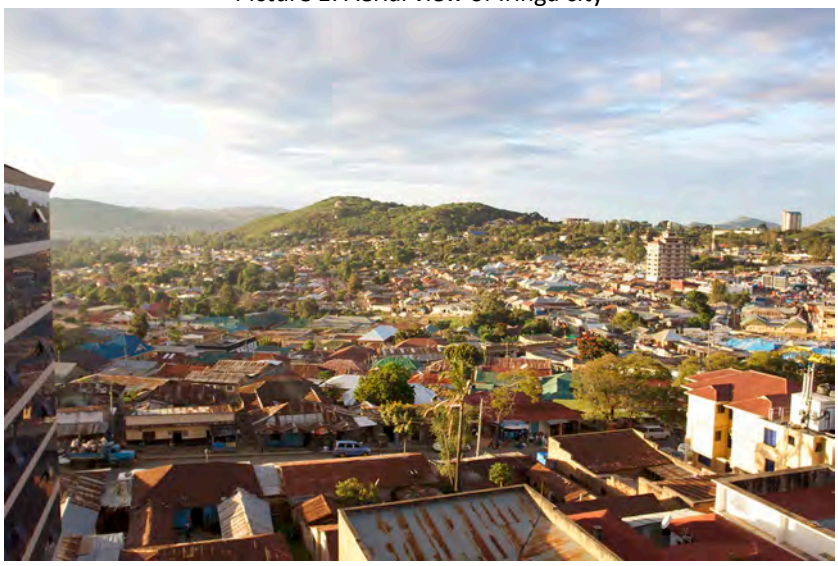


Photo credit: Cecilia D'Alessandro, ECDPM.

Iringa has a relatively well-established industrial base, including food processing and logistics. Most of its electricity comes from the nearby Mtera Dam. The town represents a minor **transport hub** for regular bus travellers as well as trucking services to major Tanzanian cities such as Dar es Salaam, Mbeya, Songea, and Dodoma.[10] It offers services for trucks travelling to neighbouring countries such as Zambia, the Democratic Republic of Congo, Malawi, and Burundi.

The Dodoma region,[11] bordering Iringa to the south, is primarily semi-arid and hosts the national capital of Tanzania, Dodoma, where the Parliament and the President's office (previously in Dar Es Salaam) were moved in 2019.

Figure 3 shows the location of Iringa and Dodoma as well as the area covered by the SASS project. For this report, four research teams conducted fieldwork between November 2017 and August 2020: the UNIMIB's Anthropology

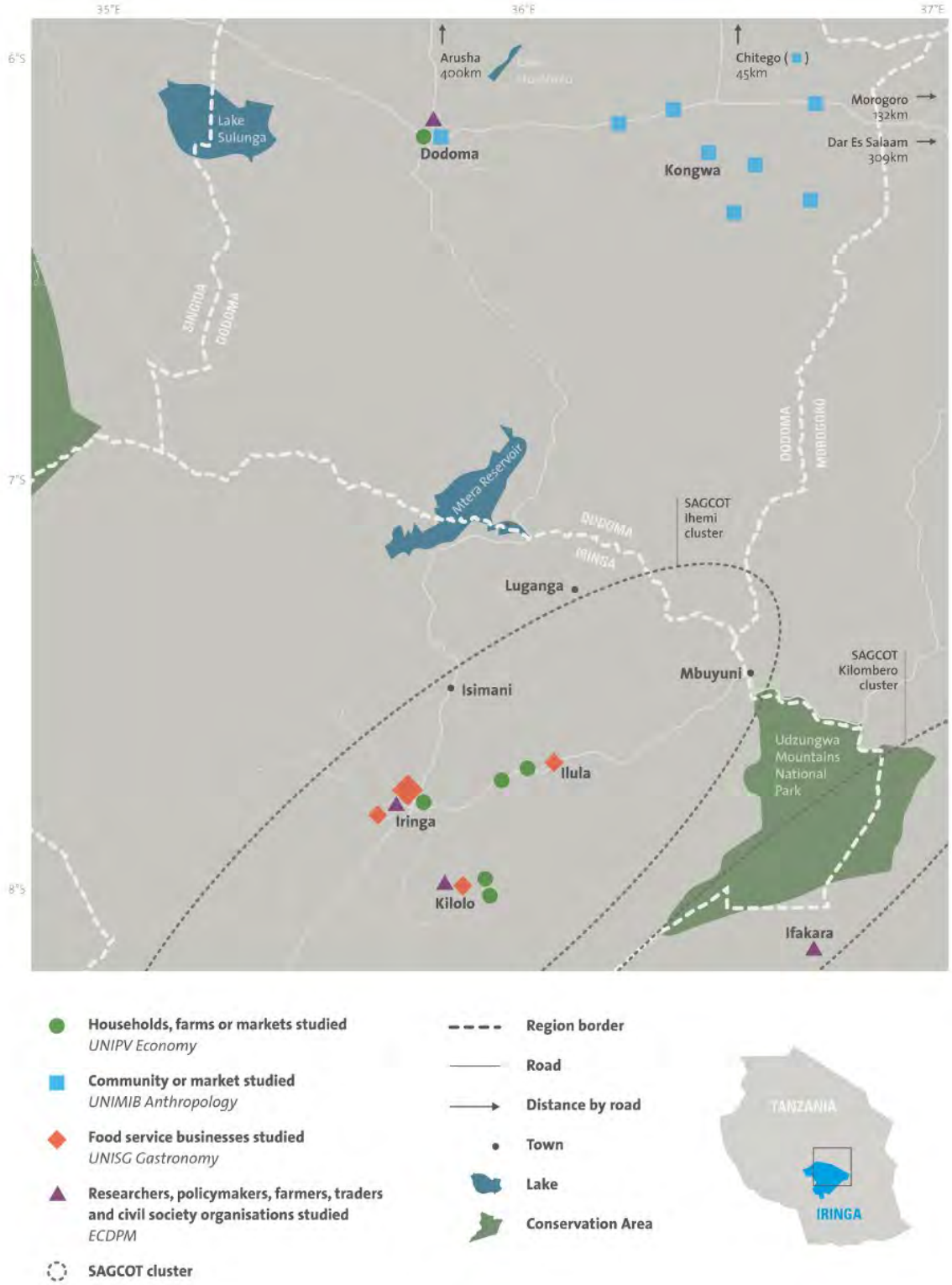
[9] Also, it comprises five Local Government Authorities which include: Iringa municipal council, Iringa rural district council, Kilolo district council, Mufindi district council and Mafinga town council.

[10] The Tanzam Highway passes through the valley below the town; the highway distance from Iringa's limits to Dar es Salaam is 502 kilometers (312 mi), via Morogoro.

[11] The region is administratively divided into seven districts: Bahi, Chamwino, Chemba, Dodoma Municipal, Kondoa, Kongwa, and Mpwapwa district.

unit studied food systems and the leafy vegetables value chain in an agro-pastoral area located in the Dodoma region; the UNIPV's Development Economics team investigated the indigenous vegetables value chain in Iringa and Kilolo, visiting farms and markets; the UNISG's Gastronomy team – with the support of the Sokoine University of Agriculture – sampled food businesses in Iringa region to study the dynamics of the catering and hospitality sector, paying particular attention to the offer and demand of traditional products; and ECDPM's researchers studied the drivers and constraints of Iringa's food system governance, with a special focus on indigenous vegetables, by carrying out in-depth interviews with researchers, farmers, traders and civil society organisations and discussing with local and national level policymakers in Iringa, Dodoma and Dar es Salaam.

Figure 3: Location of the research area, Iringa and Dodoma, Tanzania



2. The food systems approach in practice: mapping the Iringa food system and developing pathways for change

By Cecilia D'Alessandro[1], Paulina Bizzotto Molina[1], Wilson Charles Wilson[2], John Msuya[3] and Koen Dekeyser[1].

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This chapter summarises how we used ECDPM's food systems approach in Iringa to map the food system and develop transformation pathways that advance its sustainability. First, we map Iringa's food system by analysing its main activities, outcomes and drivers, and how these interact. In doing so, we identify pressing sustainability challenges in the system. We then provide an overview of the food system governance dynamics by studying the policies and actors that underpin Iringa's food system. Finally, building on the food system mapping, governance analysis and stakeholder's needs, we explore pathways to improve Iringa's sustainability, with special attention to the role indigenous vegetables can play.

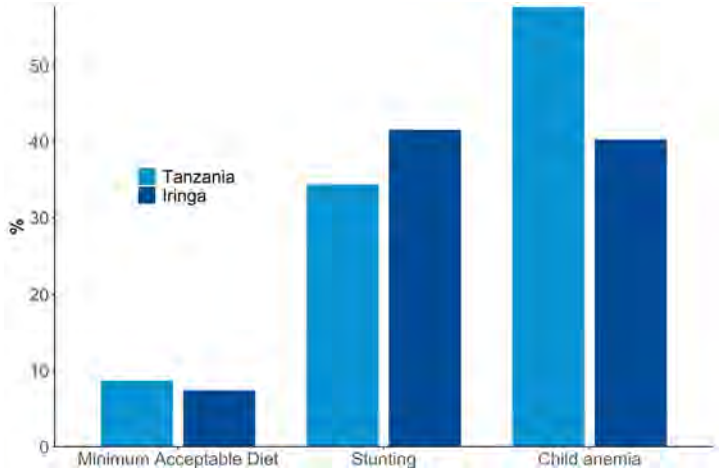
2.1. Food system characteristics and outcomes

2.1.1. Food security and nutrition

Malnutrition levels in Iringa and Kilolo district are high. 7% and 4% of children under five respectively were underweight in 2015 (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019). Stunting levels (low height for age) are higher than the national average (see Figure 1), mainly associated with limited dietary diversity among the disadvantaged urban and rural poor households (Wilson et al., 2021). Household production and consumption of vegetables, including indigenous ones, are important sources of micronutrients but they are often lacking in the monotonous local diets (Balama et al., 2015; Kinabo et al., 2006; Yang et al., 2013). **Despite being among the breadbasket regions important for food production in the country, dietary diversity in Iringa is surprisingly limited**. Diets display high consumption levels of maize and other carbohydrate-rich staples such as rice, millet, cassava, sweet and round potatoes, and low intakes of animal-sourced foods, fruits and vegetables (Wilson et al., 2021). The increase in cash crop production in the region has not translated into improved nutrition figures. This is most likely due to cultural factors and gender norms.[12]

[12] See section 2.2.2 for a more detailed analysis of the drivers of food and nutrition security.

Figure 1: Child anaemia (6-59 months), minimum acceptable diet (6-23 months), and stunting (6-59 months) in Tanzania and Iringa



Source: 2015-16 Demographic and Health Survey and Malaria Indicator Survey.
Visualisation by Koen Dekeyser for ECDPM (2021).

2.1.2. Environmental sustainability

Iringa and Kilolo districts display a favourable climate for agriculture, relatively cool compared to other regions in Tanzania and with several rivers and streams providing water resources. The highland areas have yellow and red clays that are well-drained, highly weathered and leached while the lowlands are characterised by red-brown loam soils that are moderately drained and highly fertile (Veldkamp, 2001). Temperature and rainfall differ between the high-altitude areas of Kilolo – characterised by higher annual rainfall and cooler temperatures – and the drier and hotter areas at lower altitude, with some areas suffering droughts whilst others are regularly affected by floods. In a normal year there are two seasons, the rainy season from November/December to April and the dry season from May to November. The rainy season is most important for crop production (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019). In the dry season, rivers can lack adequate water for irrigation (Mwongera et al., 2014).

The Iringa region is rich in biodiversity and agrobiodiversity, albeit both are under pressure from agricultural practices and other human activities. The Ruaha National Park occupies about half of the geographic area of Iringa district.

Picture 1: View of Ruaha National Park

Photo credit: Cecilia D'Alessandro, ECDPM.

Satellite images show a **decline in wetland and woodland areas** (Kassian et al., 2017). Forests in the highland areas of Kilolo are a source of timber for construction and firewood, the main source of energy for cooking and heating for both rich and poor households. **Top soil erosion and acidification of soils is causing a decline in soil fertility**. Due to the strategies households adopt to cope with adverse weather impacts – including the traditional irrigation farming system, *vinyungu* – river banks are suffering from erosion (Kassian et al., 2017).

2.1.3. Socio-economic sustainability

The economic base of the Iringa region is largely dependent on agriculture and livestock, trade and commerce, manufacturing, tourism and mining. Fishing in the Mtera Water Dam, located at the border of Iringa and Dodoma regions, is another important source of livelihood in the region. **The agricultural sector employs between 70 and 80% of the local population** and is by far the largest contributor to local GDP (81% for Kilolo district and 99% for Iringa district according to 2015 and 2016 Government Statistics cited in CIAT and CARE Tanzania, 2019 and Jalango et al., 2019). Maize is predominantly grown by smallholder and mid-scale farmers in Iringa region both as food and cash crop. Other food crops include Irish and sweet potatoes, legumes (i.e., common bean, soybean and chickpeas), sunflower, cassava, horticultural crops, timber and tea. The main livestock species kept in the region include dairy and beef cattle, pigs and small ruminants (goats and sheep) and chickens (traditional and improved breeds; SAGCOT, 2015; Wilson et al., 2021).

Picture 2: Rice harvesting in rural Iringa

Photo credit: Cecilia D'Alessandro, ECDPM.

Maize and beans are the dominant crops, and they are mainly grown for household consumption with surpluses sold on the market. In Kilolo, for example, maize accounts for 79% of the food production area grown as a sole crop and/or intercropped with sunflower, beans and other legumes (Vesterager et al., 2008). Tomatoes and onions are primarily grown as cash crops, often along the Ruaha River Basin, together with pyrethrum, a daisy-type flower widely used as pest control (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019). Beef and indigenous poultry are mostly kept under extensive production systems for home consumption of meat, milk, and/or eggs (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019).

Picture 3: Maize fields in rural Iringa

Photo credit: Paulina Bizzotto Molina, ECDPM.

In recent years, **soybean** production has gained ground in the region grown as a cash crop, promoted by a coalition of development partners and research institutes led by International Institute of Tropical Agriculture (IITA) and Wageningen University in the N2Africa project. (Martin et al., 2010; Murithi et al., 2014). Australian Aid has also promoted soybean farming amongst women in different villages in the Iringa district as part of their Growing is Learning project implemented by CARE.

Picture 4: Soybean-sunflower-maize intercrop in rural Iringa

Photo credit: Wilson Charles Wilson, PPS-WUR, May 2019

Amaranth (*mchicha*), **Ethiopian mustard** (*figiri*), **and African nightshade** (*mnavu*) **are among the most common indigenous vegetables produced in Iringa and Kilolo.** Other common vegetables include pumpkin leaves (*majani ya maboga*), Chinese cabbage and sweet potato leaves (*matembele*), but their classification as indigenous is more controversial. Producers of green leafy vegetables include largely women, who supply the urban markets either by directly delivering their production or through wholesale and retail traders.[13] However, according to agricultural officers in Iringa and Kilolo, some varieties of indigenous vegetables, especially the non-cultivated or wild ones, are already becoming extinct due to climate change and population pressure (clearing of bushes, interference of seed cycles).

Picture 5: Women gathering indigenous vegetables for the market in rural Iringa

Photo credit: Paulina Bizzotto Molina, ECDPM.

Livelihoods in Kilolo and Iringa district are characterised by **moderate levels of poverty**, measured by indicators such as quality of housing and access to improved water, roads, and electricity. **More than 90% of the population in Iringa and Kilolo Districts live in rural areas**, while more than 80% work in agricultural production. Women and youth play an important role in the main agricultural value chains (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019). In Iringa Municipal district, trade and commerce are the main contributors to GDP (38.6% in 2013). Part of this trade is informal and is thus captured in the size of the informal sector, estimated to contribute to 31.4% of the Municipal GDP (Iringa Municipal Council, 2016).

The industry in the Iringa region is mostly small-scale and largely located in the Iringa municipality. The food industry mainly consists of tomatoes and chili processing, milk processing, and grain milling. At Mafinga town in Mufindi District a factory processes tea for export and local markets. There is also timber and oil processing which comprise the bulk of industrial units found within the Iringa region (GoT, 2013). Iringa is also famous for its woven baskets made from local reeds.

Tourism is an increasingly important source of income for Iringa livelihoods, accounting for 17.2% of GDP in Iringa Municipality in 2013 (Iringa Municipal Council, 2016). Efforts to boost the visibility of the region, for example through the creation of the Southern Highland Tourism Circuit, are challenged by the poor state of infrastructure and low

[13] Based on the research conducted by the UNIPV Development economics department. More information can be found in chapter 4.

budgets to promote and support the sector. The COVID-19 pandemic has caused a loss of earnings from tourism in Africa of billions of dollars, Iringa being no exception. Expert organisations like the World Tourism Organisation, UNCTAD and UNDP estimate that it will take until 2023 to recover from the blow.

2.2. Structural factors and drivers that shape the food system

This section provides an overview of the main socio-economic and environmental drivers that affect Iringa's food system. Food systems drivers are defined as '*...processes and events that are known (or simply theoretically expected) to have an impact on food systems*' (Béné et al., 2019:150). Examples of major socio-economic drivers include urbanisation, economic and population growth, while key environmental drivers include climate change and soil degradation (Béné et al., 2019; van Berkum et al., 2018).

2.2.1. Environmental factors and drivers

Environmental conditions in the Iringa region are generally favourable to the production of crops and livestock. However, **climate change is increasingly affecting small-scale producers** in Iringa and Kilolo districts in different ways. More erratic rain patterns, incidences of frost in the higher areas of Kilolo and dry spells in the lower areas of Iringa and Kilolo have driven producers to apply varyingly successful coping strategies (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019; Kassian et al., 2017). Some of these strategies, such as increasing water usage for irrigation in combination with a decline of rainfall, has led to a decline of water on the fields. In addition, the heavy rains, in the context of mountainous areas and unpaved roads, make it difficult for producers and traders to reach input and output markets. At the same time, the insufficient coverage of the water drainage system in Iringa, in combination with the increasing number of flash rains, has made many areas in the city vulnerable to flooding (Iringa Municipal Council, 2016). This affects not only the (peri) urban production of food but also the conditions in which food is distributed and sold.

One of the main issues affecting the sustainability of agricultural production in the Iringa region is the **loss of soil fertility**. Soil quality has worsened due to various factors, including increased application of chemical fertilisers, pesticides and herbicides, and practices of tillage and burning residues. Soil acidity is worsened by heavy rains (CIAT and CARE Tanzania, 2019). Moreover, traditional practices on slopes are causing fertiliser and fertile soil to flush down.[14] Soil erosion is a serious challenge, especially in Kilolo. Decreased soil quality is causing people to shift from the uplands to the valleys where the fertile soils are found (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019).

The reliance on maize monocropping depletes the soil of nutrients and poses significant risks in coping with the effects of climate change. **Diversification in the farming systems is thus seen as a strategy to increase resilience against climate change** while contributing to improve household nutritional security (McCord et al., 2015; Timler et al., 2020). As such, the international and local research institutes and NGOs have invested in research and dissemination of best-bet technologies, including legume-cereal intercrop and/or rotations, and provide capacity building to extension practitioners and farmers in the region (Baijukya et al., 2019; SnP, 2015).

According to agricultural officers from Kilolo and Iringa district, soil quality and water harvesting can be enhanced through the adoption of **conservation agriculture** practices, which in turn leads to sustainable increases in production. At the same time, terracing and agroforestry, particularly growing fruit trees, on slopes has proved to reduce soil erosion. Minimum tillage, crop residue management and use of cover crops are other examples of practices that increase climate resilience.

[14] Based on interviews with officers from District Agricultural Departments in three Districts (Kilolo, Iringa Rural, and Iringa Municipal Council) in May 2019.

2.2.2. Socio-economic factors and drivers

Tanzania's economy has grown steadily for the past two decades, averaging an impressive 7% per year. But just as the rest of the world, its economy slowed down drastically in 2020 in the wake of the global COVID-19 pandemic. The real GDP growth rate fell from 5.8% in 2019 to an estimated 2.0% in 2020 and it is expected that the global economic slowdown will continue to affect export-oriented industries, tourism and foreign investment, thus slowing down Iringa's economy as well. World Bank surveys indicate that more than 2 million formal and informal jobs were lost, especially affecting informal non-farm small businesses in urban areas. The crisis will slow down poverty reduction and negatively impact food and nutrition security, whilst livelihoods from tourism will take longer to recover (World Bank Group, 2021).

Demographics

The Iringa region is sparsely populated, and its population is youthful and mostly rural.[15] Iringa town is a small but growing town, which counted around 150,000 inhabitants in 2012. Taking into account average annual growth rates, the population is estimated to reach around 350,000 inhabitants in 2035 (Iringa Municipal Council, 2016). Challenges related to demographics laid out in the Iringa Masterplan are the unpredictable and varying population growth rate and the uneven distribution of the population across the different wards. **These dynamics will likely lead to increased food demand and land pressure.** Kilolo and rural districts in the Iringa region facing harsh climatic conditions have witnessed significant **migration flows**, mostly men who move to urban areas looking for employment opportunities (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019).

Gender

Gender biases stemming from social and cultural values negatively affect the access of women to education, water, land and other productive resources. Control and decision-making over household assets such as the use, sale and purchase of land, livestock, or houses is mainly in the hands of men. Early marriages, marked gender restrictions and violence, narrowly defined household roles, and low valuation of female education are a hindrance to more equal sustainable development (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019). Without addressing gender-related factors, it will be difficult to address food and nutrition security challenges as well as increase the adoption of more sustainable agricultural practices.

Infrastructure

The road network in the Iringa region is relatively poor, with only a small proportion tarmacked. The poor road network limits the transportation of goods, people, and services, particularly during the rainy season (CIAT and CARE Tanzania, 2019 and Jalango et al., 2019). Connection to a central electricity grid is limited to the urban areas (Iringa Municipal Council, 2016). The use and accessibility of information communication technology (ICT) is low, especially in rural areas. This hinders the potential of mobile services, such as mobile banking and mobile extension services including market facilitation such as buying and selling of goods. Nevertheless, the use and accessibility of ICT is increasing rapidly in the region. Recent studies show that the use of mobile phones contribute to increased access to timely information to support farmer's decision-making, improved access to input and output markets and ultimately contribute to improved profits, decreased costs and time investment in farming (Kapinga et al., 2019; Quandt et al., 2020).

[15] The Hehe people are the largest ethnic group living in the region. Other major populations are those of Bena and Kinga groups. Pangwa, Chaga, Nyakyusa and Ngoni can be found in urban areas primarily engaged in business. Maasai, Barbaig and migrant Sukuma are mostly engaged in animal herding.

Picture 6: Tarmacked road in Iringa

Photo credit: Cecilia D'Alessandro, ECDPM

Extension services and research

Extension services and research in most cases lack the reach and depth necessary to address the complex challenges faced by producers, traders and other (small-scale) food system actors. Interventions often neglect the interlinkages between different parts of the food system. Local government authorities (LGAs) are the main provider of public services such as extension, education and health services. Public investment in extension services is limited though, and the gap between policies and implementation is large (CIAT and CARE Tanzania, 2019; Jalango et al., 2019). Over the past decade, the international and local development partners have invested in training Village Based Agricultural Advisors (VBAs) and Training of Trainers and contribute to reducing the shortages of public extension officers in Iringa (Baijukya et al., 2019).

Food insecurity and malnutrition drivers

To explain the persistently high levels of food insecurity and malnutrition in the Iringa region – a relatively well-endowed region in terms of agro-climatic conditions – **key stakeholders highlight the low levels of food knowledge.** Because of a lack of basic nutrition education, including a basic misunderstanding of nutritional needs versus hunger, households do not make optimal use of the nutritious foods that are available.[16] Besides the lack of knowledge, Beaudrault (2019) identifies other major barriers to individual and household consumption of fruits and vegetables, such as generational misinformation on cooking practices (e.g., a tendency to cook vegetables too long to 'cleanse' them of pesticides and/or counteract the bitter taste, which reduces nutritional values) and taboos concerning the effects of certain vegetables on male reproductive health. The influence of **gender imbalances** on household nutrition is also highlighted, with women and children having less access to foods like animal-sourced proteins. In addition, high prices and seasonal price fluctuations reduce affordability for poor households.

There is, however, a **growing attention for nutrition and health benefits related to healthy food**, including fruits and vegetables and indigenous foods. For instance, local agricultural officers find that people are increasingly considering indigenous vegetables as an important treatment for non-communicable diseases like diabetes but also

[16] Based on interviews with government officials and NGOs such as TAHEA Iringa, Partnership for Nutrition in Tanzania (PANITA) and Doctors with Africa (CUAMM), Iringa, May 2019.

for general well-being and to cure maladies. **Raising women's awareness of indigenous vegetables is thus seen as a strategy to affordably and sustainably improve dietary diversity** (Conti et al., 2019).

A lack of diversification of the farming system and maize monocropping have been a risk to income and nutritional security of smallholder farmers relying on maize as both food and cash crop. This was particularly evident during the export ban in 2016/17, when maize prices dropped substantially, hurting primarily small-scale producers (Diao and Kennedy, 2016; Porteous, 2017; Wilson et al., 2021). Poor water, sanitation and hygiene (WASH) conditions are also known to contribute significantly to high rates of malnutrition in Iringa, particularly stunting (URT, 2018). Finally, COVID-19 is known to have disproportionately affected the most vulnerable households, and this will most likely be the case for Iringa and Kilolo as well.

2.3. Food system institutions and actors

Food systems governance,[17] which results from the interactions of different policies, strategies, actors' agendas and capacities within the food system, forms an integral part in its functioning (Delaney et al., 2018). In this section, we thus turn to the analysis of the governance dynamics, by studying the policies and actors that underpin Iringa's food system. First, we analyse the most relevant national policies, laws and interventions relevant to the agri-food sector. Then, we look at the key actors in the food system, their interests and incentives, as well as the informal 'rules of the game' (unwritten norms, customs, beliefs) affecting the way formal policies are implemented and, ultimately, their effectiveness in attaining set policy objectives. Where relevant, we provide insights on the current policy environment for diversification and indigenous vegetables promotion.

2.3.1. National policies, laws and interventions relevant to the agri-food sector

The Iringa food system is influenced by a vast array of policies, regulations and institutional frameworks spanning across different sectors and government levels. In what follows, we provide a brief overview of the most important formal policies and institutions focusing on the nutrition, agriculture, environmental and climate domains.[18]

Nutrition has been high on the government's agenda for decades, which helped develop an enabling environment for nutrition action through substantial policy and institutional innovation. In 2011, Tanzania has joined the Scaling Up Nutrition (SUN) Movement and has taken a multi-sectoral and multi-actor approach to nutrition,[19] which has been further strengthened in 2016 with the elaboration of the National Multisectoral Nutrition Action Plan (NMNAP 2016-2021, URT 2016b).[20] The plan is supported by strong political leadership of the Finance and Health Ministers and has generated considerable funding, including support from several development partners (Beaudreault, 2019). There is a High-Level Steering Committee for Nutrition, convened in the Prime Minister's Office, which involves multiple ministries (each with its own nutrition focal point) and stakeholders. However, implementation of the plan – which relies upon Multisectoral Nutrition Committees at the village, ward, district and regional level – faces several challenges. The Mid-Term Evaluation of the NMNAP 2016–2021 has identified such challenges which include

[17] By governance of food systems, we refer to the ability of actors to steer the system to achieve selected outcomes (e.g., food security, resilience, adaptation), or to bring about transformation. It thus involves not only the actors and activities of the food system itself but also those of related domains such as land use, conservation, energy and water resource management, poverty, and human development (Ericksen et al. 2009; FAO 2012; von Braun 2009; Wahlqvist et al. 2012, in Delaney et al., 2018).

[18] A more complete analysis of the Tanzanian policy landscape is available in Bizzotto Molina et al. (2020).

[19] Policy frameworks included the Tanzania Agriculture and Food Security Investment Plan (TAFSIP 2011/12-2020/21) and the National Nutrition Strategy (2011/12-2015/16).

[20] Key objectives of the plan include, among others: promoting the consumption of bio-fortified and high-nutrient value food; conducting social and behaviour change communication to increase production and consumption of a diverse range of nutritious food; and training of agricultural officers on production of nutritious food crops crops – especially micronutrient rich vegetables and fruits, and biofortified crop varieties.

insufficient capacities of the committees, ineffective stakeholder coordination, and the lack of a mechanism to effectively track nutrition interventions at the local level (URT, 2019). Despite being supported by several development agencies, efforts to alleviate malnutrition have only produced limited results. Thus, stronger domestic investments, strengthened coordination and greater political accountability on the government's nutrition commitments are needed (te Lintelo et al., 2020). Indigenous vegetables, which are currently omitted from nutrition policies, could be better promoted and supported as important contributors to a diverse and healthy diet – something that phase two of the NMNAP is expected to consider.

Agricultural and rural policies in Tanzania have been inconsistent and sometimes contradicting, both in objectives as well as in implementation (Poulton, 2018; Eriksen, 2018). Policymaking in this area has revolved around a tension between different visions: one that prioritises government investment in small-scale producers (reflected in the Agricultural Sector Development Programme, ASDP[21]); the other oriented towards attracting large-scale investments in commercial agriculture (exemplified by a host of initiatives such as *Kilimo Kwanza* (Agriculture First, 2009), the Southern Agricultural Growth Corridor of Tanzania (SAGCOT, 2010) and Big Results Now, 2013[22]). Agriculture has been earmarked as one of the key sectors for economic transformation in the Tanzania Development Vision 2025 (1995) and the country is a signatory of the Comprehensive Africa Agriculture Development Programme (CAADP) Compact,[23] having developed a national agricultural investment plan (the Tanzania Agriculture and Food Security Investment Plan, TAFSIP) in 2011. However, **the rhetoric of prioritising agriculture for economic transformation has not been matched by strong public investment in the sector**, which remains well below the CAADP target of 10%. Moreover, due to entrenched relationships between businesses and political elites, rural policies have scarcely benefitted poor rural communities (Cooksey, 2012).

At the same time, the narrative on private sector investment has not been matched by improvements in the business environment, which is perceived as unpredictable and unfavourable by both foreign and domestic investors and entrepreneurs (Booth, 2014; Netherlands Enterprise Agency, 2018). The implementation of the various initiatives put in place in the 2000s has been challenged by a heavy state presence, a continued hostility towards the private sector (particularly foreign investors), cumbersome bureaucracy, rent-seeking, and the lobbying of influential importers of agricultural commodities opposed to import substitution (Africa Confidential, 2019). Nonetheless, with the ascension of Magufuli's successor, Samia Suluhu Hassan, in March 2021 there are signs that the atmosphere of hostility towards foreign investors and entrepreneurs is turning (Collord and Jacob, 2021; Shipani, 2021).

Box 1: The Southern Agricultural Growth Corridor of Tanzania (SAGCOT)

In this regard, it is important to note that **the Iringa region falls in the fertile Southern Highlands**, which have been targeted by the government for rapid and sustainable agricultural growth through the **Southern Agricultural Growth Corridor of Tanzania (SAGCOT)**, one of such pro-private sector initiatives. The SAGCOT, launched at the World Economic Forum (WEF) in 2010 and promoted by former President Kikwete, was an ambitious public-private partnership designed to attract global agribusiness investors. Its investment blueprint envisioned putting 350,000 hectares under production, creating 420,000 jobs and potential farming revenues of 1.2 billion US dollars by 2030

[21] The ASDP II (2016) identified priority value chains in specific agroecological zones. Maize and few other cereals largely dominate the scene of priority chains, followed by seed crops and pulses (URT, 2016a).

[22] Big Results Now was launched in 2013 to accelerate policy implementation in a number of areas, including agriculture. It aimed to attract private sector investment in medium- and large-scale agriculture, notably for maize, rice and sugarcane.

[23] CAADP is the policy framework for agricultural development of the African Union (AU) aiming to achieve agricultural transformation, food and nutrition security, and economic growth (AU and NEPAD 2003). It implies ambitious targets such as 6% annual growth in agricultural GDP and an allocation of at least 10% of public expenditures to the sector.

(Africa Confidential, 2019). The coordination of the initiative is overseen by the SAGCOT Centre,[24] who acts as a broker and catalyst of partnerships '*mediating between investors, farmers and the government*' to incubate initiatives around '*inclusive, sustainable and viable agricultural value chains*' (SAGCOT, 2011).[25] However, **despite the rhetoric of the initiative, its plans largely remain on paper** (Sulle et al., 2017) **and SAGCOT has failed to attract the level of investment envisaged** (Wegerif and Ward, 2020).

The initiative was initially conceived as a venture capital fund that aimed at financing the early growth and expansion stages of high-risk small and medium enterprises (SMEs) that had outgrower or contract farming arrangements in place. But the involvement of the World Bank has '*turned the investment component into a 'matching grant' scheme in which investors would be reimbursed for their capital outlays'*. Nonetheless, particularly under the rule of President Magufuli, SAGCOT has suffered from an institutional reluctance to work with the private sector – as exemplified by the cancellation of a 47 million US dollars Matching Grant Fund (MGF) facility in 2019 – as well as the influence of special interests (Africa Confidential, 2019). In addition, the involvement of a number of development partners, such as USAID and UK Aid, who supported the initiative, has increased complexity and bureaucracy while reducing the ownership of the initiative by Tanzanian counterparts.

Despite SAGCOT not meeting all its targets, some of the plans have been realised, including 108 large land-based investments taking place in the past 10 years (Wegerif & Ward, 2020). Recent studies on the impact of some of these investments found that, even though outgrower schemes promoted under the initiative – particularly in sugarcane and rice – have in some cases helped create jobs and incomes, **they have often favoured large-scale outgrowers while marginalising smallholder producers and exacerbating land use conflicts** (Sulle et al., 2017; Bergius et al., 2020; Wegerif & Ward, 2020).[26] **SAGCOT has thus been subject to harsh criticism from international and local NGOs**, who '*accused foreign investors of 'land grabbing' and displacing smallholders'*, due to the heavy involvement of a number of global corporate agribusinesses, particularly agricultural input producers such as Monsanto and Yara International (Africa Confidential, 2019). These actors represent more than a quarter of the partnerships SAGCOT put in place, suggesting that the area is seen by many as an outlet market rather than a production area. There are strong signs that the **SAGCOT actively advocates and lobbies for the vested interests of input companies**[27] and that SAGCOT partners often collaborate with government offices to set up demonstration plots and hold field days to promote their inputs among local farmers.[28] As a result, many of the planned crops in the corridor rely heavily on the use of pesticides, while their possible adverse effects on environmental and human health have insufficiently been addressed (Lahr et al., 2016).

[24] There are two separate institutions: one is the SAGCOT Catalytic Trust Fund, which injects funds for the activities; the other is the SAGCOT Centre, which is in charge of coordination. SAGCOT partners are in the lead for the implementation of activities.

[25] Key partnership principles included compliance with social and environmental standards such as ensuring engagement of smallholder farmers and environmental sustainability of the investments.

[26] The SAGCOT and its partners have also called for policy changes favouring the establishment of large agribusinesses, such as '*streamlining arrangements for granting secure land rights to investors*' and '*enabling communities to use their land as equity in joint ventures with investors*' (which opens the risk of losing the land; SAGCOT, 2011: 45, in Wegerif & Ward, 2020).

[27] For example, a document by the SAGCOT partnership (Lugangira, 2017) reported, among 'Policy Asks by the Private Sector in Tanzania's Agriculture Sector' in 2011 the 'Revised legislation that aligns plant breeders' rights with the International Union for the Protection of New Varieties of Plant Systems (UPOV)'. It also reports as a success achieved by the partnership that "in November 2015, Tanzania was officially accepted as a member to UPOV Convention", referring to the 1990 convention, which is strongly biased against farmers' seed systems.

[28] Interviews by the UNIPV Development Economics and ECDPM teams with officers from District Agricultural Departments in three Districts (Kilolo, Iringa Rural, and Iringa Municipal Council) in May 2019. Among the partners mentioned we find Yara International, Monsanto, East African Seeds, and Syngenta.

Agriculture and rural development policies do not explicitly promote food systems diversification and, in some cases, are working against it. This situation partly results from the fact that, in the past, most government efforts to address food security have focused on increasing staples production, particularly cereals, as key energy providers. Such policies neglected the importance of appropriate nutrition and balanced diets (Afari-Sefa et al., 2016). As a result, the potential of indigenous vegetables is not fully recognised. The bias towards cereal staples support is only slowly changing, partly as a result of the integrated multi- sectoral approach to nutrition. But given many competing policy priorities, putting the attainment of diverse and nutritious diets high on the local agenda is challenging. The next 5-year second phase of the NMNAP is expected to strongly consider social behaviour change as an aspect for improving nutrition, something that was not given a due weight in the ending phase one.

More generally, **policies and strategies related to agri-inputs in Tanzania are biased towards chemical input-based production systems and influenced by strong corporate interests**, while biological inputs are less supported and the role of ecosystem services and biodiversity is largely neglected. Seed laws are mostly geared towards the formal sector, while farmer-managed seed systems are largely unrecognised and Quality-Declared Seeds (QDS) systems limited. **Food safety standards and regulations suffer from a lack of regulatory enforcement**, scattered division of responsibilities, and inadequate coordination mechanisms for implementation, especially regarding the use of pesticides (Rajabu et al, 2017, Mrema et al. 2017).

Several climate action policies in Tanzania have been put in place (such as the National Climate Change Strategy, 2012, the Tanzania Agriculture Climate Resilience Plan 2014-2019, the National Climate Smart Agriculture (CSA) Policy, 2015) but they often failed to take into account differentiated local contexts and to trickle down to the village and ward level due to budget and monitoring problems. Also, matching adaptation and mitigation requirements remains a challenge.[29] **At the same time, environmental laws and by-laws, for example around water protection, are weakly enforced** (Kassian et al 2017).

Finally, **the decentralisation process**, which has mandated local governments for the implementation of nutrition, agricultural, environmental and climate policies, **offers opportunities for synergies at the landscape level to change current food system outcomes**. Nonetheless, this potential for increased policy integration – for instance, harmonising activities among agricultural, nutrition and health officers at the village level – and improved collaboration between local governments, development partners and research institutes has not yet materialised. A lack of sufficient financial and organisational resources hinders effective policy integration. However, conflicting political interests and incentives also affect local politicians' decisions to push or resist certain reforms. Stricter food safety inspections for example, can be underplayed if local politicians think this will harm the support they get from farmer communities (Bizzotto Molina et al., 2020).

In the context of the decentralisation process, the Municipal Council of Iringa has put in place a **Master Plan for the period 2015-2035** as a planning tool aimed at guiding and controlling land use development in the area with the stated objective to 'aspire a better and sustainable living standard for its residents' (Iringa Municipal Council, 2016). The plan provides a comprehensive analysis of the municipality's demography, resource base, economic outlook and current land use and sets out a vision for Iringa to become a centre for higher learning, industry and tourism in Tanzania. While the plan acknowledges the vital importance of agriculture and livestock keeping for Iringa's population and includes the promotion of sustainable urban farming as one of its specific objectives, it lacks a holistic approach to improving nutrition and food safety.

[29] Based on interviews with Ministry officials and other Tanzanian experts (2017; 2019).

2.3.2. Food system actors

This section overviews the main actors in the Iringa food system who, through their practices and relationships, influence the way food is produced, processed and marketed, ultimately determining the food system's socio-economic and environmental outcomes. These actors include farmers, agribusinesses and traders, but also financial institutions, regulating bodies and research institutes, civil society organisations and consumers. Here we focus particularly on the horticulture sector, with references to the indigenous vegetables value chain.[30]

The Tanzanian horticultural sector is dominated by small-scale producers with plots smaller than 2 ha, particularly for what concerns vegetable production. These farmers are loosely organised in self-help groups, cooperatives or marketing associations and mainly target the local market. Some of them produce as contract farmers or outgrowers to a few large-scale off takers such as the tomato processing company Darsh Industries Ltd and Dabaga factory in Kilolo. The national network of farmers' groups, **MVIWATA**, headquartered in Morogoro, is also active in Iringa. It advocates particularly for small-scale farmers and farmer groups, offers capacity building and training and works to foster small farmers' integration in the market.

An important player in the horticulture sector is the **Tanzania Horticulture Association (TAHA)**, a member-based private sector organisation that includes large-scale producers, input and equipment dealers as well as farmers and small processors. It focuses on capacity building and advocacy to improve the business enabling environment as well as market access, production and productivity of its members. In addition, a range of large and small-scale input providers, agro-dealers and seed companies – several partnering with the SAGCOT Centre – supply horticultural producers with agrochemicals and seeds. While the SAGCOT Centre itself is based in Dar Es Salaam, the **coordination unit of the Ihemi cluster** – which includes the Iringa region as a whole and the Njombe region (with the exception of Ludewa district) – is found in Iringa and focuses on a number of priority value chains, namely dairy, tea, Irish potato, soy and tomato (see Box 2 below for an overview of the Cluster's activities and partners).

Box 2: Priority value chains and key partners in the Ihemi Cluster of the SAGCOT[31]

- **Dairy**: located in Iringa and Njombe, the SAGCOT Centre has two main partners: the ASAS group and the smaller Kiwanda cha Maziwa (established through a project in Njombe promoted by CEFA Onlus, an Italian NGO). A key challenge for the development of the value chain is that the provision of milk to the ASAS factory is a second-best option for farmers, because they can sell at higher prices on local markets. The Njombe Cooperative, instead, involves some 900 farmers who produce less milk than the factory could process, but the cooperative is unwilling to accept new members.
- **Tea**: located in Mufindi, the SAGCOT Centre has two main partners: Unilever, which has three plants in Mufindi and plans to set up a new plant in Njombe, and the ITOA association of tea growers of Njombe. They aim to provide land for a UNILEVER plantation in Kifanya, to complement harvest from outgrowers, who are themselves medium-scale producers (minimum 2.5 acres of tea). Outgrowing schemes are challenging for this value chain, as tea leaves must be processed within eight hours from collection.
- **Irish potato**: located in Kilolo district, the SAGCOT Centre has as its main partner a seed producer, Mtanga. Here smallholder farmers are not seen as suppliers, but as buyers. Further development of the value chain is

[30] Chapter 4 provides more details on the actors involved in the indigenous vegetables value chain.

[31] This information was compiled by the UNIPV Development Economics department based on interviews and documentary review. More information on the dairy project by ASAS: https://asasgrouptz.com/dairy/; on the Njombe tea plantation: https://www.thewoodfoundation.org.uk/venture-philanthropy-in-africa/tanzania/njombe/; on Silverland's projects: http://www.silverstreetcapital.com/tanzanian-cropping and the Soya ni Pesa project: https://ndo.or.tz/soya-ni-pesa/. Additional information on the partnership with CDI, IITA and other local partners was provided by Wilson Charles Wilson.

envisaged downstream with processing of potatoes but production is not yet enough. Potatoes from the seeds offered by Mtanga, however, are not very much appreciated by consumers.

- **Soy**: located in Iringa and Njombe, the SAGCOT Centre is dedicated to poultry meals and partners with Silverland. The Njombe Christian Roman Diocese, with its project Soya ni Pesa, promoted soy production among farmers to address supply shortages for Silverland. However, there is now overproduction in Songea and Njombe and there were no formal contract farming devices to protect smallholder suppliers. In July 2021 the Tanzania Agricultural Development Bank (TADB) signed an MoU with the Clinton Development Initiative (CDI) and committed to set up a loan facility worth 500 US dollars targeting agricultural marketing cooperatives and village community banks to upscale soybean production (Keasy, 2021).
- **Tomato**: located in Iringa and Kilolo, the SAGCOT Centre partners with Darsh Industries, a company that produces consumer products such as ketchup and tomato paste. They carry the RedGold brand and are the biggest tomato processor in Tanzania. In 2015 they opened a processing facility in Iringa (they also have a plant in Arusha). SAGCOT facilitated the construction of collection centres by Darsh.

Indigenous vegetables value chains tend to be less structured and formalised compared to commercial horticulture, with farmers having almost no connections to processors and large-scale exporting companies. Conversely, linkages with input providers (particularly of agrochemicals) start to resemble those of exotic leafy vegetables (Bizzotto Molina et al., 2020). Many of the improved varieties of indigenous vegetables have been developed by the **World Vegetable Centre**, an international research centre with a strong research portfolio on indigenous vegetables that has its Eastern and Southern Africa base located in Arusha. Concerning seeds, other relevant institutions include the **Tanzania Official Seed Certification Institute** (TOSCI), a semi-autonomous government agency that, since 2003, tests and certifies seeds produced or imported by seed companies; the public **Agricultural Seed Agency** (ASA), created in 2006, that produces both basic seeds and seeds for the final market; and the **Tanzania Seed Traders Association** (TASTA), lobbying and advocating on behalf of seed providers.

Many NGOs and programmes work in Iringa on production and productivity improvement as well as value chain development and sustainable agriculture. For example, ***Mboga na Matunda*** ('Vegetables and Fruits') is the fruit and vegetable component of the USAID's global Feed the Future Initiative. The programme is implemented by Fintrac and works with several partners in different regions of Tanzania, mostly targeting small-scale producers and other actors in the value chain with capacity building on production, marketing and consumption. Activities are geared both towards commercialisation as well nutrition and health. Among other things, the programme supports the adoption of improved technologies in commercial crops such as tomatoes, cabbages, onions, Irish potatoes, watermelon, and sweet pepper.[32] **Lishe Endelevu** is another programme active in Iringa and funded by USAID, which focuses on intensifying and integrating nutrition interventions for women, children, and adolescents, while **NAFAKA** – also part of USAID's Feed the Future Initiative – focuses on cereal value chains. These programmes have strong nutritional and behaviour change components, but less so on regenerative agricultural practices. This explains the relative blind spot these programmes have for the role indigenous crops can play in improving nutritional and environmental outcomes of the Iringa food systems. Beaudreault (2019) finds that, despite having a multisectoral approach (microfinancing, agriculture, nutrition, education, and health), *Mboga na Matunda* and Lishe Endelevu could strengthen their integration with each other.

Local community-based organisations (CBOs) partnering with *Mboga na Matunda* include **TAHEA** and **TAGRODE**. TAHEA (Tanzania Home Economics Association) focuses on home economics, nutrition and agriculture with a strong

[32] Another component of the Feed the Future initiative, *Nafaka* (grain in Swahili), focuses on cereals, particularly rice and maize. There is also another USAID programme, Waridi (Water Resources Integration Development Initiative), which supports government offices in Iringa and Morogoro in the construction, expansion and rehabilitation of water supply schemes and in the design and improvements of water, sanitation and hygiene (WASH) facilities.

livelihood approach and a gender perspective. In Iringa, they work to prompt behaviour change on eating fruit and vegetables, as well as supporting farmers with improved agronomic practices. They also provide training on processing and preservation through demonstration plots and farmer field schools. TAGRODE (Tanzania Grassroots Oriented Development) targets poor and vulnerable groups in peri-urban and rural areas around Iringa and supports small-scale farmers to increase quantity and quality of crops and livestock products through adoption of sustainable agricultural practices and promoting adaptation and reduced vulnerability to climate change. They have partnered with **CARE** and other organisations to promote soybean farming in different villages in the Southern Highlands.

Rikolto, a Belgian non-governmental organisation (NGO) that has been working on vegetable and fruit projects in northern Tanzania (particularly around Arusha), has recently launched a four-year project (from 2020 to 2023), funded by the European Union, on horticulture business development in the Southern Highlands, targeting Iringa, Njombe, Mbeya, Songwe, and Katavi. The objective of the project is to strengthen farmers' organisations, link farmers with traders and buyers, and support the inclusion of women and youth in the vegetable and fruit sector. The project also raises awareness about food safety and the importance of healthy diets, promoting nutrition-sensitive agriculture through the creation of a network of community development officers and community leaders in targeted local government authorities.

Agronomists Without Borders, a Spanish NGO, is also active in Iringa, where they have three agricultural centres and two cooperatives providing training to farmers to improve their cultivation techniques. **Slow Food Tanzania** is an NGO focusing on the promotion of 'good, clean and fair food', with a particular focus on traditional products and the role they can play in the social and economic empowerment of local communities and in safeguarding agrobiodiversity and cultural heritage. It is part of an international network that works together with a broad array of stakeholders, such as chefs, policymakers, researchers and local farmer groups. Based in Arusha, it draws on its members across the country who volunteer as part of small local chapters (the Slow Food Convivia) in different regions in Tanzania, including Iringa and Dodoma. Beyond advocacy and education, the NGO promotes school gardens that improve nutrition education and promote agroecological production practices.

Among the public sector actors, district agricultural officers and extension services – part of the Ministry of Agriculture but falling under the different local governments – **have a key role in the production domain**. Extension services are often partners in the different projects and programmes targeting small-scale producers or aiming to improve production, productivity and food and nutrition security (Beaudrault, 2019). While the environmental unit of the Ministry of Agriculture officially oversees the enforcement of regulations on the safe handling of chemical inputs, in practice it is mostly agricultural extension officers and agro-vet dealers that provide information to farmers on the use of agrochemicals. The **Tropical Pesticides Research Institute** (TPRI) is part of the governmental Plant Health Services (PHS) and responsible for routine inspections of pesticide residue levels in food, and providing information on discarding chemicals. Agro-dealers in the Southern Highlands say they receive few if any visits from TPRI, despite expressing the need for more information on registered pesticides and pesticide management practices (Lahr et al., 2016).

In addition, several national and international research institutes and universities are active in Iringa and the Southern Highlands more broadly. **Sokoine University of Agriculture** (SUA) is the leading agricultural university in Tanzania, based in Morogoro. It has different departments teaching courses and conducting research in areas relevant to production (for example breeding), processing, nutrition, environmental issues and other relevant domains.[33] Nutrition officers at local governments throughout the country are often alumni of this university. The

[33] The SASS project worked together with the Food Technology, Nutrition & Consumer Sciences department of SUA.

Nelson Mandela African Institute of Science and Technology is one of the more prominent universities in the field of technologies, including food and nutrition.[34]

The **Tanzania Agricultural Research Institute** (TARI), a semi-autonomous government institution under the Ministry of Agriculture, is an umbrella organisation of different research institutes. It is responsible for conducting, regulating and coordinating agricultural research activities in Tanzania conducted by public and private research institutes or organisations in Tanzania. Formally, they also advise the government on the formulation of national policies, laws and regulatory frameworks for promoting and regulating agricultural research, and have a role in setting the national agricultural research agenda and priorities together with key stakeholders. TARI is made up of different agricultural research institutes (ARI), distributed over the country. It has 9 research centres and 8 sub-centres. Often, institutes have a focus on specific crops and provide research support to their designated zone. These are often cash crops such as coffee and cotton, but also staples such as rice and Irish potato. The Kilombero Agricultural Training and Research Institute (Katrin), based in Ifakara, for example, is one such institution focused on the rice value chain, as a key crop promoted by SAGCOT.

In addition to the World Vegetable Centre, previously mentioned, the **International Centre for Tropical Agriculture (CIAT) and other CGIAR centres** have done extensive research and implementation of research and agricultural development projects and programmes in Iringa. Because these centres work globally, they often facilitate the exchange between different countries and can draw from a vast wealth of expertise on cross-cutting issues such as gender, policy reform or innovation systems. Globally, CIAT leads the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). In Tanzania, they work together with different partners on climate-smart agriculture and smallholder resilience, such as the Sustainable Intensification Innovation Lab (SIIL), part of the USAID-funded Feed the Future program. CCAFS also works together with the Ministry of Agriculture on the nexus between climate change policies and national agriculture plans. Other CGIAR centres active in Tanzania are the International Institute of Tropical Agriculture (IITA) which is researching the soybean value chain, cassava, banana/plantain and other tropical legumes. The International Livestock Research Institute (ILRI) researches mixed crop-livestock systems and has integrated innovation platforms in their approach. Both centres are based in Dar es Salaam (Bizzotto Molina et al., 2020).

Financial service providers in Iringa finance the fruit and vegetable sector but charge very high interest rates. This means that farmers experience a lack of access to finance and other business development services, thus often not being able to make the necessary investments in technology improvements. Key actors in the finance space include the **Tanzania Agricultural Development Bank** (TADB), which is the main development finance bank, and the **National Microfinance Bank** (NMB), which was privatised in 2005. For small-scale producers, however, **Savings and Credit Cooperatives** (SACCOs) and informal saving and credit groups are more relevant in accessing finance than the formal banking system. The use of mobile money is increasing rapidly, especially among rural and lower-income groups (Anderson et al., 2016). However, the government has recently introduced a new levy to all transactions made through mobile phones (in the 2021/22 financial year) as a source of revenue for supporting rural infrastructure. This measure has raised many complaints from the users and is likely to discourage expansion of mobile money.

The food industry in Iringa consists mainly of tomatoes and chili processing, milk processing, tea production and processing and grain milling. An important player is **Darsh Industries Ltd**, a Tanzanian company headquartered in Arusha that has a big tomato processing plant in Iringa. Darsh produces several consumer products such as ketchup and tomato paste. Their business model entails working with farmers in outgrower schemes, facilitating them through the supply of improved tomato seeds and inputs. However, one of their main challenges is that farmers can

[34] SASS cooperated with its Sociology department.

sell tomatoes at farm-gate at a price that is more than five-fold the price paid by Darsh and the processing plant is only active in the post-harvest season when prices are low. This is a common challenge among processors, who compete with local market prices when trying to secure continuous supply of products. In other cases, processors are not able to secure sourcing from outgrower schemes because of the perishable nature of crops and the levels of sophistication necessary to harvest, store and transport, like is the case of fresh tea leaves. Low levels of trust and coordination often weaken the linkages between different actors in the food value chains.

Related to processing and with a considerable reach at the local level is the **Small Industries Development Organisation (SIDO)**, falling under the responsibility of the Ministry of Trade, Industries and Investment (MTII). SIDO promotes the use of local technology to catalyse industrialisation at small and medium-scale. They support individual farmers or farmer groups in the food sector, for example facilitating access to technology to preserve food and providing training on small/medium-scale processing (e.g., drying of fruits and vegetables or mixing of nutritious flours with maize and soybean), product marketing and branding, loan management and business practices. They also increase producers' knowledge of production standards established by regulating and certifying agencies such as the **Tanzania Bureau of Standards (TBS)**, which, since the coming into effect of a new Finance law in July 2019, took over part of the mandate of the Tanzania Food and Drugs Authority (TFDA) and is now called the Tanzania Drug and Medicinal Authority. Also, the **Sokoine University Graduates Entrepreneurs Cooperative** (SUGECO) provides training on food processing to support young people in agribusiness.

The distribution and trade part of the Iringa food system is characterised mostly by informal traders. Farmers mainly sell their produce at farm-gate. In some cases, they take products to the market themselves, but in most cases, small-scale traders (who are sometimes producers themselves) aggregate produce and bring it to the markets. Farmers, or intermediaries, hire the means of transportation plus drivers and often accompany them. Supermarkets play a very limited role in fresh produce trading as compared to open-air markets. Some crops such as tomatoes, onions and cabbages are traded over longer distances, while others, including leafy indigenous vegetables, tend to be traded locally.[35] Given the importance of open-air markets in fruit and vegetable trade, **market managers and traders' associations** have an important role in determining access to markets, influencing the choice of products available to consumers.

Food service providers in the different eating places, including shanty restaurants on roadsides, are becoming more and more important for low- and middle-income people to buy food and ready meals. The so-called ***mama lishe*** cook fresh meals, often sourcing their ingredients like poultry, eggs and vegetables, from (peri-)urban farming systems. *Mama lishe* can cater for 50 to 100 customers a day and often have a list of fixed customers where they deliver the freshly cooked meals. Buying ready meals is a growing phenomenon in urban areas, but also in small towns like Kilolo and Ilula, and even in more remote rural areas they are growing in numbers. It is difficult to give accurate estimates, considering the relative invisibility of informal food service providers for statistics and policies. Chapter 5 provides more detail on the restaurant sector (including the *mama lishe*) in the Iringa region, drawing on primary research.

Transportation service providers of various sorts also play an important role in the distribution part of the Iringa food system. They carry food by foot or use different types of vehicles such as trucks, pick-ups, motorbikes, bicycles and tricycles to transport food. Representing more formalised traders and shopkeepers is the Iringa chapter of the **Tanzania Chamber of Commerce, Industry and Agriculture** (TCCIA). An example of a formal local business based in Iringa producing and trading fresh vegetables across the country is **Masifio**, which has a strong logistics and distribution network and brands its high-quality products in attractive packaging reaching local, upper-end supermarkets.

[35] See chapter 4 for more details on indigenous vegetables trading.

Another important player trading and exporting horticultural produce is **TAHA Fresh**, established in 2009 as a partnership between the Tanzania Horticultural Association and some large-scale producers and exporters of Tanzania, to whom they provide logistic and distribution services, facilitating clearance, air and sea freight and trucking to different export markets offering a 'one-stop-shop' (Netherlands Enterprise Agency, 2018).

As regards to nutrition, the President's Office of Regional Administration and Local Authorities (PO- RALG) oversees most of the practical implementation of the nutrition action plans at the local level, in collaboration with a number of implementing partners. The chair and secretariat for the multi-sectoral Technical Working Group on Nutrition (comprising line ministries, UN agencies, NGOs and other development partners) is the **Tanzania Food and Nutrition Centre** (TFNC). **Doctors with Africa CUAMM** is a key partner in several working groups at the ministerial level, alongside **UNICEF** and the **World Food Programme** (WFP). Its work focuses on improving health services, particularly targeting maternal and child health, childbirth assistance and infant care, as well as promoting proper nutrition, healthy lifestyles, combating chronic and acute malnutrition and non-communicable diseases. They also support data collection efforts at the community level. CUAMM is also a member of the **Partnership for Nutrition in Tanzania** (PANITA), a consortium of civil society organisations working on nutrition-focused and nutrition-sensitive sectors (including agriculture, water and sanitation, health, education, economic empowerment and social protection). The partnership can count also on 24 Members of Parliament (MPs) who serve as nutrition advocacy champions, raising awareness with local constituencies and holding the government accountable for commitments on nutrition targets – together with the **Parliamentary Group on Nutrition Food Security and Children's Rights** (PG-NFSCR). Advocacy by PANITA through the PG-NFSCR has led political parties in the country, including the ruling party Chama Cha Mapinduzi (CCM), to include in their party manifestos the consideration of nutrition as an important component of development in the country (SUN, 2018).

Consumers from different socio-economic spheres are key in driving food system dynamics. In Iringa, as in the rest of the country and in many other East African neighbours, organised consumer interests are non-existent or at a very early stage. However, other actors play an important role in nutrition education, such as community health workers, local and international NGOs and development programmes (as mentioned above) as well as local radio stations and social media platforms reporting on food safety scandals or providing information about health and food safety. Local newspapers are another important source of information, but mostly geared towards urban, middle-class consumers (Bizzotto Molina et al., 2020).

2.3.3. Overview of drivers and constraints of indigenous vegetables integration

Table 1 summarises the characteristics of indigenous vegetable value chains in Iringa and identifies key drivers and constraints for stronger integration of these crops in the local food system. Such drivers and constraints are categorised across the production, distribution, consumption and governance domains. The table builds on the indigenous vegetables value chain analysis presented in Chapter 4 as well as on the insights from the second SASS report on sustainable food systems in the Arusha area (Bizzotto Molina et al., 2020).

Table 1: Summary of drivers and constraints to improve integration of leafy indigenous vegetables in Iringa's food system

Area	Characteristics	Drivers	Constraints
Production	Small-scale production; Female-dominated; High household self-consumption; Low food safety; Low input requirements; Some vegetables are still wildly growing – with little attempts to cultivate them.	High profitability; Important in nutrition security; Booming commercial seed production.	Poor social status; Lack of extension service support; Government support towards maize; Low quality assurance of informal seeds; Gender inequalities; Lack of good agricultural management; Agro-chemicals misuse; Limited producers' organisation; Unpredictable demand; High seasonality for some vegetables.
Distribution	High informality; Female dominated; Low supermarket share.	Extensive network of traders; Credit provision by traders to producers; Strong linkages between traders; Improvement in transportation infra-structure to reach markets (e.g., urban centres).	High perishability; Lacking storage and cold chain; Local market dependent; Low processing and standards; High transport costs and market fee; No dedicated wholesale area.

Area	Characteristics	Drivers	Constraints
Consumption	Low dietary diversity; High relative costs of fruit and vegetables; More consumed in rural than in urban areas.	High nutrition profile; Generally available at markets; Willingness to pay above market prices; Some form rare delicacies and special cuisines; There is a 'come back' trend in preferences for consuming them.	Unpredictable availability/high seasonality; Volatile market prices; Low food knowledge; Dietary shift towards animal sourced foods and processed products; Food safety concerns; Weak/absent consumer organisation. The indigenous knowledge involved in preparation and processing is getting lost (considering that most of that knowledge is not written down).
Governance	Inconsistent and contradicting policies; Focus on infrastructure; Low public investment in agriculture.	Multi-sectoral approach to nutrition starting to recognise the importance of IVs for nutrition; Decentralisation process.	Policies do not support diversification; Neglect of indigenous vegetables; Challenging business environment. Lack of informing literature materials about indigenous vegetables; Research on indigenous vegetables has received little attention – including funding by national governments.

Source: Authors' elaboration based on own research.

2.4. Three potential pathways to improve Iringa's sustainability

In this section, we build both on the food system mapping (2.2) and the analysis of Iringa's food system governance (2.3) to explore pathways that could improve Iringa's sustainability, with a view to the role indigenous vegetables can play. Our objective is to stimulate dialogue rather than advancing specific solutions, which need to be further discussed with local stakeholders and adapted to the interests, needs, and opportunities. As such, we propose 'pathways', instead of 'solutions', to signal their purpose as starting points for further discussion rather than end points of a debate.

2.4.1. Pathway 1: Strengthen extension to enhance sustainable production and healthy diets

Agricultural extension services are an important vehicle to promote diverse, economically viable and environmentally sound production systems that contribute to healthy and thriving families and individuals. Extension services that maintain closer linkages with farmers and research institutes can help shift the role of extension officers from a one-way knowledge transfer to facilitators of innovation processes that identify problems and develop locally-adapted solutions in a more participatory way. This shift, in turn, can increase the relevance and responsiveness of extension support and increase applicability of the solutions proposed. For instance, combining extension support with technical assistance (e.g., development partners' funded projects) has shown to improve adoption of more sustainable practices and positively impact environmental, economic and productivity outcomes (Piñeiro et al., 2020). Integrating a more **inclusive and participatory approach** in extension services, such as peer-to-peer action research in the form of farmer field schools (IPES-Food, 2016), is also likely to improve the impact and effectiveness of extension. These approaches do justice to the diversity of small-scale farmers, their strengths and challenges, aspirations and abilities.

In the Iringa region, agricultural extension officers are one of the main sources of knowledge for small-scale farmers. However, the importance of informal markets for the livelihoods of small-scale producers is often neglected, while nutrition-sensitive extension is slowly picking up steam (Beaudreault, 2019). Extension officers have little incentive to promote regenerative agriculture techniques such as agroecology or conservation agriculture, and place higher emphasis on input-heavy staple production. Their performance evaluation is based on the increase of main crops production. As such, **indigenous vegetables are neglected and their production is hampered by insufficient extension support**. For instance, official statistics at village and district level tend to not record the production or marketing of indigenous vegetables. Also, farmers tend to not report them when data on yields are collected at the village level. **Improved extension officers' knowledge on more environmentally-sustainable practices, the importance of informal markets and nutrition would enable farmers to make more informed choices** about what to grow, where to sell and how to prepare food.

The second phase of the five-year **National Multisectoral Nutrition Action Plan (NMNAP-II) offers the opportunity to invest more in nutrition-sensitive extension services which are responsive to farmers' needs and a stronger innovation system**. The NMNAP II is expected to improve coherence among agricultural, nutrition and health officers' approaches at community level. Beyond production targets, incentives for extension officers could be expanded to include nutrition outcomes, for example by supporting diversification of production and production of nutritious food (e.g., through increased and smart use of indigenous vegetables and crop-livestock integration systems), considering their potential to improve household income and dietary diversity. Extension services could also include strengthening business skills of different stakeholders in the food system. Past experiences of projects working together with extension services (such as the Feed the Future programmes in Iringa and Rikolto's activities in Arusha), however, show that it is difficult for capacity building to trickle down from the district to the village level if there is no budget reserved for ward-level officers. **Research institutes such as Sokoine University of Agriculture**

(SUA) and TARI could play an important role in strengthening the understanding of how innovation systems work, what helps or hinders farmers to adopt more sustainable practices and how linkages between research, extension and producers can be strengthened.

2.4.2. Pathway 2: Support the business of informal vegetable traders and food vendors

Small-scale, informal vegetable traders and food vendors have a crucial role in providing food to low and middle-income consumers in urban and rural Iringa. They also generate employment and income to support themselves and their families. However, small-scale food traders and traders of leafy vegetables in particular (who are disproportionately women) are often a neglected link in the value chain, poorly understood and supported by national policies and initiatives (see Chapter 4). **Understanding better the role these actors play in the Iringa food system, as well as their business models, their needs and challenges, can help to improve their efficiency and support the development of their businesses, which in turn is expected to improve the welfare of other actors in the food system such as farmers and consumers.**

Research in Dar es Salaam finds that relations between food vendors, small-scale producers and traders are often characterised by **reciprocity and interdependence**, supported by well-established internal and social norms (Wegerif and Hebinck, 2016). It is likely that this applies also to the large number of small-scale and interdependent actors that produce and sell food in Iringa and the neighbouring towns, who are usually not integrated into large vertical or horizontal structures such as traders' associations. Rather, relationships between value chain actors – particularly those active along the shorter trade routes that characterise leafy vegetables (Marson & Vaggi, 2021) – tend to be based on trust and mutual support (Wegerif and Hebinck, 2016). They provide credit, share the costs of transport for their goods and share business information because they are familiar with each other. **Interventions by government and development partners that do not take into account these types of more symbiotic relationships between food system actors risk negatively affecting their livelihoods.**

The analysis of indigenous vegetables in parts of Tanzania also suggests that traders do not necessarily occupy a rent position along food value chains, nor that they take advantage of a market power which endangers the efficiency of the whole chain. On the contrary, **local vegetable markets seem to be characterised by a certain degree of competition and efficiency whereby traders play a vital role, linking producers with markets while being important vehicles of information** (Marson & Vaggi, 2021). However, traders, who are mostly women, still face high risks because of perishability of the products, compounded by the challenging conditions of the roads and the poor market infrastructure. These considerations point to the complexity, the skills, and the importance of the role performed by small-scale traders.

Targeting informal traders with initiatives to strengthen income generating activities can have trickle-down benefits for consumers and producers alike. An example of this is how TAGRODE and TAHEA, in their nutrition-sensitive activities in Iringa, supported women food processors, for example by promoting juice making activities. These activities have had positive impacts both on income and nutrition outcomes, while helping to reduce food losses and waste. In addition, vegetable traders, particularly women, could benefit from better market facilities, with dedicated areas for leafy vegetable trading. This would not only improve traders' businesses but also consumer perceptions of these crops. At the same time, **awareness-raising activities around food safety, nutrition and healthy diets** could target providers of (street) food such as the *mama lishe* and their customers. These activities can help increase demand for healthier and more nutritious food, including indigenous vegetables, and contribute to reducing malnutrition rates and slow down the growing overweight and obesity rates in Tanzania.

Such targeted support to informal vegetable traders and food vendors, particularly women, could be part of a broader strategy aimed at involving local actors, particularly previously invisible and marginalised stakeholders,

in policy design, implementation and monitoring. This would help to implement more effective interventions that increase outcomes related to healthy and safe food and contribute to increased incomes and reduced poverty rates. A better enabling environment regarding informality could start from understanding where informal traders concentrate and what opportunities they identify themselves to strengthen their incomes and accelerate the creation of Small and Medium Enterprises (SMEs).

2.4.3. Pathway 3: Sustain demand for sustainable, safe and nutritious food, with a specific focus on indigenous vegetables

Increased demand for sustainable, safe and nutritious food is crucial to provide incentives to change current unsustainable practices and promote diversification of production. Understanding what factors hinder such a growth in demand is a first step. Research and local experts in the Iringa region point to a lack of food knowledge hampering consumers' choices for healthy diets. Supply-side initiatives aimed at improving the availability and affordability of safe and nutritious foods could thus be complemented by education and awareness-raising about what a healthy diet consists of and by activities to increase the ease and attractiveness of healthy and sustainable food. Such initiatives contribute to a virtuous cycle of increased demand and supply of diverse and nutritious foods, ensuring a strong market for these products. As such, **sensitisation on the nutritional value of indigenous foods and vegetables could improve consumers' perceptions of these crops and contribute to healthier diets.**

Both top-down approaches such as national food-based dietary guidelines, as well as bottom-up approaches like school garden programmes can be tools to educate and change consumers' behaviour. Organisations like Slow Food and the Word Vegetable Centre are already implementing school garden projects, in Iringa and beyond, to reach a broader population. However, schools participating in such projects are often private as national policies make it difficult to implement this type of initiatives in public institutes.

Moreover, awareness-raising campaigns need to explicitly include men as target audiences as nutrition is a whole-of-household responsibility (Beaudreault, 2019). Currently, nutrition education in the Iringa region happens mostly at health centres, focusing on women and mothers with young children. While women are often regarded as being responsible for the health of the household, in fact, men can have a strong say in household food consumption and decision making.

The promotion and uptake of traditional foods in the hospitality sector can also offer opportunities to improve the perception of indigenous vegetables, contribute to income generating activities and protect certain crops that are at risk of being extinct. To preserve such biocultural heritage, Slow Food Tanzania supports seed identification as well as multiplication and exchanges of seeds. They also invest in promotion and sensitisation on nutritional and agronomic characteristics of indigenous leafy vegetables and differentiate between traditional and improved varieties of indigenous crops to ensure local varieties are preserved. Heritage Foods Africa, a Tanzanian-based organisation, explicitly targets the high-end hospitality sector, for example through the development of a seasonal calendar and a cookbook combining the Tanzanian tradition with innovative cuisine and working with famous chefs. Their activities could be linked to those developed in Iringa by the Boma Museum, an important cultural and heritage centre. The research of the University of Gastronomic Sciences on the hospitality sector in Iringa (see Chapter 5) finds that traditional ingredients and recipes already play an important role in the restaurant sector in Iringa. According to the authors, the demand for traditional ingredients and dishes in Iringa is growing, a trend that is linked both to a gastronomic preference for these products as well as to a growing health consciousness that recognises them as safer and healthier options than processed or international foods. **As the interest for traditional products is to be growing also in the restaurants serving a wealthier clientele, including national and international tourists, there seems to be a promising niche particularly for those local products that best exemplify the specificities of the region and its people.** A good example is increased consumption of the '*mnavu*' (African nightshade) leafy

vegetable in Arusha, which has been incorporated in some popular local dishes in the area in both low- and high-income eating places (Rikolto, 2020).

Mapping Iringa's food system provided an overview of opportunities and challenges regarding the economic, environmental, and social sustainability of the food system. The food governance and key actor mapping provided insights into the overall policy environment, actor networks, and local stakeholders' needs. Against this background, three promising pathways to improve sustainability were identified, with special attention to the role indigenous vegetables can play. For such pathways to be relevant, they should be further discussed, amended and validated with local stakeholders, and fed into existing projects and partnerships.

3. *Mboga* economies: food social values and markets in agro-pastoral communities in central Tanzania

By Barbara Aiolfi (Cultural and Social Anthropology, University of Milano-Bicocca)

3.1. Putting the local perspective at the centre of the analysis of food systems and indigenous vegetables

The SASS multidisciplinary project combines different tools, vocabularies and lenses of investigation. In this chapter's anthropological study, the local perspectives of social actors at the grassroots level and their connections of livelihoods within the food value chain will be at the centre. The reader will be immersed in the Swahili and Gogo terms and the interpretation of indigenous vegetables from a 'microscopic' and local perspective that highlights social and cultural aspects of food in wider Tanzania, as well as the importance of local taxonomy of crops, local 'moral economies', and the relations of food with economic inequalities and patterns of participation or exclusion in the network.

This chapter analyses food systems and the leafy vegetables value chain in an agro-pastoral area located in the Dodoma region. The author and the anthropology team from the University of Milano-Bicocca decided to conduct the study in this semi-arid area for four main reasons:

1. Ethnographic research requires long-term field work and in-depth knowledge of the territories and communities studied to allow a qualitative analysis that from the local perspective can lead to broader national and global understandings. The researcher could build on the previous experience of living in Kongwa district, Dodoma region for three years;
2. Dodoma is a very interesting research area because in a certain sense can be considered a drop out of the SAGCOT project (Bergius, 2020) but it is also a crucial political and commercial hub. Dodoma is now the capital, the Parliament and Ministries headquarters, and it is also a central hub for maize commercialisation. This area is not just becoming a renovated political centre around the capital, but has been a central focus in national history for land reforms, state-citizen construction, and more importantly, food shortages in semi-arid environments and the respective local strategies, capabilities and patterns of cooperation to cope with them (Bryceson, 1990; Maghimbi et al., 2016). These two aspects are central in a nationwide understanding of a sustainable network for a viable future and transcend the specific locality;
3. Last but not least, focusing on Dodoma helps us to keep in mind the agro-pastoral complexity as acted from local communities. It is an historical and contemporary dynamic that concerns the most productive

agricultural areas of the country, like Arusha and Iringa (the two main study areas of the SASS project): regions with a strong pastoral tradition still present and sometimes made invisible by food and nutritional policies.

The typical daily main meal in rural Dodoma households is a stiff white porridge, called ***ugali*** in Swahili, made from maize, sorghum or pearl millet flour and is usually accompanied by a dressing of **cooked green leafy vegetables**. These vegetables come from a variety of sources: they can be either homegrown or bought at the local market; sometimes they can even be harvested from the wild. In rural areas – where the diet is considered low in animal-sourced food and in some nutrients – these vegetables play an important role in the diet because of the high concentrations of some nutrients, namely vitamin A and C, iron, zinc, calcium and magnesium (Gowele et. al., 2019). In the interviews, the term collected to indicate leafy vegetables, in addition to the single specific name, is ***mboga***.

Picture 1. *Mbande* monthly market in Kongwa district

Photo credit: Barbara Aiolfi, June 18th 2019

The present **ethnographic study** investigates the *mboga* economies to examine the topic of the so-called **Neglected and Underutilised Species (NUS)** in a specific context, the Dodoma region, in the central area of Tanzania mainly inhabited by the agro-pastoral population known as Gogo.

Mboga

In Swahili ***mboga*** is a generic term that is used both for cooked vegetables and for '***ugali* side dish**'. In daily conversations, *mboga* is said to refer to any *ugali* side dish, even those with meat, fish, beans or other. In the Dodoma region, the daily side dish is cooked leafy vegetables. The research also showed that in the Gogo language there is no specific term to indicate leafy vegetables: they often speak about *ilende* which is the ***mlenda***. The word *mboga ya mahanze* is sometimes used where *mahanze* is the Gogo term for herbs. So, it could mean edible herbs. In this sense, it is necessary to specify that ethnography was done in a **multilingual area** where some nuances of taxonomy can be lost due to the homogenising linguistic data.

Getting closer to local perspectives on food – departing not just from narratives and local values, but also local practices around food – allows to highlight constraints and resources within policy making, with the aim to be

sustainable and thus inclusive to communities who often have been left aside by development policies such as small farmers, rural consumers, and market sellers. Within a long tradition of difficulties of modernisation policies in understanding local resource management, coping risk and diversification strategies, **local cultural patterns have often been translated into mere obstacles. Instead, understanding local perspectives is the first step to highlight contradictions or changes. It is also the way to show that what are labelled hindrances to development can become resources for an equal and participatory socio-economic change**.

The structure of this chapter is as follows. The second section provides a short explanation of the research methodology and illustrates NUS and Indigenous Vegetables notions in the Dodoma region. The third section explains how the use of dried leafy vegetables is a peculiarity of agro-pastoral populations. The fourth and fifth sections illustrate the uses of sun-dried and fresh vegetables and the social value of the *mboga* economy. The last section concludes and provides some recommendations.

3.2. *Mboga gani* (i.e., which kind of *mboga*)? Answering with NUS and Indigenous Vegetables notions

To introduce the local terminology used to describe such leafy vegetables, the reader needs to get accustomed to the scientific terminology used in the literature. In this specific research context, the **local and scientific terminology do not overlap**. In the literature, **Neglected and Underutilised Species (NUS)** can be defined as wild species and ecotypes that, although widely distributed in particular areas of the world, are nonetheless hard to find at the global level: their production and consumption are limited in comparison with their economic and dietary potential (Gruère et al., 2008). This definition is used in both development policies and agronomic and nutritional studies, although it is obviously not emic, i.e., **it does not originate from local perspectives** and it is alien to local nomenclatures. In Tanzania, in particular in the Dodoma region, that refers mostly to the leafy vegetables dressing accompanying the main course, *ugali*.

The term NUS was created in the 1980s by the CGIAR to indicate neglected species, but the term neglected refers to a very specific disciplinary area of agricultural research, i.e., underutilised by the market and neglected by agronomic science. From a local perspective it is inappropriate to treat these crops as NUS because they are neither neglected (those dried and stored at home as well as the fresh ones widely available in local markets) nor even under-utilised (they are common in the daily diet of the Gogo villages).

In fact, **these crops are part of a well-established and historical coping strategy in the recurring droughts**, with their ensuing decrease in nutritious food availability. **Naming leafy vegetables 'NUS' leads us to imagine that Tanzania relies on an informal, ineffective and not very widespread production and sales network**, therefore needing some improved kind of marketing. Such assumption entails, as it happened in the village of Kibaigwa, a change in the structure of the daily and weekly markets, e.g., by building specific stalls dedicated to fresh leafy vegetables only, thus altering the precise social and economic norms that have regulated to the present day all trades and values of their goods.

Again, from a local standpoint based on local terms, it is not correct to encompass all leafy vegetables under the definition **Indigenous Vegetables**. In this case, the term indigenous refers to a crop species or variety genuinely native to the region, or to crops introduced into a region where they have evolved over a period of time, although the species may not be native (Msuya, 2004; Gowele, 2019). The choice of this denomination has the shortcoming of forgetting that every indigenous aspect lives on relationships and exchanges (e.g., of seeds), even exogenous, so that the foods labelled that way are somehow associated with an ambiguous character of exoticism. Even this denomination did not find a precise correspondence in the ethnographic study in the districts of Dodoma.

In the interviews, the word indigenous is not used and local classifications feature leafy vegetables through different criteria, thus reflecting other agronomic and culinary aspects, while not so much the origins of the crop varieties: for example the cabbage leaf, called ***chainizi*** (with a Swahili term that evokes an 'elsewhere', 'Chinese'), is not scientifically considered an indigenous vegetable even though it is locally widespread and inserted in the same culinary, economic and social context of other leafy vegetables which are marketed as fresh.

Picture 2. *Chainizi* cultivation in Chamkoroma, Kongwa district

Photo credit: Barbara Aiolfi, July 19th, 2019

Research method

The study location included **ten villages** on a border area between **three districts in Dodoma Region: Kongwa, Chamwino and Mpwapwa**. The general approach to this study involved a fine-grained ethnography where the fieldwork took place over a three months' period (from **May to July 2019**). Villages were selected according to different factors such as geographical location, water availability and consumption patterns, presence of local markets but also relationships of trust and intimacy that were consolidated in the previous Tanzanian experience (the author had spent three years, from 2000 to 2003, in the same area working for a development cooperation project).

In this ethnographic study, **participant observation** includes, beside interviews with selected people, visits to the neighbouring settlements, informal conversation, participation in a number of community and village events such as funerals, a birth, a circumcision celebration, as well as visiting researcher friends' houses, local restaurants and, above all, attendance at local marketplaces and the monthly livestock market. This research accounts for almost **thirty semi-structured interviews** conducted in Swahili.

The food value chain investigation was also conducted through the life-stories of farmers, traders and sellers by following their marketing practices in space, from fields to marketplaces (Cook, 2006) and over time (investigating changes in their families, villages, markets), staying and eating at their household. Markets have the potential to be

a linchpin in the analysis of food value chains, so that life stories were mostly collected at the **Kongwa daily market** and the **Kongwa and Mbande *mnada,*** which take place once a month.

Starting from the absence of a locally shared terminology, it was necessary to build an **ecological and social taxonomy** which, once interpreted and shared, brings out local perspectives and practices even where **the terms are apparently similar but the role and value of these foods are constantly changing**. Finding the right words is always a first step towards mutual understanding. The identification and classification of leafy vegetables is the result not only of anthropological research but of a collective work of researchers from different disciplines: it is not just a question of making a list but of sharing and aggregating linguistic, social, nutritional and economic data. Obviously, this taxonomy takes on meaning and is strongly determined by the characteristics of the agro-pastoral communities of the central region of Tanzania.

3.3. Cultivating *mboga*: an agro-pastoral strategy

The area called Ugogo in Swahili is the area where the Gogo ethnic group mainly lives. It includes the Dodoma region and part of the Singida region. However, as communities do not live isolated from each other, their identities are not static, but fluctuate in relation to the other elements of the human and natural frame in which they belong to: any group, community, society or ethnicity can thus only be understood as a part of a network of relationships (Fabietti, 2002). If such melting of cultures that Fabietti speculated about holds true – something that is supported also by the interviews collected during the field visit in the region – then these communities live side by side, overlapping the same geographical area. In the research area, such ethnic groups are mainly Gogo, Kaguru and Sagara. These ethnic groups live peacefully in the same geographic area as some inter-tribal marriages are witnessed. However, activities peculiar to each tribe are different and such differences can be noticed in the local open-air markets.

Remarkably, the **Kaguru settled in the area where water is most abundant in the district of Kongwa**, therefore they have been endowed with the production of fast crops, such as banana, sugar cane, papaya and leafy vegetables that they produce and trade in various marketplaces. **The Gogo**, on the contrary, **live in the more arid part of the region** and therefore they have been historically shepherds. Only recently, they have started attempting agricultural activities of fast crops, such as those from which the Kaguru population benefits, producing and selling crops for cash, including fresh vegetable leaves that they grow near dams, canals, springs.

Observing the social relations in the **local monthly market called *mnada***, this division of tasks is evident even if not defined as such: **cattle sales are managed by the Gogo only, whereas Kaguru people are involved in the other businesses (vegetables, clothes, beer, other goods)**. Remarkably, when it comes to the management of the markets, then such separation of roles is even more striking: the members forming the markets' committees are fully belonging to the Kaguru tribe (from Gairo town) and none of them represents the Gogo tribe.

The **unpredictability of rainfall, deforestation and climate change** are however affecting both populations. In the hills, the agricultural techniques reaching the mountaintop are drying up ancient sources and therefore changing the methods of cultivation. In Chamkoroma, **Sadock, a local vegetable producer and trader member** of the *mnada*, said that today farmers produce vegetables and sugar cane where rice, which needs more water, was once grown, but water is in shorter supply. Kongwa plain is a marginal area for cultivation, with its annual rainfall rarely exceeding 600 mm. The hindrance is not only the quantity of rainwater but the unpredictability and the length of the rainy season, often ensuing in **recurrent famines** (*njaa* in Swahili, *nzala* in Gogo).

The Gogo agriculture can be characterised as **rainfall-dependent subsistence farming** and this is a problem when the climate conditions keep changing continuously. There are two different seasons: the dry season (*kiangasi*), lasting from late April to early December, and the wet season (*masika*), the shorter one, lasting from December to mid-April. Although forecasts may help predict the incoming weather, it is very problematic to foresee when exactly the first rainfall is coming and how long it is going to last. If the first rainfall is delayed or the rain time is too short, farmers can lose a lot of produce. Agronomic statistics show that in this area over a decade, the harvest is good enough for only three years while in the other seven it is poor or very poor (Maghimbi, 2016). So harsh and common is such an experience of famine, that it is reflected in the local language: in Kigogo, each famine was given its own name. This is also known as an area prone to chronic drought famine and this climate has led Dodoma's Gogo inhabitants to develop and adapt a combination of agriculture and livestock-breeding in order to survive.

Market prices

The three months of research coincided with the harvest period and therefore the time of parties, weddings, circumcisions, and the end of Ramadan. This is a moment of the year when food is available, money circulates in greater quantities, despite the fact that the 2018/2019 harvest was very scarce. To give an idea of the volatility of market prices of staple goods, in August 2018 the price of a bag of maize of 20 kg (a debe) was 1.5 euros (4,000 Tsh) while in August 2019 it was 5.5 euros (15,000 Tanzanian shillings). When the harvest is poor, the price of crops is due to increase month by month until the next one.

By looking at the details of periodic famines, it's clear that the agricultural calendar was adapted to the rainy season. In the Gogo area, where annual weather is unstable, the Gogo rely on environmental signs to predict the amount and timing of precipitation. The practice stabilises and diversifies the entire harvest with a mix of different crops such as maize (a staple) and other crops (millet, sorghum, beans, pumpkins, vegetables, etc.). **The use of dried leafy vegetables is a peculiarity of agro-pastoral populations of semi-arid areas characterised by frequent periods of food shortage where crops must rely on an increasingly erratic rainy season.**

Mama Sebastian, who has a small shop in Chalinze, Chamwino's village, has recently bought half a hectare of land to produce sugar cane and *mboga*. She explains her decision with these words: '***I bought this land and not a zebu*** *because right now I need* ***money*** *to pay for my children's secondary school fees.* ***Owning livestock no longer ensures my family's needs***'.

For the Gogo, who live in a semi-arid region, pastoralism became a social symbol reinforcing their traditional value system; **owning cattle means a practical accumulation of wealth.** However, the social meaning embedded in pastoralism is now changing**.** The advantage of pastoralism in semi-arid areas lies in its **mobility** (in some cases it's not only cattle mobility but also **labour mobility**)**.** If rainfall is low and grass scarce, it is possible for herdsmen to temporarily move to another place to preserve their livestock. In famines, people sell cows and buy cereal to avoid starvation, although today they are also used as a temporary value, and monetary speculation is often practised. For example, in May-June, when the price of crops is low because everyone finished harvesting, *zebu* owners sell part of the cattle to Dar es Salaam traders during the *mnada* so they buy and store grains that they sell at the end of the year when the crops' price is higher.

Alternatively, cattle are very important to human relations as a **social safety net**: livestock is part of the endowment offered as bride-wealth even though cash payments are currently used very often. Conflicts on land, issues often related to the economic dimensions and pastoral tradition, are easily perceived as originating from the **scarcity of natural resources** and the **degradation of the environment** resulting from an increase in population. **But scarcity is also the product of an adverse political process and governance that helps to reinforce inequalities and facilitates the unsustainable use of resources** (Bergius, 2020). A central premise underpinning the implementation of the

SAGCOT strategy is that Tanzania is gifted with underutilised land that can be put to a more productive use (where the term 'underutilised' used for land is referred to species as well). The emphasis on the production, transformation and semi-industrialisation of vegetables, the so-called NUS commercialisation, should be investigated as a part of this narrative, supported by the aforementioned rhetoric.

3.4. Why are sun-dried leafy vegetables less considered in food policies?

Picture 3. Cooking *mlenda* in Chalinze, Chamwino District

Photo credit: Barbara Aiolfi, July 23rd, 2019

Based on the taxonomy, one can conclude that the most widespread leafy vegetable species in the Dodoma region are over a dozen, coming from different botanical families as listed in Table 1 and Table 2 (in Annex to this chapter). In interviews, the leafy vegetables spontaneously or semi-spontaneously growing, intercropped, in cereal fields are called ***mboga za asili***. These are leafy vegetables that are harvested at the end of the rainy season, then are **sun-dried and house-stored** afterwards. They are hardly found at the marketplace and are often exchanged without money, through barter or exchange systems linked to traditional **moral economies**.

Local knowledge on how to pick wild food is passed down to the younger family members. Children learn the varieties of herbs when they go harvesting food with their parents or relatives. *Mboga za asili* carries a **strong identity connotation** of an ethnic group, a village or a clan and both the way and the kind of pot used for cooking are distinctive traits of the household preparing it and its origins. Therefore, in the Dodoma region, the leafy vegetables regarded as traditional and local are those self-produced and consumed mostly sun-dried.

Mboga za asili

Asili is a Swahili word with two different meanings: nature and ancestors. *Mboga za asili* are leafy vegetables that are harvested at the end of the rainy season, and afterwards **sun-dried and house-stored**.
In the research area, the most common sun-dried vegetables are ***mlenda*** (iuta, sesamo and simsim), ***majani ya kunde*** (cowpea leaf), ***majani ya maboga*** (pumpkin leaf), ***mgagani*** (spider-flower leaf). Rural people pass knowledge on how to gather **wild herbs** from generation to generation. They learn how to live in the driest part of the country

on wild foods and supplement the main staple, consumed in large quantities at each meal as a source of vitamins and minerals.

As listed in Table 1, the most widespread *mboga za asili* is ***mlenda***, which, as understandable from its classification, **indicates different types of herbs**. They all share a common feature: once cooked (e.g., boiling sun-dried vegetables in water) **they produce a mucilaginous or thickened dish** (*kulenda*, from which the word *mlenda* derives, means precisely 'to be elastic').

Mlenda plays a very important role in the Gogo diet when the harvest is poor, because it is **drought-resistant** and grows regardless of the amount of rainfall. People pick and dry *mlenda* leaves and preserve them in bags sometimes for several years. But the *mlenda* crop is not statistically counted (Maghimbi, 2016), because normally **it is not available (i.e., visible) in the local markets**, being a part of the informal leafy economy. Therefore, they are often invisible for food policies.

Fresh leafy vegetables

In Swahili fresh vegetables are sometimes mentioned as *mboga makavu/mboga mabichi*, literally empty vegetables/unripe vegetables. In the Dodoma Region, fresh leafy vegetables are ***mchicha*** (amaranth leaf), ***matembele*** (sweet potato leaf), ***chainizi*** (Chinese cabbage), ***mnavu*** (nightshade leaf) and ***kisamvu*** (cassava leaf).

Beyond these traditional vegetables, **fresh leafy vegetables** are becoming popular in homes and markets in the Dodoma region. According to one of my informants, a Gogo woman: '*young people no longer know how to cook sun-dried mboga and, for their taste, they prefer fresh vegetables'*. Thus, the fresh leafy vegetables listed in Table 2 are fast spreading in the kitchens and local markets of the Dodoma region.

It is important to highlight that the agricultural season of fresh vegetables and of sun-dried *mboga* do not overlap (see Tables 1 and 2). Fresh vegetables are grown in areas close to water sources and are sown around April-May, just at the end of the cereal harvest season. This activity keeps going until September, just before the rainy season. So, **unlike sun-dried *mboga*, these crops are not available throughout the whole year**. The fresh *mboga* is then carried to the local markets with local buses, motorcycles or bikes. It is a **short-range commercialisation network** (with an average distance of seven kilometres). It is sold in bunches (*fungu*). At the end of the rainy season the cost of a bunch in the Kongwa market is 200 Tanzanian shillings (0.08 euros) which can reach up to 500 Tanzanian shillings (0.20 euros) in September-October.

The 'replacement' of *mboga za asili* with the fresh *mboga* is not regarded as a nutritional improvement factor only, but rather as a change involving many social and communal dimensions. Just to mention a few: the cultivation methods, the knowledge of water management, the connections between different ethnic groups, the forms of monetary and non-monetary exchange, the transformation of cooking utensils, the culinary and flavour knowledge.

The expression of these transformations cannot be restricted to 'either-or' mutually exclusive options, such as sun-dried versus fresh vegetables. Above all, such stark contrast would not match the reality experienced by the villagers of the districts considered, where in some households, if not all, **the use of sun-dried and fresh vegetables alternates or overlaps**, depending on the season and market availability. In addition, some leafy vegetables are usually home-grown in order to be dried, and sometimes happen to be consumed fresh as well.

Picture 4. Mama Mawili sells and prepares *chainizi* at a daily market in Kongwa

Photo credit: Barbara Aiolfi, June 3rd, 2019.

3.5. Commercialisation and horticulture revolution

Mchanganiko

Why is this change happening? Using the words of another farmer, a key informant from a village in the Chamwino district, population growth has brought new people to the village and also new traditions, new knowledge: '***Today here in Makoja we are a mchanganiko of cultures, of knowledge, of ethnic groups. Once we didn't even know that this was food. Those who came from outside taught us***'. *Mchanganiko* in Swahili means mixture, mixed.

Following the fresh *mboga* trade in Kongwa and collecting the life stories of those who produce, market and transport leafy vegetables, a series of multiple commodity stories emerged. As anticipated above, it is a short-range marketing, seven kilometres on average, of products grown in presence of water sources, therefore on the hills adjacent to Kongwa or near wells, canals or dams (as is the case of the dam in Kongwa itself). For this reason, the issue of land (i.e., who the owner is or the tenant of strategic lands for the production of cash crops) is becoming increasingly important. Agricultural production comes from plots of less than one hectare. Larger tracts of lands are found in Mpwapwa and on the hills of Chamkoroma and its surroundings.

Picture 6. Mama Bahati sells fresh *mboga* at Kongwa's *mnada*

Photo credit: Barbara Aiolfi, June 28th 2019.

As stated in Table 3 (in Annex), **in Kongwa markets it is possible to also commercialise other leafy or non-leafy vegetables** (not always considered indigenous vegetables) **recently produced or locally consumed**.

In the Kongwa district, by studying the journey of food from field to plate and analysing the links and connections between food production and consumption, it is possible to figure out where value is added and becomes incorporated and distributed, including the value that is 'extracted' from nature and labour. What stands out is the process of commodification of the meanings and the sense of food, which goes beyond food itself, its production and consumption, and which must certainly be placed into a broader perspective of territorial dynamics.

The leafy vegetables are mainly marketed in ways observed through the collection of life stories in this study: some small producers directly commercialise them in markets, while other farmers buy products in their village (from other farmers who produce smaller amounts) and organise the **transport to marketplaces** or sometimes sell the food door-to-door; mixed forms in which sellers are sometimes producers or are able to directly organise the sale by transporting the products (often in private minibuses). This last way involves city intermediaries (*dalali*) who resell foods to final dealers in urban areas and especially in the Kariako market in Dar es Salaam.

In this sense, the **places of production of tomatoes in Kongwa have multiplied,** in particular at a place called the dam (*bwawani*), and they have been sold as far as in the markets of Dar es Salaam. Another relevant example of this trend is Makoja, a semi-arid village in the Chamwino district, next to a dried river bed, where Makorongo and other farmers grow African eggplants (*nyanya chungu)*, which are rarely consumed in rural villages and instead are sold in urban markets through town middlemen (*dalali*). According to Matthias, farmer and leader of a national network of farmers' groups known as Mviwata, in Chitego, another village in the Kongwa district, locally little green peppers are grown, collected, selected and exported to Kenya by a Dodoma-based company. **In the Dodoma area there are no established leafy vegetables organisations of producers and many exchanges and negotiations take place by phone**. The farmers are reached by phone in order to agree upon the price per plot and the harvest period. As the middleman arrives, he manages the collection with local labour paid by the piece and collected amounts.

However, some forms of food exchange do take place not only in local markets but also through **ancient institutions of moral economy** which are currently undergoing change and, sometimes, fragmentation too. The evolution of these forms of community moral economies has produced forms of hybrid economic exchange, between the formal and the informal, between the monetary and the trust forms.

Moral economies

Food exchanges do take place not only in local markets but also through **institutions of moral economy.** The most common practices of moral economy among the Gogo are the *kukosa* and the *songoleda*. ***Kukoza*** is the reciprocity system of livestock, so in case of difficulty, a *zebu* is lent to the family of a member of the clan, receiving milk daily in exchange and returning the animal to the owner after one or two seasons. ***Songoleda***, on the other hand, is the obligation or moral reciprocity of food exchange in the extended family and in the neighborhood (Maghimbi et al., 2016). The presence of hybrid economies is not only linked to the rural and agro-pastoral specificity of the Dodoma region, but can also be found in the food supply system of Dar Es Salaam (Wegerif 2018) or the 'new' capital, Dodoma.

Nowadays, as infrastructure development has improved transport conditions and local markets, a lot of goods circulate with money, the meaning of 'famine' has changed from shortage of food to a shortage of money: *nzala pesa* in Gogo language (Maghimbi, 2016). In the daily life of a village, the circulation of goods without the use of money is visible in many social and communal events: the collections to help out with the expenses of a funeral are mainly in kind (specific quantities of cereals), as well as attendance fees to parties, religious celebrations or circumcision rites. **Door-to-door sales** of food or utensils can also be done with a payment in kind. There is often an exchange of food between neighbours without the use of money. In any case, **the fresh *mboga* commercialisation is still based on highly fiduciary systems**: the goods are paid for just one week after delivery and only when the entire lot has been sold. There are no written contracts.

It is precisely the analysis of the leafy vegetables food value chain that highlights the connection between changes in the agricultural production, markets and diet, re-calibrating the aims of Tanzanian agricultural policies and anticipating the consequences of what would be called the '**horti-culture revolution'** (De Blasis, 2018). Stefano Ponte (2002) observed an increase in the production of the so called '**fast crops'**, also known as cash crops (i.e., tomatoes, cassava and maize, sunflowers, vegetables in general), which replaced food crops (mainly millet, sorghum, peanuts). Today, this trend is even stronger, as it has forced to neglect crops for food survival, whereas in some regions such as Tanga, Arusha and Kilimanjaro (until now, not in Dodoma) it has allocated huge amounts of land to the cultivation of green beans, peas, avocado, okra, passion fruit, which can be defined as high value food, i.e., produced for either export or urban markets. It is a farming change that is also a 'cultural' challenge.

3.6. Conclusions and recommendations

This study aimed to shed some light on public policies focusing on the production, commercialisation and consumption of neglected and underutilised food species. This investigation shows that, sometimes, academic researchers, development actors and economic planners have not been able to tap into the local knowledge about these issues, which has thus turned into a kind of '**neglected knowledge**'.

Here are some final recommendations and focus points:

1. Go beyond dichotomies and depart from local perspectives

In the policymaker language, it is possible to identify a repeated use of '**food dichotomies**': fresh versus dried vegetables; neglected species as the opposite of widespread species; indigenous versus non-local food; etc. It is crucial to go beyond this vision and to **create nomenclatures and shared taxonomies that come out of local perspectives and cultural patterns**.

2. Acknowledge sun-dried leafy vegetables as part of resilience strategies

The Gogo people have always preferred **drought-resistant cultivation systems** and practices linked to a semi-arid environment and an erratic rain season. The richness of these systems is based on the rotation of lands, a high number of varieties of seeds involved and their different combinations in diversification strategies to cope with risk. Even today, the use of a large variety of combinations of crops, such as cereals, legumes, vegetables, tree crops, tubers and roots, is the prevalent cultivation practice among the small producers of the ten villages studied.

Thus, from a policymaker's point of view, in this semi-arid area characterised by long periods of drought and recurrent famines, **economic, social and community policies on food security and food sovereignty should be implemented to enhance the role of the market and the diffusion of fresh *mboga* without limiting the extent of the moral economy and the knowledge of self-production and self-consumption of sun-dried *mboga* at the household and the village level.** Sun-dried leafy vegetables are an important part of these resilience strategies: in times of serious drought traditional knowledge enables villagers to look for edible wild vegetables in the bush for survival.

Picture 7. Mama Lishe: cooking food at Kongwa's *mnada*

Photo credit: Barbara Aiolfi, July 28th, 2019.

3. Take into account the risk of exacerbating food insecurity when promoting smallholder commercialisation

'Food insecurity strategies are not only conducted in terms of crops, livestock and other food related activities, but also in terms of relationships with relatives and friends who live in different areas' (Kilonzo in Maghimbi, 2016). **Smallholder commercialisation may induce and exacerbate food insecurity** because it brings a fierce competition for household resources, as more inputs are diverted from food crops to cash crops production (Maghimbi et al., 2016), with a subsequent **change in dietary intakes** (as in the ethnographic case, by promoting the use of fresh vegetables instead of sun-dried vegetables). This is also the case with the international success of quinoa, produced in Latin America: everything changed as the global appetite, production and export grew tremendously whereas local consumption declined (Knaepen, 2018).

4. Protect and promote traditional knowledge of gathering methods

As described in the previous pages, local agricultural knowledge is a valuable part of food strategies. Among these *agri-cultures*, the **gathering methods** of spontaneous or semi-spontaneous herbs must be promoted and transmitted to the new generations. Young villagers had less knowledge of **gathering methods** and could not identify the items as well or as accurately as the older villagers. The young people had other interests and pursuits, including

working for a salary outside their village. Therefore, their time in the village was limited and they had less chance to learn from the elders. They might also lose interest in the traditional gathering of subsistence leafy vegetables from the natural environment. This loss of knowledge in one generation is significant, since it means that newer generations will depend more on market food in the future. Policymakers, extensionists and vocational schools – when inserting *mboga* economies and cultivated IVs in their curricula – should not forget to include the skills related to the gathering of spontaneous or semi-spontaneous *mbogas* (an increasingly important topic also in other agricultural systems).

5. Place food policies in the context of power dynamics and narratives in food and agriculture

In light of the situation just described, it would be appropriate to place food policies in the context of power dynamics and narratives in food and agriculture. Using terms such as **'food regimes'**, **'food movements', 'food discourses'** or '**food institutions'** could suggest different perspectives that are useful to understand the current unsustainable and inequitable food scenario. 'Food regime' is a definition that highlights the international food framework directing the local agricultural policies, the different scales of power and the logic of exploitation of labour and land of the capitalist market. For these reasons, Selwyin uses the term ***'global poverty chain'*** (Selwyn, 2019), harshly criticising the view of the global economy through a value chain approach (Gereffi, 2014). It seems that the macroeconomic policies supporting a transition towards the commercialisation and monetisation of rural economies have impoverished them, and are more and more impoverishing their effectiveness and capability to adapt to agroecological transformations, increasing both vulnerability and food insecurity (Martiniello, 2016).

Table 1: Social and ecological taxonomy of sun-dried leafy vegetables in the research area

Typology	Swahili name	Gogo or other local name	Scientific name	English name	Consumption mode	Local market presence	Micro-nutrients	Sowing way and period	Harvest period	Availability
LEAFY VEGETABLES PICKED AND SUN-DRIED - *MBOGA ZA ASILI*	***Mlenda (A)***	Ilende	*Corchorus olitorius*	Jute mallow	Sun-dried	No	Iron, folates, ascorbic acid, polyphenols, corchorifatty acid, carotenoids, proteins, vitamin C, calcium, zinc	Spontaneous	April/May	Always (dried), while stocks last
	Mlenda (B)	Ilende	*Ceratotheca sesamoides*	False sesame	Sun-dried	No	NA	Spontaneous	April/May	Always (dried), while stocks last
	Mlenda (C)	Ilende	*Sesamus angustifolius*	Wild simsim	Sun-dried	No	Vitamin A & E	Spontaneous	April/May	Always (dried), while stocks last
	Sansa/Majani ya kunde	Safwe/Safye	*Vigna unguiculata*	Cowpea leaf	Sun-dried and fresh	Yes, small amount and not always	Niacin, folates, polyphenols, carotene, zinc, calcium, magnesium	Spontaneous	April/May	Always (dried). while stocks last
	Maboga/Majani ya maboga	Ng'halambuajila/Majenje/Mu'za/ Mhuza/Mu'huzi	*Cucurbita pepo*	Squash leaf/ Pumpkin leaf	Sun-dried and fresh	Yes, small amount and not always	NA	Spontaneous	April/May	Always (dried), while stocks last
	Mgagani	Mzimwe/mgagani	*Cleome gynandra*	Spider-flower leaf	Sun-dried	Yes, small amount and not always	Iron, ascorbic acid, glucosinolates, polyphenols, carotenoids, proteins, vitamin C, iron and calcium	Spontaneous	April/May	Always (dried), while stocks last

Table 2: Social and ecological taxonomy of fresh leafy vegetables in the research area

Typology	Swahili name	Gogo or other local name	Scientific name	English name	Consumption mode	Local market presence	Micro-nutrients	Sowing period	Harvest period	Availability
FRESH LEAFY VEGETABLES	***Mchicha***	Fwenhe	*Amaranthus spp*	Amaranth leaf	Fresh	Yes, in every local market	Vitamin A, C, E, B6, iron, calcium, manganese, zinc, carotenoids, flavonoids, phenolic acids	Many times between March and July	From April to September-More than one time	From April to September
	Matembele	Sagula and other names as translation of potatoes leaves: Majani ya viazi, Mahama (leaves) Mandolo (sweet potatoes)	*Ipomea batata*	Ipomea leaf Sweet potatoes leaf	Fresh	Yes, in every local market	NA	Many times between March and July	From April to September-More than one time	From April to September
	Chainizi	Chainizi	*Brassica rapa*	Chinese cabbage	Fresh	Yes, almost every time	Glucosinolates, phenolic acids, iron, zinc, magnesium	Many times between March and July	From April to September-More than one time	From April to September
	Mnavu	Mnavu	*Solanum scabrum/villosum/americanum*	Nightshade leaf	Fresh	Yes, almost every time	Alkaloids, iron, zinc, manganese, flavonoids, proteins, calcium	Many times between March and July	From April to September-More than one time	From April to September
	Kisamvu	Makaweha/ Muhogo	*Manhiot esculenta*	Cassava leaf	Fresh	Yes, almost every time	NA	Many times between March and July	From April to September-More than one time	From April to September

Table 3: Leafy or non-leafy vegetables (not always considered indigenous vegetables) recently produced or consumed in the research area

Typology	Swahili name	Gogo or other local name	Scientific name	English name	Consumption mode	Local markets presence
OTHER LEAFY VEGETABLES	***NA***	Mhilile	*Cleome hirta*	Spider leaf	Dried	Not always
	Sukuma wiki	Figiri	*Brassica Carinata*	Ethiopian mustard/ (slang) Spinach	Fresh	Not always
	Mhunga	Suunga	*Launaea cornuta*	Bitter lettuce	Fresh	Not always
	Mblonge/mlenda	NA	*Moringa oleifera*	Moringa	Fresh	Not always
NON-LEAFY VEGETABLES	***Bamia***	Bamiya	*Abelmoschusus esculentus*	Okra	Fresh	Yes
	Nyanya chungu, ngowe	NA	*Solanum macrocarpon*	Eggplant and African egg plant	Fresh	Yes
	Nyanya	NA	*Solanum By*	Tomato	Fresh	Yes
LEGUMES	***Njugu mawe***	Nzugu	*Vigna suberranea*	Bambara groundnut	Fresh	Yes
	Fiwi	Fwili	*Lablab purpureus*	Lablab (Lima bean)	Fresh	Not always
	Mbaazi	Mhanje (pl.zimhanje)	*Cajanus cajan*	Pigeon pea	Fresh	Not always

4. An economic analysis of the value chain of leafy indigenous vegetables in Iringa

By Marta Marson and Gianni Vaggi (Development Economics, University of Pavia)

4.1. Introduction: objectives and methods

The Development Economics Department of the University of Pavia investigated indigenous vegetable value chains in the Iringa region. The objective of the research was to provide key insights into the main stages of the supply chain, including production, processing and distribution activities. The research focused on the main leafy indigenous vegetables produced in the Iringa region.

This chapter is based on field visits and a literature review. Field visits were carried out by the UNIPV Development Economics team in April, May and November 2019. Farmers from **Lulanzi and Luhindo** (Mtitu Ward) and **Mazombe and Mbigili** (Lugalo Ward) were met in two focus group discussions (FGDs) in 2019.[36] The areas are located in **Kilolo district**: the first one, along the rough road towards the mountains south of Iringa town (which are around 2000 meters high), and the second one, in the lowlands placed along the main road connecting Iringa to Ilula and Morogoro (see Figure 3 in chapter 1 for a map of the studied area).

Picture 1: Mapping the value chain in a focus group discussion in Lulanzi, Kilolo district, May 2019.

Photo credit: Paulina Bizzotto Molina, ECDPM.

[36] The FGDs entailed: a value chain mapping exercise for farmer-selected indigenous vegetables, and a four months costs and revenues recording, including individual recall of acreage allocated to different crops, and cost and revenues associated with indigenous vegetables production.

Furthermore, the research team visited and interviewed farmers from Iringa Municipal Council (Iringa urban district), and held a workshop with indigenous vegetable traders from all the studied areas. Key urban markets were visited and interviews with key informants, including private and public sector actors, were carried out.[37]

The team also visited Dodoma for a quick assessment of the indigenous vegetables value chain, including the main markets and production areas. Findings and insights from the fieldwork conducted in this area are reported in footnotes or in the text where relevant, to provide some comparison.

4.2. Agricultural inputs

Organic farming is not common among the farmers producing indigenous vegetables in Lulanzi–Luhindo and Mazombe–Mbigili (Kilolo district). It is also not widespread among the farmers from Iringa Municipal Council. Due to the acidic nature of the soils in the study area, the use of **inorganic fertilisers** is widespread. To improve the nutrient content of the soils, at least half of the farmers from both areas use industrial fertilisers, purchased from local agro-vet shops. Others use manure.

Pesticides are even more common and virtually all farmers spray their vegetables to prevent pests at certain stages of the growing cycle. Some traders reported that sometimes the same products are used to preserve the leaves after harvest.

When **seeds** are considered, a difference can be noticed between the two areas: farmers from Lulanzi–Luhindo mostly use local seeds, saved or purchased from informal shops and local markets, for indigenous vegetables, while in Mazombe–Mbigili most farmers prefer commercial seeds.

There is a certain confusion about the features of improved varieties when compared with traditional ones. According to the agro-vet dealers interviewed in Iringa, the main advantage of commercial seeds for indigenous vegetables is yields. Also, farmers from Iringa Municipal Council explained that improved varieties, compared to the local ones, can be harvested more times before uprooting. Traders explained instead that the amaranth with white roots is the local variety, while the one with red roots, also very common, is the improved variety, and, once harvested, the latter is more perishable than the local variety. There is an improved variety of amaranth whose main feature is the shorter growing season (three weeks instead of four to five). An extension officer from Lulanzi explained that local varieties of African nightshade are more drought-tolerant but less pest-resistant than improved ones. Overall, there is not a very clear and strong narrative about the advantages of improved seeds, but the idea that they are better seems to be dominant, at least among farmers.

A reason for the relatively high intensity in the use of commercial inputs in the area might be found in the presence of the SAGCOT partnership, as the area belongs to the Ihemi Cluster, one of the priority clusters identified by the SAGCOT initiative.[38]

4.3. Production

Lulanzi–Luhindo and Mazombe–Mbigili are important **tomato producing areas** in Kilolo district, particularly the area of Mazombe and Mbigili, which are less than 10 km away from Ilula, an important market for tomatoes at the national level.

[37] These included Agricultural District Officers, SAGCOT representatives and partner entrepreneurs, the Chamber of Commerce, and agrovet shops.

[38] For an overview of the SAGCOT initiative, see Box 1 in Chapter 2.

The study areas are also suitable for indigenous vegetables' production. In both areas, farmers have access to **irrigation** for the production of vegetables, or at least to sources of water like streams and tap water. The main indigenous vegetables, common among most farmers and produced in large quantities, are **amaranth** (*mchicha*), **Ethiopian mustard** (called *figiri* in this area[39]), and **African nightshade** (*mnavu*). Pumpkin leaves (*majani ya maboga*), Chinese cabbage and sweet potato leaves (*matembele*) are also common but their classification as indigenous seems to be more controversial.

The **acreage** devoted to indigenous vegetables is higher for farmers from Lulanzi (who devote more than 0.5 acres) than for farmers from Mazombe (who prefer more intensive cultivation, with the modal acreage being 0.5).[40] Almost all farmers used irrigation for indigenous vegetables production.

We couldn't find large farms and commercial farms,[41] only heterogeneous household-level producers. A particular pattern of **specialised small-scale production** was found in Iringa Municipal District, in Mawelewele (or Itamba) and Don Bosco (Mkwawa Ward).[42] No focus groups were carried out with farmers from this area, but the production sites were visited and individual producers interviewed. These areas enjoy irrigation from natural springs and from the municipal waste-water treatment plant respectively, and host at least fifty **women producers** of green leafy vegetables under land rental arrangements.[43] These producers **supply the urban markets** only, either by directly delivering their production or through wholesale and retail traders.

All the farmers participating in the focus groups produce both for business and consumption and the most common way of selling indigenous vegetables is at farmgate, in line with the available literature (Keller, 2004; Maro, 2008; and Lotter, 2014). Farmers from Iringa Municipal Council instead prefer to bring their produce straight to the wholesale market, because of the short distance and higher prices.

Figure 1 shows the areas devoted to different vegetable crops in three districts (Iringa Municipal Council, Iringa Rural District, and Kilolo district). **The land area devoted to indigenous vegetables is lower than that devoted to exotic vegetables in all districts and tomatoes are the main vegetable crop in all cases**. The area has long been specialised in tomatoes' production and tomato is also a priority value chain for the Ihemi Cluster of the SAGCOT partnership (see Box 1 in chapter 2), which is promoting processing and trying to strengthen the link between smallholder producers and processors through facilitating collection centres located in the main producing areas.

[39] Ethiopian mustard is called *saro* in the Arusha area.

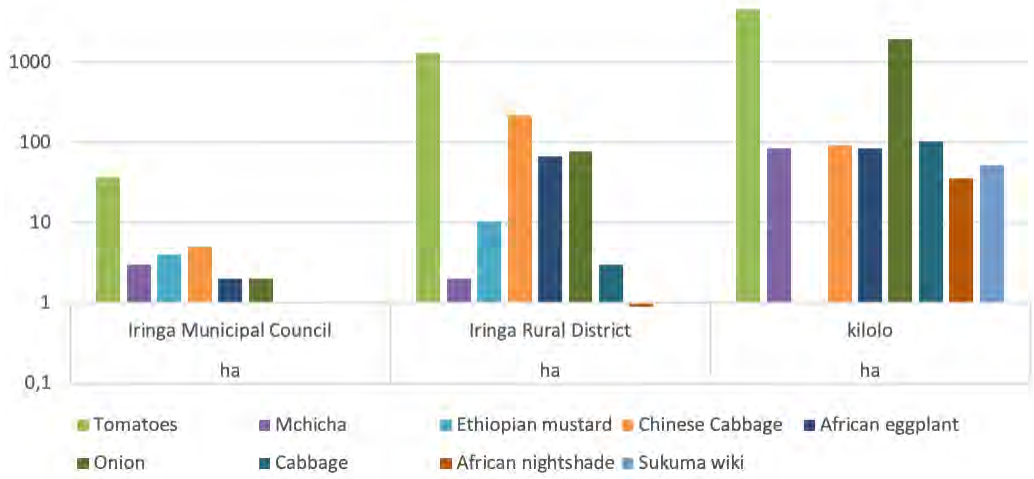
[40] Note that in Arusha one quarter of an acre was found to be the most common acreage for indigenous vegetables production, probably due to land scarcity (Bizzotto Molina et al., 2020).

[41] We prefer to distinguish between commercial farms and household level farming, rather than base any classification on acreage. We define commercial farms as production units which employ hired labour on a permanent basis. Other features of commercial units are more specialisation and bigger acreage than household plots, particularly when the area devoted to one single produce is considered. Commercial farms of indigenous vegetables (and other leafy vegetables) are very common in Nakuru, Kenya, but were not found in Arusha and Iringa. Note that our notion of commercial farm does not refer to the commercial orientation of the farming households (i.e., commercial farmers vs. subsistence farmers), but to production units other than households.

[42] The same pattern was found in Dodoma Municipal Council, in Mtumba and Ihumwa (Mtumba Ward) and in Ilazo (Ipagala Ward), supplying the urban markets.

[43] In both cases, the landowner was a Chinese investor, who recently left Mawelewele. The land was thus returned to the municipality and famers are now advocating to get formal rights on it. The annual rental fee for one quarter of acre is between 50,000 and 70,000 Tanzanian shillings.

Figure 1: Hectares devoted to different vegetables in three districts (logarithmic scale)



Source: Data from the Agricultural Routine Database System, provided by the District Agricultural Offices of Iringa Municipal Council, Iringa Rural District, and Kilolo District.

The net value of production of indigenous vegetables per hectare (as calculated from individual plot records of Lulanzi–Luhindo focus group participants) is 2,538,523 Tanzanian shillings (2019 prices), which stands in between the estimates by Weinberger and Msuya (2004) and Maro (2008). The figure, still within the two literature references, is more than 50% higher when farmers from Mazombe–Mbigili are considered, confirming that, **in this area, indigenous vegetables production is more intensive and profitable.** The proximity of the Iringa–Morogoro road seems to be the main reason behind the higher profitability of Mazombe-based farmers, as they reported that many traders come to buy their leafy vegetables.

4.4. Processing

Virtually no processing was found in the area of Iringa. **Drying indigenous vegetables** for the dry season is something that local people remember from more or less ancient times, particularly migrants and migrants' descendants from arid areas of the country. This includes drying of the entire leaves, to be later cooked as the fresh product, and drying of a vegetable powder which is called *mlenda*[44] – if made from leafy vegetables such as jute mallow, cowpea or sweet potato leaves (*kunde* and *matembele*) – or *mkalifya* and *mkunungu*, when made from the leaves of a local tree.[45]

Recently, there has been an initiative to support **solar drying of vegetables** promoted by an American NGO, Cheetah Development,[46] but only a few beneficiaries are still producing after the NGO left the country. Some processors manage to sell their dried indigenous vegetables locally, to Dar es Salaam, and to their loyal customers around the country, mostly to migrants from ethnic groups who appreciate particular products. **But these businesses are at a very small scale and difficult to scale up**.[47] At the local level, off-season fresh vegetables are increasingly available

[44] *Mlenda* is the name for several plants whose leaves make a mucilaginous or thickened dish when boiled (Lotter et al., 2014).

[45] Drying was reported to be still common in Dodoma, where the climate is more arid. Retailers interviewed in the market explained that their strategy to cope with unsold production and potential post-harvest losses includes drying left and potentially expired vegetables into something called *sansa*.

[46] See http://www.cheetahdevelopment.org/.

[47] Manufacturing processes are often associated with a certain degree of concentration, due to scale economies as well as to regulatory barriers to entry. As processed products are mainly marketed through formal channels, they must comply with the regulatory standards in place, which are often above the reach of the existing enterprises.

at a low price, while at the national level, preferences for local products are likely to become less important over time.

An interesting, recent development, when value addition is considered, is represented by the availability in local markets of clean green vegetables already chopped, sold by the same women traders at a high price, to meet the preferences of a growing urban working class. **Sorting and packaging of horticultural products** is also a value addition process that can be found in the area, which is a priority area for horticultural development in the country. This value addition process, however, **is only carried out for export horticulture** (like the French-beans from GBRI[48]) and for the high-income segment of the national demand, particularly resident expatriates, like in the case of artichokes and washed and packaged leafy salads by Masifio.[49] Entrepreneurs running these businesses were met but both were sceptical about the potential of value addition for indigenous vegetables because of their availability in every place, season and market.

4.5. Marketing

In Iringa Municipality, **most traders are also producers**. Traders usually have a group of suppliers (three to ten each) who nonetheless sell also to other traders, so that no monopsony situation can be detected.

Traders in Iringa Municipality place orders in advance, while traders from Kilolo District just look for plots ready to be harvested. In Iringa Municipality, farmers are paid only an advance sum at harvesting time while the final payment is done after the produce has been sold by the trader. This case of delayed payment, reported during the focus groups, is in line with findings from the literature (Maro, 2008). **Delayed payment is justified by liquidity constraints but it also allows the trader to renegotiate the price** in case of failure to sell. Failure to sell is nonetheless something that farmers cannot control, but traders explain that trust is usually there and cheating would be easily discovered, particularly if repeated.

In Kilolo District instead, where traders don't book the plot in advance, they pay the whole amount at harvesting. Another difference is that, in the urban area (Iringa Municipal Council), traders are the ones who harvest, sort vegetables and prepare bundles. Conversely, in Kilolo District, farmers, who are reached without previous orders and paid on the spot, are also expected to perform these tasks. **The produce is not weighted at any stage**. Traders, who visit farms, use motorcycle taxis or carry the vegetables on their heads. *Bajaji* taxis and *dala-dala* minibuses are also used.

Farmers from Mazombe and Mbigili, in contrast with findings from other areas, reported that their relationship with traders, which they rate positive, is not based on trust and loyalty. In this area, which is along the main Iringa-Morogoro road, buyers change from time to time, they simply pass by and collect vegetables, without even sharing their contacts with farmers. Nonetheless, farmers from Mazombe were found to achieve the highest profits, probably because higher competition among buyers is more than compensating for the lack of long-lasting trust relationships.

Figure 2 shows the importance of land devoted to indigenous vegetables as a percentage of land devoted to exotic vegetables in the urban district (Iringa Municipal Council) and in rural districts, respectively. The number of hectares devoted to most vegetable crops was lower in Iringa Municipal Council than in the rural districts considered (see

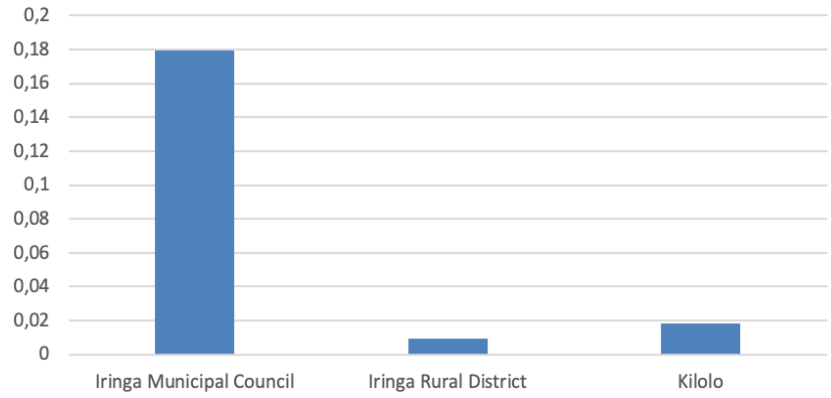
[48] See https://eatfresh.co.tz/. GBRI is also in the SAGCOT partnership and has set up an outgrowing scheme with support from international donors.

[49] See http://www.masifio.co.tz/. Masifio is owned by South Africans and targets the expats community, high segment lodges, and Dar es Salaam supermarkets.

Figure 1) for obvious reasons, such as the higher population density and the smaller dimension of the district. On the contrary, **the importance of indigenous vegetables**, as measured by the percentage of land devoted to them on land devoted to exotic vegetables, **is higher in the urban than in rural districts**. This reflects the **comparative advantage of producers located close to urban markets**, which is mostly due to the high perishability of leafy vegetables.

While tomatoes, onions and cabbages are traded over longer distances, trade flows of indigenous leafy vegetables tend to be local. **Ilula, Iringa, Ifakara, and Isimani** were mentioned **as the biggest destination markets** and they are all located within a radius of 50 km from the production sites. Indigenous vegetables were reported to be sent further only in a few cases by traders. One case is the delivery by a trader from Iringa through the bus service to a customised retailer in Dar es Salaam. Another is the sale, by vendors in Ilula, to buyers who visit the famous Ilula market to purchase tomatoes in bulk and sometimes take a chance to complement the load with some leafy vegetables. Such longer routes do not seem to have the potential to develop into anything significant so far, and probably it is not even something that should be encouraged. This is because the perishability of the produce would require cold transport which in turn raises efficiency and environmental sustainability concerns.

Figure 2: Land devoted to indigenous leafy vegetables as a percentage of land devoted to exotic vegetables (tomato, cabbage and onion)



Source: Data from the Agricultural Routine Database System, provided by the District Agricultural Offices of Iringa Municipal Council, Iringa Rural District, and Kilolo district.

Farmers themselves reach out to markets to sell when farmgate buyers are not available or when they have time to do so, but farmers from rural districts only go to village markets. For example, Luganga and Kilolo are the reference markets for farmers from Lulanzi and Luhindo, while Mbigili and Mazombe for farmers from those villages. Farmers sell in retail in their respective neighbourhoods but, despite being positively rated in terms of profitability, this trade accounts for a small share of the total revenue due to the low volume demanded. Table 1 shows the prices of indigenous vegetables in different markets.[50]

[50] The standard bunch price, even in supermarkets, is 500 Tanzanian shillings. However, these prices do not reflect a standard quantity. Informers met in the markets seldom refer to prices per kg and, to describe price variability, they do not refer to changes in prices for a constant quantity, i.e., a kg, or a standard bunch. They instead refer to changing quantities for a given price. The quantity is the variable that is adjusted across seasons and periods to reflect relative scarcity of vegetables.

Table 1: Indigenous vegetables retail prices/kg (Tanzanian shillings)

	Arusha benchmark	Iringa	Dar es Salaam supermarket
Amaranth	720	799	1,582
Nightshade	2,400	1,000	
Ethiopian mustard	1,000	926	
Packaged cowpea leaves			5,500

Source: authors' elaboration based on direct observation and measurement.

Low prices, faced by farmers at farmgate, are explained by seasonal oversupply and by huge post-harvest losses. Post-harvest losses were estimated by traders to be above 30% of the total value of vegetables. **Traders are mainly women** in the wholesale stage of the value chain, and exclusively women in retail. Traders confirm that they buy at farmgate in the afternoon and travel to the markets in the early morning (Lotter 2014). As already found in Kenya and in Arusha,[51] **wholesale markets** for leafy vegetables only **work before sunrise**. In most cases **they don't enjoy a dedicated space in the open-air market**.

All urban markets of Iringa[52] sell indigenous leafy vegetables, but whole-selling is only carried out in one of them, Kitonzini, also called *Soko la wakulima magari mabovu*. In this market, there is a dedicated, yet informal, area for leafy vegetables, along a steep slope and without any shed or pavement. Just next to this slope, there is a big cement shed equipped to function as a market, but no one uses it, probably in order to avoid tax payment, which is 500 Tanzanian shillings per day.[53] Wholesalers, who are at least 50% producers and the remaining producers and traders, bring their baskets[54] before sunrise. The area is then abandoned by 10 a.m.[55] Wholesale traders of other vegetables enjoy dedicated spaces in the market named *machine tatu*, thus wholesaling activities can continue throughout the day. The chairman of *Soko la wakulima magari mabovu* traders' association regulates greens trade, even if the women selling there are not formal members of the association – which is led by traders of second-hand clothes. He explained that he had to introduce a **system of shifts among traders of green vegetables**, in order to avoid

51 See respectively Rampa & Knaepen (2019) and Bizzotto Molina, D'Alessandro, Dekeyser, & Marson (2020).

52 These are Soko Kuu (the central market), Machine Tatu, Mlondege, Kihesa, and Ipogoro.

53 In Dodoma, traders with the trader ID card - a recent initiative of traders' regulation and formalisation by the Magufuli Government - don't pay to sell in the market. In Arusha and Iringa instead, the card is only valid to sell outside markets and registered traders still have to pay market taxes, per bag and per day. The cost of trader ID registration is 20,000 Tanzanian shillings and it never expires.

54 In the Iringa region, and also in Dodoma, bags are seldom used to transport leafy vegetables and the traditional *tenga basket*, available in different dimensions, is preferred. *Tengas* are flat, circular baskets, with very large holes between the strips. When compared to the maize bags, an advantage of *tengas* is that it allows air to flow better, but it is also more difficult to transport it with the available public means of transport because of the big diameter.

55 In Dodoma, the wholesale market for greens is *Saba Saba* market. The chairman of the traders' association of Majengo market explained that whole-selling of green vegetables used to take place in Majengo market, before the market was upgraded and renovated around six years ago. While wholesalers of tomatoes, potatoes, onions, and cabbages enjoy a dedicated space in Majengo market, greens' traders were relocated in a dedicated area in Maisha Plus market, but, due to the remoteness of this market, they don't use it and prefer the more busy and central *Saba Saba* market. In *Saba Saba*, however, they don't have a dedicated space and, from 8 a.m., the area they used is occupied by second-hand shoe traders, thus they have to leave with their leftover vegetables.

oversupply and consequent fall in prices and conflicts among traders. With this shifts system, which is in place in all seasons, the two main producing areas of Iringa Municipal Council (Mawelewele, or Itamba, and Don Bosco, both in Mkwawa Ward) are alternated, while producers and traders from other areas of the municipality and from surrounding villages can come every day because they only represent a small share of the total supply.

A workshop with selected traders in indigenous vegetables from Iringa Municipal Council and Kilolo District (both Mazombe and Lulanzi areas) was carried out in Iringa. This initiative was motivated by the identification of the trader as a critical and potentially neglected link within the value chain of indigenous vegetables. The average profit of the traders participating in the workshop was around 600,000 Tanzanian shillings (corresponding to 250 euros) per month.

The workshop allowed the identification and ranking of **priorities for traders to improve their businesses**, with potential trickle-down effects on producers and consumers. These are:

1. **To find regular buyers**. This does not necessarily refer to formal contracts but to agreements with institutions and businesses (like schools, restaurants...), which can ensure reliable and regular outlets for their produce. While some traders have this kind of regular customers, others don't. This seems to depend on the large supply of vegetables, which doesn't encourage buyers to enter into long-term relations, as it is always easy and relatively cheap to find indigenous vegetables.
2. **Traders** would like their vegetables to last longer in order to be able to **reduce post-harvest losses** and, more generally, to make their arrangements and logistics simpler and more flexible, as perishability imposes a strict timing to their activities.
3. **Traders** perceive they need **training in business management** to improve their work in the markets and in the farms. They reported that none of them has ever been targeted by any training initiative and they are not members of any association or chamber of commerce. Despite their key role in supplying urban markets and linking farmers to final customers the potentialities of traders are not developed.

The idea of making available a dedicated space to sell green vegetables at wholesale in Iringa throughout the day, instead of limiting traders' activities to the early morning, **was discussed**, as it has both pros and cons. On the one hand, it would improve the perception of such vegetables, better reflecting the importance they actually have in local people's diets. On the other hand, constraining the time for buyers to come can also be seen as a device to increase efficiency, making sure that demand and supply have a finite space and time to meet (i.e., all customers have to gather at a specific time, which minimises uncertainty for the traders).

No indigenous vegetables were found in Iringa supermarkets. This, however, should not be interpreted as a bias against indigenous vegetables particularly, but as a result of the limited role that supermarkets play in fresh produce value chains in Tanzania. Generally, supermarkets in Tanzania do not compete with open-air markets for vegetables as it seems that even high-income consumers buy most of their vegetables from open-air markets. In Dar es Salaam, however, some supermarkets sell indigenous vegetables and, according to what they reported, they purchase these indigenous vegetables in the urban wholesale markets of Kariakoo and Ilala.

4.6. Conclusions and recommendations

The analysis confirmed that **indigenous vegetables are an important value chain and a type of food that is largely consumed by virtually any social group in the area**. Local demand for indigenous vegetables is there and huge volumes are produced, exchanged, and consumed daily.

It should nonetheless be noticed that **these value chains remain very local**. While tomatoes, and to a lower extent onions, cabbages and other exotic vegetables, are produced for the local demand but mostly to be sold outside the production districts, indigenous vegetables are only, or mostly, traded locally.[56]

Targeting richer and remote markets doesn't make much sense unless some value addition is introduced. **Indigenous vegetables production could be promoted among horticultural investors and commercial farms' owners and managers**, who were found to be completely missing in the value chain. These businesses are currently focusing on export vegetables and other exotic vegetables, and indigenous vegetables are not perceived as a high segment product.[57]

The SAGCOT could provide a convenient stakeholders' platform to advocate for indigenous vegetables promotion and to pilot initiatives because many partners work in horticulture and some deal with indigenous vegetables' seeds.

Improving the efficiency of the local value chains seems more feasible and appropriate. Huge post-harvest losses are borne by traders but are transferred on to farmers through low buying prices at farmgate.

Seasonal oversupply and low prices paid to farmers are mostly driven by the risk, and the actual occurrence, of huge post-harvest losses along the supply chain. Potential demand is likely to be there, but the challenge of matching supply and demand in a limited time can be overwhelming. For this reason, **promoting more production can only be recommended if perishability is reduced**. This calls for research studies in developing simple processing or preservation technologies and varieties which have long shelf life, as already suggested by Maro (2008).

When local consumers are considered, indigenous vegetables rank very high in preferences. This doesn't seem to be fully reflected by prices and it is very realistic that willingness to pay by consumers is still above market prices, as assessed by Weinberger and Msuya (2004). A cultural bias might explain this difference and **improving consumers' perception seems to be a priority if indigenous vegetables value chains are to be promoted**. Consumer perceptions and traders' businesses could greatly benefit from better market facilities and dedicated areas for wholesale markets. Traders were found to be a neglected group generally, and traders of leafy vegetables in particular. Market managers and traders' associations involved in market places management could play a role in this, but also urban and rural district councils.

The sale of indigenous vegetables is not promoted in the markets: indigenous vegetables do not enjoy spaces which are consistent with the volumes exchanged and with the number of actors involved. Permanent areas for wholesale markets would surely improve the perception and the recognition of these products and of the actors who are involved in their production and distribution. The effect on efficiency is more controversial. More generally, **traders and women traders particularly should be targeted by initiatives to strengthen Income Generating Activities (IGAs) and Small and Medium Enterprises (SMEs)**, recognising the strategic role they play in linking producers with markets and as vehicles of information.

Moreover, farmers seem to use costly and potentially harmful commercial inputs inefficiently.[58] Reports by farmers, agro-dealers and traders about features of different varieties (traditional *versus* improved) of indigenous vegetables

[56] The same is true for Arusha, Dodoma and Dar es Salaam, each of whom rely on its rural neighbourhoods for the supply of leafy vegetables.

[57] Conversely, Kenyan demand for indigenous vegetables seems to be characterised by expectations of healthy and nutritious food.

[58] Extending irrigation and watering potential is not a main priority in the area, as most vegetable plots (dedicated small plots and home gardens) are already watered.

were found to be confused and inconsistent. **Farmers, through extension offices and agro-dealers, should be better informed and trained** on the appropriate input mix and procedures for the production of indigenous vegetables. Also, exact (dis)advantages of improved varieties should be more clearly spelled out.

5. The role of traditional and indigenous food in the restaurant sector of the Iringa region

By Michele Filippo Fontefrancesco and Dauro Mattia Zocchi (University of Gastronomic Sciences)

5.1. Introduction and objectives

The team of the University of Gastronomic Sciences **explored the drivers behind the offer of and the demand for traditional products, paying particular attention to the dynamics of the catering and hospitality sector in the Iringa region**. Specific objectives of the research were to (i) investigate the role and diversity of local, indigenous products and recipes and (ii) explore the main drivers that move the consumption of traditional gastronomy in the regional restaurant sector.

The research partially fills a gap in the academic and grey literature on the specificities of the Tanzanian market for local and marginalised foods, focusing on the hospitality sector and considering its potential role in contributing to the rediscovery of neglected foods and recipes.

The next sections present the set-up of the survey conducted in the Iringa region; discuss its findings aimed at understanding the main features and dynamics of the restaurant sector, particularly regarding the offer and demand of local and traditional food products and dishes; and present the traditional culinary ingredients and dishes mostly used in the catering sector, the place and means of supply, as well as the main trends connected to what restaurants offer. This analysis describes the promising reality of the traditional food market and points out possible lines of intervention to support the sector.

5.2. The research: methods and description of the sample

The research has been conducted in collaboration with John Msuya, Associate Professor of Nutrition at the Sokoine University of Agriculture, through a campaign of interviews in Iringa and in the surrounding area, which involved restaurant managers, staff, and owners of a selected sample of restaurants.

Restaurants were selected through a mix of convenience and purposive sampling to be representative of the regional catering sector according to the type of menu offering, the location of the restaurant, and the potential target customers.

The selection of the restaurants entailed three main stages: (i) analysis of the articulation and the main characteristics of the restaurant sector; (ii) definition of the principal typologies of restaurants based on their business structure and their clientele; (iii) selection of the informants to complete the interviews. The survey was completed between June and August 2020, combining online (social media analysis) and in-site (restaurant scouting) research.

Based on preliminary research, **three typologies of restaurants** were identified, as in Table 1.

Table 1: The main categories of restaurants in the study area and the sample

Category	No. of restaurants	Type of restaurant
1	10	Restaurants that serve mostly local, low income customers.
2	10	Restaurants that serve mostly local, middle income customers.
3	13	Restaurants that serve mostly local high income customers, tourists and international customers.

The sample includes 33 restaurants of whom: 10 that serve mostly local, low-income, customers, 10 that serve mostly local, middle-income customers and 13 that serve mostly local high-income customers, tourists and international customers.

More than half of the restaurants surveyed are located outside the city, with a higher concentration of Cat. 3 restaurants in peri-urban areas. Cat. 2 restaurants are more highly concentrated in the town of Iringa, while an even distribution of Cat. 1 restaurants is observed in and outside the town (as in Table 2).

Table 2: Classification of selected restaurants according to their location and category

Category	Iringa town	Iringa hinterland	Iringa peri-urban area	Ilula town	Kilolo district	Iringa rural district (Kalenga ward)
1	2	2	2	2	2	–
2	7	1	1	–	–	1
3	4	9	–	–	–	–
Total	13	12	3	2	2	1

The sample shows a **polarisation in terms of gender according to the restaurant typology**, as reported in Table 3: restaurants in Cat. 1 are all run by women, while the ones in Cat. 3 are largely run by men. Cat. 2 restaurants show a more even distribution.

Table 3: Gender division among the interviewees

Category	Male	Female
1	–	10
2	4	6
3	11	2
Total	15	18

The interviews were conducted with the people who run the business or with key decision-makers in designing the menu and/or sourcing the food for each restaurant. Table 4 describes the role played by the interviewees in the restaurants. In the case of Cat.1 restaurants, the key decision-maker is often the owner of the restaurant, as the business is family-run. Conversely, **Cat. 2 and 3 restaurants are distinguished by a stronger division of labour**, and an important role is played by the manager of the place, who runs the business for the owner.

Table 4: Working positions of the interviewees in the selected restaurants

	Management						Ownership	Staff
Category	Assistant manager	Co-Director	Food and Beverage section leader	Manager	Manager and Supervisor	Supervisor	Owner	Worker
1	–	–	–	–	–	1	7	2
2	1	–	–	3	1	1	4	–
3	–	1	1	9	1	1	–	–
Total	1	1	1	12	2	3	11	2

5.3. The social characterisation of the restaurant sector in the Iringa region

From a quantitative point of view, there is an overall balance between the number of female and male respondents. However, if we cross these data with the working position of the informants, **a pattern that links gender, role in the restaurant and business category emerges**. Concerning Cat. 1 and Cat. 2, the sample of respondents (20) includes 80% women, 11 of whom are owners of the business. They often run restaurants known locally as *mama lishe*. For Cat. 3, there is a preponderance (about 85%) of men who hold a managerial position.

Table 5: Average number of people working in the restaurants

No. of people	1 - 5	5 - 10	> 10
Cat. 1	10	—	—
Cat. 2	6	4	—
Cat. 3	3	4	6
Total	19	8	6

Table 5 shows the **average number of workers** in the surveyed restaurants. While in Cat. 1 the owners rely on a minimum number of hired labourers (they have on average one to two workers), for the restaurants of the other two categories there is a substantial increase in the numbers of staff with an average of about six workers for Cat. 2 and 12 for Cat. 3.

Table 6: Classification of the restaurants based on the average number of customers per day and the category

No. of customers per day	1 - 25	> 25	> 50
Cat. 1	4	6	—
Cat. 2	1	4	5
Cat. 3	—	5	8
Total	5	15	13

This figure can be explained by looking at the **business structure** and the **carrying capacity** of the restaurants. Restaurants of Cat. 2 and 3 can host larger numbers of customers and offer a broader range of food and beverage services, as shown in Table 6.

Table 7: Classification of the restaurants' customers according to their provenance

Type of customers	Mostly international visitors	Mostly local people (people from the area)	Mostly visitors coming from other parts of Tanzania
Cat. 1	—	10	—
Cat. 2	—	10	—
Cat. 3	2	10	1
Total	2	30	1

Regarding the **composition of the clientele**, there is a high prevalence of local customers (30), belonging to different social classes and with different spending capacities, and a low relevance of international and national tourists in the Iringa region (Table 7). As reported in Table 8, about 40% of respondents state that they do not serve international customers at all.

Table 8: Presence of international customers in the surveyed restaurants

International customers	Few international customers	No international customers	Regularly international customers
Cat. 1	1	9	—
Cat. 2	7	3	—
Cat. 3	3	1	9
Total	11	13	9

5.4. Results: traditional foods in Iringa restaurants

The research highlighted the **centrality of traditional cuisine for all those restaurants that deal mostly with local people, affluent and poor** (Cat. 1 e Cat. 2). However, **traditional cuisine plays an important role also in larger establishments**, being one of the main pillars of the food offer (see Table 9). This answers both the curiosity of the international travellers and the reputation of indigenous foods as safer and more nutritious than processed and international products. Moreover, as shown in Table 10, **the general interest in the traditional cuisine is quickly increasing** compared to the past, especially for the restaurants that serve a wealthier clientele (Zocchi & Fontefrancesco, 2020; Zocchi & Fontefrancesco, 2021).

Table 9: Classification of the culinary offer based on the presence and relative importance of traditional Tanzanian dishes

Category	About half of the menu is based on the traditional cuisine	Most of the food served is based on traditional cuisine	There are a few traditional cuisine dishes	There are no traditional cuisine dishes
1	—	10	—	—
2	10	—	—	—
3	8	2	2	1
Total	18	12	2	1

Table 10: Customers' attitude towards traditional food according to the perception of the respondents

Category	Decreased	Stable/ constant	Increased
1	4	2	4
2	1	1	8
3	3	3	7
Total	8	6	19

The research identified **91 traditional dishes** served in the surveyed restaurants. **The largest diversity of traditional products is displayed by Cat. 2 restaurants**, which combine the higher purchasing capacity of the clientele as well as more sophisticated kitchen equipment that allows for more elaborated and diverse preparation techniques. Overall, the largest variety of traditional food are dishes whose main ingredients are starchy products, such as *ugali* (cornmeal), boiled roots and fruits (e.g., taro, sweet potatoes, cassava, plantain, potatoes) and rice, which are combined with animal-based products (mostly dry or smoked fish, chicken and cow meat) and/or vegetables, either exotic and indigenous ones. Furthermore, while Cat. 1 restaurants offer mostly plant-based dishes or dishes made with less expensive animal products, the restaurants for international or wealthier national clientele (Cat. 2 and Cat.3) display a wider diversity of meat ingredients.

Tables 11, 12, and 13 point out the most common traditional dishes among the three different categories.

Table 11: Top 5 dishes in Cat. 1

Name	Category	Frequency
Boiled sweet potatoes	Starchy	6
Local chicken soup with chapatti	Soup + starchy	4
Boiled cassava	Starchy	4
Local chicken soup	Soup	3
Rice with beans stew	Starchy + legume	2

Table 12: Top 5 dishes in Cat. 2

Name	Category	Frequency
Rice with beans stew	Starchy + legume	4
Boiled cassava or sweet potatoes	Starchy	2
Rice with chicken stew	Starchy + animal protein	2
Rice with beans and vegetables	Starchy + legume + vegetables	2
Snack bites (rice cake, buns, roasted beef or mishikaki)	Snack bites	2

Table 13: Top 5 dishes in Cat. 3

Name	Category	Frequency
Boiled cassava or sweet potatoes	Starchy	5
Cooked plantain	Starchy	3
Beef or local chicken soup	Soup	2
Rice or ugali with chicken, beef or fish stew	Starchy + animal protein	2
Rice with beans stew	Cereal + legume	1

5.5. Results: restaurants supply chains

The supply chain of the surveyed restaurants is mostly based on **access to the local market** where most of the goods are purchased. In the case of vegetables and meat, a **direct relationship with producers** (Table 14) is also relevant. Products are purchased mostly **daily or weekly** (Table 15) despite the typology of products.

Table 14: Supply channels according to the main ingredient categories

Supply channels	Directly from local farmers	Directly from the local market	I buy from a trusted middleman	I buy from commercial companies	My production
Vegetables and fruits	16	23	7	1	3
White meat	10	19	4	–	1
Fish	3	21	7	1	–
Goat meat	2	9	–	–	–
Beef	4	29	2	1	–
Milk	15	10	5	3	1
Flour	3	29	2	1	2
Rice	1	30	3	–	–
Oil	1	33	1	–	1
Total	**55**	**203**	**31**	**7**	**8**

Table 15: Frequency of purchases according to the product categories

Frequency of purchase	Everyday	At least twice a week	At least once a week	At least twice a month	At least once a month
Vegetables and fruits	31	1	1	–	–
White meat	18	3	7	–	2
Fish	19	3	4	–	–
Goat meat	4	5	–	–	–
Beef	17	7	6	–	1
Milk	26	1	2		–
Flour	16	–	6	1	4
Rice	13	2	11	3	3
Oil	12	10	7	2	2
Total	**156**	**32**	**44**	**6**	**12**

These data, together with the marginal role of middlemen and large companies, suggest the overall **fragmentary nature of the restaurant sector and a low level of infrastructure and equipment** (e.g., refrigeration systems, places to store the ingredients, etc.) in the context of a food market that lacks big players governing the scene. In this situation, different drivers shape the choice of supply chains. Key factors are the **freshness** of the product and its **price**. The direct knowledge of the producers and seasonality, instead, play a marginal role (Table 16).

Table 16: Average perception of importance of each driver (* = not important; ***** = most important)

Drivers	Direct knowledge of the producer	Freshness	Price	Safety / Method of production	Seasonality
Vegetables and fruits	★★★	★★★★★	★★★	★★★	★★
White meat	★★	★★★★	★★★★	★★★	★★
Fish	★★	★★★★	★★★★	★★★	★★
Goat meat	★★	★★★	★★★★	★★	★★
Beef	★★	★★★★	★★★	★★★	★★
Milk	★★	★★★★	★★★	★★★★	★★
Flour	★★	★★★★	★★★	★★★	★★
Rice	★★	★★★	★★★★	★★★	★★
Oil	★★★	★★★	★★★	★★★	★★

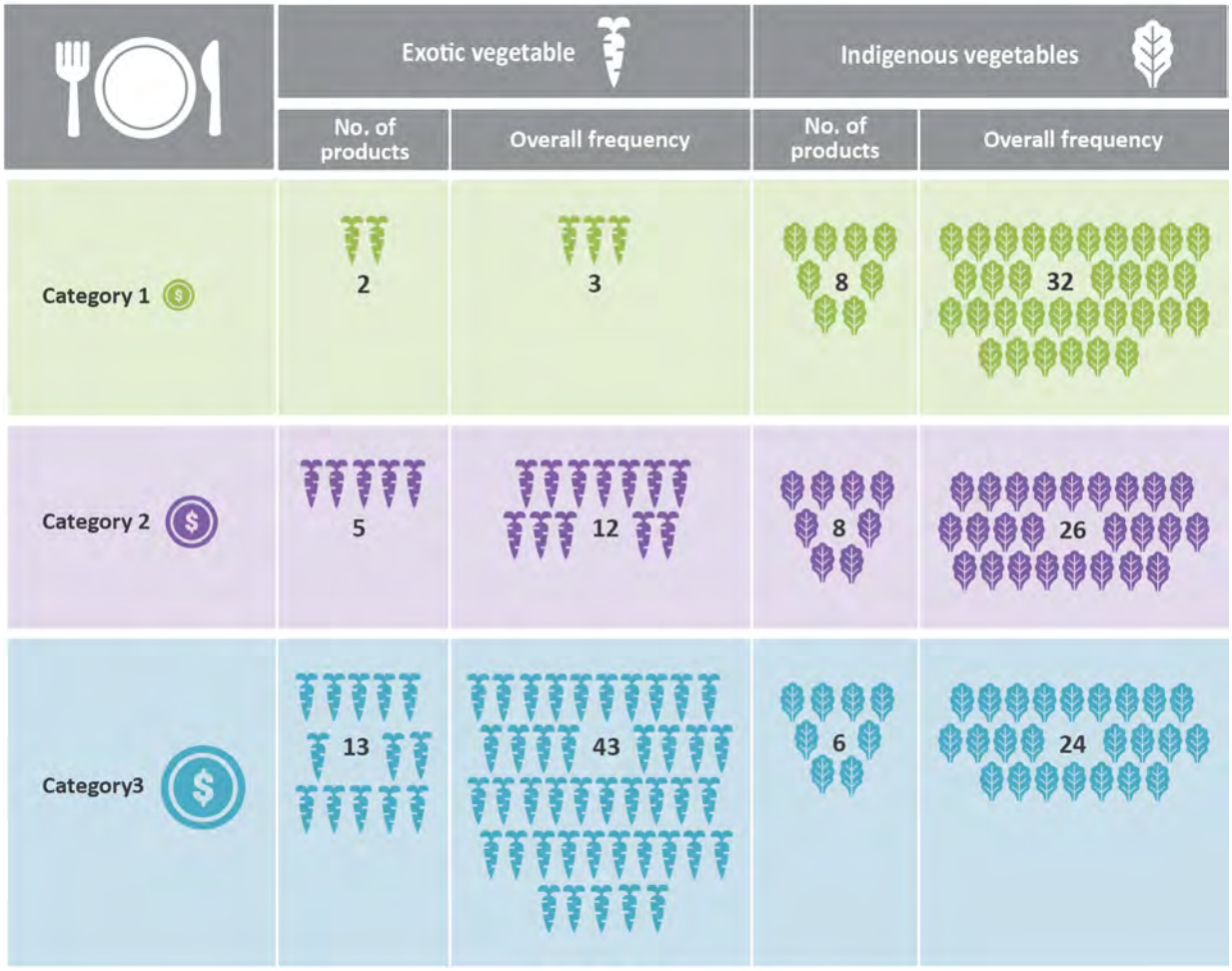
Focusing on the vegetable ingredients used in the restaurants, the foodscape is mostly marked by exotic species (species not originated from Eastern Africa, although nowadays cultivated in the area) such as spinach, collard greens and cabbage (Table 17). Despite this preponderance, **the most widespread traditional indigenous** vegetables **are amaranth leaves, African kale, pumpkin leaves, as well as sweet potato and cassava leaves**, which are common throughout the sector.

Table 17: Most purchased vegetables in the surveyed restaurant

English name (Swahili name)	Scientific name	Exotic (E) or Indigenous (I)	Category 1	Category 2	Category 3	Total
Broccoli	*Brassica oleracea* L.	E	–	–	1	1
Cabbage	*Brassica carinata* A.Braun	E	2	2	1	5
Carrot	*Daucus carota* L.	E	–	–	1	1
Cauliflower	*Brassica oleracea* L.	E	–	–	1	1
Coriander	*Coriandrum sativum* L.	E	–	–	1	1
Eggplant	*Solanum melongena* L.	E	–	–	1	1
Green bean	*Phaseolus vulgaris* L.	E	–	–	1	1
Hot pepper	*Capsicum spp.*	E	–	–	–	–
Lettuce	*Lactuca sp.*	E	–	–	3	3
Peas	*Pisum sativum* L.	E	–	–	1	1
Spinach	*Spinacia oleracea*	E	–	5	8	13
Collard greens (Sukuma wiki)	*Brassica carinata* A.Braun	E	–	3	5	8
Tomatoes	*Solanum lycopersicum* L.	E	1	1	2	4
Onions	*Allium cepa* L.	E	–	1	2	3
African eggplant	*Solanum aethiopicum* L.	I	2	4	–	6
African kale (Figiri)	*Brassica carinata* A.Braun	I	9	3	5	17
Amaranths	*Amaranthus sp.*	I	10	10	9	29
Cassava leaves (Kisamvu)	*Manihot esculenta* Crantz	I	1	4	1	6
Mlenda	–	I	1	–	–	1
African nightshade (Mnavu)	*Solanum nigrum* L.	I	–	2	2	4
Okra	*Abelmoschus esculentus* (L.) Moench	I	1	2	–	3
Pumpkin leaves	*Cucurbita sp.*	I	4	4	4	12
Sweet potato leaves (Matembele)	*Ipomoea batatas* (L.) Lam.	I	4	1	3	8

Diversity of ingredients is linked mostly with the economic possibilities of the restaurant and its clientele, as it emerges from Table 18.

Table 18: Diversity and frequency of use of exotic and indigenous vegetables in the surveyed restaurants



5.6. Conclusions and recommendations

The research investigated the presence and role of traditional products and recipes in the catering sector of the Iringa region. It showed a **greater presence of traditional products and recipes in the structures aimed at a local clientele.** Regarding the use of indigenous plant-based ingredients, the research highlighted a substantial homogeneity in the number of items and diversity of products present in the three different categories of restaurant businesses.

Concerning the supply channels and the drivers that shape the purchase choices, we highlight **the centrality of the market and the weight covered by the price and freshness of the products**. Informants motivate the choice to buy from local markets daily with the need to access fresher ingredients and cope with the logistical and technical barriers such as the lack of adequate preservation systems for the most perishable products. This choice, however, makes the restaurateurs more **exposed to price fluctuations** of products in the local food market. These constraints particularly affect those restaurants that serve primarily local, low income, customers.

Given the situation outlined in the research, we identify a need for public and private support to sustain growth in this sector by operating both on a market structural level (e.g., improving the market infrastructure as well as limiting the exposure of restaurateurs to market price fluctuations) as well as on the marketing side (e.g., implementing new campaigns aimed at promoting the nutritional and culinary potential of traditional food ingredients, as well as celebrating their history (Zocchi & Fontefrancesco, 2021).

Moreover, we recommend to:

1. **Focus local marketing strategies on themes concerning health and food safety rather than heritage.** This recommendation is based on the observation that the current revival of traditional and local gastronomy in Iringa, and Tanzania more broadly, is linked both to a growing consciousness regarding health and food safety and the fact that traditional products are increasingly recognised as safer and healthier options as compared to processed or international products.
2. Explore **the possibility of developing alternative supply chains**, complementary to the conventional market, to improve the quality and freshness of raw materials, partially limiting the exposure of restaurateurs to market price fluctuations.
3. Investigate **the possibility of creating 'farm to fork' projects, that is to develop alternative supply channels for specific raw materials of vegetable origin** (e.g., perishable products, ingredients difficult to find in the market). In this sense, we suggest the possibility of creating direct commercial relations with producers in peri-urban and rural areas. A further solution could concern the creation of 'restaurant gardens' managed individually or collectively by restaurateurs, possibly located near the catering facilities.

To evaluate the feasibility of these solutions, further studies should explore the point of view of actors located at different levels of the supply chain to identify their motivations and to figure out alternative ways to foster the creation of commercial and social networks between the restaurateurs and other actors of the local foodscape. The implementation of farm to fork projects would imply an analysis of the logistical, spatial, and legal barriers related to the development of these activities.

6. Conclusion

By Cecilia D'Alessandro and Paulina Bizzotto Molina (ECDPM)

This report analysed the economic, social and environmental sustainability of the food system in the areas around Iringa and Dodoma in Tanzania. Through multidisciplinary research, a team of economists, anthropologists and political scientists explored the factors and actors that support or hinder a shift towards more sustainable food systems and healthier diets and studied the role that diversified agroecological systems and indigenous vegetables can play in advancing the sustainability of the local food systems.

Using a food systems approach, **this report mapped Iringa's food system and analysed its governance**, providing insights into the policy environment and actor networks, **to develop pathways that can promote less uniform and healthier diets and ecosystems**. **Then, the leafy vegetable value chains in Dodoma and Iringa were analysed with an anthropological and an economic lens** to identify current constraints and opportunities for their further promotion and uptake. Lastly, the authors explored the dynamics of the catering and hospitality sector in the Iringa region and assessed its potential in contributing to the valorisation and rediscovery of traditional foods and recipes.

The research shows that, despite being a national breadbasket, the Iringa region still faces high levels of malnutrition, often due to monotonous diets and gender biases. At the same time, unsustainable agricultural practices and pressure on land use are contributing to declining soil fertility. Climate change is increasingly affecting small-scale producers, who depend on their crops and livestock for their livelihoods. An array of policies and institutional frameworks influence the local food system spanning across different sectors (e.g., nutrition, agriculture, environment) and government levels. But these frameworks are often fragmented, incoherent and weakly implemented. Moreover, **prevailing policies remain biased towards staples support and rarely promote agri-food diversification or indigenous vegetables**.

These crops, however, are already present in the plots, markets and on the plates of the local population. In rural Dodoma, for instance, dried leafy vegetables are an important **part of local resilience strategies** and a peculiarity of agro-pastoral populations of semi-arid areas that face recurrent droughts and food shortages. In Iringa, where water resources are more generous, large quantities of fresh indigenous vegetables are produced and traded, mostly by women. Fresh leafy vegetables are also becoming increasingly popular in homes and markets in the Dodoma region, where trade relations intertwine with ancient forms of moral economy. But while tomatoes and other exotic vegetables travel long distances, **leafy indigenous vegetables' value chains remain very local, due to their high perishability**. This factor, combined with the low levels of processing and value addition, increases the risk of losses along the chain and depresses producer prices. Despite these shortcomings, **traditional ingredients and recipes play an increasingly important role in the restaurant sector in Iringa**, particularly in those businesses geared towards a local clientele. This trend is linked to consumers' gastronomic preferences, but also to a growing health consciousness that identifies indigenous foods as safer and healthier options as compared to processed or international products.

Our findings suggest that stronger integration of indigenous vegetables could alleviate some of the current unsustainable outcomes of the Iringa's food system, contributing to healthier diets and more diversified and resilient agroecosystems. To achieve these outcomes, (i) agricultural extension services could be strengthened, expanding officers' knowledge on sustainable agricultural practices and nutritious crops and taking a more inclusive and participatory approach that is responsive to the diversity of small-scale farmers and their needs. Also, (ii) supporting the business of often-neglected informal vegetable traders and food vendors can strengthen indigenous vegetables integration and improve the welfare of consumers and producers alike. Finally, (iii) the demand for sustainable, safe and nutritious food can be enhanced by sensitising consumers on the nutritional value of indigenous foods and vegetables, thereby improving perceptions of these crops and contributing to better diets.

Food system transformation processes are highly complex and context-specific. As such, **efforts to improve the sustainability of a food system need to be based on a thorough understanding of the different elements, sustainability challenges and power dynamics in a given food system, and how these interact**. In this context, a food systems approach is useful to unravel the interactions between different activities, factors and drivers, thus making potential trade-offs and synergies explicit. By providing insights into the incentives and powerplay of stakeholders, this approach can thus help to design more coherent and context-specific programmes and policies, in partnership with and owned by local actors.

The multidisciplinary nature of this research allowed us to investigate different aspects of the food systems in Iringa and Dodoma and to explore the experiences and perspectives of a wide range of stakeholders, with the insights from different disciplines informing and complementing each other. As such, it is our hope that this report can feed into existing processes and partnerships and contribute to a more sustainable food system in Iringa and Dodoma.

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Chapter 5

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Zocchi, D. M. and Fontefrancesco, M. F. (2021). *A pillar for any menu. Perspectives and constraints in the diffusion of traditional foods in the restaurant sector*. In Zocchi, D. M., & Fontefrancesco, M. F. (2021), Ark of Taste Tanzania: food, knowledge and stories of gastronomic heritage. Pollenzo: University of Gastronomic Sciences.

"...efforts to improve the sustainability of a food system need to be based on a thorough understanding of the different elements, sustainability challenges and power dynamics in a given food system, and how these interact"

The Iringa region in Tanzania is well-endowed with water resources, rich in agrobiodiversity and has a favourable climate. It is one of the major breadbaskets in the country, concentrating food and livestock production to sustain a growing population. However, the sustainability of the local food system is threatened by declining soil fertility and climate change impacts. Moreover, low dietary diversity and gender biases contribute to high malnutrition levels. The region of Dodoma, on the other hand, is primarily semi-arid and has historically been prone to droughts and food shortages. Both areas witnessed increasing conflicts over land and resources due to population pressure, often exacerbated by policies favouring large-scale investments that marginalise smallholder producers.

Our two-year multidisciplinary research, in cooperation with our partners from the Sustainable Agrifood System Strategies (SASS) project, shows that a stronger integration of indigenous vegetables – which are highly nutritious and locally-adapted – could alleviate some of the unsustainable outcomes of Iringa's and Dodoma's food systems, contributing to healthier diets and more diverse and resilient agroecosystems. In rural Dodoma, dried leafy vegetables are already an important part of local resilience strategies, while in Iringa small-scale women farmers produce large quantities of fresh vegetables for the local market and restaurants increasingly offer traditional foods. However, a policy environment biased towards staples support and inefficiencies along the supply chain constrain the uptake of these crops.

In our research, we identify three pathways towards stronger integration of indigenous vegetables: i) strengthen extension services, creating a more inclusive and participatory approach and expanding officers' knowledge on sustainable agricultural practices and nutritious crops; (ii) support the business of often-neglected informal vegetable traders and food vendors; (iii) sensitise consumers on the nutritional and culinary potential of indigenous vegetables and traditional foods.

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