



Knowledge brokers within the multiple streams framework: The science-policy interface for livestock and climate change discussions in Kenya

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ABSTRACT

Livestock production is affected by climate change, but also contributes to climate change through greenhouse gas emissions. This leads to ambiguity in how livestock are framed in climate and development policy processes. We use the Multiple Streams Framework (MSF) to investigate the role of knowledge brokers in Kenyan livestock and climate change policy processes. We analyse how knowledge brokers deal with ambiguity from different problem and response framings within science-policy interfaces using the case of a project that seeks to inform Kenyan policies relevant to livestock and climate change. We identify ambiguity within the problem stream where actors recognise adaptation and mitigation as dual challenges of livestock and climate change. This ambiguity creates tension between actors but can be strategically deployed to help match the problem and policy streams. Actors use the terms 'climate smart' and 'co-benefits' to link the dual adaptation and mitigation needs. In the political stream, nationally defined priorities and external funding possibilities influence the political will and motivation to adopt identified response options. There are opportunities for knowledge brokers to address the ambiguities and translate knowledge during windows of opportunity when the streams are being coupled, but challenges exist, resulting in slow and inadequate development of policies. This paper makes two contributions to the MSF literature. First, we further refine the concept of knowledge brokers and establish their role across all three streams. Second, we apply the MSF in a lower income country and demonstrate that international organizations must be among the actors considered.

1. Introduction

A situation that can be seen from different viewpoints or cast in varying lights creates ambiguity, which can make the exact problem or the appropriate responses unclear (Brugnach and Ingram, 2012; Giordano et al., 2017). Debates around livestock and climate change, at both global and national levels, present such ambiguity. In lower income and agrarian countries, many households depend on keeping livestock to meet nutritional and livelihood needs, to store assets, to hedge against risks, to provide organic fertilizer, and to fulfil other interests (Herrero et al., 2013; Randolph et al., 2007; Weiler et al., 2014). These livestock keepers and the related value chains are negatively affected by the changing climate (Godde et al., 2021; Rojas-Downing et al., 2017), causing many agrarian countries to prioritize adaptation in agriculture (including within the livestock sector) in their national responses to

climate change. However, global environmental policy discussions emphasize the inefficiencies of livestock production systems in lower income countries, which result in high greenhouse gas emissions (GHGE) intensities when compared with industrialized countries (Caro et al., 2014; Forabosco et al., 2017; Steinfeld and Gerber, 2010). While many lower income countries, especially those in Africa, prioritize reducing vulnerability to climate change and improving adaptation in livestock systems (Nhamo, 2018), they have also made pledges to reduce GHGE as part of their international commitments. These alternative framings around livestock and climate change lead to ambiguity in which different stakeholders hold divergent, but still valid, views of the issue (Dewulf et al., 2005).

The presence of ambiguity results from different framings of problems and possible solutions (Giordano et al., 2017) around the topic of livestock and climate change. Ambiguity also arises due to differences in

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knowledge systems, expertise and stakes within a situation (Brugnach and Ingram, 2012). Given that climate change is a global issue, what is happening at international levels, for example in the negotiations within the United Nations Framework Convention on Climate Change (UNFCCC), interacts with national level activities and priorities. The way problems of livestock production's environmental impacts through methane emissions and other detrimental effects are presented and discussed in international arenas does not match up with the framing of the vulnerability and adaptation issues for livestock keepers at national levels in low-income countries. This divergence is a result of differences in experiences, beliefs, values, economic positions and interests between countries and actors within those countries (Giordano et al., 2017). The most appropriate policy solutions then become difficult to determine at national levels. The problems and solutions are not always well aligned because while low-income countries wish to focus on adaptation, the international finance offered to support climate action is often disproportionately focused on mitigation and targeted to sectors other than agriculture. For example, in Kenya in 2018, only 11.7% of climate finance overall went to adaptation measures (Mazza et al., 2021).

The climate smart agriculture (CSA) approach lays out three pillars that should be addressed to ensure food security under the changing climate: sustainably increasing productivity, strengthening resilience and improving adaptation to climate change, and reducing GHGE from agriculture (Lipper et al., 2014). This approach can be applied to livestock production and includes such interventions aimed at improving quality and quantity of feed, veterinary care, manure management and breed types (Erickson and Crane, 2018; Shikuku et al., 2017). However, the adoption of the climate smart approach requires that scientists and decision makers move beyond strict separation of adaptation and mitigation approaches to consider the trade-offs or synergies of actions in a holistic manner (Bryan et al., 2013). In this paper, we look at how the concept of climate smart livestock is applied in Kenya, and how knowledge brokers make connections within science-policy interfaces between researchers and government technical staff when ambiguity around how to address climate change within the livestock sector precludes straightforward solutions.

Much of the research on science-policy interfaces has been done in wealthy, industrialized countries (Cairney and Oliver, 2017), but the approach is growing in lower income country contexts (Clark et al., 2016; Koch, 2018). International development donors increasingly emphasize that researchers in development need to generate evidence to inform policy and to demonstrate research findings being taken up during policy formulation (Evans and Cvitanovic, 2018; Oliver and Cairney, 2019). This is a distinct departure from the earlier school of thought that scientists should remain separate from politics (Jasanoff et al., 1998). Funders increasingly encourage scientists to engage with science-based stakeholder forums (Welp et al., 2006), and such activities take place in 'science-policy interfaces' (Dunn et al., 2018; Sullivan et al., 2017; Watson, 2005).

Science-policy interfaces offer opportunities for scientists and policy makers to interact, but active participation of actors requires bringing different groups together for successful knowledge brokering (Bielak et al., 2008). Evidence use in policy making is affected by the ways actors within the process deal with ambiguity around issues (Cairney et al., 2016) and co-construct frames used to discuss issues they want to address (Dewulf et al., 2009). Some aspects of a situation are accentuated and others are de-emphasized when it is framed as a problem, and this process is a political activity (Knaggård, 2016). The livestock sector in Kenya can be framed in multiple ways as described above; the possible options for addressing the issue will be shaped by how it is framed (Dewulf, 2013). These framings, and the ambiguity inherent within having multiple ways to approach the subject, are both set within, and emergent from, complex policy making networks. It is within these network that scientists and policy makers interact, along with other actors, to navigate toward policy change (van Lieshout et al., 2012).

This paper examines the case of livestock and climate change problem and response option framing in Kenya, with a particular focus on how a Nationally Appropriate Mitigation Action (NAMA) for the dairy sector was developed through the involvement of several institutions. The overall aim is to investigate how knowledge brokers deal with ambiguity surrounding problems and solutions in the Kenyan climate change and livestock science-policy interface. The next section describes the theoretical frameworks used in this paper. We then detail the research methods employed before presenting the results and providing a discussion of those results in context.

2. Theoretical framework

To answer our research questions on how problems are framed, how policy solutions are put forward in science-policy interfaces and how knowledge brokers deal with ambiguity, we employ the Multiple Streams Framework (MSF) (Kingdon, 2003). This framework has been applied in many different contexts to look at how governments make policy decisions under conditions of ambiguity (Cairney and Heikkilä, 2014; Zahariadis, 2003) and time constraints (Zohlnhöfer and Rüb, 2016). Ambiguity factors strongly in the MSF because complex issues can have vague and shifting definitions and can be seen in multiple ways and through different lenses (Brugnach and Ingram, 2012). The MSF acknowledges a nonlinear process of policy-making by focusing on three separate streams (problem, policy, and political streams) that exist independently but must come together simultaneously to create a window of opportunity during which policy change can occur (Cairney and Zahariadis, 2016).

These three streams will help us answer the research questions by allowing us to separate the problem setting from the solutions. In the *problem* stream, a set of actors identify, frame and highlight issues of concern they believe need to be addressed. This can be done by capitalizing on a 'focusing event' that helps bring attention to an issue (Birkland 1997 as cited in Cairney and Zahariadis, 2016) or through routine monitoring of indicators that shows existence of a problem (Kingdon, 2003). In the *policy* stream, actors create possible solutions independently of whether they address problems raised in the national consciousness. These solutions are more likely to be adopted if they are technically feasible and align with accepted values. The third stream in the framework, the *political* stream, is where actors develop the will, motivation and opportunity to address an issue (Béland and Howlett, 2016; Cairney and Zahariadis, 2016). This stream includes the *national mood*, which is described as changing periodically in noticeable ways that have an influence on policy agendas and outcomes (Kingdon, 2003).

A key assumption of the MSF is that these streams are independent of each other. It is possible that an issue may garner attention as a problem, but not have a ready solution. Alternatively, policy solutions may be available for an issue that has not (yet) been identified as a problem or may be promoted by a policy entrepreneur independently of whether it responds to an actual policy issue because it is a 'pet' solution. Furthermore, a problem and solution may be well matched, but the political will to address it and adopt the solution may not exist. The MSF is useful because it is a flexible enough metaphor (Cairney and Zahariadis, 2016) to be applied to lower income countries, while other policy theories formulated in an industrialized country context cannot readily be applied in agrarian contexts (Purdon and Thornton, 2019).

The concept of ambiguity is central to the MSF, which also makes it an appropriate framework for studying the case of livestock and climate change in Kenya. Ambiguity refers to the idea that an issue can be interpreted in different ways due to the complexities of language (Best, 2008; Dewulf et al., 2005) and because people can view a situation from different angles based on their own beliefs, values and experiences (Brugnach and Ingram, 2012), as noted with the topic of livestock production in the introduction. The idea of ambiguity fits closely with framing theory and helps examine the diverse ways in which actors can frame a problem. Framing theory has been used in a number of social

sciences to explore how people assign meaning to different issues and events (Dewulf, 2013). Framing a problem in a certain way highlights different solutions by emphasizing some aspects and downplaying others (Knaggård, 2016), bringing implications for what may result when the streams within the MSF are coupled.

The MSF was originally applied at the federal level in the United States' presidential system of government (Cairney and Zahariadis, 2016), but it is now regularly used in other industrialized countries with parliamentary systems (Zohlnhöfer et al., 2015) and at sub-national levels and in international contexts such as the European Union (Cairney and Zahariadis, 2016). Its use is also being extended to lower income country contexts (Faling and Biesbroek, 2019; Goyal et al., 2020; Ridde, 2009; Sanjurjo, 2020). Further developments are also being made to adapt the framework to policy implementation processes (Fowler, 2019; Howlett, 2019).

While some scholars are expanding the framework for use in studying policy implementation, it is also being further developed to better understand the role of knowledge across the streams (Blum, 2018; Knaggård, 2016). The MSF includes some attention on the role of knowledge but “can benefit from further developing the possible types, carriers, and uses of such knowledge” (Blum, 2018, p. 96). Knaggård has developed the MSF to delve into and describe the role of ‘*knowledge-broker*’ (2016). In this conceptualization, the knowledge broker acts specifically in the problem stream (Knaggård, 2016). We distinguish the role of knowledge brokers from that of policy entrepreneurs by comparing the characteristics and actions of the two roles (Table 1). The concept of *policy entrepreneurs* has been well described (Cairney, 2018; Faling and Biesbroek, 2019). They are policy actors who take advantage of opportunities (Zahariadis, 2003) that arise through changing conditions to rally the support of others for their solutions (Mintrom and Luetjens, 2017). Policy entrepreneurs are seen as working within time constraints to try to couple policy problems with existing policy solutions (Jones et al., 2016). In comparison, knowledge brokers are less well described in MSF literature but are seen as having credibility, access to decision makers, and spending time framing problems without promoting a pet policy solution (Knaggård, 2016).

The knowledge brokering concept also exists outside of the MSF as a way to explore and improve science-policy relations. Three conceptual frameworks have been proposed for knowledge brokering: the *knowledge system framework*, which focuses on production and use of knowledge; the *transactional framework*, with brokers linking between knowledge producers and users; and the *social change framework*, in which positive social outcomes are the aim of brokers who provide access and training to knowledge users (Ward et al., 2009). Further research has studied the repertoires of knowledge brokers and highlighted the actions of supplying, bridging and facilitating as key activity categories among knowledge brokers (Turnhout et al., 2013). This relates to earlier scholarship on knowledge utilization based on the ‘two communities’

Table 1
Characteristics and actions of policy entrepreneurs and knowledge brokers from the literature.

Policy entrepreneurs	Knowledge brokers
<ul style="list-style-type: none"> • Either from within or outside the political system and willing to invest time, energy and reputation (Kingdon, 2003) • Active in problem framing (Cairney, 2018; Mintrom and Luetjens, 2017) • Match specific policy solutions to existing problem frames, seizing opportunities created by shifting conditions (Cairney, 2018) • Skillful at generating, brokering and disseminating ideas using advocacy and networking (Mintrom and Luetjens, 2017) 	<ul style="list-style-type: none"> • Maintain contact networks in the political system and credibility within those networks (Knaggård, 2016) • Frame conditions as political problems (without intent to match with specific policy solutions) (Knaggård, 2016) and avoid suggesting specific policies (Knaggård, 2015); refrain from coupling the problem to specific policy alternatives (Knaggård, 2016) • Interpret knowledge to be understandable in a political context (Knaggård, 2016; McGonigle et al., 2020; Turnhout et al., 2013)

model of science-policy interaction, in which scientists and policy-makers are seen as operating in different ‘worlds’ (Pregernig, 2014). While this conceptualization of the science-policy interface is not without criticism, we adopt this framing because it allows the creation of a third ‘community’: actors with policy-relevant knowledge who are not policy-makers but participate in policy-making (Lindquist 1990, as cited in Radaelli, 1995). We conceptualize this third community as containing subsets composed of knowledge brokers in the science-policy interface and policy entrepreneurs. We maintain the MSF’s distinction between policy entrepreneurs as promoting pet solutions and knowledge brokers as transmitting knowledge to policy makers.

Phipps and Morton (2013) also view the role of knowledge broker as creating and working in a shared collaborative space rather than bridging the gap between research and policy/practice. This is a growing role in research organizations where there is greater emphasis on the ‘impact agenda’, or the inclusion of assessing research impact within policy arenas as a measurement of quality of research (Knight and Lyall, 2013; Maag et al., 2018). Overall, there is little consensus on what ultimately defines knowledge brokers (Haas, 2015) because their roles and functions are not traditionally spelled out in organizations, and they may take on different roles under different circumstances, giving each knowledge broker a unique role (Maag et al., 2018; Meyer, 2010). Acknowledging that knowledge brokers have different roles in different institutions and situations, we also acknowledge that they have different motivations behind their actions and activities.

In interacting with different groups and transferring and interpreting knowledge, knowledge brokers ultimately are involved in creating a new type of knowledge: brokered knowledge (Meyer, 2010). They also wield power through their positions (Haas, 2015), and their decisions on who to call upon to answer which questions (Cairney et al., 2016) means they bring different groups together (Bracken and Oughton, 2013) and have influence over who contributes (or does not contribute) to policy processes, which gives them a level of power over evidence used to reduce ambiguity (Cairney et al., 2016). Given these very engaged roles, knowledge brokers cannot be considered neutral parties in their interactions (Shaxson and Ahmed, 2012) and further research is needed on the power relations surrounding knowledge brokers (Haas, 2015). The broad spectrum of knowledge brokering approaches (McGonigle et al., 2020) and activities (Maag et al., 2018) provides impetus to examine whether knowledge brokers are active across all three streams, thereby integrating the MSF with science-policy interface scholarship (Engels, 2005; Godfrey et al., 2010; Sullivan et al., 2017).

We combine the MSF with the concepts of science-policy interfaces and knowledge brokering and apply them to the aim of investigating how knowledge brokers deal with ambiguity in science-policy interfaces related to climate change and livestock in Kenya. We use these concepts to address three research questions in this paper: (a) How do knowledge brokers discuss issues in the problem stream related to climate change and livestock in Kenyan science-policy interfaces? (b) What role do knowledge brokers play in science-policy interfaces to develop climate change and livestock policy solutions within the policy stream? And (c) What strategies do knowledge brokers within science-policy interfaces use to deal with ambiguity in the political stream around climate change and livestock?

This paper contributes to the MSF theoretical refinement literature by offering an adaptation of the framework to a lower income country context that highlights the aspect of knowledge brokers as actors bringing together national ministerial technical experts, development partner decision makers within international funding agencies and national and international researchers for the purposes of dealing with ambiguity. These alterations will help hone the framework for wider application across international contexts. We work toward these refinements by applying the MSF to Kenyan climate change and livestock discussions, with a focus on how these interactions are shaping research for development programs and setting national priorities.

3. Methods

3.1. Introduction to the Kenyan case study

This study is based on participatory action research (Lake and Wendland, 2018) resulting from the involvement of two of the authors (LC, TC) as scientists in ongoing discussions and work around livestock and climate change in Africa. A general abductive approach was used in this research, allowing for the MSF to provide a general theoretical framework and then for observations to help guide subsequent theory development (Haig, 2018). A major portion of the research comes out of the Programme for Climate Smart Livestock (PCSL), a four-year project funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) and implemented by the German Society for International Cooperation (GIZ) through the International Livestock Research Institute (ILRI) in Ethiopia, Kenya and Uganda. The program is relevant to the research questions because PCSL's research components are meant to inform national policies relevant to livestock and climate change in the three focus countries. The program has worked with national partners to either use existing stakeholder platforms or form new ones to serve as science-policy interfaces in which to assess decision maker needs around these issues and to share knowledge generated from other aspects of PCSL. These 'Learning Platforms' were designed to hold quarterly meetings in each country. In the beginning the meetings were physical, but with the Covid-19 pandemic, some meetings were missed and then the format changed to virtual before continuing with a hybrid model. In addition to the Learning Platforms, PCSL had other components that worked to quantify emissions coming from specific livestock systems in the three countries and identify farmer-led adaptation strategies for sharing with other farmers.

Additional research for the study comes from development of a NAMA for the Kenyan dairy sector. A consortium of partners including the Kenya State Department of Livestock, international donors and a research program hosted in part by ILRI collaborated to undertake the NAMA development. This case of a strategy development process is used to illustrate how all three streams of the MSF were coupled successfully and the role of knowledge brokers in that process.

3.2. Data collection and positionality

The first author of this study (LC) has been based in Kenya since 2010 and has been engaged with national stakeholders in agriculture and climate change science-policy interfaces since that time. In acknowledging the role that demographics and personal characteristics can play in interpretive research (Schwartz-Shea and Yanow, 2013), she has built strong relationships within a network of stakeholders and has worked to overcome differences of race, birthplace and nationality (gaining Kenyan citizenship in the process) to establish her credibility within this group of actors. She has played the role of a knowledge broker in the past, which allows for a unique point of view for this study which is focused on other brokers. As a PhD student in the PCSL project, she stepped back from an active knowledge broker role to a participant observer role to conduct research on the science-policy interactions and study other knowledge brokers and their activities from a research perspective. We propose that this position of familiarity improves data collection and interpretation of results because it allows for studying the science-policy interface using policy ethnography methods (Dubois, 2015). We note, however, that the first author has not analyzed her own interventions, as this paper is not meant to be a reflexive ethnographic study (Davies, 2012). Although the PCSL project has concluded, the first author remains engaged in the Kenyan climate change and agriculture science-policy interface and serves as a member of the steering committee of the CSA Multi-Stakeholder Platform described in the findings section.

The first and second author regularly take part in meetings and interactions with government officials, other research institutes and

international development funders regarding the issues of livestock and climate change. These interactions provided additional sources of data for the study. The lead author presented the research topic for this paper and obtained informed consent from any meetings that were recorded and regularly reminded her contacts of her research topic during interactions to abide by ethics procedures. Discussions with key informants regarding the topic aided in further developing the research scope and applying and refining the theory, adding to the application of participatory action research (Ferreyra, 2006). The opportunities for engagement within science-policy interfaces and the embeddedness of the researchers beyond the confines of PCSL lent additional strength and credibility to the research findings, although there were challenges that we present in the discussion section. The third author aided the first two to reflect on their roles as ILRI researchers embedded in the Kenyan science-policy interface and to examine how their positionality might affect how they were perceived by other actors and their interpretation of the data.

To examine how actors in science-policy interfaces deal with ambiguity resulting from different framings, we used participant observation of the Learning Platforms, plus additional livestock and climate change meetings held between December 2019 and May 2021. The selection of interactions to include in the research was based on the topic of the meetings. Meetings focused primarily on the issue of dealing with climate change in the livestock sector were included in the sample. Using detailed meeting notes and selectively transcribed audio recordings, we coded data based on the themes of framing, science-policy interactions and problem, policy and political streams. Although the MSF can be used to describe how policy decisions are made in legislative settings, we focus here mostly at the technical ministerial level, where science-policy interfaces are more direct and there is greater exchange between researchers and civil servants. A total of 14 meetings are included as empirical observations in these findings (see Annex 1).

Semi-structured interviews were also conducted between November 2019 and March 2020 to explore the topics of knowledge brokering and use of evidence in decision making. A total of 16 interviews were held with national and international scientists (including six from ILRI), technical experts within the ministries of agriculture and environment and other actors. These interviews were recorded and transcribed. The interviewees were selected based on their involvement in the existing science-policy interface related to livestock and climate in Kenya. Using a topical interview guide, they were asked to reflect on their involvement in policy (broadly defined) and decision-making processes as related to the two-communities theory of science-policy interfaces and the policy stream of the MSF. Those in government roles were asked about avenues through which they seek evidence or research findings to help shape policies, and those in research roles were asked to describe their interactions with policy makers and ways of sharing research findings with those in decision-making roles. Respondents were also asked whether they identify themselves as knowledge brokers. Based on responses to the question about self-identification as a knowledge broker and observations of the activities of individuals, three knowledge brokers were identified within the Kenya science-policy interface.

3.3. Data analysis

We coded transcribed interviews, meeting notes and selected meeting transcripts using Nvivo 12 to enable thematic analysis of the data (Braun and Clarke, 2012). We used a combination of deductive and inductive coding and coded for both manifest and latent themes (Joffe and Yardley, 2004). We initially used deductive coding categories based on our theoretical frameworks guiding this research—frames, ambiguity, knowledge brokering, policy stream, politics stream, problem stream and coupling of streams—and then we added sub-categories inductively as needed until no new themes emerged and the list of codes was sufficient for addressing the research questions. See Annex 2 for the resulting coding structure.

The analysis highlights how knowledge brokers react to and deal with ambiguities and different framings. We distinguish activities and discussions relating to livestock and climate change within Kenya that can be identified with each of the three streams of the MSF and examine the roles that the knowledge brokers played in these activities. The knowledge brokers in this study are a lead agriculture negotiator with a long history of engagement in the climate change science-policy interface (KB1), an international consultant with many years of experience assisting the Kenyan government with GHG emissions calculations for the livestock sector (KB2), and the ILRI scientist who led PCSL (KB3). The following results section presents actions and ideas appearing in the problem, policy and political streams sequentially, and then uses one specific policy process – development of the Nationally Appropriate Mitigation Action (NAMA) for the dairy sector – to illustrate the roles of knowledge brokers acting across streams.

4. Findings

4.1. Discussing livestock and climate change issues in the problem stream

In defining the problems related to livestock as a consequence of climate change, actors in the Kenyan science-policy interface alternate between identifying the climatic changes (e.g., more frequent droughts and increased water and feed variability due to altered rainfall patterns) affecting livestock keepers and the high emissions intensities associated with the livestock sector. During many of the observed meetings, when the negative impacts of climate variability and shocks were raised, participants discussed them in relation to agro-pastoralists and pastoralists living in arid and semi-arid regions of Kenya. Respondents from the government and research organizations frame climate change as a problem for these livestock keepers, citing more frequent droughts that reduce their resilience and diminish their herds, making recovery difficult. The respondents cite such indicators as the increased frequency of droughts over the previous decades, the numbers of livestock deaths recorded as a result of drought and the recurring emergency food aid distributions to highlight these problems. Meeting participants and interview respondents mentioned the problem of emissions intensities, which was discussed in science-policy interactions in relation to the dairy sector that is primarily based in the wetter highlands. Researchers participating in the Learning Platform meetings compared the emissions intensity of dairy production in Kenya to industrialized countries. Meeting participants viewed dairy farmers as contributing large proportions to the GHGE inventory of the country. This division of identifying negative climate change consequences for livestock keepers in drylands and high emissions intensities of dairy farmers in areas with higher rainfall was made explicit by a staff member from the Uganda Ministry of Agriculture, Animal Industry and Fisheries during a regional meeting on climate change and livestock on ILRI's Nairobi campus in 2019 when he remarked, “*Basically, for adaptation, you need pastoral communities, but for mitigation you can have it with more dairy farmers. You can be able to have those [mitigation] interventions.*”

If these framings are taken as separate problems, no ambiguity arises. The difficulty comes when these different facets need to be combined and addressed within national legislation and policies and during international climate change negotiations. When the Kenyan delegation negotiates within the UNFCCC, they do so in coordination with the African Group of Negotiators and other blocs. These groups have historically resisted the push to prioritize global mitigation efforts and have asserted the need for wealthy countries to provide financial assistance to lower income countries to aid in dealing with the negative effects of climate change.

As much as Kenyan stakeholders declare that the country prioritizes addressing the negative effects of climate change, there are international donors and investors who have focused on the problem of high emissions intensities. An additional problem that is frequently identified by those both in government and in research is the lack of data for use in

calculating GHGE accurately. This results in dual problems of high emissions intensities from livestock keeping in Kenya and not knowing just how high those intensities are.

In January 2020, when Kenya was experiencing the beginning of the worst locust invasion in 70 years, a team of representatives from NGOs, academia and research worked together with the Climate Change Unit (CCU) of the Kenya Ministry of Agriculture and Livestock Development¹ (hereafter the Ministry of Agriculture) to convene a meeting with high-level Ministry officials. The effort was coordinated by KB1, who has many years of experience in science-policy interfaces working for the Kenyan government, regional agencies and as an international negotiator. KB1 planned to use the locust invasion as a ‘focusing event’ to raise awareness of the threat posed by climate change to the agriculture sector and more prominently frame it as a problem facing Kenya. Despite knowing about the tenuous link between climate change and locusts, the meeting organizers used the locust invasion as an urgent situation with which to focus attention, as increases in pests are expected under climate change. Several planning meetings between the coalition of partners focused on how best to frame the problems. Advice from KB1 to the scientists included shifting from a primarily science-focused framing by removing what were deemed to be overly complicated graphs and instead using emotionally stirring images to convey the key messages as human impact stories to better communicate the urgency of the situation, thereby stimulating political commitments to address climate adaptation. In making sure that the Ministry's sub-sectors of crops, livestock and fisheries were all addressed, KB1 also acknowledged during one of the planning meetings the sentiment that livestock are overlooked in climate change and agriculture discussions: “*In the current arrangement and generally over the years there has been favouritism toward crops and discrimination against others.*”

The focus of the first planning meeting was on communicating to high-level Ministry officials the science around the negative impacts of climate change on the agriculture sector and the need for adaptation, but mitigation was not excluded. KB3, other ILRI scientists and a participant from the State Department of Livestock all agreed that additional work was needed to reduce the emissions intensities within the Kenyan livestock sector. KB1 also made the link between revising the nationally determined contribution (NDC) and creating a low carbon, climate resilient long-term strategy for the country. In short, the ambiguity was not seen as a barrier but the focus was on climate variability and shocks as the immediate priority with emissions intensities discussed as offering potential future opportunities for climate finance.

4.2. The role of knowledge brokers in developing solutions in the policy stream

The policy stream encompasses possible solutions that may address issues bubbling up in the problem stream or may be ‘pet’ solutions that do not directly relate to something that has gained attention as a problem. While there are two quite distinct framings around livestock and climate change in the problem stream (i.e., livestock keepers are affected negatively by climate change; the livestock sector is contributing a large amount of the country's GHGE), in the policy stream there is less distinction between the possible solutions. Kenya has adopted use of the CSA concept and has developed a national CSA strategy (Government of Kenya, 2017) and an implementation framework (Government of Kenya, 2018) to address the need for improving productivity, adapting to climate change and reducing GHGE. There is value acceptability for CSA among the majority of stakeholders and the three knowledge brokers. The Ministry of Agriculture CCU has worked with partners to set up a national CSA Multi-Stakeholder Platform and is working to establish linkages with county governments and their

¹ This is the Ministry's current name but when the work started it was the Ministry of Agriculture, Livestock, Fisheries and Irrigation.

agriculture departments to set up county platforms as a means of on-the-ground execution of the CSA implementation framework. The CCU is also engaged with international development partners to improve the measurement, reporting and verification (MRV) system for livestock sector GHGE. KB2 is a frequent consultant contributing to the development of the MRV system, bringing data from research institutions and matching them to the Ministry's needs. However, one interview respondent from the Ministry of Agriculture said of a livestock bill being developed: *"Unfortunately, I've been brought in very late...but when I look at it, I don't see the eye of climate change issues in it. But it's still on, I have an opportunity...probably we may have to look at how we can present in a more focused way some of these climate change issues into the livestock bill."* This indicates that government policies and strategies are still not entirely aligned, and CSA is not fully embraced throughout the Ministry of Agriculture. While there has been creation of a specific climate change strategy and implementation framework, and funding is coming in for aspects of that work, the members of the CCU are trying to work more comprehensively to ensure that other livestock-related policies under development are also responsive to climate change issues.

One of the aims of the PCSL project was to enhance the capacity of countries to develop evidence-informed climate-smart livestock policies and strategies. The project designers envisioned this taking place through providing research findings on the technical feasibility of integrating the CSA approach within livestock systems through specific practices and technologies and improving decision support through the use of futures thinking exercises. To help fulfil this, ILRI conducted research on emissions from different manure management and feeding practices that will be used to calculate more accurate emissions factors for inclusion in Intergovernmental Panel on Climate Change (IPCC) methods. ILRI also conducted research on adaptation practices used by pioneering farmers at selected local research sites and developed adaptation tracking protocols to aid governments in monitoring the success of adaptation implementation. The PCSL Learning Platform established in Kenya was set up through the national CSA Multi-Stakeholder Platform convened by the CCU as a means through which to share this emerging evidence.

Researchers and policy makers use the term "climate smart" to build on its value acceptability and join the two conflicting problem framings to offer solutions that address both at the same time. They use the term in a strategic way to deal with the ambiguous nature of climate change and agriculture, by employing an umbrella term that can be applied to projects that focus overwhelmingly on just one of the three pillars. Actors also use the term "co-benefits" within the policy stream to pitch solutions that primarily have benefits on one side but will bring additional (co-)benefits to the other side. Because of Kenya's national priority on adaptation, actors often discuss adaptation actions that offer mitigation co-benefits as a way to bring the two problem frames together more closely and reduce ambiguity. In the first meeting to plan the presentation to high-level Ministry officials, the use was made explicit by KB3: *"In livestock, mitigation has been our entry point even though I know adaptation is a more urgent need. For this presentation, we would frame livestock as adaptation with mitigation co-benefits."*

Stakeholders in the science-policy interface also use co-benefits in the other direction. The World Bank is working with the Ministry of Agriculture, in consultation with other livestock sector actors, to design a credit line for the dairy sector that would be conditional on recipients adopting measures to reduce GHGE intensities. During meetings to discuss this program design, the meeting organizers used "adaptation co-benefits" to achieve buy-in from those who might be reluctant to focus solely on mitigation. In virtual meetings, small group discussions were focused specifically on using co-benefits to 'crowd in' other actors. Beyond the emissions reductions expected from the implementation, participants described co-benefits such as higher incomes, lower production costs, increased food safety and higher quality products that would accrue to farmers and the general public.

The Learning Platform meetings convened by CCU and PCSL were

mechanisms operating in the policy stream for sharing solution ideas. They constitute science-policy interfaces where ILRI and others in academia and research can share research findings with those working on program design and policy development within the Ministry of Agriculture, NGOs and civil society. It is not guaranteed that findings shared in these interfaces will make their way into program or policy design, however. One respondent noted that technical directorates within the Ministry of Agriculture initiate policy processes, but revision of an existing policy or development of a new one is then taken on by the policy directorate. There has not been any participation from policy directorate staff in these interfaces.

The role of the three identified knowledge brokers in promoting climate-smart livestock development within these science-policy interfaces has been to invite relevant stakeholders who can serve different purposes, for example presenting new evidence, serving as a link with higher level Ministry staff, or making a compelling case for why solutions are needed. This knowledge broker role carries with it a level of power in deciding who will be invited to participate and who may be left out or not represented. KB1, KB2 and KB3 use this role strategically to invite those actors they know may have influence to bring funding on board, get official sign off for activities or even to omit individuals they know may disrupt or frustrate the process. They stay abreast of what is happening within the research arena, including at ILRI, and developments within the Ministry of Agriculture and the Climate Change Directorate to be better able to act as a bridge between other actors and to help supply knowledge. Knowledge brokers do not necessarily need to be experts, as highlighted by KB1 during an interview: *"You see, that's the beauty about versatility: once you get into a space of science and policy, because you do not need to be an expert in that area, all you need to do is get the right evidence and people so that you're able to get the right information and to feed into the other processes."* By staying abreast of what is happening, these knowledge brokers are able to call upon the right people at the right time. They are not advocating for a specific policy solution to be adopted as policy entrepreneurs would do, but instead aim to bring together the people they deem necessary to address the issue of what should be done.

4.3. Dealing with ambiguity in the politics stream

Despite the funding being put toward improving the livestock MRV system mentioned in the policy stream, there was a feeling among some respondents that the livestock sector is not given enough attention within policy discussions and climate change negotiations. The attention, when agriculture is discussed, is seen to be primarily focused on crops, with livestock being neglected except as an avenue for pursuing mitigation targets. For example, a concept note from the Africa Low Emission Development Strategies Partnership to form a livestock community of practice, spearheaded by KB1, notes that "climate-smart livestock management has received much less attention than crop-based agriculture." This is despite the acknowledgement in the problem stream that livestock keepers need assistance to adapt. The perceived unwillingness of some stakeholders to address adaptation in the livestock sector drives some of the ambiguity around how to frame the problem and potential solutions, which then has political implications. Some respondents noted that the push for MRV and mitigation initiatives was being driven by international bodies and was reflective of the global mood around livestock production being harmful to the environment and contributing too much to GHGEs. KB3 described the obstacles to receiving funding for PCSL in an interview: *"For a very, very long time, the livestock people at the [international foundation] did not want to talk about climate change, because it wasn't in their strategy. And I think that I-it's literally been two years of me just explaining to them why it's a challenge, explaining to them how our research is helping to solve that."* Convincing BMZ to put money toward climate smart livestock development was not easy, according to KB3, because there is a wariness among donors to fund livestock programs given the negative attention within

international discourse around livestock contributing to GHGE and environmental degradation in general. ILRI has a separate project that works toward providing information to global ‘livestock champions’ (high level individuals in the global agricultural development community) who can educate others through international fora on the importance of livestock to people’s livelihoods and nutrition in lower income countries. This is in direct response to media attention emphasizing negative aspects of meat consumption and calls for shifts away from livestock production to plant-based diets as a way to combat climate change.

Although one interviewee recalled how donors were influential in setting funding priorities, which then drove specific project design, an interviewee from the CCU described how Kenya does have a say in what government priorities receive international funding.

“Of course, the donors will come with their own way of what they want to support. But I do believe that the countries have a lot of say in what the governments want supported. So, it’s up to us to say that, ‘yes, this is the way you want to support us. But this is where ... our key problem is’. So, for me, I feel like we cannot say we blame the institutions for dictating to us what they want to implement because I don’t think they just come and dictate it on us. They also do a lot of consultations in development of these projects. So, unless we do not tell them, we do not put our feet down and say ‘this is what we want’—and sometimes maybe we don’t—then that is when the development partner will do it their way.”

KB1 was critical of the ability of Kenya’s representatives to insert the issue of livestock into the country’s position statements, however. Because there are many competing priorities for attention, other issues overshadow that of the livestock sector, making it difficult to gain traction in the political stream.

At the national level, there is a push by government officials to mobilize climate finance from the international community to help cover the costs of actions in Kenya’s NDC, which includes both adaptation and mitigation. The most appropriate ways of measuring and tracking adaptation are under discussion, but building the national capacity to implement an effective MRV system is seen as achievable. This is leading to greater donor willingness to fund MRV projects than fund adaptation interventions. In one of the science-policy interface interactions, a participant noted, “*When we mix adaptation and mitigation, mitigation will start taking over. We need to give adaptation due attention.*” This relates to a concern of one of the respondents that the political issue can be seen through a different lens of pastoralists and agro-pastoralists—traditionally marginalized populations within Kenya—repeatedly being overlooked. The coalition that collaborated to organize the high-level Ministry of Agriculture meeting internally discussed the issue as one of agriculture competing against other sectors for budgetary allocation from the National Treasury. Achieving an increase in budget allocation would be a political win for the Ministry of Agriculture. Research organizations also contain political elements. KB3 described the struggle to get others within the institute to see the climate change-related aspects of their research and to incorporate more consideration of climate change in project designs.

4.4. The NAMA policy window and the role of knowledge brokers

An opportunity for advancing the topic of livestock within climate change discussions in the national agenda arose in recent years, and the three streams were coupled successfully during this window. This coupling resulted in completion of a NAMA for the Kenyan dairy sector.

Development of the dairy NAMA was led by a European consultancy firm which employed KB2 with inputs from the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), which was simultaneously supporting research at ILRI to develop GHGE factors from the Kenyan dairy sector (Goopy et al., 2018; Ndung’u et al., 2018) and to identify gender implications for low-emission development

(Tavener et al., 2019). The NAMA is a policy option that was designed in response to the problem framing that prioritized reduction of emissions intensities from dairy. KB2 and KB3 assisted in developing the plan, calculating potential emissions reductions, targeting activities to geographic areas, and more. The submission of a full proposal to the Green Climate Fund (GCF) stalled when the original international funding partner paused its support. Actors within the Ministry of Agriculture worked to find other partners to help continue pushing development of the NAMA forward. During the pause in the GCF preparation, the solutions proposed within the NAMA remained relevant, and the problem also stayed ripe. In 2020, when the World Bank was interested in funding climate finance in the livestock sector, a Kenya dairy sector project was selected to go forward as one of two projects from among many possibilities. This World Bank initiative planned to support activities similar to the NAMA. The original NAMA partner was reinvigorated and convened a meeting in March 2021 to convert the NAMA into a full GCF concept note. Thus, the three streams were ultimately coupled. KB2 and KB3 were active in sharing the work that had been done to that point on the national dairy GHG inventory and helping calculate potential emissions reductions, which helped the other stakeholders understand the potential outcomes of the program.

5. Discussion

The discussion focuses on applying the MSF to livestock and climate change policy discussions in Kenya by (1) highlighting how knowledge brokers act across all three streams and navigate ambiguity and (2) expanding the MSF from the national mood to the global mood and emphasizing the need to consider international actors’ roles in influencing policy and agenda-setting processes as part of this expansion.

5.1. Knowledge brokers active in all three streams of MSF

Our research expands the previous conceptualization of knowledge brokers acting in the problem stream (Knaggård, 2016) and highlights the roles that knowledge brokers play across all three streams of the MSF. The knowledge brokers in this research are active in the *problem stream* by helping frame problems and highlighting issues of concern such as climate change’s effects on the most vulnerable livestock keepers and the need to consider gender-differentiated climate change impacts. The knowledge brokers are outside of the political system, but have connections to those within it. For example, KB1 is now external to the government but worked within the government earlier in his career and has maintained many contacts within various ministries. In their activities within the problem stream, the knowledge brokers help navigate ambiguity around climate change and livestock by prioritizing discussions around the need for adaptation among the most vulnerable livestock keepers but acknowledging the role that livestock production plays in contributing to national GHGEs.

Unlike policy entrepreneurs, who will push a specific policy, the knowledge brokers engage in the *policy stream* by promoting a menu of options for policy makers’ consideration, acting as honest brokers and not favouring a particular solution. This can result in some policy solutions being left behind, as in the NAMA case where mitigation solutions were prioritized over adaptation solutions. Knowledge brokers who play the role of ‘honest brokers of policy alternatives’ (Pielke, 2007) help actors within science-policy interfaces identify and deal with the ambiguity inherent in the livestock and climate change discussion space but ultimately are also guided by the prevailing policy processes in the country, which may be influenced by external actors (a point on which we expand below). By linking policy makers with researchers who are producing evidence on both the emissions coming from the livestock sector and the opportunities for adaptation among livestock keepers, knowledge brokers assist the policy makers with evidence regarding both the need to adapt and to mitigate within the sector. Although they do not promote a specific policy solution, knowledge brokers still make

use of their different forms of power to decide who should or should not be included in meetings. They should therefore not be seen as neutral actors.

Knowledge brokers participate in the *political stream* by advocating for livestock to be incorporated into climate change discussions and given equal treatment with crops within the agriculture sector. This involves pushing policy makers at national level and donors at international agencies to bring livestock issues to the forefront. This advocacy is made possible through their connections within and outside the political system and their ability to interpret knowledge to be useful in a political context (refer to Table 1).

Within livestock and climate change science-policy interfaces, knowledge brokers are not necessarily wedded to any certain solution (like policy entrepreneurs usually are), but make the connections so that researchers and decision makers can exchange information on possible options, where they might be suitable, and for whom. Knowledge brokers also differ from policy entrepreneurs in the amount of effort they expend on coupling streams. Whereas policy entrepreneurs invest time and energy into policy change or adoption, knowledge brokers are focused on identifying existing open windows and attaching themselves to ongoing processes. In the dairy NAMA, although KB2 and KB3 assisted in calculating potential reductions in GHGE intensities and selecting priority geographies, they were not pushing for the NAMA to be created, but stepped forward with solutions they had been researching when the opportunity to contribute arose. It is important to note, however, that activities in the policy stream (NAMA/GCF) and the problem/solution streams (ILRI) were both supported by the same research program in what is effectively a concerted external effort to create rapid change. This underscores the importance of MSF research examining international actors as key players in national policy arenas, which we discuss below.

Knowledge brokers within Kenyan livestock and climate change science-policy interfaces use ambiguity strategically in problem and response framings to connect with stakeholders who can match a given need at a given time. For example, if a donor is interested in developing a mitigation project, but some stakeholders are resistant to strictly addressing mitigation, a knowledge broker may highlight adaptation co-benefits to bring the hesitant party on board. The climate-smart approach aids in navigating this ambiguity by providing a framework through which the challenges of climate change and need for increased productivity can be addressed. The knowledge brokers in this case effectively handle the topic's ambiguity by maintaining a wide network and understanding the nuances of the problem framings used within different organizations. We acknowledge that this navigation of ambiguity can result in the neglect or loss of some problem framings, as seems to be happening with the NAMA case drawing focus away from specific solutions for adaptation. Knowledge brokers are also attuned to the happenings in the political stream and understand the implications of addressing livestock and climate change within the broader field of national and international priorities.

5.2. Expanding the Multiple Streams Framework

Our research findings point to the need to expand the MSF to consider international actors within the framework. International donors hold a significant amount of power to influence actions in the Kenyan livestock and climate change arena, but the MSF, as originally conceived, does not include space for international actors. Our own positionality as international researchers conducting this research and publishing this paper illustrates how external actors are involved in these policy processes. In the case of this research, the first author is a member of the Steering Committee of the CSA Multi-Stakeholder Platform, a role that reflects her embeddedness within Kenyan stakeholder engagement and policy processes. In line with this, we have encountered issues of positionality that have been documented in other research on ethnography of policy translation, such as difficulties in being critical of

policy processes (Mukhtarov et al., 2017) or becoming too similar to others in those processes (Peck and Theodore, 2012). This reflexivity has been useful in helping us consider our own roles in these policy processes.

We propose that in lower income countries, international donor agencies and research organizations must be considered across all three streams as actors who substantively shape discourses and actions, especially through simultaneous and deliberate engagement in multiple streams in pursuit of particular outcomes. This is similar to a recent finding that there are two separate policy entrepreneur roles: local policy influencers and international actors (Shephard et al., 2020). In the original applications of the MSF in industrialized countries, international donors were not conceptualized because they were not relevant, but as MSF expands to lower income country contexts (Ritter and Lancaster, 2018; Shephard et al., 2020), the role of donors becomes more prominent. We acknowledge that this is based currently on a narrow case which limits the generalizability to other contexts, although other research has documented the role that international donors play in contributing to national priority setting (Forestier and Kim, 2020; Khan et al., 2018). We hope that others currently applying MSF to lower income countries will evaluate this addition to the framework.

Low-income countries often strive to meet funding agency demands (Ridde, 2009). Donors can influence what research takes place within national and international research institutes, including within ILRI, effectively laying a foundation for problem and solution framings. International funding agencies also influence whether and how a country's policy priorities receive funding. Developing a new policy or revising an existing one can be a costly process in Kenya, where public participation is required and funding to host meetings is often not available in the Ministry's budget. Technical Ministry staff rely on international development and research partners to help convene necessary meetings and generate knowledge instrumental to solutions. Partners with available financial resources (such as ILRI) often help set meeting agendas and exert power over the problem framings presented. Even ILRI, however, has its research agenda influenced by external donors. In effect, when large international funding organizations choose to invest in a particular goal in a certain country, they can act across multiple streams to heavily influence policy and agenda-setting processes. This is not to say that other, local actors lack influence through exertion of agency. It is important to differentiate international actors and agencies and understand their actions as global policy entrepreneurs (Shephard et al., 2020) or knowledge brokers.

The hesitancy of international donors to finance livestock and climate change projects due to the poor reputation of animal product consumption portrayed in the media influences what activities are, and are not, undertaken in Kenya. News stories of cattle contributing to GHGE abound, and these portrayals filter through to decision makers within donor agencies. This effect was felt when ILRI scientists were seeking funding for PCSL. Previous research has noted the influence of international partners on Kenyan policy, specifically the country's CSA strategy, noting that policy frames used by both the agriculture and environment ministries reflected the "signature of global and bilateral donors and partners" (Faling, 2020, p. 234). Recalling Kingdon's original use of the 'national mood' within the political stream (Kingdon, 2003), our research identifies a 'global mood' around livestock and environmental issues, a prevailing and intertwined set of influential discourses and institutions that shape financial flows. While there may be a dominant discourse among international research and development funders, it is not monolithic, and it is contested by other actors, meaning "global" should not be conflated with "universal". Regardless, when applying MSF in contexts where research and policy formulation are heavily influenced by international organizations, the global mood is an essential addition to the MSF.

ILRI's separate project (not related to PCSL) to equip global livestock champions with information on the importance of livestock keeping for nutrition and livelihoods is an attempt to add nuance to the debate

around livestock and climate change that is influenced by this global mood around livestock production. ILRI scientists also use experiments and participatory action research to work on possible solutions for reducing GHGE from the livestock sector and helping livestock keepers adapt to climate change (Habermann et al., 2022; Leitner et al., 2021). This is an illustration of how, in the agriculture research for development space in which ILRI works, scientists do not necessarily limit themselves to received problem definitions, as noted by Knaggård (2016). Our findings show how knowledge brokers' exertion of agency permits them to move across the three streams. These actors were not behaving as policy entrepreneurs, nor were they limiting themselves to a single stream. Because knowledge and knowledge sharing are relevant in both the problem and policy streams, and the use (or non-use) of knowledge takes place in the political stream, we propose that MSF will benefit from expanding its conceptualization of knowledge brokers' behaviour to consider how they move across all three streams as discussed above.

6. Conclusion

Knowledge brokers deal with ambiguity resulting from different problem and response framings within science-policy interfaces as part of livestock and climate change policy discussions. Using insights from interviewees and observations from more than 18 months of participatory research within science-policy interfaces, we find that knowledge brokers use ambiguity in strategic ways – depending on the context and the purpose – to achieve their desired goals of bringing actors together to exchange knowledge. In cases where a donor is using a problem framing of high GHGE intensities in the livestock sector of Kenya, the knowledge brokers form connections with scientists able to advise on baseline emissions levels or interventions that can reduce GHGE intensities. When adaptation framing is needed, some of the same researchers may be called upon or others with different expertise more related to adaptive capacity. These knowledge brokers also keep abreast of international negotiations and understand the different framings used by governments, financial institutions and development partners. Strategic use of different framings helps navigate the ambiguity around climate change and livestock issues and creates room for dialogue between different sets of actors at different times.

The Multiple Streams Framework is useful for analysing the ways

that different problem framings get coupled with appropriate policy solutions when the political timing is right. Greater incorporation of the understanding around these framings and their uses in science-policy interfaces can help further the conceptualization of knowledge brokers across problem, policy and political streams within policy processes. Applying MSF in developing country contexts requires consideration of international organizations' roles in shaping the three streams.

CRedit authorship contribution statement

Laura Cramer: Conceptualization, Formal analysis, Investigation, Methodology, Writing - original draft, Writing - review & editing. **Todd Crane:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Art Dewulf:** Conceptualization, Methodology, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Data will be made available on request.

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Annex 1. Meetings attended as part of participant observations

Date	Meeting	Location
9 December 2019	Kenya PCSL Learning Platform meeting Topic: presentation of a policy coherence report	Nairobi
14 January 2020	Preparatory meeting for high level Ministry of Agriculture meeting	Nairobi
21 January 2020	Preparatory meeting for high level Ministry of Agriculture meeting	Nairobi
17 February 2020	Post COP25 Kenya civil society meeting	Nairobi
19 February 2020	Regional partner visit to ILRI campus	Nairobi
29 July 2020	Scenario development for Kenya long-term strategy in agriculture	Online
30 July 2020	PCSL regional online workshop for Learning Platforms Topic: GHG mitigation in agriculture	Online
6 August 2020	PCSL regional online workshop for Learning Platforms Topic: Climate change adaptation in East African livestock systems	Online
13 August 2020	PCSL regional online workshop for Learning Platforms Topic: Scenarios for change: using the future to enable transformative change	Online
2 September 2020	Development of a credit line with environmental conditionalities for the dairy sector in Kenya	Online
12 November 2020	Building back better through accelerated implementation of Kenya Climate Smart Agriculture Strategy (webinar)	Online
25 November 2020; 2 December 2020	PCSL Learning Platform Kenya futures thinking workshop (2 half-day sessions)	Online
12 April 2021	Developing a common Kenyan position on the Koronavirus Joint Work on Agriculture	Online
21 April 2021	Kenya PCSL Learning Platform meeting Topic: Livestock in Kenya's NDC, small ruminant emissions factors, and adaptation tracking	Online

Annex 2. Coding structure used

Ambiguity	
	<ul style="list-style-type: none"> Contradicting data Disagreement on time scale of importance Disagreement on what the issue is Focus on cattle, lack of emphasis on other species Knowledge on CC Non-existence of ambiguity Priority setting <ul style="list-style-type: none"> Donors and funding driving priorities International discourse influence on national agenda Priorities driven by internal national priorities
	Questioning of data
Frames	<ul style="list-style-type: none"> Issue frames <ul style="list-style-type: none"> Adaptation issue Attraction of finance CC impacts on livestock production <ul style="list-style-type: none"> Drought Feed and fodder Heat Pasture and grazing Rain and water variability Future of pastoralism Governance concern <ul style="list-style-type: none"> Concerns about institutions and capacity Implementation of policies Policies not supportive of livestock keepers Livestock development challenges <ul style="list-style-type: none"> Conflicts over resources Diseases Environmental degradation Extension Feed availability and quality Intensification Investment in the sector Land tenure Poor markets Problems with breeds Productivity Sustainability Weather challenges Livestock excluded from CSA discussions Mitigation issue <ul style="list-style-type: none"> Absence of or problems with data Emissions intensities Multiple purposes of livestock Resilience Social inclusion concern Technical concern Trade-offs Relationship frames <ul style="list-style-type: none"> Coordination between actors Information co-production Information sharing Integration and info sharing of research programs Local research not up to international standards Policy makers not interested in social concerns Researcher engagement with decision makers Science-policy collaboration Staff overturn Technical info too technical Response option frames <ul style="list-style-type: none"> Adaptation to CC Climate smart practices Extension Intensification incentives and activities Low emissions development Mobility MRV NAMA NDC Negotiations Policy Rangeland management SLM Research

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(continued)

	Resource mobilization
	Risk reduction
	Synergies between adaptation and mitigation
Multiple Streams Framework	
Coupling of streams	
Knowledge brokering	Creation of credibility
	Formation of coalitions and partnerships
	Interpretation or translation of knowledge
	Multi-stakeholder platforms
	Use of knowledge in a political context
Policy stream	
	Policy and program design
	Policy review or revision
Politics stream	
	Political motivation
	Political opportunity
	Political will
Problem stream	
	Competing priorities
	Identification of CC as a problem for livestock
	Lack of data for MRV
	Livestock as a problem for environment

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