Reflection report

Linking national climate adaptation and mitigation policies and community-based research

An exploration in case studies in the Global South

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An exploration of case studies in the Global South

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Abstract (NL) Dit reflectierapport onderzoekt het verband tussen nationaal klimaatadaptatie- en mitigatiebeleid (NDC's, NAPA's en NAMA's) en gemeenschapsgericht onderzoek in de context van voedsel- en voedingszekerheid voor groepen met lage inkomens in landelijke en stedelijke voedselsystemen in het Zuiden, waaronder Kenia, Ghana en Oeganda. Het doel is om betere inzichten te verwerven en suggesties te geven voor toekomstig onderzoek en activiteiten die de verbinding tussen nationale ambities en gemeenschapsgericht onderzoek kunnen versterken. Door middel van bureaustudie, kaartanalyse en interviews wordt aangetoond dat het een uitdaging is om een strategische en praktische link te leggen tussen de algemene nationale plannen/ambities en de op de gemeenschap gebaseerde innovaties en processen. In de toekomst is het nodig om gemeenschapsgerichte-innovaties, -processen, het beoordelen van hun impact en bijdrage aan een structurele verandering in het voedselsysteem in lijn met de klimaatdoelstellingen te onderbouwen.

Abstract (UK) This reflection report explores the link between national climate adaptation and mitigation policies (NDCs, NAPAs, and NAMAs) and community-based research in the context of food and nutrition security for low-income groups in rural-urban food systems in the Global South including Kenya, Ghana, and Uganda. It aims to gain better insights and provide suggestions for future research and activities that could enhance the connection between national ambitions and community-based research. Through desk study, mapping analysis, and interviews, it is shown that there is a challenge to build a strategic and practical link between the overall national plans/ambitions with the community-based innovations and processes. Substantiating grassroot innovations, processes, assessment of their impact and contribution to a structural change in the food system in line with climate targets is needed in the future.

Keywords: food systems framework, national climate polices, community-based research

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Abbreviations

COPs:	Conferences of Parties
GHG:	Green House Gas
ICS:	Improved Cooking Stoves
LDC:	Least Developed Countries
LP:	Linear Programming
LPG:	Liquefied Petroleum Gas
MSP	Multi-Stakeholder Partnerships
NAMAs:	Nationally Appropriate Mitigation Actions
NAPAs:	National Adaptation Programmes of Actions
NCDs:	Nationally Determined Contributions
SDG2:	Sustainable Development Goal 2
UNFCCC:	United Nations Framework Convention on Climate Change
WENR:	Wageningen Environmental Research
WUR:	Wageningen University and Research

Verification

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Preface

This reflection report embeds a series of interviews with KB-35-102-001 project team members. Many thanks to the contribution from the following experts: Siemen van Berkum, Katherine Pittore, Karsten Beekmann, Asaah Ndambi, Huib Hengsdijk, Eugene Rurangwa, Jan Broeze, Marleen Hermelink, Marlene Roefs, Vincent Linderhof and Katrine Soma.

Summary

In the Global South, rapid population growth and urbanization elevate current and future challenges facing the Low- and Middle-Income Countries (LMIC), especially their food systems. Food and nutrition insecurity is a major concern in rapidly growing urban areas, particularly in the informal settlements where the most economically vulnerable people live. Urbanization does not only impact the cities and their population, but also rural-urban food systems, since rural and urban areas are interconnected through food trade, remittances and migration. The complex interactions between these spatial scales, societal changes, and governance systems demand a holistic food systems approach to achieve sustainability goals.

With this food systems approach, several projects have been initiated in the research program KB-35 Food Security and Valuing Water. In the project KB-35-002-001 Feeding Cities and Migration Settlement (2019-2022), a multifaceted and integrated understanding of food systems in urbanizing societies in the Global South are explored. As a follow up, this project KB-35-102-001 Food and Nutrition Security for Low Income Groups in Rural-Urban Food Systems in The Global South (2023-2024) builds further on the understanding and results, with an emphasis on challenges of water and climate change in relation to food systems resilience. The overall project aim is to contribute to resilient and sustainable rural-urban food systems, providing food and nutrition security for low-income groups. This is achieved by investigating the complexity of rural-urban food systems and implications for low-income groups, as well as by developing approaches to improve consumer access to nutritious food and water, with a focus on Sub-Saharan Africa and Southeast Asia.

Food systems are both drivers and victims of climate change. In the last decennia several international agreements have been made in response to climate change, of which the Paris Agreement (2015) is the most influential. At the different Conferences of Parties (COPs), as follow up of the United Nations Framework Convention on Climate Change (UNFCCC), the current situation is assessed, additional agreements are made, and new actions are outlined. The Paris Agreement's central aim is to strengthen the global response to climate change by limiting global temperature rise through the reduction of greenhouse gas emissions (GHG) emissions (climate mitigation), as well as increasing the ability of countries to deal with the impact of climate change (climate adaptation). Following the Paris Agreement, countries submitted their national climate actions plans. These plans set forward the Nationally Determined Contributions (NDCs). The ambitions of each successive NDC are expected to increase. Through their NDCs, countries outline actions to reduce emissions and build resilience to adapt to the impacts of climate change on UNFCCC. These actions have found their ways into local and national policies.

In implementing the UNFCCC, the COP (in 2001) established the Least Developed Countries (LDC) work programme. It included the National Adaptation Programmes of Actions (NAPAs), to support LDCs to address the challenge of climate change given their vulnerability. In the COP18, the Nationally Appropriate Mitigation Actions (NAMAs) were agreed upon. Developing countries will take these actions to reduce emissions, directed at change within a certain economic sector and/or across sectors for a broader national focus. Additionally, in the COP21, for the LDC, the NAPAs were introduced. These NAPAs aim to address urgent and immediate adaptation needs. As UNFCCC states, in the process towards these NAPAs, prominence is given to the grassroot communities. Agriculture and food security is one of the priority areas of the NAPAs. The NAPAs are important steps towards the LDC Fund, which was also agreed upon in the COP21.

These NDCs, NAMAs and NAPAs are important policies, which link directly to actions and instruments. They touch upon much of the research work in this project KB-35-102-001. Although NDCs, NAMAs and NAPAs, play an important role on the international and national stage, are not yet well known in the research community. To improve food security with considerations considering environmental pressures and potential trade-offs, as well as to improve environmental conditions for a resilient and healthy food system, it is key to bridge the gap between these national policies and local actions. Therefore, questions as follows have been raised:
One question focuses on the translation of national policies into local actions:

- *How do local actions take the national policies and strategies into account?*

A set of questions focuses on the knowledge of these policies to the research community, and the translation into research questions:

- *How well-known are the national policies in the research community?*
- *How do the current local actions and research in the project contribute to the ambitions of the national policies?*
- *How is the focus on the formal and informal sectors in the plans and research?*

The main aim of this report is to gain better insights and provide suggestions for follow-up research and activities that could enhance the connection between these national ambitions and community-based research. This report could also be used to develop new governance strategies to guide the transitions towards sustainable food systems.

The research activities carried out included: gaining insights on the NDCs, NAPAs and NAMAs from the involved countries (Kenya, Ghana, Uganda), and assessing the potential impact of suggested actions from previous and current research engagement, contributes to the national ambitions and actions. Via desk study and interviews, this research dives into the world of the NDCs, NAPAs, NAMAs and local actions. It grasps complex reality and reflects both on understanding, uptake from a food system perspective. In doing so, this research tries to build a common understanding, enhance linkages, and strengthen implementation, integration and sustainable food systems that contribute to a healthy, secure and just food future.

This research shows that the national climate policies, action plans and ambitions are almost unknown by the current research community. It remains a challenge to build a strategic and practical link between the overall national plans/ambitions with the community-based innovations and processes. Substantiating grassroot innovations, processes, assessment of their impact and contribution to a structural change in the food system, and its impact on climate, are needed in the future.

1 Background

1.1 Introduction

The research project Food and Nutrition Security for Low-Income Groups in Rural-Urban Food Systems in the Global South (KB-35-102-001) aims to contribute to resilient and sustainable rural-urban food systems providing food and nutrition security for low-income groups in the Global South. It involves community-based research in Sub-Saharan Africa, focussing on Kenya, Ghana, and Uganda, as well as integrating reflections from a food system perspective. A multidisciplinary team of researchers from the different knowledge institutes within Wageningen University and Research (WUR), work together in investigating the complex rural-urban food systems, and developing approaches to improve consumer access to nutritious food and clean water, especially for low-income groups. This project aims to unlock new livelihood opportunities but also to safeguard natural resources necessary for a healthy and sustainable environment.

One of the tasks outlined in this project has the ambition to unravel the NDCs, NAPAs, and AMAs (see chapter 1.2), by bridging the local and regional actions among various case studies in this project with the national policies, strategies, and targets. To assess how much, and to what extent, the different case studies contribute to climate adaptation and mitigation and are in alignment with the NAPAs and NAMAs. This assessment includes an exploration on the national and local strategies and targets across different elements and activities within the food system. Additionally, it involves gauging the researchers' knowledge of these national policies, targets, and their association with them. Eventually, new research orientation suggestions for the follow-up research projects are given based on link and gap assessment and the ideas from project members.

The main aim of the research for this report is to gain better insights and provide suggestions for follow-up research and activities that could enhance the connection between these national ambitions and community-based research. This report could also be added to new governance strategies in guiding the transitions towards sustainable food systems.

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- *How is the focus on the formal and informal sectors in the plans and research?*

1.2 National policies for climate adaptation and mitigation

Following the Paris Agreement (2015), countries have been submitted their national climate actions plans. These plans set forward the Nationally Determined Contributions (NDCs). The ambitions of each successive NDC are expected to increase. Through their NDCs, countries outline actions to reduce emissions and build resilience to adapt to the impacts of climate change on UNFCCC. In implementing Article 4.9 of the UNFCCC, the COP (in 2001) established the Least Developed Countries (LDC) work programme. It included the National Adaptation Programmes of Action (NAPAs), to support LDCs to address the challenge of climate change given their vulnerability. In the COP18, the Nationally Appropriate Mitigation Actions (NAMAs) were agreed upon. Developing countries will take these actions to reduce emissions, directed at change within a certain economic sector and/or across sectors for a broader national focus. Additionally, in the COP21, for the LDC, the NAPAs were introduced. These NAPAs aim to address urgent and immediate adaptation needs. As UNFCCC states, in the process towards these NAPAs, prominence is given to the community-level and

grassroot communities. Agriculture and food security is one of the priority areas of the NAPAs. The NAPAs are an important step towards the LDC Fund, which was also agreed upon in the COP21.

In general, NDCs, NAPAs, and NAMAs are interconnected and mutually supportive (see figure 1). They share the common goal of addressing climate change and promoting sustainable development. NAPAs and NAMAs are often implemented under the guidance of the UNFCCC. The specific definitions for the 3 policies are shown below:

- Nationally determined contributions (NDCs):
  NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. NDCs are the core of the Paris Agreement and the achievement of its long-term goals (UN, 2022). Every country is expected to prepare their own NDC every five years. NDCs include targets, measures and policies (World Resources Institute, 2022).

- National Adaptation Programmes of Actions (NAPAs):
  NAPAs are the plans submitted by the LDC to the UNFCCC (UN, 2011b). They describe how the countries perceive their most urgent and immediate needs to adapt to climate change (UN, 2011a).

- Nationally Appropriate Mitigation Actions (NAMAs):
  NAMAs refer to any action that reduces emissions in developing countries. They are prepared under the umbrella of a national governmental initiative. They can be policies directed at transformational change within an economic sector, or actions across sectors for a broader national focus. NAMAs are supported and enabled by technology, financing, and capacity-building and are aimed at achieving a reduction in emissions (UN, 2011b).

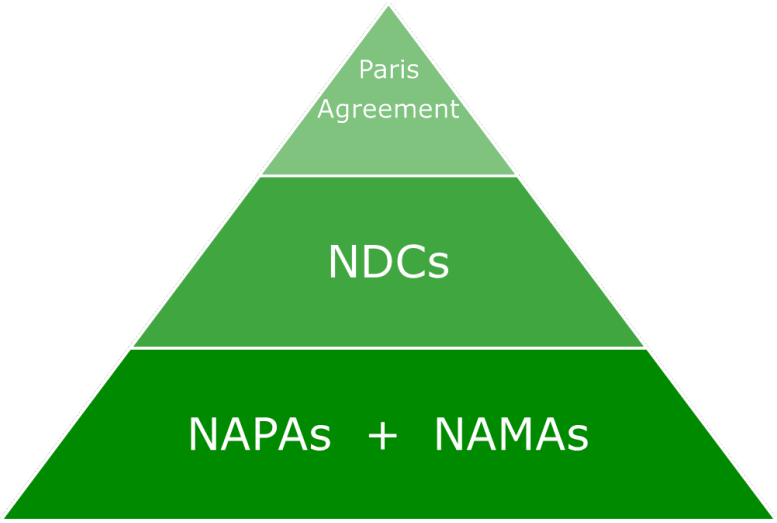

Figure 1. Simplified visualisation of interconnected and mutually supportive relationship among NDCs, NAPAs and NAMAs

2 Methods

As mentioned in Chapter 1, NDCs, NAPAs and NAMAs are important (inter)national policies and action plans with a focus on climate action. These policies and plans directly relate to the food system and the environment. From the national policies, local actions and strategies could support to mainstream and upscale, financing and further substantiation regarding the contribution to climate mitigation and adaptation. In another way, national policies could benefit from input, feedback, and outcome from local actions. It is not to choose between top-down and bottom-up, but to bridge the gap between national policies and local actions by unlocking their interactions.

The research methodology involves a desk study, a mapping exercise and a series of semi-structured interviews. The desk study focuses on unravelling the NDCs, NAPAs and NAMAs of Kenya, Uganda and Ghana. The mapping exercise reveals the links and gaps between policies and research. The interviews are to reveal how familiar are the researchers with the national policies.

The desktop study and mapping exercise focus on the following three sub-research questions, based on the main research questions:

- *Which elements in the Food Systems Framework are mentioned in the NDCs, NAPAs & NAMAs of the countries?*
- *In each country, what are the gaps and links between the case studies, and the targets/strategies in the NDCs, NAMAs and NAPAs?*
- *Which conclusions can be drawn from this analysis to better align local actions with the NDCs, NAMAs and NAPAs in future research?*

The outcomes of this analysis will inform policy recommendations to bridge future local actions with outcomes.

2.1 Desk studies

In this research we carried out a desk study on the NDCs, NAMAs and NAPAs of Kenya, Ghana and Uganda, starting with an overview of the available documents. Afterwards, we did a deep dive into the documents to see where they directly link to the different food system elements and aspects. The data was recorded in Excel tables for the comparison between current research activities in the case studies and the national policies, based on the Food System Framework from van Berkum (Berkum et al., 2018) (see figure 2). As the research intents to be exploratory, a broad outline is presented, instead of an extensive overview.

2.2 Mapping

In the second step, the topics addressed in the NDCs, NAPAs and NAMAs are mapped onto the food system framework. All the mapping is at the basis of the Food System Framework from van Berkum (Berkum et al., 2018).

For each country, the topics addressed in the national policies and the case studies are marked in red and blue circles respectively. Topics circled both in red and blue are in both national policies and case studies. The figures can reveal the links and gaps between the national policies and the case studies. However, differences in approaches, strategy and actions may lead to mismatch or divergence. Therefore, for each mapping specific description is written to articulate the difference in each topic.

The outcomes of the desk study and the mapping exercise are translated into a first understanding and recommendations for local policy and future research.

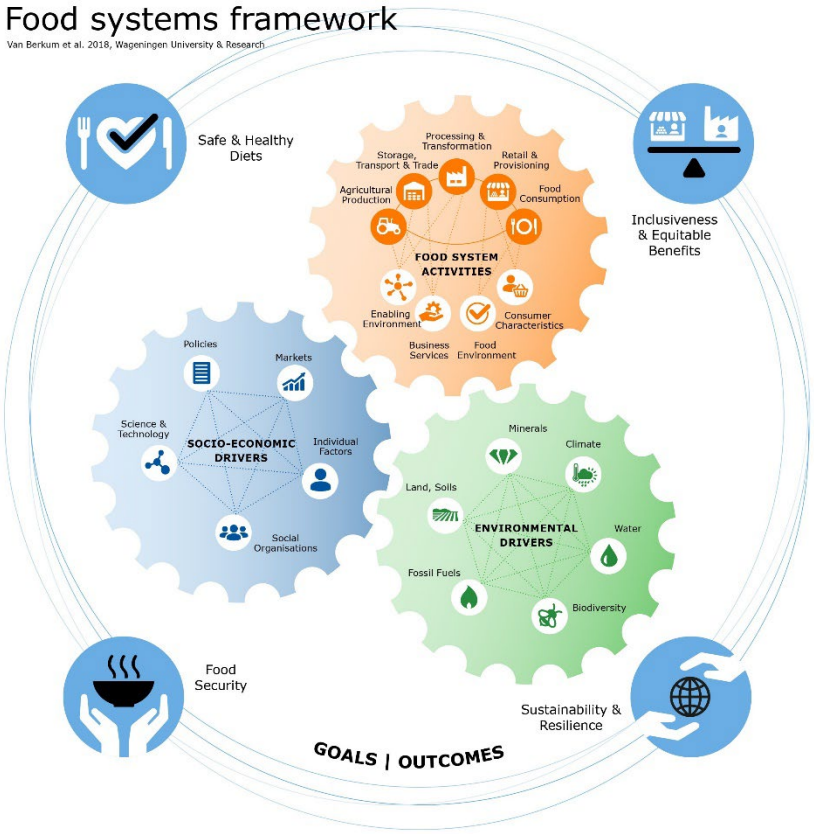

Figure 2. Food System Framework (van Berkum et al., 2018).

2.3 Interviews

Additional to the analysis, semi-structured interviews have been carried out. to find out how climate adaptation and mitigation in general is considered in the current research activities within the overall project and more specifically how national policies are considered. A total number of 13 members of the project team, involved in different case studies and the related food system, have been interviewed. The interviewees have different scientific backgrounds and represent the multidisciplinary nature of the project.

The guiding interview questions were:

- *What is your task/topic in this project?*
- *Does your topic and/or activity relate to climate adaptation and mitigation?*
- *Does it link to the local national policies?*
- *What research topics will be interesting for the coming years?*

3 Exploring potential links and gaps between policies and research topics

In this chapter the linkage and the gaps between the national policies and the research topics are illustrated.

3.1 Kenya

3.1.1 Brief description of Kenyan NDC, NAPA, NAMA policies

Kenya's national policies include many aspects of the food system, such as livestock, fish, smart agriculture. The livestock sub-sector was repeatedly mentioned in several NDCs, NAPAs and NAMAs, since livestock is the largest source of GHG emissions in the agricultural sector. Proposed actions include the development of new feeds, restoration of degraded grazing lands, the promotion of livelihood diversification, and conducting a pilot baseline emissions survey for the dairy sub-sector. Fishing sub-sectors were also explored, including expanding fishing zones in inland and coastal waters, and upscaling sustainable aquaculture initiatives. In addition to specific sub-sectors, many options of climate change adaption and mitigation were highlighted in the documents, including the promotion of indigenous knowledge on crops, climate smart agriculture, and developing early warning systems. The national plans and actions also include objectives about fostering new food habits, establishing infrastructure for waste management, and efforts to bolster the adaptive capacity and resilience of the informal sector.

3.1.2 Links and gaps

Links

The two common topics from Kenya's national policy and the research are in the field of agriculture, and circular value chains.

The convergence is noticeable in the realm of agriculture production, where both the national policies and KB research center their attention. The national policies discuss stakeholder engagement and institutional support for upscaling adaptation and mitigation strategies, particularly in the livestock subsector. With the rapid expansion of urban areas in Kenya, an increasing competition between farmers for land, water, labour and other production assets is important challenge for agriculture, potentially leading to increased vulnerability or conflicts over scarce resources. The KB research, collaborating with academic institutions including Laikipia University, Egerton University, and a technology and innovation company. The research investigates circularity in livestock including pig, and poultry farming, as well as engages with traders largely operating in the informal sector, and urban consumers in Kibera informal settlement in Nairobi. The NAPAs further have an ambition into developing sustainable fisheries, and the KB research has been working with local cooperatives, regarding the small-scale fish farmer.

Another overlapping topic is circular value chains. The national plans proposed the establishment of infrastructure for recycling and reuse of water and a framework for the informal sector to participate. KB research delves into circular feed systems via valorizing waste by insects to reduce one of the largest costs for low-income farmers. The team also explores, in addition to technical feasibility, relevant factors to consider for supply chain organization of the small-, medium-, and large-scale application of insects to valorize waste in the Kenyan context. Regarding food systems impacts on environment, the research team has done an environmental footprint assessment of farmed fish, chicken and microalgae (spirulina), which corresponds to monitoring the effects of agricultural production on climate change from Kenya's national plan.

Case study 1-a:
The protein transition - environmental footprints of farmed fish, microalgae and chicken for food, a case study in Kenya

This study focuses on Kenya's quest for sustainable protein sources amidst a looming hunger crisis amplified by climate change in sub-Saharan Africa. Examining fish farming by Affordable Recirculation Aquaculture Systems (A-RAS), fish farming in ponds, microalgae (spirulina) production, and semi-intensive chicken production, it compares the environmental footprints in the fields of GHG emission, land use, water consumption, and energy use. Results favor spirulina and A-RAS fish farming due to their lower environmental footprints compared to chicken farming and pond fish farming. Notably, it explores how replacing cattle-derived protein with these alternatives could offer environmental benefits. Yet, this research isn't a standalone solution but part of a larger effort addressing Kenya's food system resilience. Discussions revolve around exploring alternative feed ingredients, advocating for local production, ensuring accessibility, and aligning with existing policies for sustainable progress among smallholder farmers (Hu et al., 2024).

Gaps

While the national plans embrace overarching environmental concerns within the food system, their operationalization remains sparse, primarily fixating on national infrastructure and formal sectors. This disparity leads KB research to act as a conduit, connecting national strategies to the informal sector through knowledge dissemination and innovative collaborations, aiming to infuse operational viability into these plans.

As pointed out earlier, opportunities do not automatically occurs especially to the farmers working in the informal sectors. Recommendations spring forth from the chasms, urging the introduction of new food habits, integrated warning systems in livestock management, and fostering partnerships with local knowledge institutions to harness indigenous knowledge.

Additionally, the need for alternative energy sources echoes resoundingly across the national documents, advocating for viable options to curb unsustainable practices, particularly in the charcoal sector. Increased charcoal consumption has further increased the unsustainable harvesting of trees. Solar, wind and other renewable energies are mentioned, especially how to implement in the considerate amount of areas currently off-grid. Further research is recommended to investigate into affordable and viable energy options for the off-grid areas.

Case study 1-b:
The role of research in developing Nationally Appropriate Mitigation Actions for Kenya's dairy sector

This case illustrates the complexity of developing a NAMA and emphasizes the role of research. Developing a NAMA is a timely process. The concept was first introduced in 2007 by the United Nations Conference of Parties. Then, member states could communicate their intent to implement a NAMA to the UNFCCC, and outline concepts of proposed mitigation actions, which Kenya did for the dairy sub-sector. An important goal of developing NAMAs is to access climate financing; most of the climate financing is in the form of loans as opposed to grants (van Dijk et al., 2015). To develop the NAMAs also requires funding, and implementation of NAMAs has however been slow due to a lack of financial support for developing the NAMAs in the first place.

The development of a NAMA for Kenya's dairy sector is relatively well-documented. Documenting the process was motivated by the limited information about emerging experiences from developing and implementing NAMAs at the time the process started in 2015 (van Dijk et al., 2015). As figure 3 from Wilkes et al. (2013) (below) shows, research is key, particularly for the technical dimensions of the NAMA. In the Kenyan dairy sector, research has explored: the role of public private partnerships (Odhong et al., 2018), the carbon footprint of milk production (Wilkes et al., 2019), financing (Khatri-Chhetri et al., 2020), and measurements, reporting and verification of emissions (reductions) (Wilkes et al., 2019; Wilkes et al., 2018). While other countries could potentially learn and benefit from these experiences, in practice, NAMAs can vary substantially between countries and sectors.

Documenting the process of developing the NAMA for Kenya's dairy sector has also sparked researchers that are not directly involved in the development of the NAMA to reflect on their findings in relation to the development of the NAMA. For example, throughout the process of developing the NAMA for Kenya's dairy sector, key concerns are increasingly voiced through research about the directions of the NAMA development and potential negative externalities related to its implementation. For example, Tavenner & Crane (2016) developed a guide to best practices for gender and social inclusion in Kenya's intensive dairy sector, meant to inform the development of Kenya's dairy NAMA. This research has the potential to enhance the quality and success of NAMA implementation. Inferring from this, to conclude, KB research also has to potential to enhance the inclusivity and address (other) concerns in the development and implementation of ongoing NAMA (and NAPA) developments.

Figure 3. Key elements in NAMA development (Wilkes et al., 2013).

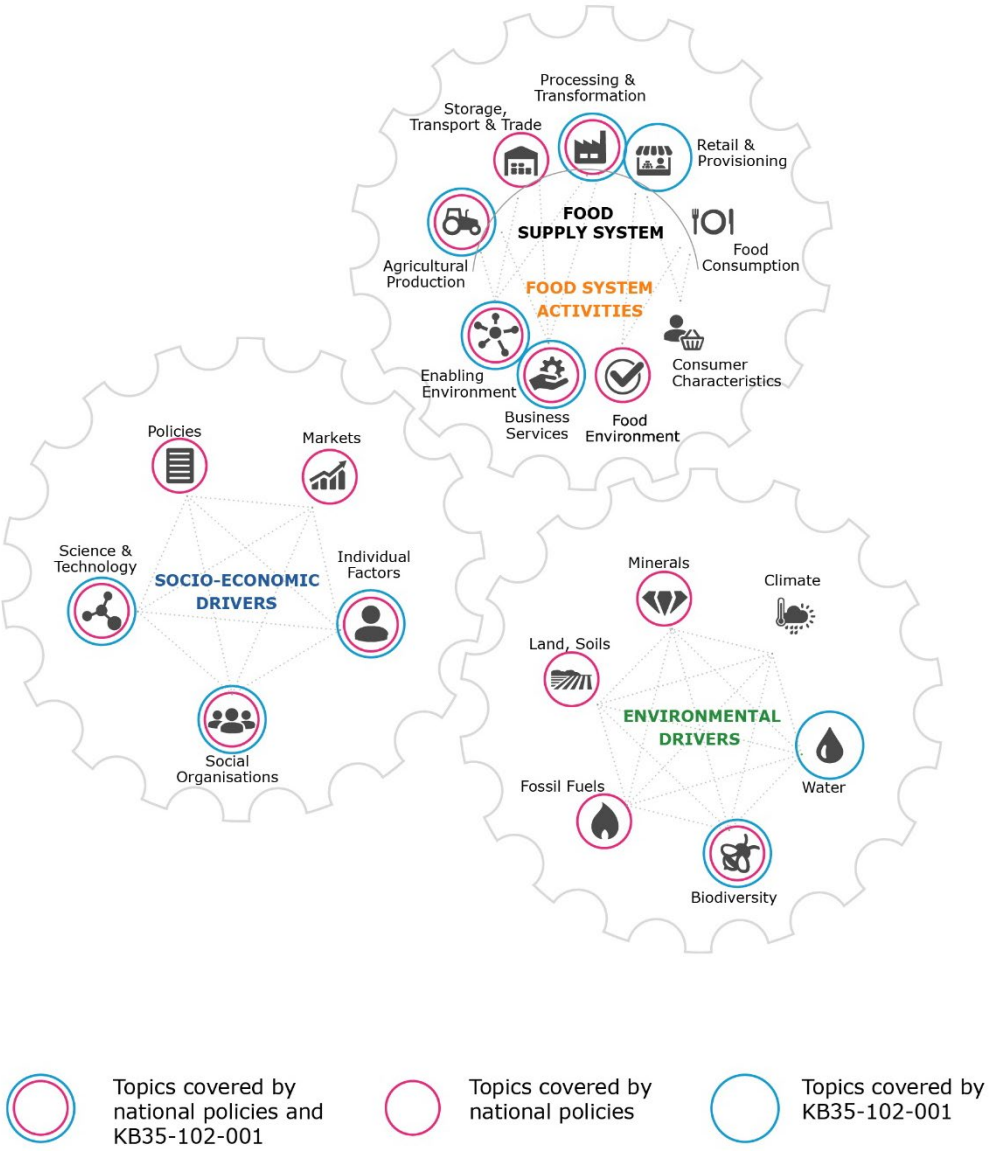

Figure 4. Links and gaps between Kenya national policies and research topics.

3.2 Ghana

3.2.1 Brief description of Ghanian NDC, NAPA, NAMA policies

Within Ghana's NDC, NAPA and NAMA national policies, a tapestry of initiatives surrounding energy production and utilization prominently emerges. The national policies underscore approaches to address critical concerns such as cleaner cooking solutions, enhanced energy efficiency, and fostering sustainable charcoal manufacturing practices. Charcoal, energy sourcing for home cooking in off-grid remote areas, stands at the crux of this narrative. Its prevalent but inefficient, and production not only contributes to carbon emissions but also poses significant threats to forests, biodiversity, and human well-being, particularly respiratory health. In response, Ghana's policies advocate for measures including energy efficiency improvements, transitioning to natural gas, sustainable forest management, and an amplified reliance on renewable energy sources, marking an ambitious stride towards a sustainable energy landscape. Beyond energy, these policies also bring together strategies aimed at fortifying the value chain, balancing food security with sustainable production. Recommendations call for farmer training, encompassing adaptive agricultural practices, intelligent cropland management, and innovative aquaculture techniques. Augmenting these efforts are technologies that promote water reuse, harvesting, and law enforcement to curb

detrimental bush burning practices that imperil agricultural productivity. Many policies also call for protecting and sustaining biodiversity, integrating tress into farming systems and enhancing landscape restoration with relation to climate adaptation and mitigation.

3.2.2 Links and gaps

Links

As mentioned previously, Ghana has addressed critical concerns and ambitions regarding energy efficiency, production and transition. KB-35 Research has been deeply involved in various projects related to charcoal production aligning with Ghana's national energy transition. One key initiative involves circular food and charcoal production, established in the Bono East region to serve low-income communities in Accra and Kumasi. Another research actively works with young and women entrepreneurs on promoting sustainable charcoal production in industry. They focus on the mitigation of Short-Lived Climate Pollutants (SLCPs) which pose significant health risks. Notably, their efforts have led to a remarkable 31% reduction in black carbon emissions from charcoal production.

Expanding beyond energy, KB research extends to building resilient rural-urban food systems, aligning with the 2016-2020 NAPA. This NAPA emphasizes enhancing research in climate-smart agriculture, encompassing initiatives to document indigenous knowledge, generates meteorological data, and enforce regulations on bush burning. KB research focuses on informal settings and collaboration with stakeholders. It allows for a more comprehensive understanding, enabling the creation of sustainable and resilient food systems. Parallel to the guidance outlined in the 2016-2020 NAPA and the National Environment Policy of 2014, KB research highlights the importance of fostering good governance. Specifically, emphasis is placed on climate-smart agricultural activities, population control, and economic growth, recognizing the necessity of governance at various levels. Furthermore, the KB research is working on developing strategies and effective communication channels to enhance governance practices in these critical areas.

Case study 2:
Tradeoffs and synergies in the transition away from charcoal production in Ghana

The project is managed by an interdisciplinary team from Wageningen Economic Research, focusing on identifying, valuing, and navigating tradeoffs within projects aiming for food systems transitions. Estimating impacts of interventions in the food system is essential. Understanding trade-offs (both, between interests of different stakeholders, as well as between different outcomes) is considered of paramount importance to gain a broad support for developments in food system transitions.

Based on previous work by WUR in landscape approaches in Ghana, charcoal production surfaces as a recurring issue, intertwining environmental and health concerns. However, environmentally friendly alternatives for charcoal are scarce, the availability and affordability of charcoal is important to mainly low-income consumers in Accra. Moving to alternatives requires a good assessment of tradeoffs, together with relevant stakeholders, aiming to delineate feasible and agreeable pathways for action.

The team, employing co-creation methodologies and qualitative research methodologies, works with a small group of local stakeholders. This engagement aims to collectively explore and discuss the complexities surrounding charcoal production in Ghana, seeking potential avenues for alternative solutions. The team applied to the issue of charcoal production in Bono East as a case study, consider charcoal use by households in urban areas.

Gaps

Ghana prioritizes the energy transition as a pivotal component in its climate adaptation and mitigation strategies. Beyond focusing solely on charcoal, the country is committed to transitioning to natural gas produced in thermally generated power plants and expanding investments in renewable energy sources. To further bolster this transition, future research endeavors should encompass an exploration of diverse energy sources, aiming to diversify the energy supply across regions that currently rely on a single energy source.

This diversification will lead to increased stability and efficiency within these regions. Collaboration with both industry and commerce is instrumental in scaling up the availability of renewable energy. Hence, establishing partnerships with both formal and informal sectors provides valuable entry points for collaboration. The KB research team could contribute extensive knowledge, cutting-edge technologies, and implementation and governance experiences to support these collaborative efforts.

Besides, Ghana also includes the topics about farmer training, intelligent cropland management, and water reuse, to build up a sustainable food system. For further research these topics have the potential to be looked upon.

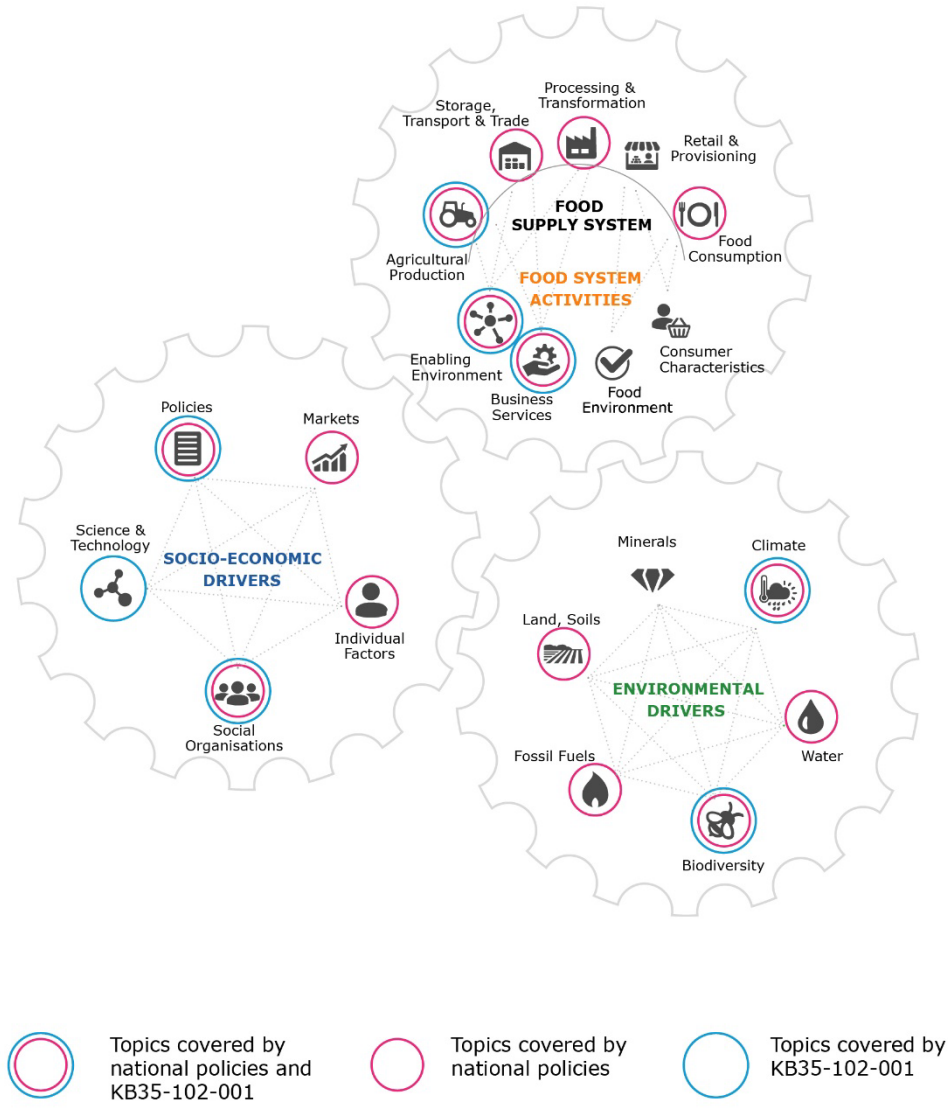

Figure 5. Links and gaps between Ghana's national policies and research topics

3.3 Uganda

3.3.1 Brief description of Ugandan NDC, NAPA, NAMA policies

Ugandan NDCs, NAPAs and NAMAs all outline a strong emphasis on transforming the energy landscape. They advocate for the development and promotion of a clean and resilient energy system while significantly

increasing the utilization of renewable energy sources and energy-efficient technologies. This strategic direction aligns with the overarching goal of enhancing access to clean energy cooking technologies throughout the country. Ugandan energy policies exhibit a multi-pronged approach, with specific directives targeting various facets of the energy domain. There is a push to encourage the widespread use of Solar PV lighting systems. In terms of cleaner and more efficient cooking methods, policies advocate for adoption and transitions to LPG and Improved Cooking Stoves (ICS), as well as a special emphasis on the sustainable production and consumption of clean charcoal kilns. These policies collectively represent Ugandan agenda towards a more sustainable and environmentally conscious energy paradigm.

Uganda's water-related policies within the NDC, NAPA, and NAMAs emphasize strengthening water harvesting and irrigation farming while ensuring resilient access to water for domestic and productive purposes. Additionally, the policies stress the need to enhance sanitation and wastewater treatment infrastructure and services across the country, addressing critical public health and environmental concerns. There is also a directive to scale up Integrated Water Resources Management approaches and to optimize water use efficiency, which highlights the importance of responsibly exploiting aquatic resources and their contribution to the nation's development agenda.

Uganda's agricultural policies form a comprehensive framework aimed at fostering resilient and sustainable farming practices. These policies advocate for climate-resilient agricultural development through diverse approaches. They prioritize promoting climate-smart agriculture, enhancing land management, and developing resilient crop varieties to mitigate climate risks. Additionally, strategies targeting postharvest handling, livestock, fisheries, and forestry underscore a holistic and sustainable approach. National policies also include afforestation, agroforestry, and organic farming techniques to diversify the sector. There are also polices that stress regulation and reclamation on wetlands, peatland restoration, data collection to provide climate information services.

3.3.2 Links and gaps

Links

The regional perspective of the research on energy, water, and food production resonates with Uganda's emphasis on fostering clean energy access, ensuring water availability, and promoting sustainable agricultural practices. Particularly, the in-depth exploration of food system scenarios in Arua district mirrors Uganda's commitment to fostering sustainable food production and forging strong connections between natural resources, farmers, and consumers. Furthermore, KB projects focusing on waste recirculation and

Case study 3:
A healthy diet for a growing population: a case study of Arua, Uganda

It is uncertain whether Sustainable Development Goal 2 (SDG2), a healthy diet for all, can be achieved in East Africa given its strong population growth, low agricultural yields, and the high perishability of nutrient-dense foods. We examine the consequences of a locally produced healthy diet on land use in a case study of the Arua district in Uganda. This type of analysis can alert policy makers to looming nutrition gaps and support the selection of alternative strategies to ensure that the population can access a nutritious diet. Using a Linear Programming (LP) model and three population growth projections are used to estimate the minimum agricultural area needed in 2040 to produce a healthy diet that follows EAT-Lancet dietary diversity guidelines and supplies the average requirements of calories, proteins, Iron, and vitamin A. This is compared in scenarios to consider to what extent i) production intensification, ii) food loss reduction, iii) by-product consumption, and iv) vitamin supplementation could reduce the required agricultural area needed to healthily feed the population. Results show that the necessary area to produce a healthy diet in 2040 is 160% larger than Arua's current crop area and is larger than district's total area. Additionally, none of the proposed changes from the scenarios allows a sufficient increase in food production, suggesting that a mix of even more drastic changes across sectors will be necessary. The results underline the challenge for rural areas in East Africa like Arua to provide a healthy diet to its fast-growing population, requiring integrated food system changes and policy coordination to increase the availability of diverse and nutritious foods.

innovative approaches like insect-based feed and spirulina production complement Uganda's policies advocating for sanitation, waste management, and exploring alternative food sources.

Gaps

Future research endeavours can focus several key emerging areas, aligning with Uganda's environmental and socio-economic landscape. Priorities encompass enhancing wetlands management and restoring critical ecosystems such as peatlands, riverbanks, and lake shores. Furthermore, research can support development of climate-resilient crop varieties through diversification and emphasizing food preservation techniques, addressing food security challenges amid changing climatic conditions. The exploration of alternative livelihood with local community and indigenous knowledge will enhance the need to diversify income sources and enhance community resilience.

Research in Arua could delve deeper into enhancing the integration and scaling up of successful community-based projects within Uganda's national policies and securing adequate financial support for these initiatives to bridge the gaps with the national policies and eventually maximize the social impacts.

Figure 6. Links and gaps between Uganda’s national policies and research topics.

4 A view on awareness and acquaintance within the research community

The desk study and the mapping exercise reveal that there are clear potential linkages between the national policies, action plans and the research which is carried in the support of regional and local initiatives and innovations.

As a start, a series of interviews was carried out within the research community currently involved in the case studies and the project. These interviews can give an initial view on if the research community are aware of their research activities related to the national policies and action plans.

Although more than 60% of the interviewees indicate that their research actions/topics are related to climate adaptation and mitigation, only 30% of the interviewees articulate that their research topics are linked to national climate policies.

According to the interview results, around half of the local actions are related to the national policies and strategies. In Uganda, no local actions seem to have any link to the national policies. In Kenya, feed innovation and alternative production systems development is related to national plan Kenya 2030. In Ghana, circular food and energy system development is closely related to the national policies. Particularly, a policy analysis for Ghana is made and published about food security.

Notably, the NDCs, NAMAs and NAPAs are not directly mentioned as linked national policies. Direct uptake of or feedback to these national policies and actions seems lagging behind.

The results of the interviews are summarized in the table below.

#	Action/topic	Relation to climate mitigation and/or adaptation	Extra information	Relation to national policies and action plans	Extra information	Upcoming research focus
1	Rural-urban food system connectivity	Not directly/could be	Focus on integrated policies is emerging	No	Focus on integrated policies is emerging	Making food system transformations more tangible
2	Rural-urban assessment framework	Not directly/could be	Not specifically. It is establishing a process to climate adaptation and mitigation at the end. Broad range of themes including mitigation and adaption.	Not directly		The human factor, behaviour and trade-offs. change. Long-term thinking and short-term action: national and local. Applicable knowledge and room for reflection
3	Environmental analysis and strategy development	Directly	Addressing importance of including and aligning with mitigation and adaptation strategies	Not yet		Improve the understanding of the dependencies and relation with the environment and climate through clear indicators, figures and insights
4	Scenario development	Not directly/could be		Not yet	There is a lot of the interest in the local area. Close to the capital. The regional policies have linked to the topic. National policies are lagging behind.	Improving linkages with environmental sciences (e.g. soil conditions and climate)
5	Multistakeholder engagement	Not directly/could be	Sustainability of the food system, including climate, is a topic, but one of many	Not yet	Sustainability of food systems is emerging	Applying COM model on multistakeholder platforms

#	Action/topic	Relation to climate mitigation and/or adaptation	Extra information	Relation to national policies and action plans	Extra information	Upcoming research focus
6	Circular systems: feed innovation and alternative production systems	Not directly/could be	Ranked 1, but not sure. Probably.	No		
7	Circular systems: feed innovation and alternative production systems	Directly	Mitigation	Yes	Kenya 2030	Lower cost system by capturing rainwater and manure driven systems
8	Circular systems: feed innovation and alternative production systems	Directly	Informal settlements are the consequence of climate change. So, working on food security in informal settlements is a climate adaptation	Yes	Blue economy Program	Understanding the bottlenecks for food system transitions
9	Circular systems: aquatic systems	Directly	The innovation will reduce the pressure on land and water with positive effects on the climate adaptation and production footprint.	Yes	Blue economy program	Research on performance of new values chains and systems. Research on production and efficiency of additional organic sources for the large-scale production of alternative feed. Measuring the socio-economic-environmental impact on the food systems and beneficiaries.
10	Circular systems: post-harvest	Directly	Mitigation	If food waste can be used in feed it reduces emissions in differed parts of the value chain	Not clear	The transition from supply driven food system to demand driven. Focus on the nutrients locally needed and then think about where to produce and how to transport.
11	Circular systems: post-harvest	Directly	Mitigation	Valorising food loss and waste reduces emissions	Not directly. Many policies become integrated, opportunity	Exploring where logistical synergies between 1 or more supply chains be supported and created for enhancing circularity in value chains.
12	Circular systems: food and energy	Directly	Adaptation and mitigation	Focus on energy use	Directly, Policy analysis for Ghana is published in 2019 about food security. Not only on agriculture but also include other perspective. Economic and environment policies. Timeline has been used.	Deepening the charcoal research; more insights in synergy and trade off. What will be the future perspective? What are the technological options? What is the affordability? Alternative solutions e.g. commons?
13	Trade-offs	Indirectly	Mitigation and adaptation	Broad range of themes including mitigation and adaption.	Policies are considered	

Table 1. Interview results.

5 Suggestions for future research and the focus on climate

Although most interviewees consider climate mitigation and adaptation as relevant topics, in practice, the national policies and action plans have not generally been taken into considerations in case studies. Also, in the focus on future research, national policies are not explicitly part of the strategies outlined.

Based on the results from mapping and interviews, a list of suggested research topics is shown below. The most frequently mentioned themes are put forward. The underlined are directly promising to bridge the gap between the NCDs, NAPAs, NAMAs and the current research project.

Research orientations in general:

a. How to make food system transformation more tangible?
    i. What are the bottlenecks for food system transition?
    ii. What kind of monitoring tool can be used to measure the sustainability level of the food system?
    iii. How do we make the transition from supply driven food system to demand driven food system?
    iv. What are the synergies between supply chains to enhance circularity?
b. How to change the customers' behaviours?
    i. How can we enable the culture transition towards food with low climate impacts?
    ii. How to guide the government and citizens into long term thinking?
c. How to face with the challenge of feeding urban populations diets which are sufficient in terms of both quantity and quality?
    i. How to produce safe food through urban agriculture?
    ii. How to produce food on poor soils in a sustainable way?
    iii. How to involve the refugee population with the local population to reduce the conflicts in food?
d. How can we apply Multi-Stakeholder Partnerships (MSP) to support developing more sustainable future food systems?
e. How to understand the linkages, and eventually reach a better integration, among food security, resilience, climate, biodiversity, societal and spatial challenges?

National topics:

a. Kenya:
    i. Spirulina:
        1. A comparison in business models of spirulina for food and feed in the total food chain from production to consumption:
            a. Who is benefiting?
            b. Can it be applied in smallholder farms?
            c. What are the environmental impacts?
        2. Manure driven spirulina production system based on rainwater can be tested to see if the product can be used for food instead of feed.
        3. Find a way to enable local production to produce feed and food by instead of relying on foreign companies.
    ii. Insects:
        1. What is the potential of the application of insects to valorise organic waste streams?
        2. What are viable business models for Black Soldier Fly Larvae in Kenya's context?
        3. How can insects be utilised to valorise waste and feed ruminants to reduce GHG emission?

iii. How can we scale the A-RAS, spirulina, and Black Soldier Fly application towards commercialisation?

b. Ghana: Deepen the charcoal research with social scientists:
   iv. What will be the future perspective?
   v. What are the technological options?
   vi. What is the affordability?
   vii. How do we approach the public?
   viii. How economic can keep on growing?
   ix. How can we help the new culture transition?

c. Uganda:
   x. What are the bottleneck nutrients in food in the case area?
   xi. How much does it cost for publics? Eq. by calculation models with social scientists.

Looking at the mentioned topics and focus, climate mitigation and adaptation is still limited in its representation. However, food security in the mid- and long-terms is highly linked to this key topic. It remains a challenge to build a strategic and practical link between the overall national plans/ambitions with the community-based innovations and processes. Substantiating grassroot innovations, processes, assessment of their impact and contribution to a structural change in the food system in line with climate targets is needed in the future.

6 Conclusions

Through desk studies, mapping exercises and interviews, the research questions can be answered as follows:

- *How do local actions take the national policies and strategies into account?*

According to the interview results, around half of the local actions are related to the national policies and strategies. In Uganda, no local actions seem to have any link to the national policies. In Kenya, feed innovation and alternative production systems development is related to national plan Kenya 2030. In Ghana, circular food and energy system development is closely related to the national policies. Particularly, a policy analysis for Ghana is made and published about food security.

- *How well-known are the national policies in the research community?*

In the interviews, the NDCs, NAMAs and NAPAs are not directly mentioned as linked national policies. Direct uptake of or feedback to these national policies and actions seems lagging behind.

- *How do the current local actions and research in the project contribute to the ambitions of the national policies?*

In the mapping exercises the contributions of the current local actions and research to the ambitions of the national policies are illustrated. Notably the existing linkages are more than the mentioned linkages in the interviews.

In Kenya, the research investigates circularity in livestock including pig, and poultry farming, explores the potential of Black Soldier Fly Larvae to valorize organic waste streams, engages with traders largely operating in the informal sector, and urban consumers in Kibera informal settlement in Nairobi. These actions can contribute to the national policies which discuss stakeholder engagement and institutional support for scaling adaptation and mitigation strategies, particularly in the livestock subsector.

Ghana addresses critical concerns and ambitions regarding energy efficiency, production and transition in its national polices. KB research addresses charcoal production, aligning with Ghana’s national energy transition. One key initiative involves circular food and charcoal production, established in the Bono East region to serve low-income communities in Accra and Kumasi.

In Uganda, the regional perspective of the research on energy, water, and food production resonates with Uganda's emphasis on fostering clean energy access, ensuring water availability, and promoting sustainable agricultural practices. Particularly, the in-depth exploration of food system scenarios in Arua district mirrors Uganda's commitment to fostering sustainable food production and forging strong connections between natural resources, farmers, and consumers.

- *How is the focus on the formal and informal sectors in the plans and research?*

The national plans are generally focused on formal sectors. The informal sectors are barely directly mentioned. While the research focuses on informal ones. For example, in Kenya, the national plans embrace overarching environmental concerns within the food system, their operationalization remains sparse, primarily fixating on national infrastructure and formal sectors. The research engages with traders largely operating in the informal sector, and urban consumers in Kibera, Nairobi.

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