Critical Policy Studies

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/rcps20

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**To cite this article:** Laura Cramer, Art Dewulf & Todd Crane (25 Mar 2024): Livestock and climate change frames and interaction strategies in East Africa: exploring tensions between adaptation and mitigation options, Critical Policy Studies, DOI: 10.1080/19460171.2024.2331706

**To link to this article:** https://doi.org/10.1080/19460171.2024.2331706



Published online: 25 Mar 2024.

CRITICAL POLICY STUDIES
https://doi.org/10.1080/19460171.2024.2331706

Routledge
Taylor & Francis Group



# Livestock and climate change frames and interaction strategies in East Africa: exploring tensions between adaptation and mitigation options

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**ABSTRACT**

East African livestock systems, which support many livelihoods, are suffering from climate change but also contribute a large portion of national greenhouse gas emissions. There are various ways to frame livestock and climate change problems and solutions. We use data from interviews, policy documents and participant observations of science-policy interfaces in Ethiopia, Kenya and Uganda to answer: (1) How do frames used by scientists and policymakers affect discussions about climate change and livestock keeping in East Africa? and (2) What framing interaction strategies are employed to deal with ambiguity in science-policy interfaces? Findings show emphasis is given to framings describing livestock and climate change problems and less to response framings. While adaptation and mitigation are both used as issue frames in general discussions, funding availability to address climate issues draws attention to the need for measurement, reporting and verification systems, leading to more concrete discussions on mitigation-related response options and less attention on adaptation. Actors use different interactional framing strategies to co-construct meaning around problems and response options. The findings highlight the need for governments and partners to co-create knowledge on how livestock interventions can address adaptation and mitigation simultaneously to move away from the adaptation-mitigation divide in response framings.

**KEYWORDS**

Livestock; climate change; East Africa; framing analysis; science-policy interface

## 1. Introduction

Livestock are vital assets to many households across East Africa and contribute significantly to GDP. Although livestock's GDP contributions have been undervalued (Serra et al. 2020), efforts to calculate the sector's contributions to agricultural GDP show it contributes approximately 45% in Ethiopia and Kenya (ICPALD 2013a, 2013b). Beyond economic value, livestock serve many other functions (e.g. credit, dowry payments, wealth, organic fertilizer, and food security) (Smith et al. 2013). Climate change is having multiple effects on livestock keepers in East Africa which will negatively impact

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production systems. Climate change affects livestock in many ways, including reduced feed quantities and quality, increased heat stress and greater disease pressures (Rojas-Downing et al. 2017). Although the livestock sector is vulnerable to climate change, in East Africa the sector is also one of the largest contributors to greenhouse gas emissions (GHGE) (FAOSTAT 2020).

Livestock production and animal-source foods consumption have come to the forefront in debates over climate action, mainly in industrialized nations. Consumers can decrease their carbon footprint by reducing meat and dairy intake and countries can take actions to reduce ruminant numbers (Ripple et al. 2014). The narratives around climate change and livestock's contributions in industrialized countries have the potential to influence decisions made by donor agencies on adaptation and mitigation programming and funding in the developing world (Hartmann 2010). Although more nuanced understandings of livestock production acknowledge livestock as important components of mixed farming systems in developing countries (Smith et al. 2013), this nuance gets drowned out by more prominent discourses that focus on unsustainable animal production practices in industrialized economies (Bailey et al. 2014).

Approaching the topic of livestock and climate change from different angles results in differing framings of the problem and ambiguity over what appropriate responses may be. Depending on actors' identities, their power in relation to others and the setting in which they interact, the strategies they use to discuss different angles and deal with the ambiguous nature of the problems and responses can change. The objectives of this paper are to analyze the frame interactions between actors within science-policy interfaces (SPIs) in Ethiopia, Kenya and Uganda and understand how these affect discussions. This paper aims to answer two research questions (RQs):

(1) How do frames used by scientists and policymakers affect discussions about climate change and livestock keeping in East Africa?
(2) What framing interaction strategies are employed to deal with ambiguity in science-policy interfaces?

Understanding framing differences and interaction strategies is a step toward determining the best options to support livestock keepers in the face of climate change and toward reducing ambiguity around response options. Researchers and donors emphasize using science to inform policy (Oliver and Cairney 2019) but this focus on evidence-based policy is not without critique (Saltelli and Giampietro 2017). Funders encourage scientists to engage with science-based forums (Martin et al. 2006), and such activities take place in SPIs (Dunn, Bos, and Brown 2018). Much of the research on SPIs is from industrialized countries (Cairney and Oliver 2018), but the topic is growing in lower income contexts (Koch 2018). Given the differing contexts of these settings, however, it is unwise to assume that the conclusions of studies based in industrialized countries apply to lower income countries (Koch 2018). For example, the focus on SPIs in lower income countries includes linkages with global processes and the influence of international non-governmental organizations (NGOs) that are well-skilled in preparing science documents for use in policy processes (McConney et al. 2016). Examining the framing of adaptation and mitigation options for livestock and climate change within SPIs in East

Africa can contribute to the understanding of how science and policy actors interact in developing countries.

The concept of framing has been used in several disciplines (Van Hulst and Yanow 2014). Although there are divergent definitions for the concepts of frames and framing, in general frames can be said to 'define problems, . . .diagnose causes, . . .make moral judgements. . .and suggest remedies' (Entman 1993, 52). The use of different frames can be helpful to focus on certain aspects of issues at specific times, but there are disconnects between frames used by different actors which result in some aspects being neglected. We explore how frames are used and what framing strategies are employed to help stakeholders deal with ambiguity around livestock and climate change within SPIs in Ethiopia, Kenya, and Uganda.

## 2. Theoretical framework

We employ complementary theoretical frameworks to answer our RQs. We focus on SPIs to study interactions between researchers and decision-making processes. Interactional framing theory offers a framework to analyze how actors construct meaning and react to the actions and statements of other actors.

Interactions within SPIs are rarely linear processes (Dilling and Carmen Lemos 2011). The process is often non-linear and complex, and there is 'limited pragmatic advice on when and how to mediate the science-policy interface' (Dunn, Bos, and Brown 2018, 144). Several disciplines have examined evidence production and use (Oliver and Boaz 2019), and there is a wide literature on knowledge utilization for policy but it is often not linked to policy process theories (Blum 2018). This disconnect between knowledge utilization and policy theory literatures can be addressed by research on SPIs that couples the two areas (Blum 2018). Although policy does not have an agreed-upon definition among scholars, here we use it to mean an idea expressed by a government body that outlines a problem and how it will be addressed (Evans and Cvitanovic 2018). For this research, science encompasses all academic undertakings including social and biophysical research (Wesselink et al. 2013) and is also referred to as knowledge or evidence. Ambiguity refers to a situation in which there is confusion among actors as to whether something is a problem or not, whose problem it is and what might be done to handle it (Giordano, Brugnach, and Pluchinotta 2017).

SPIs are defined as 'social processes which encompass relations between scientists and other actors in the policy process, and which allow for exchanges, co-evolution, and joint construction of knowledge with the aim of enriching decision-making' (van den Hove 2007, 815). While evidence-based policymaking has been criticized for oversimplifying problems and recommending flawed policy solutions (Saltelli and Giampietro 2017), SPIs are being seen as venues for co-production of knowledge and decision-making (Howarth et al. 2022; Maas, Pauwelussen, and Turnhout 2022). There has been limited study of SPIs across the Global South (Wagner et al. 2023), however this is changing as researchers and governments seek ways to work together to address topics such as food systems and climate change (Eroğlu and Öğüt Erbil 2022; Singh et al. 2021). Studies of SPIs in developing countries reveal the need to adjust policy process theoretical frameworks (Cramer, Crane, and Dewulf 2023) and the importance of involving a wide range

**Table 1.** Definitions of framing interaction strategies.

| | |
|---|---|
| a.Frame incorporation | 'Incorporating a downgraded reformulation of a challenging element into your own issue framing' |
| b.Frame disconnection | 'Disconnecting the challenging element from the ongoing conversation as irrelevant, unimportant or the like' |
| c.Frame accommodation | 'Accommodating your own issue framing to the challenging issue element' |
| d. Frame polarization | 'Polarizing the difference by reaffirming your own issue framing or an upgraded version of your own issue framing' |
| e.Frame reconnection | 'Reconnecting frames by taking both elements seriously and taking away the incompatibility between them' |
| f. Frame exploration | Allowing an ambiguity to exist or surface while questioning the difference between frames |

a-e (Dewulf and Bouwen 2012, 179); f (Dewulf, Craps, and Dercon 2004).

of actors (Scarano et al. 2019). In developing countries, the emphasis on co-framing of problems and co-designing of solutions through SPIs is particularly important to ensure that participants are acknowledged as contributing valuable knowledge alongside scientists (Buyana 2020).

Our use of framing theory draws from interactional framing literature (Dewulf et al. 2009). In interactions between researchers and decision makers, frames are 'communicative devices that individuals and groups use to negotiate their interactions' (Dewulf et al. 2009, 160). SPIs take place through publication of written information and interpersonal interactions (Sullivan et al. 2017). Interactional framing theory (Dewulf and Bouwen 2012) enables us to investigate the ways actors co-construct frames. As such, and given the hybrid settings in which science and policy interact (Saltelli and Giampietro 2017), we do not distinguish between the origins of the frames used. This approach comes from the understanding that frames which are not compatible lead to framing differences. There are six interaction strategies (Table 1) that can be used to deal with frame differences: (a) frame incorporation; (b) frame disconnection; (c) frame accommodation; (d) frame polarization; (e) frame reconnection (Dewulf and Bouwen 2012); and (f) frame exploration (Dewulf, Craps, and Dercon 2004). This concept of interactional framing addresses the ways in which meaning is made through discourse (Dewulf et al. 2009) and is well suited to address the RQs.

## 3. Methods

We use a qualitative multi-site research design that allows the same RQs to be investigated in multiple case studies and using the same data collection techniques (Herriott and Firestone 1983). This allows for learning within the individual cases and for comparison between them. The Program for Climate Smart Livestock (PCSL) served as the entry point. PCSL was a four-year project funded by the German Federal Ministry for Economic Cooperation and Development (known by the acronym BMZ) and implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (Society for International Cooperation, known as GIZ) through the International Livestock Research Institute (ILRI) in Ethiopia, Kenya and Uganda. These countries have distinct characteristics but are like other East African countries facing comparable challenges. They are in the same region but have different governance structures; they are affected by climate change; livestock is economically significant; and all have ratified the Paris

Agreement. They differ in their climate and livestock policy frameworks, but through PCSL and other activities they all engage in SPIs on livestock and climate change.

### 3.1. Data collection

We used multiple data collection methods. Participant observation was key to gathering evidence on the interactional framings between actors. The lead author used participant observation to collect in-depth qualitative data during project meetings, interactions with government officials and science-policy dialogues. The data collected included statements made during the meetings plus who was present (or absent), the convening organizations and who determined the agenda. As an embedded PCSL researcher, she also recorded interactions between project scientists and policymakers.

The main interactions took place during PCSL-convened Learning Platform (LP) meetings in each country. We explained the research to the participants, and they signed informed consent forms before audio recording started. We used these recordings to supplement notetaking and produce transcripts of key portions. The LP meetings involved actors engaged in livestock and climate change topics from ministries of agriculture, development partners, NGOs, universities and research institutes. There was a mix of those involved in policy processes and those involved in research and development projects. Almost all participants were nationals of the country where the meeting was held. The exceptions who were foreigners were the PCSL project leader, the lead author (an American with dual Kenyan citizenship), an FAO representative who attended in Ethiopia and a Dutch embassy representative who attended in Uganda.

Other SPI meetings involving discussions on livestock and climate were included as opportunities arose, and these involved actors who were present in the LP meetings due to the close-knit nature of the livestock and climate community. Many meetings shifted to virtual formats during the Covid pandemic. We acknowledge there may be additional framings around livestock and climate change at sub-national or local levels, but for the scope of this research we limited our focus to national and regional SPIs.

We also used content analysis to capture frames used in written documents. Relevant project documents, workshop reports, and national livestock and climate change policies were collected through expert opinion, web searches and citation tracking. At least five policy documents (e.g. National Adaptation Plans, Nationally Determined Contributions, etc.) were reviewed per country, along with peer-reviewed articles and technical reports on the topic.

The lead author conducted face-to-face interviews to explore views on SPIs and livestock-climate change dynamics. Interviewees were selected through purposive sampling based on involvement in PCSL and through snowball sampling. Interviews were semi-structured and continued until data saturation became evident. Interviews were conducted in English and digitally recorded for later transcription. A total of 38 interviews were held with ILRI scientists, government ministry staff, university faculty, national agricultural research organization scientists, NGO representatives, and members of civil society organizations. There were 14 interviews of people based

in Kenya, 12 with people based in Uganda, 11 with Ethiopia-based respondents, and one with a respondent engaged in the SPIs of East Africa but based outside the region.

### 3.2. Data analysis

Field notes, collected documents, and interview and meeting transcripts were loaded into QSR International's Nvivo 12 qualitative data analysis software. Using a thematic analysis approach (Braun and Clarke 2006) that contributed to our framing analysis, we developed a preliminary coding structure that was then adjusted as data were coded. After coding, we analyzed the problem frames and response options frames to compare across the countries.

One LP meeting from each country was selected for detailed analysis of interactional framing strategies. These meetings began with a presentation from PCSL's Principal Investigator. They presented findings of a policy coherence analysis conducted as part of PCSL (Ashley 2019). The Uganda meeting (October 2019) was followed by Kenya (December 2019) and Ethiopia (January 2020). We transcribed discussions and coded the interactional framing strategies used by participants. We focused on discussions relating to livestock-specific adaptation and mitigation actions. Additional discussions were omitted from the analysis.

Following the concept of act – interact – double interact from Dewulf and Bouwen (2012), we used the presentation as the act in most sequences and then a participant's first introduction of a framing difference as an interact, with subsequent discussions regarding that framing as double interacts. There were a few sequences that began with new acts, such as the presenter posing a question to generate additional discussion. As many participants as possible were allowed to contribute, which led to occasional branching in the discussions, e.g. a speaker would present their point of view, another speaker would contribute on a different topic, and the third would respond to the point of the first. This required a slightly different approach to code interactions with many speakers. We had to identify the sequences to clearly label the act, the related interact, and the double interacts following that interact. The double interacts were coded according to the six possible interaction strategies. We then analyzed the use of and patterns present in these strategies.

## 4. Results

This section is structured in two parts. The first presents the issue framings used by individuals during interviews and meetings and by institutions within publications. The issue framing is dissected into problem framings and response option framings. These findings respond to the first research question by describing the frames used in SPIs. The second part uses meeting transcript extracts to highlight interactional framing strategies employed by actors in SPIs. These findings contribute to both RQs by examining how the employed frames affect science-policy discussions and how the interaction strategies are used to deal with ambiguity. Combining these two approaches is a novel way to explore what individuals verbalize and what institutions publish in documents and to analyze what strategies are used to adjust and modify framings or to deal with

**Table 2.** Problem and response framings of livestock and climate change within national science-policy interfaces.

| | (A) Problem framing | (B) Response options framing |
|---|---|---|
| 1 | Climate finance and other funding sources focus on 'quick wins' which are often mitigation-related | More funding needed for issues which take longer/are more difficult to solve, e.g. improving feeding and breeding for more adapted/heat tolerant animals, disease surveillance and control, rangeland rehabilitation, etc. that relate to adaptation |
| 2 | Livestock are often left out of climate smart agriculture (CSA) discussions | Livestock-specific CSA projects such as PCSL; giving greater attention to livestock in general in CSA projects and policies |
| 3 | Climate change is affecting livestock (drought, diseases, heat stress, dwindling pasture lands and overgrazing) | First priority should be adaptation and increasing productivity; mitigation not a priority. |
| 4 | Pastoralists keep too many animals, causing environmental degradation and contributing to high GHG emissions | Better linkages to markets to develop the value chain and de-risking through insurance to make pastoralism more profitable will help limit the numbers kept |
| 5 | Livestock production contributes high GHGEs. Ruminants contribute more emissions than monogastrics | Improved feeding to reduce emissions intensities; incentivizing production of monogastrics to help reduce emissions by reducing numbers of ruminants; breeding for lower emitting ruminants. |
| 6 | Too much emphasis on the Ethiopian lowlands where adaptation is a priority | Consider both adaptation and mitigation and select low emissions development pathways |
| 7 | Emissions are high because too many animals die from poor health | Increasing productivity can allow people to keep fewer, more productive animals and reduce emissions intensities |
| 8 | Accurate measurements and livestock data are lacking | Functional livestock MRV systems can help countries access climate finance |
| 9 | African countries are not high emitters and should focus primarily on adaptation | African countries can contribute to mitigation by adopting adaptation solutions that have mitigation co-benefits |
| 10 | African livestock emissions intensities are high compared to other countries | Countries should contribute to mitigation by reducing these intensities |
| 11 | Livestock and meat/animal source foods (ASF) consumption are portrayed negatively, affecting donor perceptions | Need to publish evidence on how livestock are important to livelihoods and Global South nutrition |

differences during interactions. This research responds to the need for better understanding developing country contexts in which science interacts with policymaking by offering empirical evidence related to both knowledge utilization and policy process theory.

### *4.1. Problem and response option framings*

The dominant livestock and climate change problem and response option framings within SPIs are summarized in Table 2. The issue framings are common across all three of the countries except #4, which was only used in Kenya and Ethiopia. The response options framings are presented alongside their corresponding problem framing. These problem and response framings are not presented in any particular order, and since they were largely similar across countries they are presented together, and we note where there were small differences between countries. Their frequency of use has not been quantified because we are interested in the qualitative differences between the

frames and the strategies that are used when the framings are advanced during science-policy interactions.

The first issue framing identified is that climate finance interventions and other funding sources place emphasis on options that can achieve 'quick wins' in the livestock sector (#1A). This frame was used most often in Kenya. Several interviewees – particularly those from international organizations – noted that there is an overemphasis on actions such as developing measurement, reporting and verification (MRV) systems for governments to be able to quantify livestock sector GHGE, while not enough attention is paid to interventions that will help livestock keepers adapt to climate change. The corresponding response to this problem framing is that the livestock sector needs more funding specifically for adaptation (#1B). A related but slightly different framing is used to note that discussions regarding climate smart agriculture (CSA) focus primarily on crops and tend to ignore livestock (#2A). To counter this, experts advocate for livestock-specific projects using the CSA approach (#2B). This frame was used equally across countries.

An overarching concern with how climate change will affect livestock is another problem framing (#3A). Respondents from all three countries and from international organizations gave examples of how livestock production will suffer, including the deterioration of rangelands and increase in woody browses, rainfall changes and increased droughts, increased diseases, feed and water shortages, reduced growth and reproduction, all leading to reduced productivity. The corresponding response option framing highlights maintaining adaptation as the priority in climate action (#3B), which is what all three countries propose in their policy documents.

In Kenya and Ethiopia, a problem framing in interviews and meetings related to pastoralists' herd sizes. Some respondents and meeting participants framed large herd sizes as a problem contributing to environmental degradation and high GHGE (#4A). We note not everyone agreed with this framing, leading to the use of interactional framing strategies to deal with framing differences (described in the next subsection). Those who put forth this problem framing offered a response option of better linking pastoralists to markets and providing risk management through livestock insurance (#4B). Beyond pastoralists, there is a framing that highlights the high GHGEs from ruminants (#5A). This problem framing corresponds to the response option framing emphasizing the potential for mitigation within the livestock sector (#5B). Response options include improving feeding practices, especially for cattle, to reduce emissions generated per unit of milk or meat (known as 'emissions intensities') and, especially in Ethiopia, encouraging the production of monogastrics (e.g. chickens) to shift away from ruminants.

One of the problem framings relates only to Ethiopia and was used by an interview respondent and the same person during the LP meeting. The concern was that there has been too much attention on livestock in Ethiopian rangelands, while more livestock exists in the highlands (#6A). The response option proffered was to balance attention on livestock in different systems and opt for low emissions development strategies that can be implemented in highland mixed crop-livestock systems (#6B).

The issue of animal health is a problem framing that identifies animal deaths as an additional cause of high GHGE (#7A). This problem was mentioned most frequently by Ethiopian respondents and meeting participants. When animals die due to diseases, they

have contributed GHGEs while alive without resulting in meat production (beef cattle), or achieving the optimal number of lactation cycles (dairy cows). The corresponding response option involves improving animal care and management to reduce losses due to diseases (#7B).

One of the most dominant problem framings employed by actors is the issue of inaccurate and/or missing livestock data (#8A). This has been an area of much discussion, particularly in Uganda, and the correlated response option is the focus of many projects and activities. 'Activity data', as they are known by GHG inventory experts, include population numbers of different types of animals (e.g. adult males, adult females and calves), body weight per animal type, daily weight gain, milk yield, and more (FAO, and GRA 2020). The lack of these data poses a problem for accurately knowing livestock sector GHGEs. If a country does not have detailed data, it must use emissions factors published by the Intergovernmental Panel on Climate Change, which most experts agree are not accurate for East Africa's livestock systems. Part of the response option framing to the issue is improved measurement and tracking of emissions by type of animal and feeding strategy. Part of PCSL's work was to help improve these baseline data so they become part of national MRV systems and help track emissions reductions resulting from interventions. Improved livestock MRV systems are essential to access climate finance because they provide a way to measure GHGE intensities reductions (#8B), and this was discussed in all three countries.

Despite the focus on improving livestock MRV systems, some meeting participants in Kenya and Ethiopia used a problem framing that the focus countries are not high emitters compared to industrialized nations and should therefore focus primarily on adaptation rather than mitigation (#9A). In response to this problem framing, other participants offered a response option of selecting adaptation measures that have co-benefits (#9B), e.g. improved feeding practices can improve animal health and productivity while also reducing emissions intensities. A different problem framing used in both Kenya and Ethiopia is the relatively high emissions intensities in the focus countries compared to elsewhere (#10A). The response option related to this problem is to reduce the intensities through concerted efforts to improve production systems (#10B).

Finally, an issue framing that came primarily from representatives of international organizations based in Kenya and Uganda is the challenge brought by negative portrayal of livestock and consumption of animal source foods (ASF) within industrialized country media and the perceived effect on donor willingness to fund livestock programs in low-income countries (#11A). ILRI respondents framed the problem of securing research funding for livestock and climate change considering the pushback against excessive ASF consumption in industrialized countries. In response, ILRI is working to publish evidence on livestock's importance to ecologies, livelihoods and nutrition in low-income countries (#11B).

These framings were used by the full range of actors within the SPIs, except for framing #11 which was used mainly by individuals from international organizations. We did not find any other correspondence between the types of actors and the framings they used. The different framings were employed at different times by the various actors depending on their individual backgrounds, interests and the context in which they were speaking. Individuals from international organizations, when using framings related to

**Table 3.** Interaction framing strategies used during learning platform meetings.

| Ethiopia | | Kenya | | Uganda | |
|---|---|---|---|---|---|
| S1 (#4) | Disconnection | S1 (#9) | Accommodation | S1 (#8) | Disconnection |
| | *topic closed* | | Exploration | | Polarization |
| S2 (#6) | Exploration | | Accommodation | | Accommodation |
| | Incorporation | | *topic closed* | | *topic closed* |
| | *topic closed* | S2 (#10) | Reconnection | S2 (#3) | Incorporation |
| S3 (#5) | Incorporation | | Exploration | | *topic closed* |
| | Polarization | | Reconnection | S3 (#8) | Polarization |
| | Exploration | | Incorporation | | *topic unresolved* |
| | Incorporation | | *topic closed* | S4 (#8) | Polarization |
| | Reconnection | S3 (#4) | Incorporation | | Polarization |
| | *topic closed* | | *topic closed* | | Disconnection |
| S4 (#10) | Exploration | S4 (#8) | Incorporation | | Incorporation |
| | Disconnection | | Incorporation | | Incorporation |
| | *topic closed* | | Polarization | | Reconnection |
| S5 (#1) | Accommodation | | Reconnection | | Incorporation |
| | Disconnection | | *topic closed* | | Disconnection |
| | Polarization | | | | *topic closed* |
| | *topic closed* | | | | |
| S6 (#7) | Disconnection | | | | |
| | *topic closed* | | | | |

adaptation, indicated that these come from government priorities. We reflect more on this in the discussion section.

### 4.2. Interactional framing strategies

Participants within SPIs used varying interactional framing strategies when discussing topics related to climate change and livestock. The interaction strategies used during each of the double interacts are presented in Table 3. Each sequence (S) focuses on a framing presented above. The number of the framing is provided at the beginning of each sequence and corresponds to the numbering in Table 2.

During the Ethiopia meeting, six sequences included 14 double interacts focused on adaptation and mitigation. The discussion focused mainly on framing #5, regarding the high GHGE produced through livestock (especially ruminants) and framing #1, on the divide between funding for quick wins and more difficult issues. The most frequently used interactional framing strategy was disconnection (four instances out of 14). Incorporation and exploration were each used thrice (see Table 4).

The meeting in Kenya had fewer sequences related to adaptation and mitigation; the meeting included discussion on the government's capacity to develop and implement

**Table 4.** Total number of times each framing strategy was used per country meeting.

| | Ethiopia | Kenya | Uganda | Total |
|---|---|---|---|---|
| Incorporation | 3 | 4 | 4 | **11** |
| Accommodation | 1 | 2 | 1 | **4** |
| Disconnection | 4 | 0 | 3 | **7** |
| Polarization | 2 | 1 | 4 | **7** |
| Reconnection | 1 | 3 | 1 | **5** |
| Exploration | 3 | 2 | 0 | **5** |
| Total | **14** | **12** | **13** | **39** |

policy, which falls outside this analysis's scope. The Kenya meeting discussions centered around the livestock sector's ability to contribute to mitigation because of high emissions intensities and the need for good MRV systems, relating to framings #8, 9 and 10. The strategies most frequently employed were incorporation (four instances) and reconnection (three instances) out of 12 double interacts.

In Uganda, quantifying and monitoring livestock emissions dominated discussions. These relate to framing #8. Polarization and incorporation were each used four times out of 13 double interacts (Table 4). The meeting in Uganda presented a challenge in coding because there were times when a speaker was not responding directly to the previous speaker but to someone who had contributed earlier. In some instances, responses were omitted from the analysis because they did not fit within the scope of adaptation and mitigation discussions. In the case of Sequences 3 and 4, these both originate from the same act, which was a question posed by the ILRI presenter. The topic in sequence 3 remained unresolved as a new Interact in response to the same act started sequence 4. We described this challenge in the methods section.

Frame #8 was the most dominant within these selected LP meetings, which is likely a result of the content of the presentation given by the ILRI project leader who convened the meetings. Frames #10, 5 and 1 followed as the most frequently discussed.

The most frequently used interaction strategy was incorporation (used 11 times), followed by disconnection and polarization (7 uses each) (Table 4). We present transcript excerpts from the interaction strategies to illustrate how they were used. The excerpts have been shortened to reduce their word counts but the key aspects illustrating the interactional framing strategies are included. We have used [. . .] to indicate where words were omitted. The pronouns 'they' and 'their' are used in singular form to refer to individuals to avoid revealing participants' gender and help preserve anonymity.

#### *4.2.1. Incorporation*

This was the most frequently used strategy in the studied meetings. Incorporation is used when a speaker agrees with a portion of what the previous speaker has said but incorporates that aspect into a broader framing of their own. Someone using incorporation accepts that the first speaker had a valid point but does not fully take their framing on board, instead using part of it to support their own framing which has differences from that of the first speaker. To illustrate this, we use an extract from the Kenya meeting. Participant 1 starts a new topic (the act) and brings up policy implementation at local levels. Participant 2 builds on this to shift the framing from not just a need to implement policies at local level but also the need to collect data from farmers and reward them for using good practices. The presenter then takes on board the point about rewarding and incentivizing farmers (through access to finance) and incorporates that aspect into the broader framing of the need for MRV and adaptation tracking. In doing so, the presenter reduces ambiguity around what the problem is by specifying how policy implementation and tracking adaptation are linked to accessing climate finance for the livestock sector.

Extract 1. Illustration of frame incorporation from Kenya S4 (frame #8)

[ACT] Participant 1: My point is on the uptake of these policies, especially by counties, [. . .] Do the counties have the capacity to understand these policies and implement? I think we're still missing that aspect.

[INTERACT] Participant 2: If we look at the implementation perspective, and we look at a completely eroded extension system in the country. [. . .] Right now, we have hundreds of thousands of farmers who are doing things that are very clearly aligned with the SDGs but they're invisible, they're not counted, and it's not fair. They should be rewarded and incentivized to continue.

[DOUBLE INTERACT] ILRI Presenter: Well, that's the idea behind the MRVs and the adaptation tracking is that that's linked to finance but without those it's like a chicken and an egg. Without the tracking systems you can't get the finance, and without the finance you can't develop the tracking system. [Incorporation]

Beyond this example from the Kenya meeting, incorporation was used in the Uganda meeting in discussions on availability and reliability of livestock data to accept a portion of the framing that better data are needed and then incorporate that into a proposal for better collection methods and a suggestion on the need for a new policy requiring government sectors to fulfill data requirements of the Climate Change Directorate. In Ethiopia, incorporation was used by participants to agree partially with a previous speaker and then add additional elements to the topic from a slightly different angle. The strategy of incorporation allows speakers to contribute more to a discussion and add their own framings without disagreeing fully with what was already said. This helps reduce ambiguity by introducing additional information on a problem or its solutions.

#### *4.2.2. Disconnection*

To illustrate disconnection, which is used to remove a challenging element from discussion by casting it as incompatible with one's own framing, we present an exchange that took place in the Ethiopia LP meeting. The first participant to speak following the ILRI presentation, a representative from a government agency, asked a question regarding low GHG-emitting animal breeds. The presenter responded and the same speaker then continued their comments with an interact regarding pastoralism.

Extract 2. Illustration of frame disconnection from Ethiopia S1 (frame #4)

[INTERACT] Participant 1: [ACT] Presentation on policy coherence report [. . .] for example in pastoral areas, [. . .]. The prestige is having more livestock and more livestock breeds. I think this will be a challenge. What is the solution for this? Are you going to limit the number of livestock for pastoralists or what?

[RESPONSE] ILRI Presenter: [passes the question on to Participant 2, who has a long history of work in pastoral areas]

[DOUBLE INTERACT] Participant 2: It has been said so many times that pastoralists are keeping livestock in large numbers of livestock for prestige, but these things have been changing. [. . .] They are now making rational decisions either to keep small, more productive, diverse type of herds than keeping large herds which can be lost in one drought or two . . . . In fact, you know, it was not for no reason that they were keeping large numbers of livestock. It's not only for prestige. It was their risk management strategy. [. . .] [Disconnection]

Participant 1 (P1) uses the framing of pastoralism being problematic due to the perceived desire for large herds. They challenge the presenter to provide a solution to this issue. The presenter acknowledges that is not a problem for them, as a scientist from an external organization, to solve (response was removed for brevity). To facilitate discussion, the presenter then invites another participant (P2) to contribute. P2 is a long-time ILRI collaborator with expertise in pastoralist systems. P2's double interact can be seen as a direct response to the interact of P1, and P2 uses disconnection to dismiss P1's view on pastoralists as irrelevant because they are outdated and not in line with how pastoralists are changing their practices. P2 further disconnects from P1's framing by noting that the large herd sizes were not just for prestige but served a needed purpose given the nature of that production system and the ecology to which it is adapted.

Disconnection was used several other times in the Ethiopia LP and during the Uganda meeting when a speaker dismissed a previous assertion as untrue or postponed a discussion topic. The speaker using disconnection would either offer an experience or a statistic that nullified what the previous speaker said or indicate that information on a particular topic was not yet available and would be addressed later.

#### *4.2.3. Accommodation*

The accommodation strategy involves reducing a difference between one's own framing and someone else's by adjusting one's own to better fit with the challenging element. We provide an example in Extract 3 from Ethiopia. A leader of a landscape and sustainable livestock production program asked about the presented findings regarding emphasis on adaptation in national policies. The presenter expounded on the findings, explaining there is greater emphasis on adaptation in policies but often higher funding available for mitigation activities. The presenter then asked for the participant's view. The participant responded using disconnection to offer a different framing from that of the presenter. In the response, they note they are working on adaptation in Ethiopia because of the low levels of income and that mitigation work will take time. The presenter then gives a quick response to accept and accommodate the participant's framing rather than contradict it.

Extract 3. Illustration of frame accommodation from Ethiopia S5 (frame #1)

> [ACT] Participant 1: [question about the findings regarding more emphasis on adaptation in Ethiopia]
>
> [Response] ILRI Presenter: [clarification of point from presentation, inquiry about P1's experience]
>
> [INTERACT] Participant 1: When it comes to Ethiopia, there is the central government and there are regions. We have different structures. [. . .] The livestock project is working together on MRV and we are also expected to do a carbon fund while doing the MRV. [. . .] But all these things, adaptation and mitigation, depend in some way on centralization; and the regions are working on their own. [. . .] pastoralism and livestock is a major living income. We said unless we teach them how to do adaptation, we will go straight to mitigation and those things might not be fruitful. In the case of Ethiopia, that's why adaptation is facing more attention than mitigation. [. . .] Especially in mitigation path it will take us time. That's why the adaptation is more.
>
> [DOUBLE INTERACT] ILRI Presenter: And I think that's fine. [Accommodation]

Accommodation was the least frequently used of the six strategies. We found that it was used to concede certain points and allow the discussion to move forward.

#### 4.2.4. Polarization

A speaker using polarization increases the framing difference by re-emphasizing his/her own framing or building on the difference already emerging between previous speakers. To look at polarization, we use an extract from the Uganda meeting. The topics of livestock contributions to GHGEs and measuring those contributions dominated the meeting. The presenter posed a question about including livestock in the conversation on mitigation in the country (related to frame #5), which brought responses from participants regarding the issue of establishing a baseline of livestock sector emissions (frame #8).

Extract 4. Illustration of frame polarization from Uganda S4 (frame #8)

> [ACT] ILRI presenter: One question we had that might focus the conversation. [. . .] What about the issue of whether to include livestock in the conversation on mitigation?
>
> [INTERACT] Participant 1: [. . .] as a country we don't know how much of the emissions come from livestock. How can we think about mitigation without knowing how much we are contributing?
>
> [DOUBLE INTERACT] Participant 2: In talking about the baseline, we can't run away from this target thing because it's a commitment now. We had little time to prepare the NDC [Nationally Determined Contribution] but the basis is on our first and second national communication. [. . .] The climate change department has put together already a GHG inventory for the different sectors. [. . .] How much we are contributing, we already know, we are trying to improve our data so we have concrete national data. [Polarization]
>
> [DOUBLE INTERACT] Participant 3: I think if we say we are sure about emissions it's not true. We are guessing, we don't know how many cows we have. We need to put our house in order from the basics. Then we can give a definitive figure. [Polarization]

Participants 2 and 3 in this exchange both use polarization to set their statements apart from the previous speaker. P2 is a staff member of the Climate Change Department within the Ministry of Water and Environment. This person disputes P1's assertion that the baseline is not known and emphasizes their own framing that the baseline exists and they are trying to improve data collection. P3 disagrees with P2's assertion that the country knows its baseline and reaffirms the issue that they do not know the true figures. P2 takes the stance that Uganda is implementing the response option by establishing a baseline, even if it was done in less time than was ideal and will continue to improve the data going forward. P2 uses polarization to distance their stance from that of P1, who asserted that the country does not know the amount of livestock emissions. P3 then pulls back in the other direction toward the problem framing regarding lack of accurate measurements in the sector, openly saying that P2's statement is not true. P3 states outrightly that the country does not know how many cows it has, heightening the difference between P2's statement that they are working with their best emissions estimates and taking it to the level of not even knowing the population of animals. This strategy was not able to reduce ambiguity around the issue.

The other uses of polarization we found were similar in the way they were used to create an obvious difference between one's point and that of the preceding speaker. Outright disagreement is not common in such stakeholder meetings, but it is used when a participant strongly pushes their own framing of an issue without conceding any points.

#### 4.2.5. Reconnection

The reconnection strategy can be described as someone accepting a challenging element from another speaker and linking it with their own framing in an indirect way. This allows a speaker to take both elements seriously and deal with their incompatibility. The example of the reconnection strategy comes later within the same sequence used to illustrate polarization in Extract 4. Following several more statements regarding the availability or lack of livestock data in the country, an officer from the Ministry of Agriculture, Animal Industries and Fisheries (MAAIF) speaks (P4) and notes that there is a livestock census planned for the near future.

Extract 5. Illustration of frame reconnection from Uganda S4 (frame #8)

> *Continuation of sequence in extract 4, following several other double interacts regarding livestock data*
>
> [DOUBLE INTERACT] Participant 4: [. . .] To answer the issue of us guessing the numbers of livestock, we had a census in 2008, we have been using that record for a long time. The good news is that UBOS [Uganda Bureau of Statistics] and MAAIF are organizing to count all your livestock in February. Please, when that exercise comes up, be there because we really need the data. [Reconnection]

This same participant had been one of the earliest speakers to respond to the question about including livestock in mitigation, and that first interjection was a complaint about setting targets when there is no emissions baseline. After other speakers used polarization, disconnection and incorporation to deal with their framing differences, the MAAIF officer reconnects the CCD officer's assertion that they have data with which they are working into their earlier framing to then accept that there are data available and in use, although they are quite out of date. This removes the incompatibility between the two sides by accepting that data do exist but are outdated and will be updated.

Reconnection was also used during the Kenya and Ethiopia meetings by speakers who took on another person's point and gave further explanation. They used reconnection to go back and adjust a previous statement to fit around a newer challenging element that was raised, folding them together.

#### 4.2.6. Exploration

Framing exploration is not often included in framing strategies literature, but we include it here because we found several instances in which a speaker did not directly present a different framing but rather posed a question that pushed another speaker to further elaborate on the framing difference at hand. We show how this was done during the Ethiopia meeting in Extract 6. Following the ILRI presentation, a participant professed the view that the highlands should not be neglected since that area holds the majority of

the country's livestock. The speaker mentions highlighting lower emitting species rather than shifting species, and the ILRI presenter poses a question to further explore the differences of that framing.

Extract 6. Illustration of frame exploration from Ethiopia S2 (frame #6)
[ACT] Presentation by ILRI Presenter

> [INTERACT] Participant 1: Whenever we talk about livestock, we always think about lowlands. But where's most of the livestock in concentration in Ethiopia? I think we really need to think about that. When we think about shifting, it's not shifting but highlighting the importance of lower emitting species. I think we need to consider the highlands. [. . .] I think Ethiopia has this interest to move away from draft animals, for example. [. . .] I think whenever we think about livestock, let us please think where seventy percent of the livestock is concentrated in the highlands.
>
> [DOUBLE INTERACT] ILRI Presenter: So, when you say lower emitting species you just mean sheep and goats rather than cattle or draft animals? [Exploration]
>
> [DOUBLE INTERACT] Participant 1: I think there's also an interest to move into poultry in the highlands. I think there's a big interest. Plus, yes, there are socio-cultural implications and considerations in the lowlands. [. . .] Considering the mixed crop and livestock farming systems in Ethiopia especially in the highlands, there is need to think about livestock importance, so we need really integration of livestock, especially low emissions development within the livestock sector. [Incorporation]

By expanding the species under discussion from sheep and goats to also include poultry, P1 further is emphasizing the importance of working in the highlands because poultry are culturally not accepted by people living in the lowlands. If P1 had limited the species under discussion to sheep and goats, that could have included working in the lowlands to highlight importance of those species as part of mixed herds. The inclusion of poultry clarifies the framing as being focused mainly on highlands areas where it is socially acceptable to promote poultry farming. By posing the question to P1, the presenter was exploring P1's framing in more detail to have a better understanding.

The presenter was the speaker who used exploration in all but one of the instances. This strategy was used to probe further on a topic and give the participants more time to expand on their views. In one sequence of the Kenya meeting, another participant posed a question to explore a framing difference on the emphasis on adaptation among African negotiators in international fora.

## 5. Discussion

This research found the same sets of frames appearing in the interviews, policy documents and science-policy dialogues. Ten of the 11 frames that emerged from the document review and interviews were employed in LP meetings. The exception was Frame 2 (see Table 2): the issue of livestock being left out of CSA discussions. It was used during interviews, but did not arise during LP meetings, most likely because the PCSL meetings were a response to that problem framing. As a research-for-development project, PCSL was designed to address both adaptation and mitigation and so the issue was not applicable in its meetings. Frame 11, on the negative portrayal of livestock in media,

was mentioned during interviews and in the Uganda LP meeting. However, it did not elicit a framing difference during that meeting and therefore does not appear in any of the coded sequences.

The frames were similar across the three countries, although frame 4 did not appear in Uganda despite the pastoralist system being present there. Policy documents in all three countries embrace the CSA approach, which is a result of influence from international organizations promoting it (Faling 2020). Frame 8 (GHGE measurements) dominated discussions in Uganda. The discussions resulted in many framing differences that continued beyond that initial LP meeting and were still being discussed in subsequent meetings attended by the lead author. The similarity of frames across countries can likely be attributed to influences from international SPIs and interactions between government representatives facilitated by organizations such as GIZ and the World Bank. There are still differences between the framings, however, so we do not find that the actors have created an 'echo chamber' by converging on all the same frames as has been found in other research on online climate change discussions (van Eck, Mulder, and Dewulf 2020).

Adaptation-related discussions within SPIs were limited in range and scope by actors' frames. This is notable when considering policy documents in Kenya and Uganda declare adaptation to be the top priority (Government of Kenya 2016; Republic of Uganda 2022). In Ethiopia, the guiding policy document for growth and development is its Climate Resilient Green Economy plan that emphasizes achieving a middle-income economy that is resilient to climate change and develops in a low carbon manner (Federal Democratic Republic of Ethiopia 2011). Among the identified frames, only frames 3 and 9 are explicitly about putting the focus of livestock interventions on adaptation. Frame 1 relates to adaptation and the need to prioritize adaptation options despite mitigation actions often resulting in more easily achievable and measurable outcomes. The response option is to garner more attention to adaptation, but this is not a specific, actionable option. Frame 6 is about drawing attention away from adaptation in the Ethiopian lowlands and balancing the focus by looking at low emissions development pathways in the highlands. While this involves both adaptation and mitigation, the offered response suggests reducing the focus on adaptation to cater for more emphasis on mitigation and actions that have adaptation co-benefits.

Overall, these adaptation-related frames drew relatively few discussions within the LP meetings despite the presentation given by the ILRI project leader on the results of a policy coherence analysis (Ashley 2019) covering both adaptation and mitigation. It is possible that adaptation does not receive as much discussion because there is generally more agreement on the need for adaptation, and therefore fewer framing differences around it. When discussed in the meetings, frames 3, 6 and 9 elicited incorporation, accommodation and exploration framing strategies. Disconnection and polarization were only used in conjunction with these adaptation-related frames during a discussion involving frame 1 in Ethiopia. By employing the theoretical framework of frames and interactional framing strategies, we can see that the general agreement around adaptation frames and less agreement on mitigation frames result in mitigation frames receiving much more attention during discussions and side-lining more technical and substantive discussions on adaptation options within these SPIs. The importance of this is that when governments are interacting with donors, designing policies and engaging in international climate policy negotiations these frames set the scene for

what is discussed which shapes the actions they take. Although national policies prioritize adaptation, mitigation problem and solution frames receive more attention.

In interviews, where the guiding questions included both adaptation and mitigation, the frames that emerged were distributed between both issues. Within policies, the careful consideration placed on writing the documents allows for adequate coverage of adaptation problems and responses, in line with national priorities as mentioned above. Yet when actors came together within SPIs, the mitigation-related frames dominated discussion. Frames 4, 5, 7, 8 and 10 relate specifically to mitigation, and the bulk of discussions in the LP meetings revolved around these. This may be because there is more ambiguity around adaptation; it is seen as more challenging than mitigation, in terms of actions needed to reach targeted populations and means needed to measure adaptation (Eriksen et al. 2021) and is therefore separated from discussions on the more manageable aspects of mitigation and MRV. This mismatch between perceived ease of intervention implementation for adaptation and mitigation actions and ability to track such is another reason adaptation options are not thoroughly discussed or implemented despite adaptation to climate change being the expressed priority of these governments.

By studying the use of interactional framing strategies, we can see this mismatch has implications for the ambiguity surrounding climate change and livestock in East Africa. In some cases, actors use reconnection to reduce ambiguity by bringing adaptation back into conversations by highlighting the adaptation pillar of CSA and using the term 'co-benefits'. Using this term reduces the divide between adaptation and mitigation interventions and recognizes that many actions have dual purposes, while still acknowledging the primacy of one over the other. This strategy for reducing ambiguity is similar to the dialogical learning and negotiations strategies identified within natural resource management settings (Brugnach et al. 2011). High levels of ambiguity around problem framing present challenges in developing common modes of action; dealing with ambiguity through processes that co-create new shared knowledge can be the starting point for joint action (Giordano, Brugnach, and Pluchinotta 2017). It is possible that co-creation of knowledge – such as how livestock interventions can achieve both adaptation and mitigation goals simultaneously – could help shift the framings and break down the adaptation-mitigation divide. This relates to similar findings that engagement between researchers and policymakers based on negotiation and reflection within an SPI is a productive way to approach climate change adaptation (Iyalomhe et al. 2013).

Without successful operationalization of the 'climate-smart' framing around the win-wins of livestock interventions having both adaptation and mitigation outcomes, actors must continue to be selective in their use of frames and actively choose which frame to use in which situation. Depending on the topic or host of a meeting, actors opt to strategically use frames they know will either create common ground with others in the room or set them in opposition to others. These choices, which affect their ability to exercise power within the SPI, then influence the interactional framing strategies they employ to either find shared meaning or undertake oppositional modes of action by imposing their frame or ignoring the frame of others, similar to findings of (Brugnach et al. 2011).

In reflecting on the effect of the topic/host of meetings, we consider that the meetings included here are representative of SPIs in these countries because they were convened as part of a research-for-development project exercise and included a diverse range of

stakeholders such as government officials, NGO representatives, and local and international scientists. Meetings convened by governments or by donors may show different interaction patterns or frame usage given their differing levels of power and their interests. This study is inherently limited by the authors' access to other such meetings. Despite this limitation, the meetings we have included offer relevant science-policy interactions because they illustrate instances of bringing together a range of stakeholders to exchange knowledge, build trust and move toward co-production within policy spaces (Eroğlu and Öğüt Erbil 2022; Maas, Pauwelussen, and Turnhout 2022). Research on the use of power within developing country SPIs to improve understanding of actors' levels of power and their ability to exercise it is emerging (Buyana et al. 2021) but more is needed to understand the use of power specifically around climate change discussions. The findings here contribute to the growing body of literature around science-policy interactions in developing country contexts as related to addressing climate change within the agriculture sector. Additional comparative future research on how livestock and climate change related frames and interaction strategies are used in East Africa compared to frames and use of interaction strategies in other low-income countries and in higher income countries could help shed light on possible implications for international climate negotiations and interactions between development partners and low-income countries.

## 6. Conclusion

In this paper, we have addressed the questions of how frames used by scientists and policymakers affect discussions about climate change and livestock keeping in East Africa and what framing interaction strategies are employed to deal with ambiguity in SPIs. Actors use many different problem frames when discussing livestock and climate change which include frames calling for adaptation and for mitigation in the sector. The response option frames offer solutions to both problems, but mitigation solutions are central during discussions within SPIs in Ethiopia, Kenya and Uganda. This results in adaptation options being ignored in favor of achieving quick wins from mitigation activities, which is contrary to national climate change priorities.

This research contributes to the literature on frames and interactional framing strategies in SPIs. A deeper understanding of the frames employed and how actors use interactional framing strategies can help understand the ways in which knowledge is used by different stakeholders in SPIs. Ethiopia, Kenya, Uganda and many other African countries have prioritized adaptation to climate change within their national policies and strategies. In applying the analysis to the domain of livestock and climate change discussions within three East African countries, an improved understanding of how adaptation and mitigation options are discussed within SPIs may be helpful for these countries to meet their national goals of prioritizing adaptation response options. By consciously working within SPIs to co-create new shared response option frames that incorporate a climate-smart approach to livestock production, national priorities can be better addressed. Interaction strategies that incorporate, accommodate or reconnect mitigation response option framings with adaptation response option framings can help reduce ambiguity and raise the prominence of the topic of adaptation within these SPIs.

## Acknowledgments

We thank the interviewees and meeting participants for agreeing to be part of this research.

The origin of this work was funded through the Program for Climate Smart Livestock (PCSL) which received financial support from the German Federal Ministry for Economic Cooperation and Development (BMZ) commissioned by the Deutsche Gesellschaft für Internationale Zusam menarbeit (GIZ) through the Fund International Agricultural Research (FIA), grant number: 81231239. Additional funding has come through a grant from the World Bank, "Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA)" signed between the Alliance of Bioversity and CIAT and the International Development Association (IDA) (Grant no. D7540). Support is also acknowledged from the One CGIAR Research Initiatives on Livestock and Climate and Low Emissions Food Systems.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

The work was supported by the Deutsche Gesellschaft für Internationale Zusammenarbeit [2017.0119.2]; World Bank Group [P173398].

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