Can scenario planning catalyse transformational change? Evaluating a climate change policy case study in Mali

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ABSTRACT

The potential of participatory scenario processes to catalyse individual and collective transformation and policy change is emphasised in several theoretical reflections. Participatory scenario processes are believed to enhance participants' systems understanding, learning, networking and subsequent changes in practices. However, limited empirical evidence is available to prove these assumptions. This study aimed to contribute to this knowledge gap. It evaluates whether these outcomes had resulted from the scenario planning exercise and the extent to which they can contribute to transformational processes. The research focused on a district level case study in rural Mali which examined food security and necessary policy changes in the context of climate change. The analyses of interviews with 26 participants carried out 12 months after the workshop suggested positive changes in learning and networking, but only limited influence on systems understanding. There was limited change in practice, but the reported changes occurred at the individual level, and no policy outcomes were evident. However, by building the adaptive capacity of participants, the scenario process had laid the foundation for ongoing collective action, and potential institutional and policy transformation. We conclude that to enhance the resilience of agricultural and food systems under climate change, participatory scenario processes require a broader range of cross-scale actors' engagement to support transformational changes. Such process will both catalyse deeper learning and more effective link with national level policy-making process. In addition, individual scenario planning exercises are unlikely to generate sufficient learning and reflection, and instead they should form one component of more extensive and deliberate stakeholder engagement, learning and evaluation processes.

1. Introduction

Dryland regions of Africa are exposed to critical and increasingly complex sustainability challenges, including population growth, economic volatility and urbanisation which intersect with extreme climate events and generate unexpected outcomes and shocks for livelihoods and food systems (Hallegatte et al., 2016; Reynolds et al., 2007). Previous research, including work from Hendrix and Salehyan (2012) demonstrates a possible relationship between environmental shocks (e.g., deviations from normal rainfall patterns)

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and the propensity for increased political tensions and communal conflicts. In Sub-Saharan Africa (SSA), many such tensions have emerged in recent decades, partly resulting from competition over access to natural resources (Osumah, 2013; Tonwe & Eke, 2013).

Additional pressures on the SSA region's food systems are expected to build in the future. The latest Intergovernmental Panel on Climate Change assessment finds strong consensus that climate change will negatively impact food security worldwide, especially in Africa due to its rapid population growth, dependence on rain fed crop production, persistent poverty and a dearth of livelihood alternatives in rural areas (Niang et al., 2014). Addressing these challenges will require a transition towards the intensification of agriculture through the adoption of innovative and novel practices and policies (Niang et al., 2014). To date, conventional approaches to enhance food production and agricultural productivity have legitimised expert-led and technocratic strategies, disregarding the agency and capacity of affected local communities (Wong, 1999). This approach yields limited success. Consequently, advocates for inclusive food security have sought to challenge previous technocratic conceptions and practices of agriculture by integrating both technical and institutional perspectives.

Participatory scenario planning may facilitate such an inclusive approach, because it allows a complex systems analysis of food security challenges (Butler, Bohensky, Suadnya et al., 2016; Vervoort et al., 2014), and engages multiple stakeholders and their diverse knowledge and values to integrate climate adaptation into decision-making for future uncertainty (Butler et al., 2014; Wise et al., 2014), generating innovation (Butler, Suadnya et al., 2016). Hence it may be a valuable tool for fostering novel interventions which can mitigate agricultural risk and mainstream climate change into development policies at national and sub-national levels (Vermeulen et al., 2012). The scenario planning approach promotes the engagement of multiple perspectives to enable a more inclusive development process, and hence has been applied to a variety of issues: agro pastoralism (Ravera, Tarrasón, & Simelton, 2011), ecotourism (Bohensky, Butler, & Mitchell, 2011), cash cropping (Carrere, 2010), water management (Thongbai, Pipattawattanakul, Preechapanya, & Manassrisuksi, 2006), land policy (Patel, Kok, & Rothman, 2007), forest management (Wollenberg, Edmunds, & Buck, 2000) and protected area conservation (Oteros-Rozas et al., 2015).

Scenario planning processes can also generate the social change necessary amongst participants to identify, adopt and implement innovation. First, they can create a platform for collaboration between stakeholders with diverse knowledge, values and expertise (Chaudhury, Vervoort, Kristjaanson, Ericksen, & Ainslie, 2013; Malek & Boerboom, 2015), enabling participants to collectively envision potential future development trajectories by building on their collective expertise and knowledge. Through this step, participants can anticipate plausible future challenges and accordingly design better-informed interventions (Johnson et al., 2012). Second, while the scenarios may facilitate jointly-designed plans for highly uncertain future conditions (Kahane & Van Der Heijden, 2012), the processes encourage social learning and knowledge exchange, capacity-building and strengthening social networks (Armitage & Plummer, 2010; Johnson et al., 2012; Reed et al., 2010). When integrated, these features allow each scenario participant to learn from a group process, and this individual learning in turn enhances group knowledge (Brown, Martin-Ortega, Waylen, & Blackstock, 2016; Reed et al., 2010).

Johnson et al. (2012) refer to the potential of scenarios to enhance participants' understanding of others' perspectives, triggering a shift toward systems understanding to address complex problems. This dimension is further confirmed by a recent review of scenario literature, which also reveals the capacity of scenario processes to improve participants' understanding by encouraging people to explore their environment over a wider area than they would normally undertake (Amer, Daim, & Jetter, 2013). Enhancing participants' capacity also implies knowledge sharing across a diverse range of actors and organizations to facilitate collective action (Chaudhury et al., 2013). By facilitating such a shift, the scenario process prepares participants to face unpredicted situations as they arise and promote proactive leadership (Mietzner & Reger, 2005). Having been exposed to scenario processes, participants can then champion change and lead the development and implementation of effective interventions (Butler, Suadnya et al., 2016). Such transformational change in participants' actions can be attributed to social learning (Cundill & Rodela, 2012), and the effect of individuals' double- and triple-loop learning, whereby participants question their assumptions about cause and effect or re-assess underlying values and beliefs, respectively (Reed et al., 2010; Pahl-Wostl, 2009).

While there has been considerable theoretical reflection on the potential outcomes of participatory scenario processes for social change (Johnson et al., 2012; Olabisi, Adebiyi, Traoré, & Kakwera, 2016; Schmitt Olabisi et al., 2010), these have not been fully evaluated, and limited attention has been devoted to testing these assumptions empirically (Butler et al., 2015; Butler, Suadnya et al., 2016; Olabisi et al., 2016). The objective of this study was to address this gap by testing the empirical evidence of social change that may have resulted from the scenario case study against key attributes of scenario highlighted in the literature. The study focused on four primary outcomes of scenario planning portrayed in the literature: (i) *systems understanding*, which relates to enhanced comprehension of dynamism and complexity (Meadows & Wright, 2008); (ii) *relationship building*, whereby scenario processes are an opportunity for participants to interact and build social networks (Schusler, Decker, & Pfeffer, 2003); (iii) *learning across boundaries*, whereby participants gain new knowledge from stakeholders from different social levels or types, and (iv) *change in practices*, whereby participants alter their decisions or norms as a consequence of the prior three themes. We refer to this final outcome as 'transformational change', while recognising the plethora of additional conceptualisations of transformation in the context of climate adaptation, at least (see Section 3 below).

This case study was carried out at Koutiala District, Mali under the Climate Change, Agriculture and Food Security (CCAFS) programme. In the next sections we provide an overview of the CCAFS programme that was designed to facilitate cross-scale dialogue on climate change, agriculture and food security policy-making, and to mainstream climate change into national and sub-national development planning. The background information aims at contextualising the scenario exercises. Then, we describe the methods and the results. In the discussion, we explore how the findings contributed to the expected outcomes of CCAFS programme, the extent to which transformational change was evident amongst participants, and the implications of our results for the design of future evaluations in similar social and political contexts.
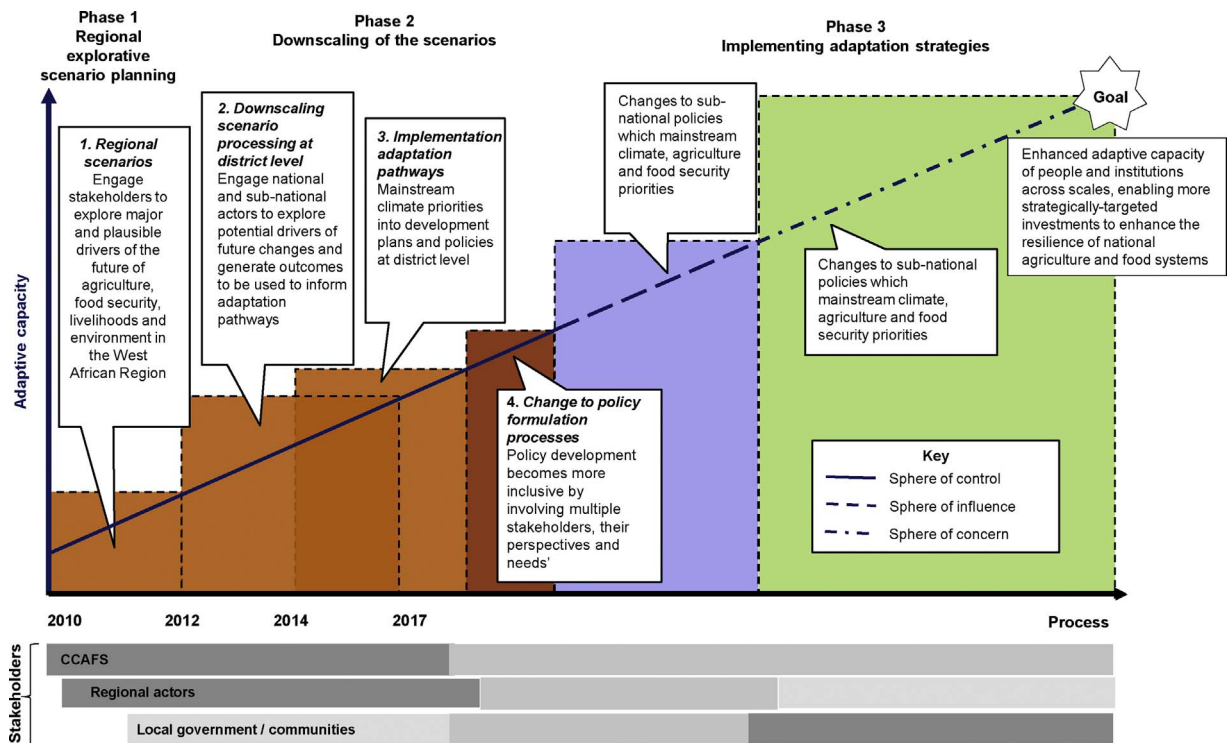
Fig. 1. Theory of Change for the CCAFS Flagship 1 on policy and institutions, three phases, four project activities and stakeholders' involvement (adapted from Butler, Suadnya et al. (2016)). The programme goal was to enhance the adaptive capacity of people and institutions across scales, enabling more strategically-targeted investments to enhance the resilience of national agriculture and food systems. The programme's life is illustrated by the solid 'sphere of control' path. The relative involvement of different stakeholder groups is illustrated below by the shaded bars, with greater involvement indicated by darker shading.

2. Background

The CCAFS programme is an interdisciplinary research initiative of the Consultative Group for International Agricultural Research (CGIAR). It seeks to address the impacts of climate change through a portfolio of projects. Key among them is Flagship 1, which targets the promotion of policy interventions that realise synergies between agricultural productivity and climate adaptation and mitigation. Flagship 1 assumes that effective adoption of technologies by farmers can be enhanced by creating an enabling institutional environment at all levels (local, district and national). From Flagship 1's perspective, multi-actor platforms have been identified as promising institutional tools that can catalyse transitions in agriculture-based livelihoods and economies (Hounkonnou et al., 2012). These platforms bring together interdependent actors to pool knowledge and expertise in defining problems, negotiating priorities, identifying solutions, and implementing interventions to achieve common goals (Tenywa et al., 2011). In each CCAFS country in West Africa (Ghana, Mali, Burkina Faso, Senegal and Niger), one national and three sub-national platforms have been formed with diverse functions, including analysing challenges and opportunities for innovation, building organisational capacity, and creating and sustaining networks of actors.

The Flagship 1 project followed a Theory of Change involving three causally-linked phases, which are synthesised in Fig. 1. It assumed that bringing together a diversity of actors with stakes in agricultural development and natural resource management, and endowed with different forms of knowledge would result in the mainstreaming of multi-scale climate strategies into development plans and policies, and change the policy formulation process. By doing so, the programme would cumulatively build the adaptive capacity of people and institutions across scales, enabling more strategically-targeted investment, and ultimately enhancing food security.

Beginning in 2010, Phase 1 *Regional explorative scenario planning* involved one activity, scenario planning amongst researchers and stakeholders from regional organizations (e.g. the West Africa Farmers' Association), governments and civil society. Phase 1 engaged these stakeholders in an explorative scenario processes to assess plausible future development pathways for food systems, environments and livelihoods in the region, under different assumptions about likely environmental and socio-economic change (Chaudhury et al., 2013; Palazzo et al., 2017).

Phase 2 of the programme, which aimed to contribute to the CCAFS goal in Mali, focused on *downscaling of the scenarios* to a sub-national level. It involved three activities to examine how the drivers identified at the regional level resonated in each country. First was downscaling of the scenarios to the district level to generate information for policy actors (Gockowski, Afari-Sefa, Sarpong, Osei-Asare, & Agyeman, 2013). Relevant stakeholders were engaged to identify potential drivers of change in agriculture, food security, livelihoods and environments, and decide which were most uncertain. The second activity of Phase 2 was implementing adaptation

pathways, which mainstreamed climate adaptation priorities into development plans and policies (Totin, Roncoli, Traoré, Somda, & Zougmoré, 2017). The third was changes to policy formulation processes. Outcomes of Phase 1 and 2 were intended to be inclusive policy design which engaged stakeholders from different backgrounds.

Through each phase, the project prioritized strategies for both regional and district levels, and an action plan to address the gaps and barriers to implementation. The project also assumed that the numbers of stakeholders engaged would grow, cumulatively building their adaptive capacity (i.e. social networks, knowledge, systems understanding), and enabling them to take collective action and instigate Phase 3 *Implementing adaptation strategies* after the programme's completion in 2017. This was expected to achieve the programme's goal, which was the enhanced adaptive capacity of people and institutions across scales, enabling more strategically-targeted investment to enhance the resilience of national agriculture and food systems.

3. What is transformational change?

While 'transformative' and 'transformational' have often been used interchangeably in the literature, Henderson (2002) however, clarifies the two concepts. Transformational refers to the outcome of a process, and transformative refers to features of the process that enable the outcome. For example, transformational change happens through transformative learning. The concept of transformation is widely used across diverse fields including risk management, climate change adaptation, and sustainable development (Chung Tiam Fook, 2017; Hadarits et al., 2017; O'Brien & Sygna, 2013; Rippke et al., 2016). With the recent discourse on large scale and potentially catastrophic global change, there is a growing research interest in the issue of transformation. The recent international conference on 'Transformation in a Changing Climate' held in Oslo in 2013 (U.o. Oslo, 2013) exemplifies this.

The concept of transformation is explained from different perspectives in the literature and most of them see it as an outcome or process, which demands significant change- 'usually for the better' (Mustelin & Handmer, 2013). Apgar, Allen, Moore, and Ataria (2015) propose that transformation is the ability to shift to new arrangements when the current state is no longer viable. Transformation is then understood as a change such that what emerges is fundamentally different from what went before. Transformational change in other words should lead to a 'positive' change, which is profound and radical at heart (Mustelin & Handmer, 2013). Other authors (e.g. Pelling and Manuel-Navarrete (2011), O'Brien and Sygna (2013)), interpret transformation from a critical social science perspective, whereby it implies the forms of societal change that challenge the structural root causes of vulnerability and adaptive capacity, including development pathways (Few, Bendapudi, Mensah, & Spear, 2016). This approach emphasizes that it is the type of society that emerges through transformation that is important (Tschakert, van Oort, St. Clair, & LaMadrid, 2013).

By comparison, Kates, Travis, and Wilbanks (2012) observe that there are at least three forms of transformational changes: those that are adopted at a much larger scale or intensity, those that are truly new and have never been used in a particular region or resource system, and those that transform places and shift locations. Further, Kates et al. explain that transformational changes can be the outcome of either collective or individual changes, both autonomous and explicitly planned. Similarly, Few et al. (2016) identify four major characteristics of transformation, which include *innovation* (a completely novel activity or application of an activity in a new location), *expansion* (an application of an existing activity at a much greater scale or much greater intensity), *reorganisation* (a fundamental shift in organisational structures, and *reorientation* (a reconfiguration of societal values, such as radical change to social power relations, participation, livelihood opportunities, and value systems).

Henderson (2002) describes transformational change as involving "*radical changes in how members (of a community) perceive, think, and behave at work*". The main aim or attribute of transformation therefore is the simultaneous and radical shift of perception, thinking and practices from a status quo to a situation "*with little or no resemblance with the past configuration or structure*" (Henderson, 2002). This approach mirrors Kates et al.'s second form of transformation. Because we were interested in how participants' systems understanding, networking and learning across boundaries had catalysed subsequent novel shifts in their individual actions and decisions, it is this conceptualisation of transformational change that we applied in our study.

4. Research context and approach

4.1. Site characteristics

In Mali, the Phase 2 scenario planning process was conducted at Koutiala District, in the Sikasso Region. Koutiala is one of the main agricultural production areas in Mali, and is stressed by a fast-growing population (estimated at 3% per annum in 2015 (Index-Mundi, 2016)), resulting in increasing pressure on scarce natural resources. About 80% of the labour force is engaged in small scale farming and fishing, which contributed 38.5 percent of national GDP in 2016 (Index-Mundi, 2016). The agricultural trade balance of Mali has been in deficit since 1976 (MAFAP, 2013). Grains, including rice, account for 80 to 95 percent of the value of total agricultural imports, and cotton accounts for 92 to 97 percent of total agricultural exports (MAFAP, 2013).

The climate in southern Mali is typical of the Sudano Sahelian zone of West Africa. Average long-term annual rainfall at Koutiala is 846 ± 163 mm (Traore et al., 2017). In the Sikasso Region, a single rainy season, spanning between late May and early October, provides most of the annual rainfall, but is characterised by high variability. Rainfall records show a shift in the timing of planting rains (defined as 20–30 mm followed by no more than 10 dry days) from mid-March to April-May during the last 20 years (Efisue et al., 2008). Likewise, there is evidence that dry spells and heavy rains during the rainy season are more frequent (Efisue et al., 2008). Given that most of the region's population relies on rainfed production of crops – particularly cotton as the main cash crop, in rotation with cereals such as maize, pearl millet, sorghum, and legumes (groundnut and cowpea) – this variability drives vulnerability to food insecurity and rural poverty (MAFAP, 2013).

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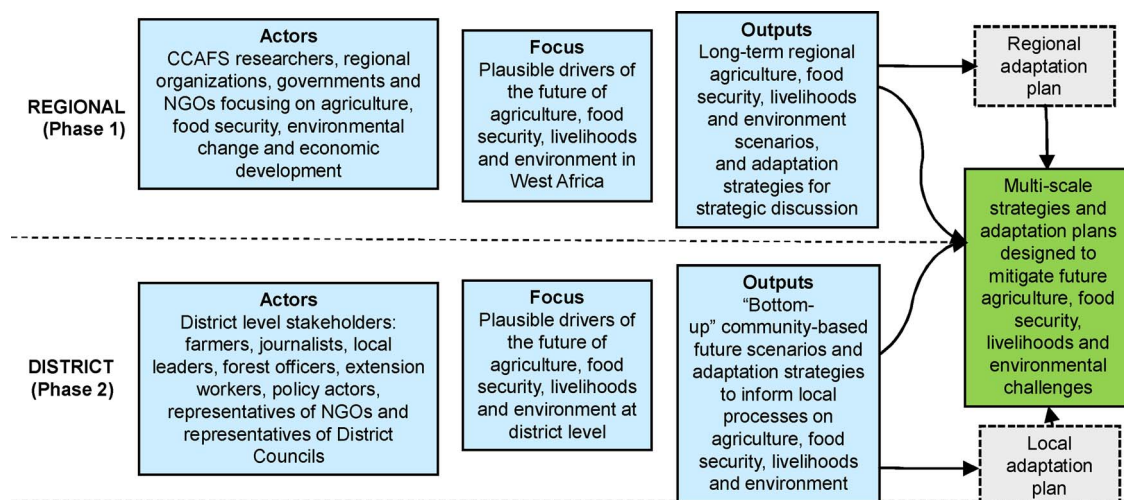

Fig. 2. The regional (Phase 1) and sub-national (Phase 2) scenario planning process, which supported the development of multi-scale adaptation plans.

The impact of climate fluctuations is exacerbated by land scarcity and soil depletion. A recent study showed that by mid-century, maize grain yields were predicted to decrease by 51% to 57% under current farming practices (Traore et al., 2017). Under future climate and current cropping practices, food availability is expected to decline for all farm types in southern Mali (Traore et al., 2017). The primary causes of low productivity in the region are:

- dependency on variable rainfall patterns, droughts and floods, plus locust invasions;
- lack of adequate production infrastructure, particularly irrigation, and a lack of access to inputs (e.g. seed, land, fertilizer) and credit, which is hindering investment;
- poor extension services which constrain farmers' access to agricultural services;
- price volatility in domestic and international markets.

Food insecurity is exacerbated by the migration of people from rural to urban areas in search of employment resulting in an annual urbanisation rate of 5.08%, which has tripled over the past 50 years (Index-Mundi, 2016). This trend is further driving population pressure and poverty in cities.

4.2. Downscaling of the scenarios in Mali (Phase 2)

The regional scenario planning process was downscaled to establish consensus amongst stakeholders on plausible future development pathways for food systems, environments and livelihoods at the district level (Fig. 2).

This process followed the (I)NSPECT approach, described by Johnson et al. (2012), which considers the natural, social, political, economic, cultural, and technological dimensions of a given future. Exploring these dimensions allowed stakeholders to think more deeply about future options for agricultural development and food security under climate change, and to identify innovative investment opportunities for sustainable agriculture and livelihoods in the region, with a time horizon of 2030.

To develop the scenarios, a 2-day workshop was held in August 2015 in Koutiala, with a range of stakeholders from three districts in Mali where the CCAFS project was operating – Ségou, Bougouni and Koutiala. In total, 38 participants (comprising members of multi-stakeholder district platforms, farmers, journalists, local leaders, forest officers, extension workers, policy-makers, representatives of NGOs and District Councils) took part. Participants were selected from sectors related to agriculture, food security and environment. Prior to Phase 2, the project team carried out a consultation meeting with local leaders to identify individuals with responsibility and knowledge in these domains. Potential participants were approached by the project team to assess their availability and willingness to attend the scenario planning workshop, which resulted in the large and diverse range of participants. The workshop was facilitated in French with interpreters working in parallel to translate between French and *Bambara*, the local language.

Scenarios were developed to address the question "*What should agriculture look like in 2030 to support food security and livelihood improvement in Koutiala, under conditions of climate change?*" As a first step, participants were asked to identify factors they thought could be important in driving changes in agriculture, food security and living conditions in the district by 2030. The participants considered the natural, social, political, economic, cultural, and technological drivers of future changes by working in small groups. This was followed by a ranking exercise, whereby participants were asked to rank the drivers according to their level of uncertainty and relative influence (Fig. 3). The drivers perceived as the most uncertain and influential were explored through the subsequent scenarios. In this next step, storylines were developed in four groups, using the drivers to construct a scenario for the district in 2030 (Fig. 3).
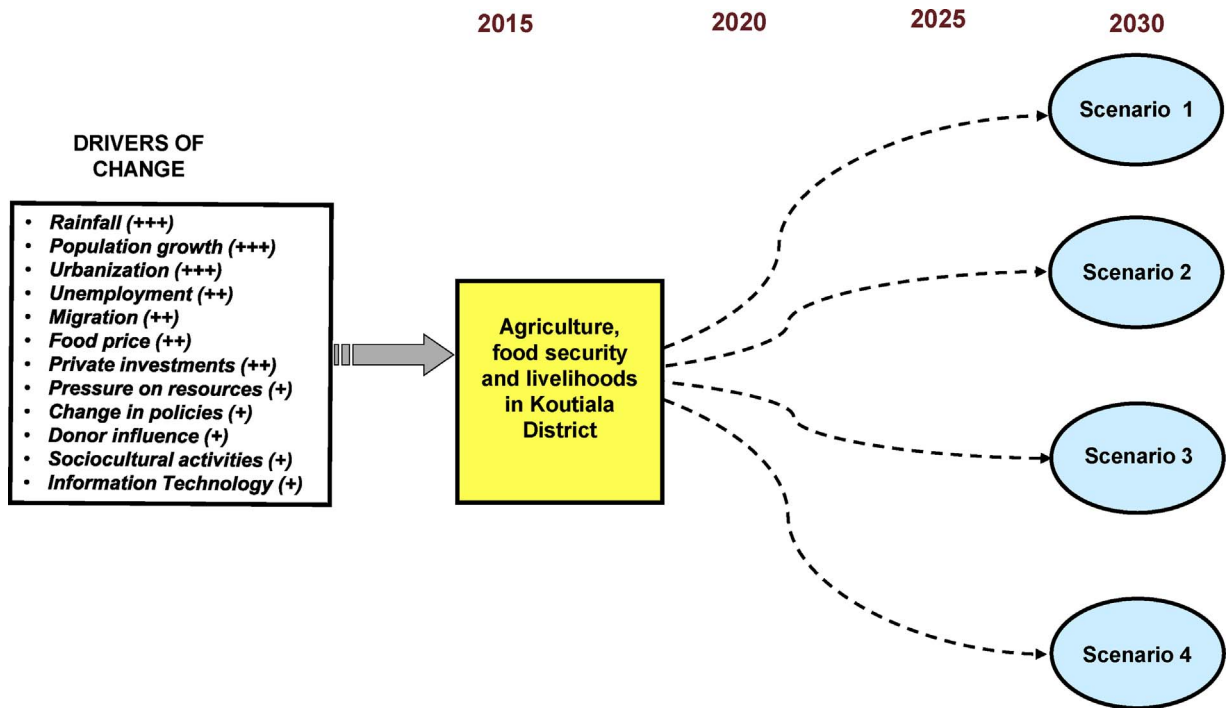
2015   **2020**   **2025**   **2030**

DRIVERS OF CHANGE

- *Rainfall (+++)*
- *Population growth (+++)*
- *Urbanization (+++)*
- *Unemployment (++)*
- *Migration (++)*
- *Food price (++)*
- *Private investments (++)*
- *Pressure on resources (+)*
- *Change in policies (+)*
- *Donor influence (+)*
- *Sociocultural activities (+)*
- *Information Technology (+)*

Agriculture, food security and livelihoods in Koutiala District

Scenario 1

Scenario 2

Scenario 3

Scenario 4

Fig. 3. The scenario planning procedure for the Koutiala District workshop, and drivers of change and their rankings (+ + + = highly uncertain and influential; + + = moderately uncertain and influential; + = least uncertain and influential) identified by participants.

4.3. Research design

We sought to assess the influence of the scenario planning process by asking participants to consider whether they had experienced the following four potential outcomes: (i) systems understanding; (ii) social networks; (iii) learning across boundaries, and (iv) changes in their practice subsequent to the workshop. Evidence for each outcome we sought was as follows:

- Systems understanding: the participant had considered multiple perspectives and interconnected dimensions to explain social and natural events.
- Social networks: the participant had expressed that the process had offered them the opportunity to build or strengthen relationships with other stakeholders.
- Learning across boundaries: the participant had gained new knowledge, learning or understanding from others' experiences, especially those from other social levels or groups.
- Changes in practice: the participant had been empowered by the workshop to make fundamental and novel changes to their day-to-day practices, norms and routines in the period after the workshop.

We conducted structured interviews with 26 participants (18 men and 8 women; Table 1), representing 68% of workshop participants (10 from Koutiala, 10 from Bougouni and 6 from Ségou), 12 months after the workshop. Interviewed participants included district officials, development agents, traditional authorities, civil servants, and farmers (Table 1). Two of the participants had other commitments at the time of the interviews, nine had moved from the areas could not be reached and one of them had passed away, which made total coverage of all participants impossible.

Interviews explored each of the four outcomes, and we assumed that the 12-month time lapse since the workshop was sufficient for participants to have changed their practices as they wished to. Scenario participants were invited to reflect during the interviews on the outcomes that they perceived as the most relevant, lessons learned from the scenario exercise and what each of the participants might consider doing differently today that could be related to participation in the scenarios workshops (See Supplementary material for more detail). Each interview lasted approximately 25 min, and was digitally recorded with the consent of the interviewees. Interviews were conducted either in French (with educated interviewees) or *Bambara*. The recordings were transcribed, and the transcriptions were thematically analysed through coding to look for patterns across the data in association with the four potential outcomes.

5. Research findings

We now describe the influence that participants reported as resulting from the scenario planning process, following the four

Table 1
Socio-demographic characteristics of scenario participants (n = 38) and interview respondents (n = 26).

Parameters		Scenario participants (n = 38)	Respondents (n = 26)
Social groups	District officials	2	1
	NGO staff	6	4
	Village leaders	3	3
	Public servants		
	- Extension officers	7	5
	- Planning officers	2	2
	- Forest/Meteo agents	1	1
	- Journalists	2	1
	Farmer representatives	15	9
Age	Under 30	10	4
	31–50	15	12
	Over 51	13	10
Gender	Men	25	18
	Women	13	8
Education	No school	8	6
	Primary	10	8
	Secondary	12	8
	Post-secondary	8	4
Districts	Bougouni	12	10
	Segou	10	6
	Koutiala	16	10

potential outcomes targeted. To assist the reader in capturing the information per stakeholder groups, an overview of the detailed responses is presented in Table 2, ahead of the findings.

5.1. Systems understanding

Overall, the workshop was least effective at stimulating systems understanding, and only four (15%) respondents provided evidence of this (Fig. 4). They stressed their new-found capacity to "*see the bigger picture*" of social phenomena, and being able to make connections between different issues. One explained that he had stopped "thinking in silos", and could see how current actions could link or interfere with the future. One NGO representative commented:

"*The scenario workshops opened my eyes on new things. I usually blame the short rainfall as the major cause of the yield decrease and food insecurity. Now I am aware that the decrease of the soil fertility, the type of [seed] variety farmers use… can all be part of the yield fall and that climate change is beyond rainfall*".

One extension officer stated:

"*As an extension officer, I used to be frustrated when I saw that farmers were not following our recommendations. The scenario workshop helped me to make another opinion of how things are complex, and the various challenges that farmers are exposed to, which can prevent them from using the advices and technologies that we promote*".

Another commented:

"*Being at the workshop helped to know the complexity of climate change challenges and food security*".

All of the four participants had post-secondary education and at least 5 years' experience with multi-stakeholder processes. They had also worked on research activities, technology dissemination, and capacity-building directed at farming communities. The technical knowledge and long-term experience working with local communities may have contributed to their capacity to think in a more systemic way.

Related to systems understanding, there was some evidence of the process stimulating foresight, and this was a significant shift. As one respondent put it:

"*So, when I heard the message that the workshop conveyed about the possible future of my region, it was like the climate change comes to stay… and we have to adapt to it and find the way to continue producing enough to feed our people. Being aware of this helps to think and plan forward*".

5.2. Networking

Social networking and relationship-building was the change identified by the greatest proportion of interviewees (Fig. 4). Twenty-four (92%) respondents agreed that the workshops helped them to create new relationships or to deepen their social relations with

Table 2
Perception of changes for the four themes evaluated by different stakeholder groups.

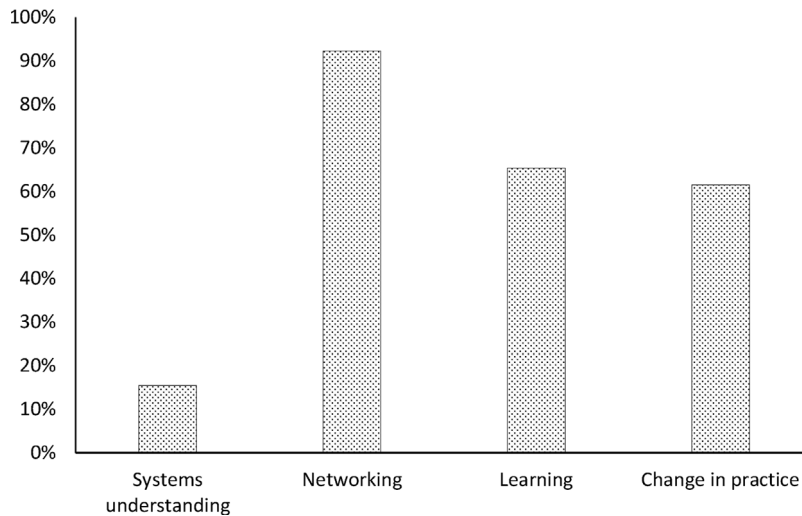| Themes	Stakeholder groups								Total (n = 26)
	District officials (n = 1)	NGO staff (n = 4)	Village leaders (n = 3)	Extension officers (n = 5)	Planning officers (n = 2)	Forest/Meteo agents (n = 1)	Journalist (n = 1)	Farmers (n = 9)	
Systems understanding									4
"Gaining a deeper understanding of issues discussed"									
"Have a full picture of issues discussed"									
"Understand the complexity of phenomena"				2	1				
"Understand the link between events/phenomena"		1							
Networking									24
"Establish new social linkages"		3		3	1		1	5	
"Strengthen the relationships with people I knew before"	1		2	2	1	1		4	
Learning across boundaries									17
"Learn new things from other participants"					1		1	1	
"Exchange of experiences"	1			1				2	
"Challenge each other's opinions and gain new knowledge and experience"				3		1		6	
Changes in practice									16
"Adopt new day-to-day practices"	1	4						5	
"Plan forward and anticipate"						1		4	
"Changes in norms and routines"				1					

Fig. 4. Proportions of scenario planning workshop participants (n = 26) that mentioned evidence of the four themes evaluated.

other participants, for example:

> "*I met many people at the workshop who I did not know before. I met a colleague who was also involved in the same project as me, but we did not know each other before. The scenario workshop opened an opportunity to know him and, since then, we keep in touch and exchange information about our activities. Anytime that I encounter a challenge, I call him to ask for guidance… and he does the same as well. We support each other, it is very useful*".

> "*At the workshop, I met a journalist who was also invited. By the end of the workshop, we became friends and we established a collaboration to disseminate agricultural technologies. He often helps to synthesize agricultural information into simple messages, formulated in the local language, which are broadcast by the community radios*".

Another participant, a retired extension officer, stated that he had been reacquainted with a former colleague with whom he started his career in 1974. The workshop also served to reconcile a difficult relationship between a village chairperson and an extension officer. The latter bought a piece of land from a relative of the chairperson, but there was latent tension between the two. Having been together for two days in the workshop, sharing the same space and assessing a common future challenge, they became close and a peaceful resolution was found to the issue.

5.3. Learning across boundaries

Seventeen (65%) of the respondents reported that the workshops enabled them to learn from other participants, and this was the second strongest outcome (Fig. 4). The learning often resulted from engagement between different stakeholder groups and across levels (e.g. farmers and extension officers). For example, a farmer from Koutiala stated:

> "*There have been many exchanges of experiences between participants … I did not know anything about climate information, and the Senekela service − provided by the mobile service provider. I learned from a participant [a district government officer] at the workshop who is working with Mali-Meteo [the Mali meteorological service]. I am now using this service which helps a lot to better anticipate my farm activities …*"

The following quotes from another farmer from Ségou and a journalist from Koutiala illustrate some of the learning that occurred amongst participants:

> "*At the workshop, one of the participants explained that he uses extracts of chilli pepper in mixture with onion bulbs and lemon grass leaf against some leaf-eating insect pests in his vegetable farms. It was new for me …*"

> "*Before the workshop, I thought that tree-cutting is the major cause of climate change, but through this workshop I learned from participants that many other human activities, including the pollution from the cotton factories and the abusive use of agricultural lands also contribute to the change …*"

Respondents highlighted that the workshop had created room for them to discuss things they did not know before (e.g. climate information, use of botanical extracts, etc.). The workshop was a space where the participants exchanged and discussed their experiences by building on each other's knowledge, including farmers' understanding derived from their everyday farming practices. Government extension staff also learned from farmers about local livelihood challenges and coping options. One respondent stated that:

"[…] the fair facilitation of the workshops valued the experience and knowledge of each participant and made the knowledge generation more inclusive. We had the feeling that our opinions counted."

A district government extension officer commented that the open interaction among the participants had offered room for knowledge exchange, and allowed them to challenge each other's opinions and gain new experience, gaining a deeper and diversified understanding of climate change and its plausible future effects on food production in the region.

5.4. Changes in practice

Sixteen (62%) of respondents agreed that the workshop had been responsible for novel changes in their day-to-day practices, norms and routines subsequent to the workshop. Of these, all indicated that the scenario planning had shifted their understanding of climate change by encouraging learning, which led them to adopt new practices, as stated by one farmer:

"Based on what I learned at the workshop, I now have another consideration of climate change manifestation. I do not worry anymore when rains delay… I reschedule my plan, and use short duration varieties to cope with the change"

Ten participants stated that the workshop had been intensive, and they needed more time to reflect on their learnings and to consider their future plans, and anticipate possible change:

"After this workshop, I start taking time to look forward to what the future could be and think already about options to cope with future challenges. It helps to not be surprised, but it is not easy to do…"

Five other farmers also claimed that the workshop aided them to adopt environmentally-friendly behaviours such as tree planting, home waste recycling, and raising community awareness to reduce tree-felling. One representative of a District Council reported that the workshop exercise helped him to become more aware of the impact of climate change on food security, and to prioritize investment in the dissemination of climate information through local radio to stimulate change. One of the participants who was also a member of an association of artists reported that the collective thinking that the scenarios had promoted had partly inspired the association's committee to broaden membership of the national core team to include local community representatives. Originally only 8 local people were members of the core team, but this had since increased to 15 as illustrated in the following quote:

"The workshop was useful to me. I particularly liked the way each of us brought its experience and knowledge to inform the process and constructed different stories that all captured our perspectives. By building in this experience, I encouraged the committee of the artists' association to include more members in decision-taking…"

6. Discussion

This case study provided a useful opportunity to evaluate the contribution that scenario planning can make towards stimulating change amongst participants under uncertain climate conditions. Our evaluation showed that there was no evidence that the Phase 2 – *downscaling of the scenarios* – at Koutiala District had generated such integrated adaptation planning in Mali, even 12 months after the workshop. Participants seemed to learn most about climate complexity and agricultural practices, and there was little evidence of policy-related impacts as the programme aims to achieve. This may have been due to the lack of representation of relevant stakeholders across scales (e.g., lack of national government stakeholders who had participated in the Phase 1 workshop). Schusler et al. (2003) showed that a diversity of stakeholders can enhance learning by exposing participants to a breadth of viewpoints, and Butler et al. (2015) present an adaptation planning process that deliberately integrates 'bottom-up' and 'top-down' approaches to promote knowledge exchange between actors from international to community levels, and hence social learning and innovation. In our case study, most participants were from the district or community level, including farmers, journalists, local leaders, and government extension staff. It is possible that this limited diversity did not encourage in-depth discussions about issues such as national food security and climate policy. This corroborates other research which indicates that the identification and involvement of strategic champions is important for scenario processes to be effective and to catalyse policy change (Johnson et al., 2012). Furthermore, understanding the 'knowledge cultures' of different stakeholder groups, and the views that they may therefore bring to scenario planning is a key pre-requisite (Bohensky et al., 2016).

The primary outcome from the process was enhanced social networks. The large majority (92%) of respondents agreed that the workshop facilitated new relationships, and encouraged more depth to existing ones. This result mirrors the findings of Brown et al. (2016) in Latin America. However, while the workshop encouraged network-building, it only connected stakeholders across local scales (e.g. farmers and district government). Without the inclusion of higher-level actors, the process offered little room for more extensive networks. Again, the careful selection of participants, to include multi-level stakeholders, as trialled by Butler et al. (2015), Butler, Suadnya et al. (2016), could have made more progress towards fulfilling the CCAFS Theory of Change.

Moreover, some of the participants complained that they were not able to keep in contact with the other participants. Strengthening the relationship among key strategic actors might therefore require the maintenance of interactions subsequent after the workshops that can enable participants to better know and understand each other's perspectives and to build trust (Johnson et al., 2012; Olabisi et al., 2016). For example, Butler, Suadnya et al. (2016) designed an initiative in Indonesia which maintained a process subsequent to scenario planning workshops. It included the integration and prioritisation of actions amongst multi-level stakeholders, implementation of these actions, testing of innovative strategies in pilot sites, focussed engagement with formal planning

development processes, and ongoing participatory monitoring and evaluation amongst the key stakeholders to stimulate further action through reflection. In our study the workshop outputs were subsequently used by the CCAFS programme team to inform National Parliament Members about the challenges faced by farmers.

The scenario process had also clearly stimulated learning across boundaries, with 65% of respondents commenting that the workshop had created the conditions for them to critically reflect on the issues discussed and to learn from other workshop participants. They learned from other participants' perspectives, and re-assessed their own assumptions and values. Therefore, the scenario planning may have enabled social learning, and also double-loop learning amongst participants, whereby they reframed issues, questioned one another's views to judge their validity and utility for addressing perceived future challenges (Flood & Romm, 1996). This finding is consistent with previous research on the outcomes of scenario planning, including Brown et al. (2016), Johnson et al. (2012) and Olabisi et al. (2016), who also concluded that the process successfully stimulates social learning and innovation among participants. In an extended process of multi-stakeholder adaptation planning in rural Indonesia and Papua New Guinea which included scenario planning as a sub-component, Butler et al. (2015) also found that innovative thinking was the primary benefit gained by participants, followed by empowerment.

There was limited evidence that systems understanding had been encouraged. Stimulating a rich understanding and reflection on complex issues requires time, and a two-day workshop is usually insufficient (Butler, Bohensky, Darbas et al., 2016; Butler, Suadnya et al., 2016). Salomon and Perkins (Salomon & Perkins, 1998) emphasised that systems understanding only occurs through lengthy collective participatory processes of active knowledge construction. Our process was limited to a single two-day workshop. Regular meetings with a more diversified group of participants would allow critical reflection on different issues, and strengthen networks and skills (Atwater, Kannan, & Stephens, 2008). Moreover, the profile of participants probably also influences systems understanding outcomes. Studies have shown that the capacity of people to gain systems understanding is heavily dependent on the conceptual knowledge that they acquire at earlier stages of their education (Atwater & Pittman, 2006; Paraskevas & Wickens, 2003). This was reflected in our findings, which showed that the four participants who mentioned this outcome had a post-secondary education and at least 5 years' experience of work with multi-stakeholder processes. It is also possible that other participants did experience changes, but could not articulate this due to a limited educational level.

We defined transformational change as novel shifts in participants' day-to-day practices, norms and routines, following from Henderson's (2002). In the study, about 62% of interviewees mentioned changes in their norms and practices in the 12 months since the workshop. Novel actions reported included tree-planting, home waste recycling, and reduction of tree-felling, largely amongst local farmers. Such individual and localised change may not be the progress that had been anticipated by the CCAFS programme (Vermeulen et al., 2012). While transformational these actions may appear for the participants, they could rather be considered incremental adaptation in terms of Kates et al.'s (2021) perspective. There is no guarantee that these changes were novel in the districts, nor that they were instigated solely as a consequence of the scenario planning workshop. For example, there have been many on-going initiatives in the district promoting solid home waste recycling for agricultural purposes (Cofie, Bradford, & Dreschel, 2006; Drechsel, Quansah, & Penning De Vries, 1999). Hence, within 12 months of the workshop there was only debatable evidence of transformational change amongst individuals, despite significant networking and learning that had been catalysed by the scenario planning process, and no obvious alterations to policies or policy-making norms. This tends to confirm the findings of Butler, Bohensky, Darbas et al. (2016) in Indonesia, who concluded that for climate change to be mainstreamed into development planning, a 5–10 year process is required which involves multiple components, including scenario planning, that continually trigger learning and encourages the emergence of champions at both sub-national and national levels who can maintain this change, and take advantage of policy windows of opportunity when they arise.

7. Conclusion

The CCAFS programme on Policy and Institutions aimed at mainstreaming climate change and food security into sub-national and national development plans. Scenario planning workshops were the first steps in a causal process as shown by the programme's Theory of Change. Although our evaluation was based on a small sample size of respondents from a single workshop, we found that there was good evidence of change amongst individuals. However, there was limited evidence of collective transformation. The study also showed that changes in policy have not yet materialized, but by engaging a more broad and diverse range of stakeholders in follow-up activities, the intended transformational institutional change may yet occur. Scenario processes alone may not be sufficient to stimulate transformation. Nonetheless, the generation of extensive learning and social networks are critical elements of adaptive capacity (Butler et al., 2015), and hence the Phase 2 scenario planning workshop has at least contributed to the CCAFS Theory of Change in this regard, and created the foundation for future steps. Whether such institutional and policy change occurs will require long term and reflexive evaluation.

Acknowledgements

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.futures.2017.11.005.

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