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Understanding and managing trade-offs in food systems interventions: THE CASE OF NAKURU COUNTY, KENYA

**SUSTAINABLE
FOOD SYSTEMS**

By Cecilia D'Alessandro, Paulina Bizzotto Molina, Koen Dekeyser and Francesco Rampa

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Food systems around the world are facing unprecedented, interlinked sustainability challenges. As such, actions aimed at making them more sustainable inevitably encounter hard choices between multiple – and sometimes competing – goals. For example, efforts to boost agricultural production may damage the soil in the long-term. Yet, researchers and policymakers often downplay these trade-offs, which risks making the unintended consequences of interventions harder to mitigate. Therefore, as an increasing number of policymakers in Africa and Europe acknowledge the need for more sustainable food systems, the necessity to understand trade-offs – and how to manage them – is now greater than ever.

In this paper, we draw on our research in Nakuru county in Kenya to understand the potential trade-offs and synergies between different policies and investments to improve people's access to nutritious food. For instance, if not coupled with targeted accompanying measures, the enforcement of standards to enhance food quality and safety may end up marginalising small-scale producers and informal traders, and increase poverty instead of improving people's diet. To avoid such unintended negative outcomes, we help policymakers understand and minimise the trade-offs of their interventions, while building on potential synergistic actions.

This paper is part of a series on how the ECDPM's food systems approach can support policymakers and practitioners in navigating complex choices, and making food-related policies and interventions more coherent and effective. This approach puts the spotlight on the analysis of power dynamics to understand what hinders or supports the transformation towards more sustainable food systems.

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Acronyms

BAU	Business As Usual
EAOPS	East African Organic Product Standards
ECDPM	European Centre for Development Policy Management
GDP	Gross Domestic Product
HLPE	High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KALRO	Kenya Agricultural and Livestock Research Organisation
KEPHIS	Kenya Plant Health Inspectorate Services
KOAN	Kenyan Organic Agriculture Network
MoALF	Kenyan Ministry of Agriculture, Livestock and Fisheries
MFIs	Micro-Finance Institutions
NCPB	National Cereals and Produce Board
NGOs	Non-Governmental Organisations
PGS	Participatory Guarantee Systems
SASS	Sustainable Agrifood Systems Strategies
SDC	Swiss Agency for Development and Cooperation
SMEs	Small and Medium-scale Enterprises
SSN	Seed Savers Network
UN	United Nations

1. Introduction

Food systems around the world are changing rapidly and are confronted with unprecedented, interlinked sustainability challenges requiring responses at local, national, and international level. Consensus is growing on the need for a transformation in the way food is produced, processed, distributed and consumed (Willett et al., 2019). This requires generating new knowledge and insights into how such transformations can be achieved. In this context, using a food systems approach is useful to analyse the complexity and interrelated drivers of food system sustainability. Such an approach can help practitioners and policymakers develop more coherent, effective, and context-appropriate interventions to support the transition to more sustainable food systems.¹

ECDPM has developed an iterative, step-based sustainable food systems approach to navigate complexity that can be adapted to available resources. In this paper, we present a case study where we **piloted this approach in Kenya** to develop transformation pathways and policy interventions that increase the sustainability of the food system of Nakuru county. We also explain how **this approach can be used to analyse and manage the trade-offs** that food systems interventions inevitably encounter as they try to achieve multiple, competing objectives.

Using the case of Nakuru county and based on experts' consultations, we assess the likely impacts of emerging pathways on selected sustainability objectives. We also evaluate the trade-offs or synergies potentially arising between the pathways. Finally, we use a **political economy analysis** to draw insights on the power dynamics and key actors' interests and incentives currently hindering policy changes in the Nakuru food system. This analysis helps guide strategies to navigate likely resistance to the interventions proposed and identify opportunities for partnerships and coalitions for change. The analysis also helps refine the pathways by proposing measures to mitigate potential unintended, negative impacts and identifying an optimal pathway mix that maximises synergies and minimises trade-offs in food system transformation processes in Nakuru.

In what follows, we introduce our sustainable food systems approach and explain how it can be applied to analyse and manage trade-offs in food systems (section 2). We then describe the application of the approach in Nakuru county, focusing on emerging pathways and policy recommendations (section 3). Following this, we analyse the potential impacts of the proposed pathways on the sustainability of Nakuru county's food system, the trade-offs or synergies between the pathways, and the political economy issues related to implementing the pathways (section 4). Finally, we provide concluding remarks and reflect on lessons learned (section 5).

¹ Sustainability transitions refer to 'long-term, multi-dimensional and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption' (Markard, Raven and Truffer, 2012: 956).

2. The sustainable food systems approach

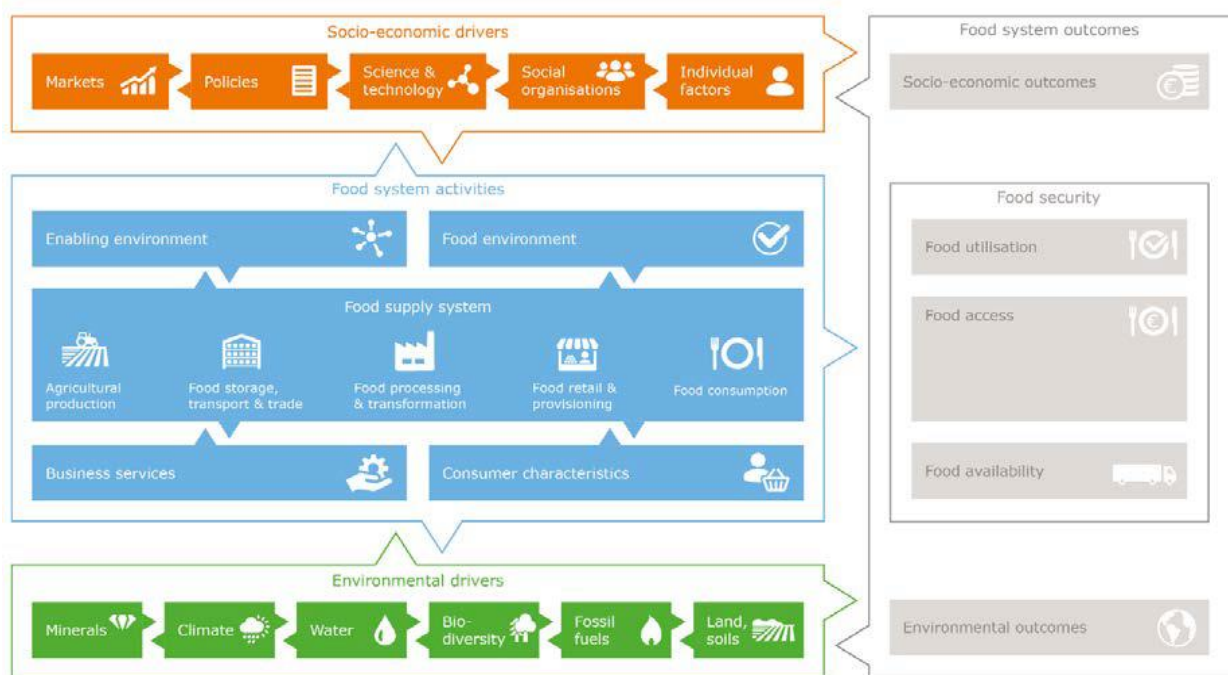
This chapter introduces ECDPM's sustainable food systems approach - featured in Dekeyser et al. (2020) - and explains how the approach can be applied to analyse and manage trade-offs in food systems.

2.1. What are food systems?

The challenges of food and nutrition security, environmental sustainability and social equity are interlinked and can rarely be tackled in isolation (IPCC, 2019; Springmann et al., 2018). To understand the (inter-)linkages of these issues with food and act upon the resulting complexity, **policymakers and researchers increasingly turn to the concept of food systems**. 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).

In this paper, we build on the conceptualisation of food systems 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). As a result of the multiple interactions, the boundaries of what constitutes an outcome, activity, and driver within a system can shift.

Figure 1. Food system framework



Source: van Berkum et al., 2018.

Environmental drivers relate to the biophysical context in which the food system operates.² **Socio-economic drivers** affect or influence the food system through trade relations and economic growth (markets); land rights and food safety legislation (policies); technological innovations (science and technology); households and social movements (social organisations); and lifestyles (individual factors; van Berkum et al., 2018). 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.

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 businesses services.³ The food environment and consumer characteristics influence the retail and consumption side of the activities.⁴ 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).⁵

2.2. ECDPM’s sustainable food systems approach

Using a food systems approach is crucial for effectively addressing the **systemic challenges** related to food. It can greatly benefit practitioners and policymakers to analyse, diagnose, and make choices in food systems (HLPE, 2020; van Berkum et al., 2018). However, this approach is often seen as too complicated and resource-intensive. As such, ECDPM developed an **iterative, step-based sustainable food systems approach** that is adaptable to available resources and can enable a fast overview or a deep dive as determined by the user’s objectives. This approach helps to navigate the complexity of food systems and can provide a basis for more coherent, effective, and context-appropriate policies and interventions.

ECDPM’s approach combines four components (or steps) as depicted in Figure 2. First, a **food system analysis** uncovers the key activities, drivers, and interactions in the food system under study. Second, a **sustainability analysis** explores the food system’s current sustainability dynamics and future sustainability challenges. Third, a **political economy analysis** investigates the governance of the food system by unveiling the power, interests and incentives different actors have in shifting or maintaining the status quo. This helps practitioners to be aware of the political context in which they work and assess traction for proposed pathways and interventions. Together, these three analyses can explain *what* the food system looks like, *how* it operates, *which* sustainability challenges it faces, *who* makes decisions impacting the food system and *why* these decisions are made. Fourth, based on these analyses, **transformation pathways** are developed that present targeted and politically feasible options for increasing the sustainability of the food system or specific activities therein. The feasibility of these pathways can improve if relevant stakeholders are engaged in pathway formulation and design. In short, **ECDPM’s sustainable food systems approach can help in designing and implementing policies and interventions that address unsustainable trends in food systems.**

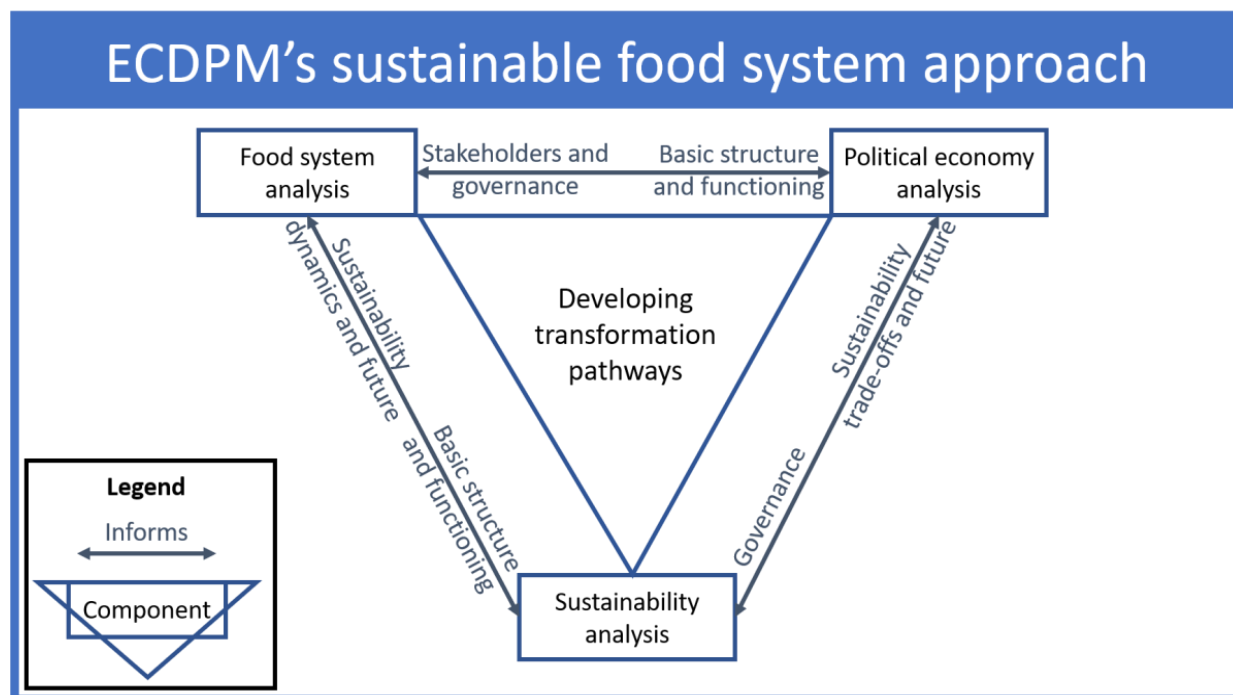
² The influence of environmental drivers differs per food system activity. For example, the biophysical context has a strong influence on food production but affects much less food transport.

³ Such as regulations and research (van Berkum et al., 2018).

⁴ 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).

⁵ Useful data sources are the Food Systems Dashboard, FAOSTAT, UN Comtrade, the World Development Indicators, and the Global Food Security Index.

Figure 2. ECDPM's sustainable food systems approach



Source: Dekeyser & Rampa (2021)

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 on 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.

While we recommend integrating all steps as they inform one another, **each project or organisation can decide on where to place its resources best**, including devoting less effort to certain steps. Similarly, not every organisation may be able and willing to undertake the food system, sustainability, and political economy analyses together and facilitate the development of pathways; partners collaborating around this food systems approach may decide to task divide based on respective comparative advantages.

2.3. The analysis and management of trade-offs in food systems

The food systems approach offers not only a means to compare different intervention options but also a framework for **systematically analysing trade-offs and synergies between various policy objectives** (van Berkum et al., 2018: 24-25).⁶ Sustainability is multi-dimensional and implies hard choices between multiple objectives, all desirable but

⁶ A trade-off is 'where a gain for one objective results in a loss for another' (Franks, 2019: 2). For instance, gains in agricultural production oftentimes come at the expense of nature conservation. A synergy is 'an interaction among two or more actions, which will lead to an impact greater or less than the sum of individual effects' (Mainali et al., 2018: 1). In this paper we refer

not simultaneously achievable (Adolph, 2020). Due to the complexity and competing objectives involved, food systems interventions advancing one dimension (e.g., food security) possibly impact others, positively or negatively (e.g., soil fertility). Trade-offs can also impact the distribution of benefits and costs within and between stakeholder groups and at different spatial (local, landscape and national) and temporal (short- and long-term goals) scales (Franks, 2019). Nonetheless, synergistic interventions that simultaneously advance multiple goals are possible as well.

Often, researchers and policymakers designing and implementing interventions in food and agriculture overemphasise win-wins. But win-wins are relatively rare (Béné et al., 2019). **Ignoring potential synergies and trade-offs comes at a cost**, as it can lead to policy incoherence, adverse impacts of policy in one sector on another, loss of opportunities for positive synergy effects, and delayed outcomes (Mainali et al., 2018).

The four-step ECDPM's sustainable food systems approach can help *analyse* the trade-offs (or synergies) that can be expected from specific interventions and develop strategies to better *manage* them.⁷ First, the food system and sustainability analyses (steps 1 and 2) explore the **potential impacts of intervention options** on different sustainability outcomes (as opposed to continuing in a business-as-usual scenario). This helps **make likely trade-offs (or synergies) explicit**.⁸ Then, the political economy analysis (step 3) unearths the **power differentials, interests and incentives influencing decisions on how to manage these trade-offs**. It also unpacks stakeholders' narratives and assumptions on the desired food system changes (see Box 1). This helps to assess potential resistance to interventions (e.g., identifying influential groups of stakeholders who may *lose*), mitigate their unintended consequences (e.g., to avoid leaving marginalised stakeholders behind) and build on expected synergies. Lastly, when refining transformation pathways (step 4), the development of **targeted strategies to engage with different stakeholders** and gauge opportunities for pathway-supporting coalitions can improve implementation prospects.

Box 1: Diverging narratives and assumptions in food systems transitions

Different stakeholders can have diverging narratives about sustainable food systems ('feed the world', 'healthy and nutritious diets', 'inclusive and equitable food systems' or 'improved resource use'). These narratives can influence the emphasis placed on certain food system outcomes, the bias towards specific intervention options, and the way trade-offs are managed in their implementation. For example, interventions guided by a 'feed the world'-narrative typically have a bias towards yields, production and productivity increases, while those inspired by the 'healthy and nutritious diets'-narrative tend to emphasise nutrition, food environments and consumer behaviour (Brouwer et al., 2020). Leaving these assumptions, and potential trade-offs, implicit increases the risks of blind spots and biases that can compromise the effectiveness of interventions (Gaitán-Cremaschi et al., 2020). Conversely, combining interventions at different levels and entry points of the food system makes sustainability transitions more likely to succeed (Brouwer et al., 2020).

When designing interventions, stakeholders also have different notions and ambitions regarding the type of change that they desire, both in terms of scope and depth of change (Figure 3).⁹ Interventions and policies can aim at optimising (through incremental changes), reforming or radically transforming current food systems (Wigboldus et al., 2020).

to synergies as likely simultaneous benefits in terms of food system sustainability (social, environmental, economic sustainability).

⁷ 'Trade off management is not just a technocratic process. It is fundamentally a negotiation between stakeholders who have different interests in the range of possible ecosystem services outcomes' (Franks, 2019: 3).

⁸ A variety of qualitative or quantitative methods can be used to weigh trade-offs and synergies between sustainability objectives. These include simulation methods, optimisation methods, multicriteria analysis, spatially explicit methods, integrated modelling methods and stakeholder-centred methods (Gusenbauer & Franks, 2019).

⁹ The scope and depth of a change can be assessed by asking how complex is the envisioned change process and how different from the previous status quo is the envisioned change (Wigboldus et al., 2020).

Figure 3: Visualising different types of changes, with indicative examples

		Scope of what changes		
		Products and practices	Relationships and institutions	System/sector configurations
Depth of Change	Reinforce/optimise	‘Smart’ application of external inputs	Enhancing efficiency of processes	Optimising value chains
	Playing the game better Doing things right			
	Reform			
Changing the rules of the game Doing the right things				
Transform	Game-changing new practices	Food councils co-developing food policies	Social transformation	
Changing the game Redefine what is considered ‘right’				

Source: Authors' elaboration based on Wigboldus et al., 2020

The difference in the type of change envisaged influences the level of political traction or opposition that can be expected, as well as the likelihood and magnitude of possible trade-offs.

Transforming food systems may seem like a daunting task. Creating political traction for change is difficult when it challenges vested interests and goes against dominant perceptions and discourses. Breaking down transformation pathways into smaller, incremental interventions allows to make trade-offs clearer and easier to manage. This way, more radical food system changes become attainable.

In what follows, we describe the practical application of ECDPM's approach in Kenya and show how its four components can support the analysis and management of trade-offs in the development and implementation of transformation pathways.

3. The food systems approach in practice: the case of Nakuru county, Kenya

This chapter summarises how we used ECDPM's food systems approach in Kenya to develop transformation pathways and policy recommendations that increase the sustainability of the food system of Nakuru county. These will be the subject of the trade-offs and synergies analysis in chapter 4.

3.1. ECDPM's work in Kenya: The Sustainable Agrifood Systems Strategies project

Between 2017 and 2020, the **Sustainable Agrifood Systems Strategies (SASS) project** piloted ECDPM's sustainable food systems approach in Kenya (Rampa & Knaepen, 2019) and Tanzania (Bizzotto Molina et al., 2020).¹⁰ By iteratively applying the four components of the approach, the food system drivers (e.g., urbanisation, drought and regional trade), activities (e.g., food supply, food environments, and distribution), and outcomes (e.g., diets, malnutrition, and food security) were analysed both in the national food system of each country and in the local food systems of Nakuru county in Kenya and Arusha region in Tanzania. This research was undertaken in close consultation with local stakeholders by a consortium led by ECDPM and involving Italian and local universities. The multidisciplinary team brought together researchers in anthropology, economics, agronomy, biology, nutrition and political science. This broad disciplinary base proved especially valuable given the complex nature and operation of the food systems under study, which are influenced by many factors and subsector dynamics.

First, a food system analysis was carried out, resulting in a **comprehensive map of food system elements and dynamics** for both the local food systems and their interactions with the national food systems. Secondly, from this map, the **level of sustainability** of the local food systems was studied, including malnutrition rates, pressure on natural resources, and economic marginalisation. Together, the food systems and sustainability analyses helped the team understand the current weaknesses of the food systems and key economic, social and environmental sustainability challenges. They also provided a starting point for reflecting on what should be the priorities for improvement or transformation of the local systems. This allowed the team to narrow down the complexity of the analysis, setting the boundaries of the studied food systems and deciding on what subsectors, actors and drivers to focus on.

Among the emerging features of the local food systems, what stood out was a dualism between commercial, mostly mono-crop export-oriented agriculture, and smallholder farming - largely informal, multi-crop and destined to local markets. The scarce diversification of food production and consumption, with the associated social and environmental risks, was identified as a key sustainability challenge. These first two components thus led the SASS project to focus on **diversification** as a way to improve the economic, social and environmental sustainability of the local food systems, with particular emphasis on understanding the current role of **indigenous vegetables** within these systems and their potential for increased sustainability.¹¹

¹⁰ SASS (2017-2020) is a multidisciplinary consortium funded by the Italian Ministry of Education, University and Research, and comprised of ECDPM, the University of Milano-Bicocca, the Catholic University of the Sacred Heart, the University of Pavia and the University of Gastronomic Sciences.

¹¹ Indigenous vegetables 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). 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 et al., 2019).

Thirdly, for the political economy component, an **in-depth analysis of the governance** of the food systems (within the set boundaries) provided clarity on the key policies, processes and main actors in the national and local food systems. It also shed light on policy and investment choices, political traction, economic incentives, power relations and partnerships. Through the policy analysis and stakeholder mapping, drivers and constraints of more sustainable food systems for the Arusha region and Nakuru county could be identified.

Lastly, from these analyses, several **pathways to improve sustainability** were developed in consultation with local stakeholders. These were organised along production, distribution, consumption, or governance.

The implementation of the four components was **iterative**. Hence, the research and dialogue activities under every component benefitted from further insights that in the meantime had emerged from one or more of the other three components, including new evidence from the political economy or sustainability analyses or new information about the feasibility of a proposed transformation pathway.

In the case of Kenya, piloting ECDPM's approach led to the following results. Nakuru county is experiencing growth in economic opportunities and jobs, especially in export-oriented floriculture and horticulture. However, the scarce diversification within the local food system creates unsustainable outcomes in the social and environmental dimensions. Rather than caloric intake, the key food security issue is lacking adequate nutrition in this part of Kenya. Moreover, the affordability of food seems more problematic than its availability. The depletion of natural resources caused by mono-cropping and the polluting effects of fertilisers' overuse points to an urgent need to address the impact of different production models on the quality of soils and biodiversity. A **'systemic bias' in favour of staples and export-oriented horticulture**, and the marginalisation of indigenous vegetables, is also identified. Attracting foreign direct investment into export-oriented agriculture, for instance, has received much more policy attention than the many small and medium-scale enterprises (SMEs) producing for the Kenyan market. Moreover, the government is heavily supporting the maize sector (e.g., through output market interventions, input subsidies and trade restrictions).¹²

Thanks to the insights provided by the food systems approach, the SASS project chose to prioritise and deepen the analysis in the following areas: soil quality, dietary adequacy and market price dynamics; challenges and opportunities to diversify the food system beyond maize and large-scale horticulture; and a better understanding of SMEs as actors that could receive more support in future policies and investments.

The political economy analysis explained the factors underlying the current neglect of indigenous vegetables. In the food distribution system of Nakuru, for instance, indigenous vegetables have limited access to rural and urban markets, which restricts incentives to produce and consume more of them. This is the consequence of the current nature of the vertical and horizontal linkages between key actors in the distribution subsystem. Such linkages, in turn, are shaped by the array of interests, opportunities, and constraints that these actors face. Informal and spontaneous cartels formed by the traders and the 'costs of formalising' indigenous vegetable value chains contribute to making the demand for these vegetables unstable and uncertain among supermarkets and individual consumers (e.g., due to safety concerns, or uncertainty about contracts). This discourages growth in production and consumption.

¹² The Kenyan government, through the National Cereals and Produce Board (NCPB), purchases maize directly during the harvest season to build strategic reserve stocks for periods of food shortages or to influence prices. Maize production is also incentivised by means of inorganic fertiliser or other input subsidies, including improved seeds. At least 50% of the Ministry of Agriculture budget is spent on buying maize and its subsidies (Mureithi, 2019). In addition, the Kenyan government routinely implements changes in tariff rates and other cross border trade control mechanisms for maize.

3.2. Emerging pathways for sustainable transformation in Nakuru

Based on the food system, sustainability and political economy analyses described above, entry points for food system diversification and improved sustainability were identified and the feasibility of related policies and investments were discussed iteratively with Nakuru county stakeholders.¹³ This led to the selection of **four transformation pathways** supporting a stronger integration of indigenous vegetables in the food system of Nakuru county:

1. **Policies and investments to increase the availability of smallholders-saved seeds** (a pathway focusing on production drivers, also improving environmental outcomes of the food system);
2. **Measures to incentivise the processing of vegetables** to reduce their perishability and create new market opportunities (focusing on distribution drivers and improving economic outcomes, e.g., drying vegetables and blending them into maize flours);
3. **Policies and investments to improve market access** (focusing on consumption drivers and improving nutritional outcomes of the food system, e.g., via public procurement of vegetables for hospitals and schools); and
4. **Creation of a multi-stakeholder platform** including often-neglected informal actors to coordinate support for indigenous vegetable value chains (focusing on enhancing governance at the systems level). The specific implementation steps, roles, responsibilities and public-private partnerships that could contribute to these four pathways are currently being designed within such a platform, under the leadership of the Nakuru county administration.

Figure 4. SASS multi-stakeholder workshop, Nairobi, September 2019



Photo credit: Silas Wanjala, workshop participant.

In this paper, we chose to **focus on the first (seed supply) and third (market access) pathways**. In particular, we concentrate the analysis of trade-offs and synergies on a subset of **potential interventions**:

¹³ This and the next section build in particular on the outcomes of two workshops organised by ECDPM with key public and private actors in Nakuru county. The first one, held at the premises of the Jomo Kenyatta University of Agriculture and Technology, in September 2019, helped refine the emerging pathways by outlining their potential benefits, drawbacks, and key actors and drivers of change. The second one, held at the Nakuru Agricultural Training Centre in February 2020, drafted a roadmap for the indigenous vegetables multi-stakeholder platform, describing key actions, roles and responsibilities of platform members.

-
1. Adapting, domesticating and enforcing, at the county level, the **KEBS Standard on Horticultural Products**, particularly its Part Two – Fruits and Vegetables (KS-1758-2:2016). The KS-1758 is a government standard that was developed under the leadership of the private sector and is currently at a very early stage of implementation.¹⁴ It has a scope like that of GLOBAL GAP, covering issues of food safety and traceability, environmental sustainability, and social welfare. The standard aims at providing rules for safe and sustainable production and supply of fruits and vegetables in Kenya. It applied to both export and domestic markets. Under this pathway, compulsory compliance with KS-1758 would be extended and enforced to all industry value chain players and operators involved in the primary production, processing, transportation and marketing of fruits and vegetables. This would include those producing indigenous vegetables and selling in local informal markets.
 2. Supporting small scale indigenous vegetable producers in obtaining **organic certification through Participatory Guarantee Systems (PGS)**.¹⁵ This certification mechanism requires producers to comply with a set of agreed standards based on the East African Organic Product Standard (EAOPS). PGS certification is more affordable for small producers compared to third-party certification schemes. It also provides access to an organic label (the East Africa Organic Mark) and, potentially, a price premium. Adherence is voluntary, the choice of standards adequate to the reality of informal vegetable markets, and the implementation gradual.
 3. Establishing a **public procurement scheme** for indigenous vegetables (e.g., quotas for meals in schools, hospitals or the army) to provide a ‘guaranteed’ market for these products. Contracts would set a fair producer price (based on the average production costs and seasonal market price fluctuations) and clear quantity and quality requirements, as well as build capacities of producers and their organisations to comply with set requirements. This scheme would be designed to favour smallholder farmers.
 4. Implementing a **seed system reform** to improve indigenous vegetable seed availability and access for smallholder producers in Nakuru county. This pathway entails: (i) advocating for the certification of indigenous vegetable seeds without ‘registration of varieties’ and for (phytosanitary) group certification mirrored on PGS (to make the process affordable to small seed producers); (ii) promoting indigenous vegetables seed production and developing assistance for the selection, storage and testing of indigenous vegetable seeds, including by supporting community-based seed banks and through the involvement of extension services; (iii) advocating for free access to seeds registered by public institutions, community seed banks, and universities.

The likely impacts, synergies and trade-offs of these four pathways will be analysed and discussed in the next chapter.

¹⁴ Especially the Kenya Horticultural Council.

¹⁵ PGSs are certification systems for organic products based on trust mechanisms and the active engagement of stakeholders, particularly the producers, who participate directly in the development and implementation of standards and control mechanisms. They are mostly designed for small-scale farmers relying primarily on local markets and direct selling. PGSs are characterised by a strong focus on capacity building and accountability of members, the application of different social and cultural control mechanisms, and a rich and transparent exchange of information. Besides providing a credible guarantee for the organic quality of food, PGSs contribute to expand local markets for organic products, encouraging a closer interaction between producers and consumers and guaranteeing a fair return to producers. Participation in a PGS can improve food and nutrition security and favour smallholder access to local, high-value markets while improving their production practices. Moreover, participation in a PGS empowers producers by basing their activities on long-term social processes and fostering collective action. Participatory certification in Kenya, although still at a young stage, is recognised as a valid assurance system for the national market by the Kenyan Organic Agriculture Network (KOAN). PGS-certified products are granted the use of a common regional organic mark, which allows trade with neighbours in the East African Community (D’Alessandro, 2018).

4. Trade-offs and synergies in the Nakuru food system: using our 4-step food systems approach for action

This chapter sheds light on the potential impacts of the proposed pathways on the sustainability of Nakuru county's food system. It also explores the trade-offs or synergies between the pathways (and other relevant existing policies) and investigates the political economy issues related to implementing the pathways. This analysis helps clarify how the sustainable food systems approach can support policymakers and practitioners to make choices among different options in complex systems.

4.1. Approach, tools and methods

Based on experts' consultations and the authors' analysis, this exercise is a **second iteration of the four components** of ECDPM's sustainable food systems approach, with a focus on trade-offs and synergies. First, the proposed pathways - emerging from the first iteration as described in section 3 - are contextualised within the broader food system (step 1) and their impact is analysed through a sustainability lens (step 2). This is done in section 4.2. Then, in section 4.3, the political economy analysis is deepened to understand how to better manage the trade-offs and synergies emerging from the analysis (step 3), to ultimately refine the pathways and make choices aimed at maximising the synergies and minimising the trade-offs (step 4). Eventually, the combination of these four steps provides some guidance on the implementation of the proposed pathways.

The data for the trade-off and synergy analysis were collected in November 2020 through **interviews with experts** from government, farmers' organisations, civil society organisations and private sector. Interviewees scored the impacts, trade-offs and synergies on a scale ranging from -1 (high negative impact or high trade-off) to 1 (high positive impact or high synergy). They were also asked for the arguments (*why*) behind their impact perceptions. The degree of interest and influence of stakeholders in supporting indigenous vegetables was also gathered, as well as perceptions on who are the main winners and losers resulting from the proposed interventions.

4.2. Applying the food system and sustainability lenses to the trade-offs and synergies of proposed pathways

Expected sustainability impacts of the pathways

As a first step in this second iteration, **we investigate the trade-offs and synergies of the selected pathways through a food systems lens** to understand how a policy shift towards increased support for indigenous vegetables would interact with current policies in the food system and key drivers and activities therein. To narrow down complexity, we select maize - and in particular the long-standing government support for this sector - to better contextualise the pathways centred on indigenous vegetables. We thus contrast, in our interviews and analysis, the likely impacts of the pathways to continuing in a **'business as usual' (BAU) scenario**, which is proxied by the current public support for maize.

We then apply a **sustainability lens** to analyse the impacts, trade-offs and synergies of all pathways and scenarios. Seven sustainability dimensions were selected and grouped across economic (i.e., agricultural gross domestic product and poverty), social (i.e., undernourishment, undernutrition, and social equity), and environmental (i.e.,

climate adaptation and soil quality) sustainability.¹⁶ Table 1 shows the **expected impact** of the four pathways and the BAU scenario **on key sustainability indicators**.

Table 1. Perceived impacts of selected pathways on the sustainability of Nakuru's food system

			Current maize support	Standard KS-1758	PGS certification	Public procurement	Seed support
Sustainability Nakuru's food system	Economic	Agricultural GDP	-0.1	0.0	0.4	0.5	0.6
		Poverty*	-0.1	0.1	0.4	0.5	0.6
	Social	Undernourishment*	0.3	0.1	0.4	0.6	0.5
		Undernutrition	-0.2	0.2	0.4	0.4	0.6
		Social equity	-0.1	-0.1	0.4	0.4	0.5
	Environmental	Adaptation	-0.4	-0.1	0.6	0.5	0.6
		Soil quality	-0.5	0.3	0.6	0.5	0.6

Note. Numeric scale of -1 (high negative impact) to 1 (high positive impact). Colour scale of -0.7 (red) to 0.7 (green).

*These indicators were deemed most important by interviewees

On average, **interviewees deemed the BAU scenario as having a negative impact on most indicators**. The environmental dimension is perceived as the most affected. By subsidising synthetic fertilisers, the current public support for maize negatively impacts soil quality, which is already decreasing in Nakuru county, as little training and support are provided to farmers on matters of soil health and safe agrochemicals use (Rampa & Knaepen, 2019).¹⁷ Maize support is also perceived as detrimental to climate adaptation as it disincentivises the diversification of production and of crop loss risks. Interviewees also stressed that the dependence on a few selected hybrid seeds poses a risk to agrobiodiversity. Moreover, according to some, subsidies for maize production trigger expansion of cultivated land at the expense of forest and water catchment areas (such as the nearby Mau forest). As for the social and economic dimension, the government's support for maize somewhat reduces undernourishment, maize being a staple food in Kenya and input support allowing to increase production for self-consumption. However, nutrition outcomes are perceived to suffer from maize's dominance. There are also increasing concerns for the safety of the food consumed due to high levels of pesticide residues. In terms of social equity, poverty and agricultural production, the impact of maize support is slightly negative for all three indicators. First, input subsidies mostly benefit the owners of bigger landholdings, while smallholder farmers tend to be neglected; secondly, the impact on farmers' incomes is unclear, as profit margins seem to remain low for this crop; thirdly, Nakuru county is not a large maize producer compared to the rest of the country, thus the impact of subsidies on the county's overall agricultural GDP is limited. There are also feedback loops between different impacts: for example, decreasing soil fertility and limited adaptation to climate change will negatively affect production in the long run.

¹⁶ A few additional indicators were suggested by interviewed experts as relevant in the context of Nakuru. These include biodiversity conservation and climate mitigation in the environmental domain, and access to markets and credit, particularly for smallholder producers, in the economic domain.

¹⁷ Nonetheless, the County Agricultural Department of Nakuru, under the cereal enhancement program, has been encouraging farmers to analyse their soils and building capacities to adopt natural measures to deal with certain challenges, such as pest management.

From Table 1, we infer that **all pathways** supporting stronger integration of indigenous vegetables in the food system **advance several sustainability objectives at once**.¹⁸ Yet, some pathways are more impactful than others: in particular, seed support achieves the most impact on almost all sustainability dimensions, while the enforcement of the standard KS-1758 is the least impactful.

We summarised these findings by grouping the indicators per dimension and calculating the simple average impact of the selected pathways (as well as the BAU scenario) on economic, social and environmental sustainability. This is shown in Table 2. Based on these aggregated scores, **a policymaker may rank the available options for future support**. As highlighted by the colours in the table, seed support, public procurement, and PGS certification would be given higher priority, as they all show expected positive impacts on economic, social and environmental sustainability. This would be followed by standard KS-1758, given its perceived negligible effects. Maize support would rank last, due to its possible negative impacts.

Table 2. Average perceived impact of pathways on sustainability dimensions of Nakuru's food system

Sustainability Nakuru's food system		Current maize support	Standard KS- 1758	PGS certification	Public procurement	Seed support
	Economic	-0.1	0.1	0.4	0.5	0.6
	Social	0.0	0.0	0.4	0.5	0.5
	Environmental	-0.4	0.1	0.6	0.5	0.6

Note. Numeric scale of -1 (high negative impact, red) to 1 (high positive impact, green). Colour scale of -0.7 (red) to 0.7 (green).

As aggregated scores risk hiding potential trade-offs, we now consider more in detail each pathway and their impacts on sustainability. Where possible, we explore how such **impacts may be different for different groups of stakeholders and at different spatial and temporal scales**. Trade-offs may exist not only between sustainability objectives in different dimensions (e.g., reducing poverty and increasing climate adaptation) but also within the same dimension (e.g., an intervention may reduce overall poverty but decrease income for a particular group, such as labourers in large farms). Similarly, different pathways may have a positive impact at the county level but a negative one at the national scale (e.g., devoting more land to small-scale production for local markets may help smallholders in Nakuru, but could reduce the overall volume of agricultural exports with negative consequences on foreign exchange availability).

Most interviewees agree that the **standard enforcement** pathway could improve soil quality. By providing clear guidelines and stricter regulations for the use of agrochemicals, particularly for smallholders, the standard would push farmers to comply with good and soil management agricultural practices, thus reducing pollution. The use of the standard could also enhance nutrition outcomes, by enhancing food safety in the supply chain and increasing incomes for producers (provided they receive a premium for the higher quality achieved). The slightly positive impact on poverty and undernourishment is also explained by the income effect. However, some interviewees highlighted the risk of a negative impact on hunger if food becomes more expensive for poor urban dwellers (as a result of compliance costs). Also, stricter safety standards likely lead to higher rejection by retailers or processors of smallholder-supplied indigenous vegetables, with negative consequences on farmers' income (especially for women). Moreover, if the operationalisation of the standard does not support job creation and expansion of market

¹⁸ A possible explanation for the relatively low differences encountered in the impacts of different pathways is the low differentiation of the pathways among them. They all advance indigenous vegetables production and consumption, thus the impacts on sustainability dimensions may be a reflection of the expected impact of such increase in production and consumption of indigenous vegetables on the food system's sustainability.

access, the impact on poverty may be neutral or negative. The standard may impact agricultural GDP neutrally or negatively, particularly short-term, as small producers may initially struggle with compliance (in terms of capacity and investment needs). Social equity may suffer from the enforcement of KS-1758 unless provisions for fair remuneration and women and youth participation are included. Nonetheless, in the longer term, the standard may support increased and sustained production, better quality and traceability, expanded local and international markets, higher incomes and reduced poverty levels. An implementation of the pathway rolled out in phases and with accompanying measures (e.g., targeting small farmers and low-income earners) may help reduce the time and cost of adapting.

The **PGS certification** pathway performs particularly well in terms of environmental impacts. Interviewees expect that, by joining a PGS scheme and adhering to organic or broader sustainability standards for production and processing, farmers will be pushed towards climate-smarter farming systems involving improved soil management, reduced use of chemicals and recycling of organic matter. The PGS also ranks high in terms of socio-economic impact. This certification is expected to push farmers to diversify their produce and venture into specific niches (especially if they receive a price premium). Although production volumes may not increase, interviewees suggest that costs may lessen (as a result of the reduced reliance on external input purchases) and quality would be enhanced. The overall impact, though, will depend on the extent of the market as well as the number of farmers who will be involved. Poverty and hunger may decrease, if the certification opens new market opportunities, providing higher incomes for rural producers. If profitable, this may trigger the interest of newcomers, particularly younger generations, to engage in vegetable farming, and thus further expand job opportunities. Nutrition may also improve, based on the consideration that higher incomes increase access to quality food and allow for more balanced diets. Diversification and increased production of nutritious crops also play a role. However, as in the case of KS-1758, the question of affordability, particularly for the urban poor, remains central. Interviewees expect social equity to improve, as farmers gaining formal negotiating power and new market outlets would be less dependent on middlemen and could increase their profit margins. Besides, if the certification focuses particularly on indigenous vegetables, this would mostly benefit women, as they play a large role in the production and trade of these crops. Nonetheless, some interviewees voiced the concern that the scheme would only benefit better-off farmers who have the means to participate in it.

The **public procurement** pathway ranks better than the PGS in terms of economic and overall social impact. By providing a guaranteed market for producers, this pathway is expected to support increased agricultural production. This would provide participating farmers with secure incomes and trigger increased agricultural activities, motivating more actors to enter the sector and reducing poverty levels. This pathway also has the highest impact on reducing undernourishment, based on the expected income effect and the resulting increased access to food. While increased income does not automatically result in increased consumption of nutritious foods, higher availability of indigenous vegetables in schools, hospitals and other public food catering would also improve diets and nutrition outcomes. Social equity may also improve, provided contracts are well structured and guided. Nonetheless, the minimum requirements set to participate in the scheme may exclude resource-poor farmers. On the environmental side, public procurement achieves slightly less positive results than the PGS. Interviewees expect that, if contracts stipulate provisions on good agricultural practices, soil quality may be improved. Moreover, as indigenous vegetables are promoted by the scheme, less external inputs will be used. Also, with an assured market, farmers will invest more in water harvesting and other technologies that enhance year-round production.

The **seed pathway** is the most impactful. In terms of economic impacts, increased access to a variety of quality seeds, particularly for indigenous vegetables, is expected to boost production and reduce poverty. Better indigenous vegetable seeds would encourage crop diversification and discourage monoculture. Farmers would have better choices of what to grow, eat and market, and better-quality seeds would translate into higher yields. Incomes would

increase thanks to higher quality and volumes of sales as well as the participation in seed multiplication initiatives and seed sales. Increased agrobiodiversity could mean that farmers have an all-year-round source of income due to seasonality. The seed reform would reduce hunger (indirectly, through increased incomes) and have an even larger impact on undernutrition (through the incorporation of highly nutritious indigenous crops in diets). Social equity would increase the most, compared to other pathways, as the reform would favour small-scale farmers, particularly women, who are also more active in seed conservation and exchange. Environmentally, the reduced reliance on agrochemicals, the wider variety of seeds (particularly of traditional crops that can withstand harsh climates) and the increased awareness of farmers (e.g., to use appropriate seed during a particular season, for certain types of soils, and in certain regions) would improve soil health and climate adaptation capacity.

In sum, based on Tables 1 and 2, **KS-1758 has negligible or negative sustainability impacts while the other three indigenous vegetables-supporting pathways advance several sustainability impacts at once.**

Expected trade-offs and synergies of the pathways

Zooming into the analysis of trade-offs and synergies between (and within) sustainability dimensions, Table 3 shows that, **for the three indigenous vegetable-supporting pathways** (namely PGS certification, public procurement, and seed support), the **sustainability dimensions are generally synergetic with one another**. This means that the three pathways generally do not trade off, for example, poverty reduction with climate adaptation. All sustainability dimensions have broadly the same level of synergy with one another, with social equity on the lower end and soil quality on the higher end.

Table 3. Trade-offs and synergies between sustainability dimensions of indigenous vegetable-supporting pathways, namely PGS certification, public procurement, and seed support

	Agri-GDP	Poverty	Undernourishment	Undernutrition	Social equity	Adaptation	Soil quality
Agri-GDP	NA						
Poverty	0.48	NA					
Undernourishment	0.49	0.49	NA				
Undernutrition	0.49	0.49	0.50	NA			
Social equity	0.46	0.46	0.47	0.47	NA		
Adaptation	0.52	0.52	0.53	0.53	0.50	NA	
Soil quality	0.52	0.52	0.53	0.53	0.50	0.56	NA

Note. Numeric scale of -1 (high trade-off) to 1 (high synergy). Colour scale of 0.4 (green) to 0.6 (deep green).

Conversely, Table 4 shows that the **KS-1758 pathway trades-off slightly social equity and climate adaptation with the other sustainability dimensions**. This reflects the risk that, while the enforcement of the standard may increase market access for the average farmer (thus lowering poverty and undernourishment), it might also reduce opportunities for poorer producers, who may be forced to operate exclusively in informal markets if they struggle with compliance. Moreover, by focusing mostly on food safety, the standard does not provide sufficient incentives to support more climate-adapted production systems. This is an example of trade-offs within the same sustainability dimension: among social objectives, undernourishment may improve for the majority, but social equity would worsen because a group of stakeholders suffers. Similarly, among environmental objectives, soil fertility may improve at the local level, but adaptation to climate (which relates to a different spatial scale) is not addressed.

Table 4. Trade-offs and synergies between sustainability dimensions of standard KS-1758

	Agri-GDP	Poverty	Undernourishment	Undernutrition	Social equity	Adaptation	Soil quality
Agri-GDP	NA						
Poverty	0.05	NA					
Undernourishment	0.03	0.08	NA				
Undernutrition	0.08	0.13	0.10	NA			
Social equity	-0.03	-0.08	-0.05	-0.10	NA	NA*	
Adaptation	-0.04	-0.09	-0.06	-0.11	NA*	NA	
Soil quality	0.13	0.18	0.15	0.20	-0.15	-0.16	NA

Note. Numeric scale of -1 (highest trade-off) to 1 (highest synergy). Colour scale of -0.2 (red) to 0.2 (green).

*No synergy or trade-off

We now turn to the **expected trade-offs and synergies between different pathways**. We try to answer the question whether different pathways reinforce or diminish each other's workings, and vice versa. We also analyse the interaction of each pathway with the BAU scenario. Table 5 summarises our findings.

Table 5. Trade-offs and synergies between pathways

	Current maize support	Standard KS-1758	PGS certification	Public procurement	Seed support
Current maize support	NA				
Standard 1758	-0.2	NA	0.4	0.4	0.4
PSG certification	-0.2	0.4	NA	0.5	0.6
Public procurement	-0.2	0.4	0.5	NA	0.6
Seed support	-0.2	0.4	0.6	0.6	NA

Note. Numeric scale of -1 (high trade-off) to 1 (high synergy). Colour scale of -0.7 (red) to 0.7 (green).

Trade-offs exist between the current public maize support and all other pathways considered. Some reasons for this cut across pathways. First, from a budgetary perspective, higher support for maize means that other crops will receive less attention and resources. Secondly, in terms of land use, higher maize production trades off with increased production of indigenous crops. Thirdly, if the profitability of the indigenous vegetables sector increases (thanks to higher market access or seed availability), the attractiveness of maize for farmers may comparatively decrease.

Other reasons behind the trade-offs with maize support are pathway-specific. As for the PGS, the public support for maize, aimed at maximising output through subsidies for inorganic inputs, trades off with organic production methods advocated by PGS initiatives. Similarly, the current maize support trades off with the proposed seed reform because it advocates for a few selected hybrid seeds that are believed to be commercially viable, thus undermining agrobiodiversity conservation. Nevertheless, **the size of these trade-offs is not perceived to be very large**. The

standard KS-1758, for instance, being focused on horticultural products, would not impact the way maize is produced, thus the interaction between these two pathways is relatively low.

The **seed pathway**, besides being the most impactful in terms of sustainability outcomes, has also **the most synergies with other pathways**. It particularly synergises with the PGS certification and public procurement. A seed reform would increase traceability and ‘legalise’ organically-produced seeds, thus reinforcing the quality assurance provided by the PGS. Moreover, higher availability of quality seeds would particularly benefit small-scale farmers, who would be better able to comply with the quantity and quality requirements of a public contract. Seed reform is perceived as reinforcing standard KS-1758 since food quality and safety starts from the seeds. Also, if farmers gain higher market access thanks to the enforcement of the standard, they could better lobby for certification of their seeds. Nonetheless, some interviewees see the risk that, if the standard is too strict, it may marginalise small producers and their demands (e.g., for less restrictive variety registration requirements), thus diminishing the working of a seed reform (which explains the relatively low level of synergy).

The public procurement pathway would highly synergise with the PGS certification, and, slightly less, with standard KS-1758. Farmers certified through PGS would have an added advantage when negotiating procurement contracts, thanks to the increased traceability and quality of their produce. PGS certification would increase consumer trust and knowledge on food choices. As organic production does not use pesticides, the PGS could work well when setting contracts with hospitals, where healthy products are privileged. Similarly, in the case of KS-1758, producers will have to comply with the standard if they want to enjoy the guaranteed market, thus the two pathways may reinforce each other, or even be complementary. However, some stakeholders voiced again their concern of a marginalisation risk for small producers, if the standard is too rigorously implemented (which explains the relatively low level of synergy).

Lastly, **the PGS certification and the standard KS-1758 are perceived as mutually reinforcing** in terms of ensuring traceability in the value chain, building consumer confidence and guaranteeing a code of conduct among farmers that addresses food and environmental safety. As the process of developing compliance with the organic standards requires training and investments, producers involved in a PGS scheme may also more easily meet the requirements of KS-1758. Nonetheless, the target markets of the two interventions may differ, as the KS-1758 may better serve more formalised markets, while the PGS can also target small farmers selling in informal markets. A gradual move from a PGS system to a stricter KS-1758 may also be envisaged.

Given the objective of maximising synergies and minimising trade-offs between proposed policy interventions, **the food system and sustainability analysis components of ECDPM’s approach provide arguments to advocate for policy changes** in the Nakuru food system. While acknowledging this trade-off analysis is an illustrative exercise,¹⁹ our insights show that the three pathways supporting indigenous vegetables (namely seed support, public procurement and PGS) are perceived as benefitting sustainability in Nakuru and should be prioritised. Conversely, **the current dominant focus on maize should change towards a more diversified approach**.

The next section focuses on the actors and factors currently hindering such policy changes and completes this second iteration of the food system approach, leading to refined pathways that can help maximise synergies and minimise trade-offs in food system transformation processes in Nakuru county.

¹⁹ The analysis and consultations carried out in this paper do not aim at providing a conclusive, comprehensively science-based policy-making advice for Nakuru stakeholders. They rather illustrate how the ECDPM’s approach can be used for trade-off analysis and management in food systems.

4.3. Applying the political economy lens to trade-off management and pathway development

As part of the second iteration of the four steps of ECDPM's approach, in this section we explore some of the main **political economy issues related to the management of the trade-offs** emerged from the analysis (step 3), intending to refine the pathways and support their implementation (step 4).

Conflicting interests and diverging narratives: exploring measures to minimise trade-offs

Changing current policies and practices in Kenya - geared towards increasing production and productivity of maize - is a difficult task. **Maize is a political crop**, as stated by almost all interviewees. Being a staple and a key component of Kenyan diets, powerful (often large-scale) maize producers can put pressure on policymakers to maintain the support measures currently in place.²⁰ Powerful actors are likely to protect their position against changes and newcomers. They could block a policy shift to support indigenous vegetable value chains.

At the same time, our analyses of sustainability impacts and trade-offs show that **the costs and the risks of inertia are high**. Besides, support for diversification of diets and farming systems is growing. The government, for example, is preparing guidelines for the blending of maize flour with traditional crops (such as sorghum or millet) and dried indigenous vegetables. Moreover, to address alarming malnutrition levels, the county's agricultural department is exploring options to establish a public procurement scheme for indigenous vegetables.

To better assess the readiness for 'transformative' change of the Nakuru food system, we explore the diverging narratives and conflicting interests hidden in the steps leading from interventions to desired outcomes.²¹ This analysis can contribute to a more realistic assessment of hurdles and risks in pathway implementation and identify ways to overcome them.

1. Standard KS-1758 and PGS: consensus on the need to improve soil health and productivity, diverging assumptions on the role of agrochemicals

Food system stakeholders in Nakuru agree that soil degradation needs to be addressed to achieve increased productivity, higher incomes and improved food and nutrition security. They also acknowledge that a change in producers' behaviour towards good agricultural practices is needed. The standard KS-1758 and PGS pathways are both seen as beneficial in this regard.

However, stakeholders' views differ significantly regarding the type of farming practices that should be promoted and how. **Conflicting assumptions exist**, for example, on the role of technological innovation and input use. Dominant actors in the system (such as government stakeholders) believe that increasing the 'smart' use of agrochemicals and improved (often implicitly referring to packaged, certified and hybrid) seeds will lead to synergistic outcomes (better socio-economic and environmental conditions). They also suppose that standards enforcement will be enough to promote more responsible input use. Conversely, niche actors (such as NGOs and farmers' organisations) warn against the risks of increasing producers' dependence on external inputs. They claim that biodiversity-based practices are a better alternative, recommending the adoption of agroecological approaches and advocating for increased public support towards them.²² Niche actors also point out that standards risk being

²⁰ While 98% of farmers grow maize in Kenya, about 3% of farmers produce half of Kenya's surplus maize in most years (Sitko et al., 2017).

²¹ See box 1 on types of food systems change. In this analysis, 'transformative' change refers to a policy shift away from the dominant focus on maize towards a more diversified approach.

²² Agroecology supporters stress that farmers may see the long-term benefits of switching to more biodiversity-based practices (e.g., using cover crops and mulching to improve soil fertility). However, without an external actor cushioning some of the

designed in response to the interests of powerful actors (e.g., seed companies) and that costs of compliance may be too high for small-scale producers and informal traders, who risk being marginalised.

In this context, regulatory bodies and business services could incentivise more sustainable practices by strengthening farmers' knowledge on the costs and benefits of context-specific options to improve soil health and adapt to a changing climate. **The legal system**, for instance, could protect natural resources as common public goods. However, the enforcement of existing environmental protection laws and regulations is currently weak. Polluting large-scale producers can exert pressure on local politicians and the government to remain lenient. Moreover, acting against small-scale producers that are locked in unsustainable production practices (e.g., growing close to the shores of the protected Lake Naivasha) might go against electoral logic. Similarly, building capacity of **extension service providers** - both public and commercial - in more knowledge-intensive practices (such as organic and agroecological approaches) could expand farmers' choices but goes against the interests of input suppliers. **Financial service providers**, including insurance companies, are geared towards financing more input-intensive approaches. These institutions could be incentivised to develop innovative products to finance the time lag required by biodiversity-based practices to give a return on investment.

In sum, the interests and ideas of business service providers in Nakuru make it difficult to succeed in more radical changes in production practices. Growing acknowledgement among them on the importance of soil health and climate adaptation could lead to higher investments in research and extension, and financial products more tailored to adopt appropriate solutions that improve soil health and climate resilience.

2. Standard KS-1758, PGS and seed sector reform: consensus on the need to improve access to quality seed and enhance food safety, diverging assumptions on the costs and benefits of formalisation.

Stakeholders' perceptions differ on the efficacy of formalisation (in input and output markets) to improve access to quality seed and enhance food safety. Unpacking the assumptions underlying such perceptions can help to find agreement on ways to harness the strengths of informal systems while achieving the common objectives of improving access to quality seed and enhancing food safety.

The KS-1758 and PGS pathways are expected to contribute positively to different food system outcomes in Nakuru: consumers will benefit from improved traceability, and producers will have better access to quality seeds and receive higher prices as certification will lead to better quality, higher demand and access to niche and export markets. Political traction for these pathways seems promising, thanks to these synergistic outcomes and many apparent winners. The possibility of increasing tax revenues from a formalised and regulated value chain increases the government's stake in these pathways. However, **potential losers** are poor (urban) consumers, who could be confronted with higher indigenous vegetables prices, and small-scale producers, who have to invest scarce time and money to comply with new and existing standards.

The main assumption behind the perceived benefits of formalisation is that compliance with certain standards will increase consumers' trust and that this will be translated in a price premium. There is little evidence, however, on the ability and willingness of consumers to pay such price premium. More market research is necessary, for example, to assess the extent of the demand for indigenous vegetables with an organic label.²³ If small-scale producers are to become part of the formal economy, the benefits (e.g., increased market access) must outweigh the costs.

potential losses that may occur as a result of the change in production practices, producers may be more inclined to choose synthetic inputs.

²³ MACE Foods, one of the few processing companies of indigenous vegetables in Kenya, hinted at the reduced scope for a market interest in indigenous vegetables with an organic label.

Dominant actors - government agencies, often supported by development partners - tend to overemphasise the problems of informality and ignore their benefits (e.g., resilience and inclusivity of decentralised value chains). A better understanding of the current functioning of the indigenous vegetable value chains, including what influences levels of trust between consumers, producers and traders, can help to build on the strengths of informal systems. Engagement of banks, insurance companies and other actors could support institutional innovations like PGS certification with patient and tailor-made investments.

3. Public procurement: consensus on the need to improve incomes for small-scale producers and improve nutrition levels of specific groups, diverging assumptions on costs and benefits of a guaranteed institutional market

Expectations on the political traction of a public procurement scheme for indigenous vegetables diverged on similar grounds as those elaborated on above. If a procurement scheme aims to include small-scale producers, **the costs of formalisation** - necessary to be able to take part in contractual agreements with institutional buyers - **need to be outweighed by the benefits of participating in the scheme**. On the benefits-side, most stakeholders agreed that the guaranteed market of institutional buyers could be a very important outlet for small-scale producers, enabling them to invest in the production of indigenous vegetables. On the other hand, small-scale producers will have to bear the costs of meeting the quality, quantity and continuity demands of institutional buyers, as well as the likely contractual obligations and formalisation requirements. Larger-scale producers would be at an advantage since they are already used to meeting these types of conditions and have the reserves to cushion for risks.

To minimise potential unintended consequences of this pathway, namely the risk of small-scale producers being pushed out of the scheme, **accompanying measures should be taken**. Provisions in the scheme can have built-in quotas for small-scale producers. Infrastructure, such as aggregation facilities for smallholder produce, can be developed. Capacity building for small producers at an early stage, including on financial skills, will be necessary. Farmers' organisations such as cooperatives and self-help groups can function as an 'interface' between individual farmers and buyers.

For the scheme to be effective, small-scale producers must be convinced by the advantage of a guaranteed market with a fixed price. If market prices are higher than the price set by the contract, farmers may have an incentive to drop out of the scheme or to side-sell. Another key assumption behind the presumed benefits of a public procurement scheme is that 'cutting out the middleman' will improve the profit margin for producers. Despite the common perception of 'middlemen' not adding any value, these actors play a central role in the indigenous vegetable value chain. Interventions could build on their strengths, such as their experience in logistics, credit and market information.

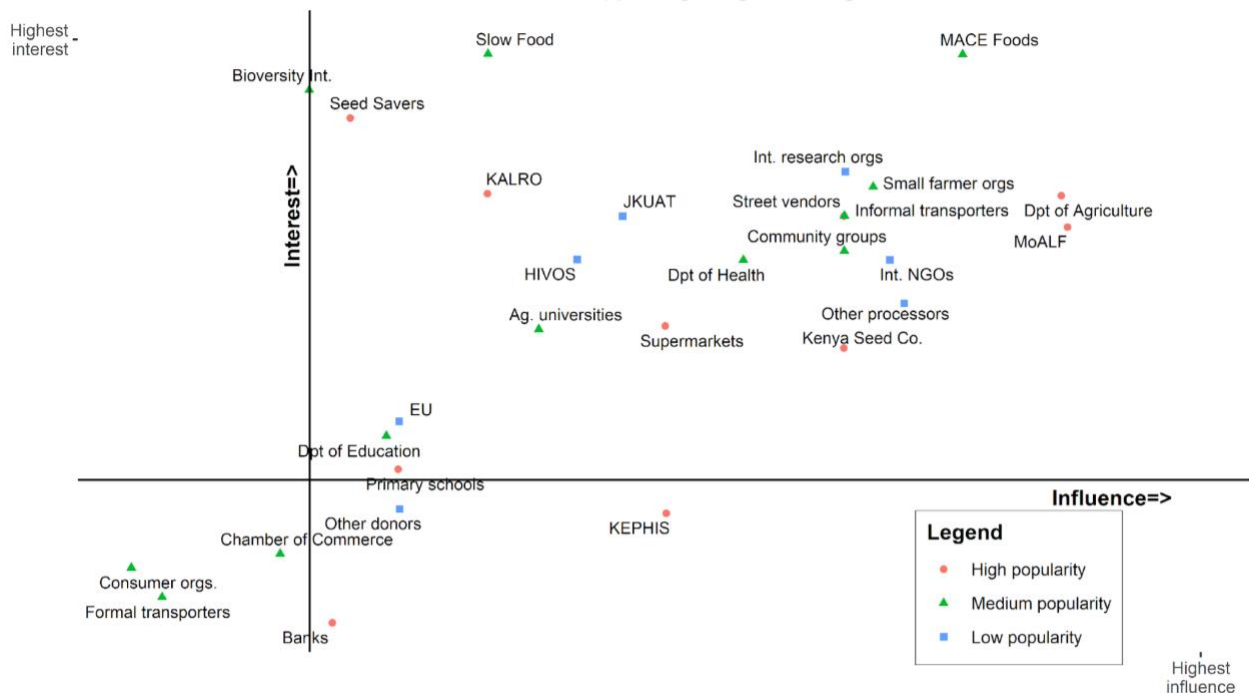
Engaging food system stakeholders towards pathway implementation

After investigating the likely resistance and conflicting narratives that may influence pathways' implementation, **we now take a closer look at the stakeholders in the Nakuru food system to identify possible drivers of change**. This stakeholder analysis²⁴ helps define engagement strategies fitting for each group. We then complete this second iteration of ECDPM's approach by providing recommendations for carefully sequenced interventions and outlining potential partnerships and coalitions for change.

²⁴ A stakeholder analysis is an important part of our toolbox. This analysis is done iteratively in different phases of the project: at the beginning, to define who to engage with; throughout the project, to analyse the distribution of impacts within and between stakeholder groups; and when developing or refining pathways, to determine how to best engage with different stakeholders to improve implementation prospects.

Figure 5 shows the degree of **interest and influence** of stakeholders (particularly those most relevant to the indigenous vegetable value chain) with regards to the pathways' objectives, as perceived by interviewed experts.

Figure 5. Influence and interest of stakeholders in supporting indigenous vegetables²⁵



Note: Popularity denotes name recognition by interviewees. Data through survey and expert opinion.

Visualisation by Koen Dekeyser.

Organisations that rank high on both interest and influence include the national and county-level departments of agriculture, farmers' organisations, MACE Foods and international research organisations. Based on this assessment, the agricultural departments could be considered important drivers of change. However, they also have an interest in maintaining the current maize support and have little incentive to adopt a more lenient stance towards standards and regulations, for example regarding seed protocols and the informal sector. As for farmers' organisations, interviewees highlighted their important role in overcoming several collective action problems. At the same time, these organisations are still relatively weak in Nakuru. MACE foods has a strong position - being a successful SME that processes indigenous vegetables. Their success can translate into increased demand for high-quality indigenous vegetables in Kenya.

Highly influential, but with a less explicit interest in supporting indigenous vegetables, are informal transporters and banks. Informal transporters, traders and vendors have large influence but lack a specific interest in supporting indigenous vegetables. Harnessing their strengths in the Nakuru food system will likely translate into more effective interventions. Similarly, incentivising banks and other financial service providers, including microfinance institutions (MFIs), to develop tailored products for small-scale producers and micro-entrepreneurs would increase the interest of the latter in investing in indigenous vegetables. But more evidence and advocacy are required for this to happen. Efforts can be undertaken to better understand the current bottlenecks banks, insurance companies and saving

²⁵ HIVOS is a Dutch development aid organisation. JKUAT is the Jomo Kenyatta University of Agriculture and Technology. KALRO is the Kenya Agricultural and Livestock Research Organisation. KEPHIS is the Kenya Plant Health Inspectorate Services. MoALF is the Kenyan Ministry of Agriculture, Livestock and Fisheries.

groups face; build on lessons from successful cases elsewhere; and pilot small experiments where government or development partners de-risk initial investments.

The Seed Savers Network (SSN) and Slow Food Kenya rank high in terms of interest, but less so on influence. SSN is implementing initiatives in Nakuru county to support a seed system more friendly to smallholder farmers, while Slow Food works on the consumer side by raising awareness of the nutritious, environmental, cultural and economic value of traditional foods. By partnering with more influential actors, such as government and development partners, they could increase their impact for change.

When defining concrete activities and stakeholders' roles, **awareness of power imbalances** is paramount, as well as sensitivity to the practical aspects of organising stakeholder engagement - especially if it involves gathering multiple stakeholders to exchange information and develop plans. Decisions on timing and location can have unintended effects on who can or cannot attend such meetings, perpetuating in practice the exclusion of marginalised groups, like women street vendors, resource-poor farmers or agricultural wage workers, from decision-making processes;

From the political economy analysis and the interest-influence chart, **concrete recommendations can be made regarding more strategic stakeholder engagement and the careful sequencing of interventions:**

1. The pressure of powerful players (larger-scale maize producers, seed companies) to maintain the status quo is strong, but forging a **strong coalition between the Ministries** of Agriculture, Health, and Education could mitigate this pressure;
2. Despite diverging perspectives on the benefits and risks of a more smallholder-friendly seed system, there is a large consensus on the need for higher availability and accessibility of quality seed. A dedicated partnership between the county's agricultural department, KEPHIS, Bioversity International,²⁶ SSN and MFIs could develop a pilot to **test a farmer-saved seed system** (such as a Quality Declared Seed production system²⁷) for one or more indigenous vegetables in Nakuru county²⁸;
3. **Engaging with informal traders and transporters** in the value chain, especially in the public procurement pathway, could both mitigate the risk of this powerful group sabotaging the intervention and make use of their strong attributes and experience in value chain development processes;
4. Developing and implementing the pathways focused on market access (namely public procurement, PGS and KS-1758) as a **coordinated and sequenced package**, rather than separately, would increase their coherence and effectiveness. Moreover, a **gradual implementation** - rolling interventions out in phases and with accompanying measures (e.g., targeting small farmers and low-income earners) - may help reduce the time and cost of adapting for producers and other actors. For example, the PGS certification could be first piloted in the guaranteed market offered by institutional buyers. Certification requirements could take different formats and features for different market segments varying in their level of formality, such as wholesale markets, supermarkets, wet markets and street vendors. The certification and procurement system for indigenous vegetables could also **learn from and be based on existing schemes** in Kenya aimed at promoting sustainable production and consumption (e.g., fair trade, organic). This could reduce the costs of setting up a new system for certifying indigenous vegetables.

²⁶ Bioversity International is a global research-for-development organisation focusing on the use and safeguard of agricultural biodiversity.

²⁷ The Quality Declared Seed (QDS) production system provides an alternative for seed quality assurance, particularly designed for countries with limited resources. It is less demanding than full seed quality control systems but guarantees a satisfactory level of seed quality.

²⁸ African nightshade (*managu* in Swahili), for instance, could be a good candidate for such a pilot since its demand has surged after the covid-19 pandemic hit, due to its high nutritional value and health benefits (Mururia and Mwale, 2020)

Finally, some **opportunities for partnerships and coalitions for change were identified**. Ongoing promising policy processes to be tapped into, and private and public actors to be involved, include: the Ministry of Agriculture; the national Education Department (currently implementing the National School Meal Strategy); Slow Food Kenya (piloting PGS in Nakuru); Nakuru county and municipalities (currently contextualising national safety regulations at the local level, including KS-1758, via their food safety committees and efforts to improve town markets management); KOAN (coordinating the use of the East African organic standards and mark in Kenya); consumers associations like the Kenya Organic Consumers Alliance; representatives of smallholders producing indigenous vegetables such as self-help groups and cooperatives; SMEs involved in distribution or processing of indigenous vegetables; development partners like FAO possibly interested in co-financing the development and implementation of marketing improvements for indigenous vegetables.

5. Lessons learned and concluding remarks

In a time where the interlinkages between sustainability dimensions are increasingly recognised and food systems face unprecedented demands to achieve higher sustainability, it is more and more important to take trade-offs into account. Policymakers always faced trade-offs in decision-making, but **the complexity of today's world increases the need for more explicit and sophisticated trade-off analyses**.

Recognising the existence of trade-offs can help improve their management and reduce their severity by addressing the risks of negative impacts. However, while conceptual and theoretical advances have been made in the definition and analysis of food systems and their dynamics, **researchers and practitioners still struggle with understanding, analysing and managing trade-offs**. In this context, this paper's contribution is to reflect on and spur the discussion on trade-offs and trade-offs management rather than achieving robustly measured trade-off and synergy values.

Currently, there is not enough relevant data for trade-off analyses at the local level, whereas effective food policy requires those insights. This is why we used stakeholders' and experts' perceptions to gauge potential trade-offs, and asked follow-up questions to better understand the interviewees' reasoning. This method can be useful to map experts' positions quickly, though it is susceptible to biases.

By iteratively **applying the four steps of ECDPM's sustainable food system approach**, we examined the trade-offs and synergies of food policy interventions aimed at strengthening diversification and sustainability in Nakuru county. Our insights suggest that **three out of four policy options** (namely, seed support, PGS certification and public procurement for indigenous vegetables) **are highly synergistic with one another and can advance several sustainability objectives at once**. Conversely, the unintended effects of **'business as usual' policies** – exemplified by the current way of supporting maize – **should be mitigated**, given their negative impacts on most sustainability indicators.

Pure win-win scenarios are rare, but interviewed stakeholders perceived the pathways that support indigenous vegetables to have only positive sustainability impacts. While this might be true, it may also indicate that assessing the implications of different pathways in a complex system is a difficult task, and interviewees may have failed to foresee potential sustainability trade-offs, which in reality are frequently prevalent. However, certain trade-offs might only come to the fore when interventions are implemented or scaled-up, highlighting the **need for constant monitoring of a pathway's trade-offs**.

A political economy analysis helps to understand how policies, programmes and interventions in food and agriculture can effectively contribute to making food systems more sustainable. Addressing the underlying causes of Nakuru's underperforming food systems requires more than optimising the way the current food system works. At the same time, **more radical changes are bound to meet resistance from powerful actors in the food system who benefit from the status quo**. When developing pathways, bringing together interventions that try to influence food system transformation at different levels and entry points can make transformation pathways more likely to succeed. **Implementing the different pathways as a package** to support indigenous vegetables in Nakuru is a case in point.

How trade-offs are managed is influenced by **different perceptions and assumptions on food system change**. Being aware and explicit about these can help reduce the bias towards certain food system outcomes and types of interventions. In the case of Nakuru, for example, actors like government officials and donors tend to take for granted that formalising value chains provides quick benefits for all. However, supporting indigenous vegetable value chains to improve food system outcomes requires a more gradual approach and accompanying measures to help informal players adapt to and benefit from standardisation and certification processes. Pathway development and implementation based on explicit actors' perspectives and assumptions, as well as incremental steps, enable a frank and concrete dialogue among stakeholders on the desired outcomes (how the transformed system will look like) as well as the process towards them (who is likely to lose or win). This, in turn, can help improve trade-off management and reduce adverse impacts of policy interventions on key sustainability objectives as well as stakeholder groups, while improving opportunities for synergistic outcomes.

Despite its limitations (e.g., limited time for consultations) and outstanding methodological questions (e.g., how to better combine the analysis of trade-offs and synergies between and within sustainability dimensions), this paper shows that **applying a food system approach can help refine policy interventions to maximise synergies and minimise trade-offs** in food system transformation processes. The case of Nakuru county illustrates **how ECDPM's approach can help decision-makers assess, select, combine and sequence different policy options to achieve better sustainability outcomes and build politically-savvy coalitions for change**.

At ECDPM, we remain **committed to refining our food system approach and providing thematic and methodological lessons** from concrete case studies, as well as contributing to the effectiveness and inclusiveness of international processes such as the UN Food System Summit.

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HEAD OFFICE
SIÈGE
Onze Lieve Vrouweplein 21
6211 HE Maastricht
The Netherlands *Pays Bas*
Tel +31 (0)43 350 29 00
Fax +31 (0)43 350 29 02

BRUSSELS OFFICE
BUREAU DE BRUXELLES
Rue Archimède 5
1000 Brussels *Bruxelles*
Belgium *Belgique*
Tel +32 (0)2 237 43 10
Fax +32 (0)2 237 43 19

info@ecdpm.org
www.ecdpm.org
KvK 41077447