Multi-Stakeholder Scenarios as a Boundary Process: Improving Food Security, Environments and Livelihoods in East Africa under Conditions of Climate Change

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Abstract

This paper examines the potential of multi-stakeholder scenarios to effectively span boundaries among actors and across disciplines and sectors related to the agricultural sector and wider food systems in East Africa. We evaluate the effectiveness of a regional scenarios approach being led by a global research program on Climate Change, Agriculture, and Food Security (CCAFS) of the CGIAR. We analyze how scenarios can be used to link knowledge with action to facilitate improved food security, environmental sustainability, and livelihoods under conditions of a changing climate. Using credibility, legitimacy, salience and capacity building as criteria for effective boundary spanning processes, and based on feedback on the regional scenario building process from participants, we draw lessons for improving the approach. Based on this learning case, we discuss the benefits and limits of scenarios processes and provide recommendations on how to improve the development of regional multi-stakeholder, participatory scenarios from the perspective of boundary spanning work.

Keywords

Multi-stakeholder scenarios; boundary spanning; East Africa; food security; climate change

1. Introduction

Skyrocketing food prices, a changing climate, and predictions that a 70% increase in food production will be needed by 2050 to feed the earth's projected 9 billion (FAO 2009) people require new initiatives that bring people together across a broad spectrum of sectors and disciplines to devise innovative ideas for tackling these complex issues. Representatives from farmers' organizations, scientists, policymakers, civil society, government and the private sector all have a role to play in formulating new policies for improved food systems within the context of climate change.

Bringing diverse communities into constructive dialogue concerning possible actions aimed at addressing complex problems is not easy and requires rigorous, yet flexible processes (Henrichs et al. 2010; Lucas et al. 2010). This type of "boundary spanning" work is important because it does several things at once: (i) it encourages and provides space for multiple perspectives to be voiced, (ii) it allows different perspectives to be captured in policies and (iii) it facilitates acceptance of policies as co-constructed and thus as legitimate and relevant to more people. Such processes are only beginning to be applied to food systems in the developing world (Kristjanson et al. 2009), where people face high vulnerability to global environmental change, and increasing food insecurity, which requires urgent action (Ericksen 2008).

An initiative being led by a global research program on Climate Change, Agriculture and Food Security (CCAFS) of the CGIAR is focused on ways of promoting 'climate-smart' agriculture and food security (Vermeulen et al. 2011). This program links research for development work across 15 CGIAR international agricultural research centers with the global environmental change community associated with the Earth Systems Science Partnership. A key objective of CCAFS is to develop and test approaches that enhance the likelihood that knowledge generated by research will lead to actions (changes in policies, practices, technologies, etc.) that improve food security in an environmentally sustainable manner (Vermeulen et al. 2010).

One such 'linking knowledge with action' approach being tested by CCAFS is critically assessed here, namely the participatory development of multi-stakeholder, regional scenarios for East Africa. These scenarios from East Africa describe plausible future development pathways for food systems, environments and livelihoods in East Africa and do so under different assumptions about likely directions/pathways of regional environmental and socio-

economic change. These scenarios can be quantified and modeled, allowing the viability of various strategies and policy options to be explored and tested, as well as debated and refined in a process of continuous strategic learning between stakeholders in the region (Wilkinson and Eidinow 2008; Biggs et al. 2007) The CCAFS scenarios development process aims to span boundaries among disciplines, societal sectors, and organizations in order to generate new insights and facilitate concerted action for improved food security, environments and livelihoods. In this context, the objective for this paper is to assess the effectiveness of the scenario process as 'boundary spanning' that results in different stakeholders and communities actively participating in helping to address the challenge of food security, environmental sustainability, and livelihoods in East Africa.

The CCAFS East Africa scenarios development process began in mid-2010. It has been an explicit learning process, aimed at exploring and improving the potential of multi-stakeholder scenarios for boundary spanning work at a regional level. In this paper, we investigate preliminary results from the initial phase of the CCAFS East Africa scenarios development process to examine the effectiveness of the scenarios work thus far. We measure the effectiveness of building scenarios as a boundary spanning process based on assessing credibility, salience, legitimacy, and capacity development. We discuss the lessons learned that can improve the ongoing scenario development process, and argue for their usefulness in other contexts that use scenarios approaches for enhancing the likelihood that new knowledge will lead to desired actions and solutions to complex societal and environmental challenges.

The paper begins with a literature review of boundary work conducted to date, particularly those relevant to developing country contexts. It then provides a review of various scenarios approaches previously used by other contexts. These approaches help frame the scenarios process used by CCAFS in East Africa. The next section describes the methodology used to analyze the effectiveness of our scenario process. We draw on the expanding body of research on boundary spanning work (Clark et al. 2010) to assess the utility of the process of developing and using scenarios in East Africa for spanning boundaries and linking knowledge with action. This involves an initial assessment of the extent to which the process of building scenarios has been credible, salient, legitimate (Cash et al. 2003), and has built capacity among participants across knowledge boundaries. We use these criteria because Cash et al. provides a way to measure the effectiveness and engagement process aimed at spanning science and non-science boundaries, which is an aim of a participatory, multi-

stakeholder scenario development process. These are key components for linking the knowledge sources needed to ultimately adopt robust policies and strategies within the region. This paper does not address technical scenario issues, such as identifying key drivers and variables. Instead, it focuses on an area that has not been well-researched to date – the process of developing scenarios at a regional level.

2. Literature Review on Boundary Work and Relevance to Scenario Development

Boundary work aims to assess the extent to which scientific knowledge can be translated into something tangible and useful for decision makers formulating new policies, rules and regulations (Clark et al. 2010). Narrowly defined, it attempts to span the divide that often exists between science and non-science disciplines and sectors (Guston 2001; Jasanoff 1996). More broadly, boundary work can be facilitated by boundary organizations or individuals that act as "knowledge brokers" and who encourage full participation of people from various disciplines and backgrounds, helping them to communicate and understand each other and jointly design problem-solving actions. Boundary organizations help to keep information flowing between knowledge producers and users, while promoting mutual respect and trust (Cash et al. 2010). They integrate perspectives and insights from different disciplines and set up the incentives and a safe environment for the joint creation of 'boundary products' such as assessment reports, articles, brief, maps, scenarios or other products based on joint creations (i.e. ideas and products jointly conceived and produced) (Reid et al. 2009). Successful boundary organizations and products are 'adaptable to different viewpoints and robust enough to maintain identity across them' (Cash et al. 2003, p. 8089). Additionally, Cash et al. (2006) propose that boundary work can do much to bridge divides and mismatches between different system levels on and across scales such as spatial, jurisdictional and ecological scales.

Cash et al. (2003) describe the main principles that underpin successful boundary work. First, *credibility* – the perceived technical quality or adequacy of technical evidence and arguments – needs to be established. This implies asking whether the information put forth in participants' dialogue is valid, accurate, tested, and viewed by those from different science or non-science backgrounds, for example, to be not only 'true' (i.e. based on rational, empirical investigation), but also up-to-date and cutting-edge in each of their respective disciplines or professional experiences. Second, *salience* – the perceived relevance of the technical

information provided to decision makers – is critical. This entails assessing whether information provided is needed by those taking actions on it, and in a form that is understandable and can be used in a timely manner. Third, the *legitimacy* of the process of generating the information is an important consideration – is it viewed by all as fair, inclusive, and unbiased? This involves analyzing who participated in producing the knowledge, how they were selected, how they were engaged, levels of collaboration, and how the agenda for the dialogue was proposed, negotiated and set.

Cash et al. suggest that establishing credibility, saliency and legitimacy requires good communication, translation and mediation efforts. Open communication in the process of boundary work can lead to the 'democratization of science' by a heterogeneous group of people (Jasanoff 2003) whereby various participants are able to express their views and see those views incorporated into larger decision-making processes. It can also empower groups that may not have the opportunity to participate in debates (Leach and Scoones 2006). Van Noordwijk et al. (2001), however, point out that to be effective, more than just good communication is needed. They developed and applied a negotiation support model, where researchers, communities and development workers engaged in systematic and continuous negotiations to jointly address and solve conflicts and natural resource management challenges.

Capacity building has also been identified as crucial to efforts aimed at linking agricultural research knowledge with sustainable poverty reduction actions (Kristjanson et al. 2009). Building capacity to interpret scientific evidence by a non-science audience can help in the translation and momentum-building processes required to bridge scientific research into policy (Jones et al. 2008). It is equally important to build the communication capacities of scientists to engage with decision and policy makers by improving scientists' understanding of the policy process and policy audience's knowledge needs (Scott 2006 cited in Jones et al. 2008). This can be done through 'boundary spanning' workshops that bring together scientists and policy makers into sustained dialogue.

We propose that enhancing the transfer of knowledge into action through multi-stakeholder, participatory, scenario development processes requires, and is underpinned by, essentially the same boundary work approaches aimed at ensuring credibility, salience, legitimacy and capacity development. Such processes bridge not only science and non-science worlds, but also sectors, and disciplines. In common with other processes aimed at building progressive

coalitions for societal and environmental change, for scenarios to be effective as decision making tools they have to demonstrate technical credibility, be useful and relevant to potential users of this tool, and ensure that a wide range of people participate legitimately so that the scenarios are, and are widely regarded as, robust.

3. Scenarios Approaches

Scenarios are descriptions of possible futures that reflect different perspectives on past, present, and future developments (van Notten et al. 2003). Unlike predictions, projections and forecasts, scenarios portray alternate futures that are considered plausible but do not claim to offer any certainty about future developments, instead recognizing the uncertainty inherent in a complex world (Van Notten 2005; Wilkinson and Eidinow 2008). Scenarios are designed to offer holistic, integrative and multi-dimensional perspectives on these plausible futures (Xiang and Clarke 2003). Both within organizations and in multi-stakeholder contexts, scenarios provide an alternative to planning and modeling based on a forecasting paradigm (Rotmans et al. 2000). Scenarios help focus on complexity and uncertainty in human and natural systems, and are most useful in situations of high uncertainty and considerable ignorance about causality constraining action to resolve problems (Gallopin 2002). Scenarios help organizations and multi-stakeholder groups shift from competitive, equilibrium-oriented strategies to more dynamic, reflexive and collaborative strategies (Wilkinson and Eidinow, 2008).

Scenario development is practiced among a wide range of sectors and disciplines, with a multitude of strategies and underlying frameworks for scenarios (Bradfield et al. 2005; Van Notten 2003). Scenarios have been in fairly wide use since the 1950s, initially mainly in single-organization contexts such as the military, NGOs and the private sector. The use of scenarios as a tool for inter-organizational or multi-stakeholder learning and capacity building in recent times has changed the potential role scenarios can play (Wilkinson and Eidinow 2008). It has also brought a series of new challenges such as the need to bridge fundamentally different agendas, world views, types of experience and knowledge. This boundary-spanning role of scenarios development and use therefore puts a stronger emphasis on the legitimacy, salience and credibility of multi-stakeholder scenarios processes and their outcomes.

To frame the scenarios process used by CCAFS within the wider practice of scenarios development, we follow Wilkinson and Eidinow (2008), who distinguish two main types of scenarios processes that have been used historically in the context of exploring environmental issues:

- Problem-oriented scenarios development. This type of scenarios process is aimed at reducing future uncertainties. An underlying assumption in this type of process is that *scientific accuracy* is key in scenarios of the future. Scenarios in this type of process are the result of generated knowledge rather than the scenarios process generating knowledge.

- Actor-oriented scenarios development. This type of scenarios process uses scenarios development as a learning process that focuses on 'thinking the unthinkable' (Kahn and Wiener 1967) in which unprecedented insights can emerge. It seeks not to reduce but to acknowledge uncertainty and the possibility for radical, unexpected and discontinuous change. It has largely been used in single-organization contexts to explore the environment in which an organization has to adapt and act (Schwartz 1991). This type of process focuses on the harnessing of the intuitive logics of an interdisciplinary assembly of participants and mainly works with qualitative information.

When scenarios are used within an organization, a variety of actor oriented scenarios processes have often been used (Schwartz 1991). Partly because of the higher need for credibility that exists in inter-organizational contexts and to make scenarios more useful to a range of users, this qualitative, creativity-oriented approach has been combined with the use of quantitative methods such as modeling (Kok and van Delden 2004).

However, when scenarios are used in a multi-stakeholder context, they have a number of additional functions and benefits. They allow for the sharing and linking of fundamentally different analytic and experiential perspectives. In this, they are able to draw upon a wide range of knowledge types that allow those involved to better explore a range of possible futures (Rotmans et al. 2000). They also show potential to generate mutual understanding and appreciation of other perspectives. Going a step beyond these potential benefits, scenarios can offer a platform for generating new relationships and networks, commitments and actionable ideas (Kahane 2010).

Wilkinson and Eidinow (2008) propose a third type of scenarios process that encapsulates and extends this potential and provides a theoretical frame for a more comprehensive and transformative scenarios approach, called the 'reflexive interventionist multi-actor' (RIMA) approach. RIMA is aimed specifically at multi-stakeholder contexts and 'wicked problems'(Rittel and Webber 1973), where problem boundaries and ownership are complex, dynamic and unclear, and potential solutions can lead to, or uncover, more complex problems. Here, complexity is not just methodological but also ethical - and conflicting purposes are at play. RIMA advocates not a linear but an iterative and reflexive process that recognizes and uses its role in shaping the environment being explored, the actors involved, and itself. One of its aims is to change the way participants think about the future and how it relates to the past and the present. Another feature that differentiates RIMA from the previous two types of scenario processes is that its aim is not simply for more participation, but more effective participation. This is built on an explicit recognition of the need for truly different perspectives and world views which can, at any time, challenge limiting paradigms that may arise and dominate the process. Wilkinson and Eidinow (2008) argue that RIMA is a formalization of what actually already happens when futures are considered by a range of actors, and is therefore, not so much a new type of scenarios process as a conscious recognition and harnessing of the realities of collaborative futures work.

4. The CCAFS Scenarios initiative as a boundary spanning process

We first describe the rationale of the CCAFS regional focus and then summarize the first steps in the development and use of scenarios within the CCAFS scenarios initiative. We then examine how this approach relates to the scenario typology described in the previous section – and, based on our initial results, what this means for its potential as boundary spanning work. These lessons are then used to inform and improve the next steps in the scenario process and enhance their potential value for boundary spanning.

4.1 Regional focus

CCAFS has taken a regional approach to scenario building. According to Liverman and Ingram (2010), regional scenarios offer an understanding of environmental change at larger scales that encompass biophysical classifications, such as river basins, which are integral to East Africa. Agro-ecological zones can also be mapped onto a region that offers common physical characteristics across national boundaries. Climate and weather perturbations often

occur at the regional levels where natural disasters span across large areas. In addition to biophysical similarities, regions may share certain cultural similarities, so that similar language, relatively integrated economies, and related social practices, such as food habits and preferences are embedded in the functioning of food systems. Intra-regional trade is often an important factor in understanding food security since it can either enhance or hinder food security depending on the nature of, for example, the management of regional strategic food reserves and the development and maintenance of transport infrastructure and food processing facilities.

In choosing to work at the regional level, the country membership of CCAFS' East African-based partner organizations was also taken into account. The key regional organizations, the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), and the IGAD Climate Prediction and Applications Centre (ICPAC) were identified as likely to be important clients (users) of the outputs of the scenario development process. Based on biophysical, economic and social similarities and regional institutional membership, Ethiopia, Kenya, Tanzania, and Uganda were taken as the initial East Africa region in the CCAFS scenario building exercise. The CCAFS scenarios process in East Africa has taken its initial cues from the actor-centered type of scenarios process and, as the process progresses, from the RIMA approach.

4.2 Actor-centered scenarios& summary of the scenarios

In the CCAFS East Africa scenarios process, participatory, multi-stakeholder scenarios have been developed that initially focused on exploring alternative futures through the harnessing of a range of perspectives from different disciplines and sectors. Figure 1 below shows the different steps in the East Africa CCAFS scenarios process discussed in this paper. The first two steps, composed of scenario development workshops 1, 2 and 2.5, follow a largely actor-cantered scenarios approach. The questionnaire that is the basis of the review in this paper of the boundary-spanning function of the scenarios in these first steps was conducted after workshop 2.5. Based on our boundary-spanning analysis, current and future steps in the CCAFS scenarios process in East Africa are revised and take cues from the RIMA model to increase the boundary-spanning function of the process.

Insert Figure 1

The first steps of the process followed a largely actor-centered scenarios approach. The questionnaire discussed in this paper was conducted after workshop 2.5. Based on this analysis, current and future steps are revised and take cues from the RIMA model.

This strategy aligns with actor-centered scenarios in the typology used in this paper. Our explicit aim was to use scenarios to create a space for the development of shared insights and the enabling of a strategic conversation (van der Heijden 1996) about multi-dimensional, complex issues (the relationships, trade-offs and synergies between food security, environments and livelihoods). The creation of this shared space makes the actor-centered type of scenarios process very suitable for boundary-spanning because it is set up to facilitate mutual understanding, the creation of networks, and a shared purpose across boundaries of discipline, sector and jurisdiction. As with the actor-centered approach, a diversity of perspectives was acknowledged as important. We aimed to invite participants from different countries, and a wide range of disciplinary backgrounds and sectors to the workshops. The focus was not only on explicitly eliciting these different perspectives, but also creating a shared understanding and a dialogue across system boundaries.

Four regional workshops were organized in which participatory, multi-stakeholder scenarios were progressively developed. The actor-oriented process started with identifying drivers of change, which includes both important and highly uncertain, as well as important and less uncertain drivers. Important and highly uncertain drivers in East Africa are the extent of *regional integration* (both political and economic); and the *proactive/reactive stance* of governments (and other regional stakeholders) at the regional level in relation to environmental management and food security.These key uncertainties determine the focus of the different scenarios. Figure 2 below illustratesthe two-axes schema which was developed to think about the drivers of change in the East African system. The important but less uncertain drivers are climate change (a nominal +1°C temp increase; with an increased level of variability & extreme events); population increase (up to ~360 million); and the influx of foreign investment (trade and influence from China and other emerging global economies).

Insert Figure 2

Once the drivers were identified, storylines were developed for each of the four scenarios created by the two axes of uncertainty. Table 1 provides a brief description of these storylines that gives a sense of their relevance for the governance of food systems, environmental management and development of livelihoods across sectors.

Insert Table 1

Based on these storylines, the workshop group determined a number of common outcomes of interest for food security, environment and livelihoods, and examined which factors would contribute to these outcomes. The 13 outcomes of interest include food affordability, regional production, food distribution, and nutritional value for food security; water quality, soil quality, forest cover, biodiversity status, and water sufficiency for environment; and financial wealth, social capital, health, and knowledge and skills for livelihoods.

4.3 Evaluation of credibility, salience, legitimacy and capacity building within an actor-centered approach.

The process and progress of the scenario building in East Africa were evaluated by the participants after each of the first two workshops. This included an assessment of the level of engagement, interest, and learning in the process of boundary work and scenario building. Although post workshop evaluations provided important insights into the process, the initial evaluations were not framed specifically in terms of assessing credibility, salience, legitimacy, and capacity building. To address these issues specifically, a structured questionnaire (see Table 2) based on these concepts of boundary work was developed.

Insert Table 2

The questionnaire was completed by 14 out of the 17 participants who are storyline writers and who have been involved throughout the process.

4.3.1 Credibility

The concept of credibility as a requisite for boundary work refers to the perceived quality of the sources of knowledge for the content developed by different audiences and users (Cash et al. 2003). In multi-stakeholder scenarios, both the producers and users of knowledge are

initially the participants. Workshop participants can be categorized into four types (Huitema and Turnhout 2009; Jones et al. 2009), including networks (i.e. farmers organizations, the private sector), epistemic communities (i.e. agriculture research institutes and meteorological offices), policy communities (national and regional policy makers, donors), and advocacy coalitions (i.e. NGOs). Choosing participants from across this range of expertise should provide a multi-faceted view of climate change, agriculture, and food security in East Africa.

Table 3 below shows the distribution of the type of stakeholders that were involved in the first and second workshops, held in August and November 2010 respectively.

Insert Table 3

The distribution of the type of participants suggests that the scenario building process was initially heavily biased towards epistemic communities, since on average 56% of participants belonged to this category. In order to assess the perceived credibility of the scenarios, scenario writers were asked to assess the diversity of backgrounds of those participating. All respondents stated that many key stakeholders were missing, such as policy makers[1], civil society representatives, social scientists, ecologists, farmers, and private sector representatives. Fifty percent of the respondents, however, thought that although certain stakeholder groups were missing, those who attend were experts in their fields, and therefore, there was sufficient knowledge and adequate discussion on East African issues to make the scenarios credible. The other half of the respondents felt that knowledge, and therefore, adequate discussion was compromised due to the lack of diversity among participants. For instance, issues such as livestock, fisheries, and biodiversity were not addressed. Despite the different views on the ability of participants to contribute knowledge and adequately discuss issues, all workshop participants agreed that the discussions were interactive, open, transparent and "rigorous", and participants "*sometimes agreed to disagree*". The space for open discussion and debate has led 79% of the respondents to state that the scenarios represent a balanced view and no one perspective dominates.

Another factor influencing perceived credibility is the degree to which participants fully understand the process of scenario development. Fifty-seven percent of respondents felt that

[1]Although key stakeholders were missing, it is important to note that these initial workshops did not to aim strategically target policy makers because organizers of the workshops felt that policy makers would not be able to able to engage in a long scenario building process. It is anticipated that such audiences will be targeted once the scenarios are finished so that policy makers have a concrete product to use for decision making.

the scenarios process became easier to engage in over time as their level of understanding grew as each step in the process unfolded. Because many respondents understood the scenario development process, 93% of the respondents stated that they envisioned using the scenario process and methods for their own subsequent work. For instance, respondents stated that they have engaged in other scenario processes after the CCAFS workshops as they have found them useful for future planning of their own work, such as in the field of famine and early warning.

4.3.2 Salience

In order to assess the salience, or the perceived relevance of the technical information discussed during the workshop, the respondents were asked if they would eventually use the scenarios as a decision making tool. Seventy-one percent of the respondents stated that scenarios would be a useful policy making tool because scenarios generate contrasting yet plausible situations and options that decision makers like to see. The scenarios as a regional decision making tool would, therefore, be very relevant and useful for policy makers. Seventy-eight percent of the participants also found the scenarios relevant as an aid to reflect on regional experiences, helping them to distinguish between terms such as "predictions" and "plausible" futures. One respondent went on to take a course in scenario development at the doctoral level.

The relevance of scenarios is also dependent on how they are put together and "packaged" and presented to decision makers. Only 50% of the respondents felt that the scenarios, in their current form, were useful as they use non-technical language more suited for policy makers. The remainder thought the relevance would be enhanced significantly by adding more quantitative information (this is currently being addressed). This split in the perceived relevance of the scenarios suggests that developing scenarios not only takes time because it is a learning process, but it is extremely challenging to bridge science and non-science boundaries and audiences.

4.3.3 Legitimacy

Workshop participants were asked if they felt that the process was fair, inclusive and unbiased (i.e. legitimate). Ninety-three percent of the respondents thought the process of scenario development was fair and unbiased largely due to open and transparent discussions during the workshop. This indicates that the workshop facilitators, acting as knowledge

brokers, were able to foster 'safe spaces' (Kristjanson et al. 2009) and contribute to dialogue needed to help build bridges between science and (smaller) non-science communities. According to 86% of the respondents, the facilitators played a key role in translating jargon so that the process and methods were better understood. Respondents mentioned that there were times when the discussions would become heated, but the facilitators minimized potential conflicts by ensuring that all viewpoints were heard.

4.3.4 Capacity Building

One of the major objectives of the scenario building exercise is to build capacity within the region for participants to be able to learn how to develop, integrate, interpret, communicate, and use the outputs from the scenarios process to inform policies and actions. Seventy-nine percent of the respondents reported having learned new skills, such as how to identify drivers of change, and how to develop storylines. One respondent stated that the difference between "forecasts" and "scenarios" as well as "projections" and "scenarios" is now clear. Methods such as stakeholder analysis and web diagram tools were particularly useful for one respondent who would now use these methods. Among those who thought their capacity to develop scenarios had increased or improved said: the process helped them to better understand: 1) the urgency of building adaptive capacity in the region; 2) concepts such as "uncertainty" and "complexity"; and 3) how scenarios can be incorporated in planning for climate change related work and developing future funding proposals; and 4) the importance of determining different adaptive capacities that exist in the region.

5. Discussion

Based on the feedback and lessons from the first phase of the CCAFS scenarios programme in East Africa, the scenarios team made some changes aimed at building on the strengths of the process to date and overcoming the weaknesses identified jointly with participants with respect to boundary spanning. The strengths of the process thus far have been high levels of interest among participants to use a scenarios approach in their own work. Those that participated believe that scenarios can be a very useful decision making tool, and one that helps link knowledge with action. These positive features of the process appear to be tied to the fact that the process was perceived as legitimate, and the ability of facilitators to not only provide an open and transparent space for discussion, but also contribute to the strengthening

the capacity of participants to use the knowledge generated. Based on the weaknesses of the process thus far, the major lessons learned and steps taken to address them are:

1) Addressing credibility through engagement with complementary networks and regional consultancies

In terms of credibility, the CCAFS scenarios process was characterized by good facilitation of interactions and a good learning curve for participants in terms of understanding and appreciating the scenarios process. However, the value of these strong points was diminished by the major flaw in the process in terms of credibility – the lack of participants from particular sectors and disciplines that were perceived to be important for producing credible outputs.

The first step taken to address this limitation was commissioning a regional consultant to identify and bring on board these 'missing actors'. This involves mapping key actors across sectors and disciplines in order to clearly identify all the organizational boundaries that need to be spanned (Clark et al. 2010). This should help to address not only credibility, but also the salience and legitimacy of the scenarios in the region.

The second step taken to enhance the likelihood that this process leads to improved policies and actions by key actors governing food systems, environments and livelihoods across East Africa, is to jointly plan a number of strategic visioning workshops with different key user groups such as the East African Community, USAID in East Africa, and the CCAFS Regional Learning Platform that is made up of a network of regional partners across sectors. These workshops will focus on creating a shared vision between workshop participants, aligning separate goals to a common desired future. Then the different policy options, strategies and technologies to move toward this desired future will be tested under the radically different socio-economic and policy conditions represented within each scenario. Each of these workshops should find different benefits and flaws in the scenarios while using them, and part of the results of these workshops will be an iterative improvement of the scenarios through user experiences. Such visioning workshops will further contribute to building credibility since various regional bodies representing a variety of disciplines will offer their different perspectives towards a shared vision.

2) Addressing credibility and salience through quantification

Qualitative scenario storylines offer a useful format for boundary spanning because storylines can integrate very different perspectives and types of information in a single story while still creating a shared language and integrated views between stakeholders. This gives scenarios the legitimacy needed for effective boundary spanning (Cash 2003). However, as stand-alone results of a scenarios process, qualitative storylines may still be lacking credibility and saliency for key audiences and user groups, because they lack the confidence-building features of quantification or 'hard figures' (Alcamo 2008). Thus the CCAFS team engaged several experienced modeling teams to design an approach for quantifying the storylines. As not all outcomes of interest can be modeled using existing data, social scientists and media experts will also be engaged to help quantify factors for outcomes of interest related, for example, to social capital. The quantification process requires the bridging the requirements of the models with the storylines, as well as more general disciplinary boundaries, involving an extension of the group's shared understanding and strategic language. Initial feedback from workshop participants indicates that they believe the quantification of the scenarios will greatly enhance their usefulness, and additionally that discussions on indicators and ways to measure outcomes of interest have indeed required participants to relate to other knowledge perspectives across sectors and disciplines.

3) Building salience through long-term engagement with regional media networks

The value of engaging regional media experts and designers to translate the scenarios into a range of different formats to cater to different audiences became clear in the first phase. These include the use of radio programs, videos, maps, graphs, comics and theatre, as well as distilling the main insights of the scenarios into simple, interactive, web-based learning models. Several of these formats will be designed and developed to allow key user groups to experiment with the scenarios in different ways which enhances their boundary-crossing potential and in turn provide different types of feedback on the scenarios content. Packaging and translating key messages for different audiences will help to build salience among both developers and users of the scenarios.

6. Conclusions

Because the development and use of participatory, multi-stakeholder scenarios provides a relatively open space for strategic discussion and the connecting of different perspectives, it is potentially an excellent tool for boundary spanning. This use of scenarios requires the process to be credible, legitimate, salient and focused on capacity building. The initial steps in the ongoing CCAFS scenarios process in East Africa that served as a learning case in this paper showed both the value of good facilitation in terms of the criteria for boundary spanning and the need for the selection of diverse key stakeholders. It also showed that actor-centered scenarios are valuable as a boundary spanning process but are limited in some ways. Therefore, a scenarios process such as the RIMA model that pays more explicit attention to different key perspectives, needs, and aims for a long-term, reflexive and iterative co-learning process shows additional potential for boundary spanning. In the CCAFS East Africa process, we are now working to harness this potential through quantification of the scenarios, collaboration with media, strategic workshops focusing on key users, and mapping and engaging with a wider range of stakeholders.

CCAFS will use the same process of building participatory, multi-stakeholder scenarios, incorporating the lessons learned from East Africa, and apply it in other regions where CCAFS operates, such as West Africa. Adding these critical elements to the process is a recommendation for other groups interested in implementing similar multi-stakeholder scenarios processes. We found the concept of boundary-spanning, and using the criteria credibility, legitimacy, saliency, and capacity development extremely useful for evaluating and improving the value of the scenarios processes at the regional level.

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