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BRACED aims to build the resilience of up to 5 million vulnerable people against climate extremes and disasters. It does so through 15 projects working across 13 countries in East Africa, the Sahel and Asia.

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RESILIENCE INTEL

How does innovation build climate resilience in the Sahel?

Natasha Grist

For farmers everywhere, and especially in the Sahel, innovation is a way of life, as they adapt and change farm practices to increase yields and decrease work inputs. With climate change posing increased risks, community and farm innovations that build climate resilience will help support and enhance the lives of many marginalised people. This paper examines five innovations from the BRACED programme working with vulnerable Sahelian populations, drawing lessons for other resilience-building efforts.

KEY MESSAGES

- In the case of the Sahel, innovation is central to improving farming families' incomes, farm and livestock yields, well-being and even survival in the face of climate shocks and cumulative stresses.
- Innovations that build people's capacities to respond to climate changes include enabling access to better information and technical knowledge, introducing financial innovations, integrating climate information into farmers' planning and social innovations.
- Innovating is a risky business: some innovations will fail or take longer and need more investment and leadership than initially planned. However, not innovating is riskier still in the face of changes to come.
- Monitoring how effectively resilience is built is an inexact science, but development partners need to demonstrate and compare the effectiveness of their programmes. Quantitative data on outputs and activities needs to be supplemented with triangulated narratives on improvements in choices, context and lives.

1. INTRODUCTION: CLIMATE-RESILIENT APPROACHES TO RAIN-FED FARMING

'Times of crisis can be creative times, times when new visions and new possibilities emerge, as the very dangers we face stimulate us to look deeper, seek alternatives, and take advantage of opportunities' (CILSS, in Gubbels, 2011, p.x).

Climate change brings severe, multifaceted new challenges to the world's farmers. In some parts of the world, drought and floods are becoming more severe and frequent over time (Field et al., 2012). In many areas, temperatures are rising and rainfall patterns are changing and becoming more unpredictable. Impacts are seen in terms of crops, livestock, water availability, pests and diseases (IPCC 2014).

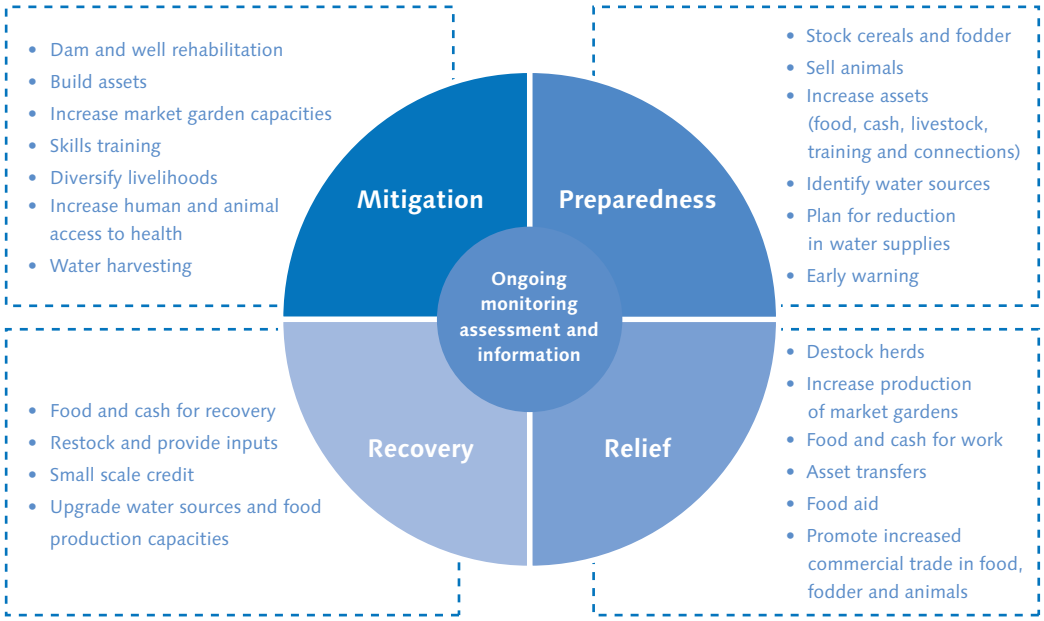
Those who are dependent on rain-fed farming are some of the most vulnerable to climate change, given periodic drought, patchy seasonal rains and generally degraded soils. This often rests against a wider background for many farmers of social vulnerability, owing to high levels of poverty in some areas of the Sahel, limited access to income sources and credit to stimulate on-farm investment, increased population pressures and very limited access to extension services or government support for farming (Gubbels, 2011). Alongside this, regional and national food demand is rising, while local farms may not be able to respond quickly and may instead have reduced production as a result of climate (or other) events. This forms part of what Gubbels (2012) calls a 'resilience deficit': a relatively modest reduction in food production can trigger a huge regional food and hunger crisis because small-scale farming communities are not resilient to change.

A villager checks the rainfall forecast on his mobile phone in Kolondialan in Mali, 16th May 2017

This may seem like a familiar refrain in the development field. But the realities facing rural Sahelian people are stark, life-threatening and increasingly dangerous. Confronted with the challenges of increasing hunger cycles as a result of drought, conflict has taken the lives of 20,000 people and forced over 1.5 million into neighbouring regions and countries that are already struggling to feed their own – a crisis largely overlooked outside of those countries (World Bank, 2014; Kingsley, 2016; Kingsley and Boseley, 2016).

The Sahelian region of West Africa will double its population in the next 20 years – and natural vegetation has been declining for

Figure 1: Possible interventions to improve food security



Source: Kelly and Kinmaung (2007).

the past 40 years (Reij and Winterbottom, 2015). This puts additional pressure on its resources. Some link outbreaks of serious prolonged conflict in the region to land pressures and lack of food and economic security (Tall, 2018).

With longer-term climate change and increased variability in climate, there is more need for action at a wider scale. Farmers now need to contend with farming conditions beyond previous generations' experience and scientific knowledge needs to be combined with current local experience to make it possible to understand and plan better ways to cope with these changes, in an ever more challenging external environment.

Despite these serious issues, major innovations in some areas have taken place through grassroots action from farmers – such as the 're-greening' of 5 million ha of Niger, doubling yields (and better) and improving land and water management (Reij et al., 2009).

A series of activities will help strengthen the resilience of farmers to disasters and longer-term climate change (see Figure 1).

Innovation in farming has been going on for millennia, as farmers share and learn better practices and crop types and improve animal breeds for their location. New variety experimentation in the 1960s led to a global Green Revolution. Prior to this, during the 19th century, plant and animal disease control and cross-breeding techniques were already in place (Frankema, 2014). Within Africa, adaptive, responsive evolution of agriculture was evident. Maize and cassava were adopted from the New World along with beans, peanuts, potatoes and many cash crops (ibid.).

Examples of recent innovations benefiting the region include seed security systems; dairy hubs (where smallholders are directly linked to dairy processors); biotechnology improvements (see Juma and Serageldin, 2007); deep placement of fertiliser for better plant nutrient uptake; digital soil maps for sub-Saharan

Africa (African Soil Information Service);[1] mobile phone applications for livestock and agricultural advice; and new feeding and corralling systems for livestock (e.g. managed rotational intensive grazing and rangeland models). The Organisation for Economic Co-operation and Development (OECD) finds that 'Innovation can make a difference in addressing urgent developmental challenges such as providing access to drinking water, eradicating neglected diseases or reducing hunger' (OECD, 2012, p.4).

Increasingly now, we hear stories of farmers using 'climate-smart agriculture' approaches to change farming practices towards more sustainable methods. These approaches have the threefold aim to increase agricultural productivity and incomes, build resilience to climate change and reduce greenhouse gases where possible (FAO, 2017). However, not enough is known about the process of developing innovations that will build resilience to climate change, how to make these viable and scalable and how to overcome challenges faced along the way.

Farmers are working with a number of organisations and initiatives that are leading the way in this area by analysing approaches and trying to promote the adoption of effective climate-smart agricultural interventions around the world. These include the Climate Change, Agriculture and Food Security (CCAFS) programme, the Food and Agriculture Organization of the United Nations (FAO), the World Bank and the International Fund for Agricultural Development (IFAD). Mostly, these have been designed as stand-alone pilot projects at different stages of research, demonstration and integration in different contexts and countries. IFAD's approach has been different, focusing on integrating climate adaptation into existing project and programme portfolios. Recent years have seen an increasing focus in some projects on scaling up and financing successful interventions with farmers.

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Producer from Zouragane (Hamdallaye commune) reading the rainfall levels

1 African Soil Information Service soil property maps are being produced for the cropland biome of Africa.

Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) interventions have represented the biggest applied programme to date, working with a large number of implementing partners and research institutions. This has significant opportunities for rapid wider dissemination and influence. In addition, innovations are tailored to specific challenging real-life socioeconomic contexts, and are expected to generate a useful learning platform for further work in this area.

In this paper, we share insights from BRACED on resilience and agricultural innovations in Sahelian farming. The paper explores five innovations for farmers implemented in the Sahel, examining how these help strengthen resilience to climate extremes and variability, as well as the benefits and pitfalls involved for farmers as they work towards a better life in a world of changing climate.

2. CONCEPTUAL APPROACHES: INNOVATIONS AND RESILIENCE IN BRACED

2.1 Building resilience within BRACED

The BRACED programme has completed its final year of Phase I, and is reporting against activities and initiatives that have aimed to build resilience to climate change. As a programme, BRACED itself is an innovation for development funding. With a sizeable three-year UK government grant of £110 million, it is one of the largest coordinated programmes on resilience-building to date. It supports more than 120 organisations in 15 consortia across 13 countries in the Sahel, East Africa and Asia. BRACED's projects carry out a diverse range of activities, each informed by existing work and expertise of the Implementing Partners and aimed at supporting and building household and community resilience to climate extremes and disasters. Across the programme, projects include improving climate and disaster risk management, expanding access to climate and weather information, improving basic service delivery across various sectors and developing access to markets and market information (Leavy et al., 2017).

How does the programme define the concept of climate resilience?

'Within BRACED, resilience is understood as the "ability to anticipate, avoid, plan for, cope with, recover from and adapt to climate related shocks and stresses"' (Leavy et al., 2017).

BRACED projects follow a common approach to measure the outcomes of resilience-building processes, thought of as a set of interlinked capacities or abilities to **absorb**, **anticipate** and **adapt** to shocks and stresses (Leavy et al., 2017, p.5). In turn, some of these may catalyse a more fundamental process of **transformation** of policy, behaviours and practice (see Box 1). Leach et al. (2012) discuss the broader issues of pathways to sustainability for human societies as a whole and claim that major transformations are needed in policies, technologies and modes of innovations themselves.

Box 1: Components of climate resilience

Capacity to anticipate climate change: Proactive action before a foreseen event to avoid upheaval, either by avoiding or reducing exposure, or by minimising vulnerability, to specific hazards. Examples include preparedness, planning and risk information.

Capacity to adapt to climate change: The ability of social systems to adapt to multiple, long-term and future climate change risks, as well as to learn from and adjust to a disaster. Examples include increasing incomes and changing livelihoods that depend on natural resources.

Capacity to absorb climate change: The ability of people, communities and social systems to face and manage adverse conditions, emergencies or disasters. Examples include generating and improving savings/safety nets and increasing substitutable assets.

Transformation: Policy shifts and changes in practice that fundamentally change people's livelihoods and build resilience to climate change in a structural way. These include strategic thinking and policy, leadership, empowerment and innovation.

2.2 Innovations within BRACED

Innovations are a principal element of the BRACED programme. Many of these projects are innovative in their parts or as a whole. Implementing partners were particularly interested in how specific innovations could help strengthen the resilience of their target populations, so the BRACED Knowledge Manager supported five consortia to engage in an in-depth study of key innovations within their project activities. Through a cooperative write-shop process (see Section 2.4), practitioners produced individual case studies at the start and towards the end of the project, once much of the activity had been implemented. The central questions posed by/for the group were:

- What kinds of innovations improve climate resilience, and how?
- How can marginalised groups benefit from these innovations?
- What can be learnt about how to spread innovations that work well?

In order to answer these questions, we needed to decide how we defined innovation and how these activities were, or were not, innovative – as well as how they help strengthen, or fail to strengthen, the resilience of target groups to climate change.

There are many ways to define innovation.[2] We use an approach that highlights five main characteristics of grassroots or community-level innovation: newness, adaptation, interaction, knowledge content and learning and diffusion (see Table 1). It is possible to assess any activity using this approach to determine its innovation characteristics. This approach to innovation values a 'grassroots, inclusive' perspective, whereby marginalised groups are active agents of change and innovations have a strong footing in the informal sector among complex sets of economic, social and political aspirations of those involved. Innovation that is designed to be inclusive focuses on improving the living standards of the poorest, in particular their health and nutritional status (OECD, 2012), through providing solutions for this group, encouraging entrepreneurship and economic activity. Leach et al. (2012) mirror this approach: for them, transformative innovation needs to recognise grassroots innovation actors and processes within an inclusive, multi-scale innovation political process.

Table 1: Five characteristics of an innovation

Newness	An innovation is an **idea, practice or object that is perceived as new** by an individual or other unit of adoption.
Adaptation	**Imitating or adapting from other efforts** at problem-solving, blending together.
Interaction	**How interactive the innovation** is with the people using it is very important. The degree to which an innovation fosters collective action, and potentially building links and networks for the community that will strengthen it.
Knowledge content	An innovation may bring **new knowledge and understandings** of **why** it is important to change existing processes **as well as how** to do things better (through doing, using, interaction).
Learning, scaling-up and diffusion	Learning can be kept specific to the individual innovators or can be scaled up and disseminated. The process of this is variable, innovation uptake can be designed or happen through existing social networks and 'natural' uptake, and can be assessed for its social inclusivity and effectiveness.

Source: Adapted from Rogers (2003) and Cozzens and Sutz (2012).

2 In our review of innovation frameworks, we found that many innovation approaches dealt explicitly with business and technology applications of innovation, entrepreneurship and growth (e.g. Nesta innovation foundation). Related to this, a commonly used '4Ps' approach developed by Bessant and Tidd (2007) categorises innovation as directions of change in Product, Process, Position (context of the innovation) or Paradigm (mental models framing innovation introduction). More recently, the ALNAP Humanitarian Actions Innovation work emphasises the political context of innovation, using this 4Ps approach. Others are more tailored to Africa and agriculture. For example, the Montpellier Panel (2013) considers successful innovation for sustainable intensification in Africa to require a combination of Multiple Benefits, Partners, Approaches and Scales, and has assessed a set of potential innovations relating to this. However, of the frameworks available, the Cozzens and Sutz (2012) approach is most appropriate for this programme, given its explicit focus on inclusiveness and grassroots community-level innovation.

2.3 Five case studies of BRACED, and how they innovate

The five case studies cover a range of activities, from those that deliver climate and weather information directly to farmers through radio and phone messages, through to training in more appropriate farming techniques and supporting households more broadly by improving the financial and savings services available to farming communities.

The projects and their innovations are described below:

1. **Conservation agriculture,** The BRICS project in Chad and Sudan, working in partnership with the World Agroforestry Centre (ICRAF), focuses on innovations of conservation agriculture, among its wider project activities. Conservation agriculture typically aims to reduce tillage, create permanent soil cover and diversify crops, growing them together in association or by rotation. The project discussed a number of techniques with farmers and then selected a series of lead farmers and farmer students, rolling out a series of innovations in demonstration fields as a result. Building on a previous project that involved training farmers, BRICS added another 60 lead farmers in Chad to make a total of 130 trained, of whom 16 (12%) are women; an expected total of 900 student farmers are to benefit this year. In the project in Sudan, 11 lead farmers have been trained since 2016, of whom 2 are women (18%); an expected 56 student farmers are to be trained during 2017 (Degrande and Benoudji, 2017).

2. **Participatory scenario planning.** Strengthening Resilience to Social and Environmental Shocks (Projet de renforcement de la résilience contre les chocs environnementaux et sociaux, PRESENCES) has developed an interactive, multi-stage participatory scenario planning in the highly climate-vulnerable Niger. The project is based in Tillaberi, with a target group of beneficiaries of just under 450,000 people (see Hama Hama and Issoufou, 2017, for full detail). Based on previous experience with the Adaptation Learning Mechanism in scenario planning, this innovation introduces seasonal forecasts and agricultural technical advice into farmers and herders' planning processes for their year. Droughts, floods, pests and diseases are increasingly common in Niger's rain-fed farming and pastoral activity, causing huge risk in this agriculture-dependent nation. Communities and individuals work closely with technical staff to integrate understandings of seasonal forecasts, climate risks and long-term change with farmers' experience of climate change. This informs planning and farm activities. Degraded land may be rehabilitated through structural works such as zaï pits, and yields and soil improved through improved seeds, intercropping, using organic manures and avoiding flood risk zones.

3. **Mobile information and training.** In Mali, Strengthening Community Initiatives for Resilience to Climate Change (Renforcement des initiatives communautaires pour la résilience aux extrêmes climatiques, RIC4REC) developed a project to use mobile phones to provide weather and climate information to farmers to support short – and medium-term agricultural planning (Traore et al., 2017). This builds on experiences elsewhere in Africa to date (see CCAFS, 2015 and Nikoi et al., 2016) and on the rapid increase in mobile phone penetration

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Radio training for broadcast, part of the Zaman Lebidi Internews community radio activities

to about 24 million in Mali by 2014, and an estimated 143 active mobile phone SIMs per 100 people in 2016 (AMTRP, 2014, quoted in Traore et al., 2017; BuddeComm, 2017). The RIC4REC project fostered a public–private partnership with Sandji SMS through Orange Mali for meteorological data and Senekela for agricultural guidance for about 5,000 farmers. Mobile phone platforms have an interactive user interface to check the accuracy of prediction information provided to the recipient. Subscription is free, with information and texts paid for. In each community, based on an existing network of community facilitators, RIC4REC trains 10–20 users (total 1,501 trained in Sandji and 2,865 trained in Senekela as of September 2017). These users then disseminate the system further (Traore et al., 2017).

4. **Village savings and loans associations.** The innovation in focus from SUR1M (Scaling Up Resilience for 1 Million People in the Niger River Basin) is village savings and loans associations (VSLAs), which are small-scale savings groups now well known across the world for their impact in terms of improving the financial situations of marginalised and poorer groups. In Niger, the communities involved in the programme have not had access to this before; the approach also innovated by creating a self-sustaining privately funded system of private 'agents' who can then spread this innovation elsewhere independent of external support. The methodology and process of this group is described in Ali et al. (2017). In addition to the normal VSLA training in financial and business management, members and extension agents for the VSLAs are trained in climate-smart agriculture, potential crop and livestock value chains, early warning systems and responses. Access to credit in emergencies is important in the first instance to build resilience to climate change. Other activities are aimed at building adaptive and absorptive capacity (see Box 1 for further detail).

5. **Community radio.** Finally, the Zaman Lebidi project in Burkina Faso uses existing community radio networks to spread information about climate change that is relevant for farmers. As part of this process,

NGO Internews trained and provided ongoing coaching to radio producers in climate information and understanding to develop their own inputs into existing programmes, rather than just adding in stand-alone programmes to schedules. This is to ensure greater uptake and sustainability of this investment (Victor and Segda, 2017). Partnering with the national meteorological agency (ANAM), the project disseminates information through local radio. It also sets up groups of listeners in communities who can discuss and interpret information in their local language. The farmers are expected to integrate this information into their farming activities. Eight community radio stations and the National Radio of Burkina Faso (RTB-Radio) have been involved; programmes reach an estimated 1.3 million people in Burkina Faso's rural areas.

These innovations have demonstrated a mixture of characteristics of innovation – the most frequent being introducing the innovation into a new geographical region; adaptation, improvement or introduction of new technologies and organisational approaches; and new knowledge of climate and weather being integrated with existing knowledge through training. Frequently, existing groups have added new partners into the innovation practice (e.g. private sector companies or government bodies such as the meteorological offices) (see Table 2).

2.4 Approach to the study

The BRACED programme is one of the largest publicly funded programmes to date aiming to build resilience to climate in rural areas of developing countries, providing an opportunity to examine what can be effective and how. Several BRACED projects have chosen to examine impacts of specific new activities over the course of one to two years. The main questions of interest include:

1. How can interventions best be designed and implemented that will improve resilience to extremes of climate and long-term climate change in vulnerable communities?
2. What complexities or trade-offs arise around specific innovations that planners should be aware of in future?
3. How can we best measure how effectively innovations improve resilience?

In reflection and writing workshops held in 2015 and 2017, project staff reflected on changes that had occurred, to understand drivers of these and links to building resilience to climate change within their communities. The cooperative write-shop process approach, brings together the authors of each case study across the groups, for four to five days of intensive writing, with review, feedback and discussion, and group and peer learning as part of the process. More details are available in Grist and Harvey (2017, p.9).

Project-level monitoring and evaluation (M&E) baseline and activities data, supplemented with individual interviews

Table 2: What is innovative about the case studies?

BRACED PROJECT NAME/COUNTRY	INTERVENTION	WHAT IS INNOVATIVE ABOUT IT?
BRICS Sudan and Chad	Conservation agriculture	**Newness, Adaptation and Knowledge:** Co-developing improved and new techniques for agriculture **Interactions:** Focusing on low-cost and participatory approach (interactions)
PRESENCES Niger	Participatory scenario planning for crop and livestock farming	**Newness:** Users receive forecast information **Interaction:** Users plan together with advisers about their response, building trust and choosing from a set of possible activities **Knowledge:** Local knowledge is integrated with scientific knowledge
RIC4REC Mali	Telephones as tools for distributing accurate climate information and farm advice	**Newness:** New to this geographical area **Adaptation:** Using new technology, tailoring information in local languages, interface design that can get responses **Interaction:** Users interact and test to information's accuracy (forecasts); direct information from agricultural experts by text **Technical knowledge** tailored and adapted: Information provided responds to specific questions from the user **Partnerships** developed between private companies and government meteorological services and extension agents
SUR1M Niger	Savings and credit scheme at local level (VSLA)	**Newness:** Introducing local savings groups to regions **Interactions:** Increasing social capital and networks; members choose the VSLA structure and rules; decisions are made by the group as a whole **Knowledge and Uptake:** Leaders are trained to spread these groups privately from within, ensuring sustainability
Zaman Lebidi/ Internews Burkina Faso	Integrating Climate Information into Community Radio	**Newness and Knowledge:** Integrating climate information into local language radio programmes; weather forecast information is relayed by satellite to regions in a creative use of technology (SMS-IVR Platform) **Interactions:** Clubs of listeners discuss programmes and actions to take; developed public–private partnerships **Knowledge:** Training broadcasters in climate information

Source: Individual BRACED Innovation Case Studies 2017. See References for full list.

with project beneficiaries and local staff, provided details about the progress and effects of the intervention.

During the two write-shops, project staff presented initial thoughts and findings, with several rounds of discussion and feedback from other staff from other projects in the consortium as they revised and updated initial versions. These discussions enriched understandings across the projects, in addition to enabling learning and sharing about the nature of resilience and how projects were measuring it and drawing links from activities to resilience-building.

In the second round of write-shops, project staff noted that some activities had been slower to implement than originally expected. In addition, some of the interventions (such as conservation agriculture) have a long lead-in time to impact. This means that, at this stage, many of the conclusions related to resilience are indicative rather than robustly tested, and more time is needed.

In studying how these innovations are being implemented, we examine progress to date and pick up on a number of issues highlighted by the case studies.

© PRESENCES field staff

PRESENCES participatory scenario planning

3. IMPLEMENTING INNOVATIONS

3.1 Results – implementation successes

Projects reported on a number of successes in terms of uptake of innovation, adoption by groups and impacts of these for improved outcomes on project goals.

RIC4REC's climate, weather and technical agricultural information has improved yields and enabled better use of available labour and families to save money on hired labour in Mali.

Farmers in many cases have access to seasonal and daily forecasts via their phones for the first time with this project. Initial reports suggest they are responding to predictions of seasonal rainfall with changes in crop choices or planting areas: high rainfall prediction means water-intensive crops can be planted, like maize, and avoiding floodplains; low rainfall means planting more drought-tolerant crops.

Daily rain forecasts guide short-term activity choices. Rainless days are best for planting, drying grain and doing laundry, and for applications of pesticides on plants. One farmer described how he saved money on hiring labour on a rainy day:

'because I know people were not going to be able to work in the rain' (M. Tigana, in Traore et al., 2017, p.4).

Technical farm guidance has encouraged some farmers to make zaï pits (which improve fertility and water availability for plants) and change types of phytosanitary (pesticide) products used because their own ones did not work. One farmer said that this guidance for products for his hectare of cowpea planted:

'solved the problem and it saved my harvest' (M. Guindo, in Traore et al., 2017, p.9).

However, some issues remain about accessibility of information passed by mobile phone, discussed later in the report.

PRESENCES' interactive community scenario planning processes used meteorological data combined with local knowledge, and helped farmers save farm produce in situations of climate extremes.

Based on knowledge of the seasonal forecast as a result of the project, about 80% of farmers from Aman Bader village were able to save their crops from failure in a season of late-onset rains and poorly distributed rainfall by planting later, according to one participant. PRESENCES' community-based planning brings together both traditional and modern forecasting methods in communities, fuelling a longer-term process of collaboration between farmers and government institutions and non-governmental organisations (NGOs) working on climate forecasting and agricultural extension. Technical advice given alongside the seasonal forecasts has reinforced knowledge. Farmers have used further advice on land sustainability, organic fertiliser and improved seeds. Interviewees report that this has reduced potential losses from crops.

SUR1M achieved high levels of uptake of its village savings and loans schemes in the target population of women and men.

In 2015, SUR1M had 5,000 members in 215 groups, with a total social fund of about US$1,100 and cumulative savings of US$3,000. By 2017, this had risen to 1,700 groups, with 40,000 members; the aim is to reach 5,757,600 members by the end of 2017. Participation in the groups is predominantly (75%) female.

Early results report a positive impact on livelihoods. The VSLAs enable women to use money for emergency health costs, schooling and family needs (e.g. marriages, funerals), as well as for longer-term investments on the farm, such as for small livestock and in small business opportunities. Most (75%) of women interviewed in the mid-term project review consider that their financial dependency on men has reduced as a result (SUR1M, 2016, in Ali et al., 2017).

BRICS' conservation agriculture programme found significant increases in knowledge of some conservation agriculture techniques, according to qualitative interviews and mid-term review data.

Few quantitative data are available, and qualitative responses are the best information to date on the progress of this project. Cereal crops yields increased after sesame was grown in rotation, one student farmer noted (Degrande and Benoudji, 2018, p.6). Others noted that, if everyone practised conservation agriculture, yields would increase, and conflicts would decrease in the village because lack of food is the source of a great deal of trouble. In addition, conservation agriculture's practices of crop rotation reduce weed and plant disease. Some people see the importance of this practice in generating sustainable healthier fields for future generations.

Zaman Lebidi and Internews's partnership with local radio stations has been successful in integrating a broadcast of a weather bulletin in the seven regions twice a day, and additional programming on climate change occasionally.

The NGO Internews has trained 124 radio producers and reach 1,236,047 persons in the project area (CA-Zaman Lebidi, 2017). In addition, in an iterative process of problem-solving while implementing the innovation, they have produced a multi-lingual lexicon of weather and climate terms, and in 2017 partnered with a phone company to introduce a system of mobile phone-based text and voice messages on weather so that

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Training in zaï techniques, Djedide (Chad), BRICS project Chad and Sudan

information can still be passed to regions when they have electricity blackouts and limited access to internet.

3.2 Modification of innovations during implementation

In response to the first question, projects reflected on how best to design and implement activities to be effective. Flexible approaches to design and implementation are very important, as demonstrated by two examples.

Within the **BRICS consortium in Chad and Sudan**, a conservation project was set up, building on experience from a similar project in one of the sites. The programme had already made recommendations for more farmer engagement in the process. BRICS set up farmer field trials and a method of farmer-to-farmer learning, with farmer 'trainers' and pupils responding to this (Degrande and Benoudji, 2017). Interviews with farmers showed an improvement in knowledge and techniques, with changes in some practices for minimum tillage and crop rotations.

But, even with ongoing reflexive modifications in the project, there have been several major limitations. Not enough manual labour is available for conservation agriculture tasks, especially when food is scarce, when people leave to look for paid work. Farmers do not invest in tools or seeds, and a broader lack of personal security in a conflict or post-conflict situation limits their desire to invest in long-term approaches of more than one season. BRICS extension staff noted a gap between training and practising – even if some farmers have received training, they may not implement this in their fields. A few farmer leaders have left the project, meaning retraining is needed of others.

Regarding measuring of improvements, staff noted other limitations. Visits planned by technical staff and oversight by the NGO are not always possible during the rainy season. Project staff have not measured yield differences between conservation agriculture plots and other plots, owing to lack of technical knowledge and excess work responsibilities. A longer timeframe of more than one season is needed to check impacts on yields. This has meant that hard data quantitative evidence of yield increases is lacking, owing to lack of measurement.

The radio programming of Zaman Lebidi in Burkina Faso also innovated through the project. Some people were experiencing difficulties in receiving radio programmes, as a result of frequent load-shedding of electrical power in certain regions and limited access to the internet. So, in June 2017 Zaman Lebidi developed a platform for SMS text and IVR delivery on climate and weather information. Local weather agents are trained in coding and use of the technical terms and laymen's terms for weather events, using a Lexicon translating these between local languages and the national language. Those who are illiterate receive verbal recorded messages in their local language. Texts and voice messages are sent to 1,200 agents, who disseminate this information to about 1 million people (Malick and Segda, 2018 estimate).

3.3 Inclusivity of process and outcome

'Social inclusion is defined as the process of improving the terms of participation in society for people who are disadvantaged on the basis of age, sex, disability, race, ethnicity, origin, religion, or economic or other status, through enhanced opportunities, access to resources, voice and respect for rights. Thus, social inclusion is both a process and a goal' (UN, 2016).

Projects can be focused on improving social inclusiveness in two areas: the outcome (reducing gender and social inequalities and not increasing income disparities in local communities, for example) or the process (ensuring empowerment of marginalised groups in the process of implementation). These case studies reported on the inclusion of marginalised groups in the process of implementation, and not the longer-term outcomes.

Within the BRICS conservation agriculture project in Chad and Sudan, a qualitative, multifaceted vulnerability indicator was used to identify potential beneficiaries of the project (see Degrande and Benoudji, 2018 for more detail). Very few of the farmer trainers selected were women (16/130; 12%). Direct participation of women as farmer trainers was limited as a result of their illiteracy and their not owning a phone; youths were sometimes included because of their higher literacy levels, but in this area many young men leave for gold mining work. Interviewees reported that male heads of households communicated information within the family. Meanwhile, among the farmer student group, women formed the majority – more than 70% of the participants on paper and reportedly more in practice, as women attended the training signed up for by male household heads (Degrande and Benoudji, 2018).

For similar reasons, the RIC4REC project in Mali acknowledges the limitations of broad social access to weather information and agricultural services through phones: many women cannot read in the communities and do not own mobile phones, and are therefore dependent on male heads of household for dissemination of information. In addition, because people have to pay for this service, it is not easily available for the poorest. RIC4REC recommends that government subsidise this to make it free of charge for the poorest, and use a variety of information dissemination methods to catch others in the community, such as voice messages, local radio and word of mouth.

The village savings and loans project of SUR1M in Niger focuses on 40,000 poor people, 75% of whom are female. Many interviews suggest significant early benefits, with lower financial dependence on men if women are involved. The VSLA is expected to reinforce community cohesion, although Weitgärtner and Pichon's (2017) work suggests this is not such an obvious conclusion; they found in a separate study of Tearfund's approaches in Ethiopia that these self-help groups empowered female members financially, socially and politically but did not transform gender-based power relationships within households or the wider community. Low literacy levels still limit involvement, reducing the number of people who can become extension agents and secretaries for these groups. This creates an ongoing dependence on the SUR1M project itself to manage the group financially until others can fulfil this function.

Within *Zaman Lebidi's radio production and SMS project in Burkina Faso*, women comprised just under a third (29%) of journalists trained in the radio production. In June 2017, 33 women were receiving SMS text messages and 63 women were receiving voice messages about weather and seasonal changes in climate.

The *participatory scenario planning process of PRESENCES in Niger* involves farmers in bringing together existing local knowledge and external meteorological information. The householders in the region are mostly extremely poor.

What becomes clear across this range of innovations is that education and access to technical tools are critical limiting factors in women's participation, knowledge-sharing and leadership. Engendered cultural norms play a further role. Projects have long worked with illiteracy in these areas, and transforming innovations into useful information accessible and actionable by these populations is a further step in local-level tailoring needed.

From this range of examples, given the current data available, it is not possible to comment on the impacts of this group of innovations on income disparities in the recipient populations. While all of them could be said to be 'inclusive' in the widest sense that they are working with the poorest people, it is more difficult to tease out whether these people have been empowered to effect change in traditional or customary decision-making practices, in government policies and in other spheres of potential influence as a result of these project activities.

3.4 Four elements of successful implementation

A few lessons are important for these innovations to be successful:

- **Getting the right information:** Local geographic microclimates and limited weather station data in some rural areas make accurate prediction very difficult in some regions. In practice, a project that provides inaccurate forecasts for scenario planning could risk fostering maladaptive practices in some cases.
- **In the right format:** RIC4REC found that provision of text messages was a significant barrier, given low levels of literacy of the target population. Voice messages would be a welcome additional medium; in addition, dissemination at village meetings, mosques, markets and fairs and through local radio is recommended.
- **At the right time:** At critical times in the farming season, a one – or two-week delay on externally produced information creates big problems for farmers. Information takes time to process and translate into the relevant local languages. If this process is not fast and well coordinated, information becomes useless.
- **Realising that information alone needs agency to make changes in actions:** There is a gap between receiving information, processing information and applying it in daily life. As is the case in many development projects, some people do not enact changes immediately after training, for a variety of reasons. The poorest often find it hardest to change behaviours, owing to lack of financial capital or time – in a tough season, family members may even have to migrate for work outside, and so cannot invest time in their farms at all. Projects staff need to be realistic about

potential uptake levels in communities. Conservation agriculture techniques have a record of very limited take-up in communities, for example, and projects need resources to understand why this is, and to modify approaches or targets and investments accordingly (Meijer et al., 2015).

4. INNOVATION TO BUILD RESILIENCE

Building resilience requires a combination of effective implementation, economic sustainability and streamlined partners. Beyond that, it is essential to understand what kind of climate resilience is being aimed at – to short-term extreme events (and what, exactly) or longer-term climate change. Each of the projects focuses on vulnerable populations, but timeframes vary on implementation and how quickly the intervention will lead to impact. In addition, their ability to effect deeper changes in societies varies.

4.1 Streamlined partners and service functions

All of the projects needed good planning and execution. With a range of partners, some of them newly working together, or being brought to work with communities for the first time, learning new skills, successful delivery is demanding.

For example, the *PRESENCES scenario planning project* needs ongoing funding; the national meteorological agency to process and provide relevant information in a timely fashion; skilled extension workers; and excellent facilitators and champions of change who speak the local languages and are trusted within the communities.

New partnerships between NGOs, the private sector and government are tricky to negotiate, and can take a long time, or may not work at all. Both RIC4REC and Zaman Lebidi invested considerable time in developing these partnerships – and, as new partnerships, they need time to resolve initial issues and to work smoothly. In many of the countries, personal networks are an essential element for effective implementation; with few links in many cases between the formal private sector, national government and NGOs, and in some cases some animosity, this can slow project progress. Good partnerships in these cases have involved negotiating the interests and priorities of the organisations involved; obtaining government sign-off and support for works planned; and finding common ground within the aims of the project.

4.2 Economic sustainability

Given the wider global constraints on adaptation and development funding available, the financial sustainability of any project is an important consideration for its long-term effectiveness, both in the direct recipient communities and for its wider dissemination.

PRESENCES' participatory scenario planning project is not financially self-sustaining; there are relatively high transaction costs to the delivery and processing of this information. The *conservation agriculture project of BRICS* also needs continuing financial support, although farmer trainers have committed to training their fellow farmers in the new farming practices, even after the project ends, so the impacts of the training may be significant post-project.

However, two projects sought to tackle this issue directly.

First, SUR1M's *VSLA savings project* has encouraged savings of approximately US$126,000, with US$94,000 currently in use, generating a reported net benefit of US$31,000, a profit rate of 16.8% (Ali et al., 2017, p.8). This high rate of internal profitability alongside rapid benefits to participants means the project has generated strong interest. The extension agents support the creation of these groups, and receive fees or stipends as incentives for this. While profit-making enables engagement, it also constrains it within some groups: among some of the local Muslim population, interest-earning is not allowed from money-lending activities (ibid., p.11).

Second, the *RIC4REC project* provides weather information and farm advice on pay-per-use through a public–private partnership. Demand for the weather texts has continued from several producers either individually or collectively since the grant and project funding ended. This is despite limitations in uptake that are a result partly of cost, as well as issues related to phone ownership, energy access and literacy. Traore et al. (2017) consider that stronger collaboration and support for the system from government could enhance its dissemination and sustainability further by reducing costs to the user, through making some numbers free of charge to marginalised areas or vulnerable populations.

4.3 What kind of climate resilience?

BRACED's framework defines the process of strengthening resilience as increasing the anticipatory, adaptive and absorptive capacity of groups and individuals that are vulnerable to the impacts of disasters and climate change, and by catalysing transformations in policy and practices. The innovations described in this paper contribute to certain aspects of resilience-strengthening in knowledge, decision-making processes, capacity-building and partnerships.

PRESENCES' participatory approaches to planning using climate scenarios develop adaptive capacity, and anticipatory capacity of climate change. Farmers have improved their decision-making and anticipatory capacity through receiving information before the rainy season. People start to understand climate risk through these discussions, and may choose to take action based on this. Potentially, in time, communities may increase absorptive capacity by increasing food security and incomes through better yields on farm, processing and selling non-timber forest products, investing in cereal storage banks. This helps them smooth consumption. However, there is little hard evidence of this to date.

In the BRICS conservation agriculture project, households' capacity to adapt to climate change is improved, with conservation agriculture and agroforestry techniques offered as options, including rotation practices, pest control, composting and tree management.

Alongside the introduction of drought-resistant varieties of maize and sorghum in 2016, farmers reported increased farm yields, household food security and household incomes.

Households that plant trees as part of the agroforestry options find their land more able to withstand extreme events and reduce erosion, and have other products and food supplements available as a result (Degrande and Benoudji, 2017).

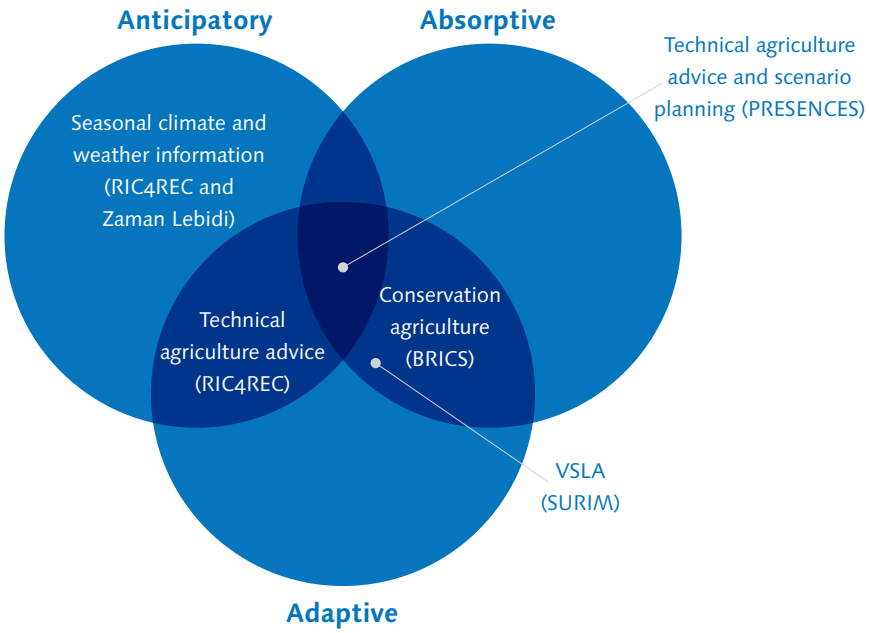
Zaman Lebidi's community radio innovation aims to strengthen the capacity of farmers to adapt and respond to anticipated weather events and climate change. Learning and understanding weather forecasts allows farmers to plan their daily activities and seasonal planting. In the longer term, beneficiary communities will increase their knowledge of climate change, alongside national-level partnerships developed with the UK Met Office and Burkina Meteo, which increases the staff's ability to produce regionally appropriate forecasts.

RIC4REC has used telephones as tools for distributing climate information. Project staff point out that data at this stage are 'largely anecdotal and inconclusive' about changes in users' behaviours based on seasonal and short-term weather information received. Farmers have developed capacities in the use of the information platforms and accessing technical advice. Results to date show that participating farmers who have responded have saved money, harvests and their own households' time through changing behaviours relating to daily and seasonal rainfall predictions. Their capacity to anticipate climate seasonal events and short-term weather events has clearly improved in the examples given. Longer-term farm changes such as building zaï pits for soil and water conservation demonstrate adaptation to climate change based on agricultural technician advice from the Senekela platform. Alongside this, new partnerships foster a potential longer-term result from the initial investment.

Finally, the VSLAs promoted through the SUR1M project have helped strengthen the absorptive and adaptive capacity of members. VSLAs improve financial capacity and empower women, and foster leadership in agents who will take forward further groups. They increase adaptive capacity through asset-building, savings mobilisation and credit availability, for use in access to climate information, animals, crops or other off-farm or on-farm businesses.

In addition, VSLAs increase absorptive capacity because savings can be made available for emergencies, and building up livestock and crop production through the VSLA increases people's ability to withstand climate shocks. There are still risks involved: in an emergency, a large withdrawal of cash from members may hobble the group.

Figure 2: Anticipatory, adaptive and absorptive resilience building in the innovations



Some of these projects will continue into a second phase from 2018 onwards, allowing for further M&E in the next two years.

4.4 Transformation from the innovations

While innovations are developed in a specific place, transformation is the process by means of which these innovations get scaled up, or bring about changes in social relationships, or become integrated into a new institutional framework. Leach et al. (2012, p.1), with examples from dryland Kenya, claimed that innovations for sustainability needed to give 'far greater recognition and power to grassroots innovations actors and processes'. Within the auspices of these relatively short 'grassroots' projects, it is not possible to conclude that they have fostered transformation to date. However, significant elements that lay the groundwork for a much wider change are noted within some of the projects already:

- **BRICS** reports little clear evidence of transformation to date owing to the relatively limited human and financial resources currently made available to support the farmer leaders and their students in their conservation agriculture efforts. However, several local NGOs have been monitoring progress with interest; this may provide a significant step change in uptake if these NGOs decide to support these approaches in their own work, scaling up these innovations through broader project programming.
- **RIC4REC** notes that its '[phone-based] innovations are still in an early stage of introduction' (Traore et al., 2017, p.11). However, these approaches are pioneering in Mali after introduction from other countries in West Africa, and with high levels of mobile phone penetration in Mali now there is a significant possibility that phone-based weather information and tailored advice could be an extremely useful, widespread innovation, allowing a large number of farmers to access vital information for decisions.

Despite the paid nature of the product, RIC4REC notes a spontaneous dissemination trend at the community level, with communities seeing telephone devices as 'a tool to build resilience' (ibid.). National TV advertising campaigns plus local development companies and NGOs are triggering a process of transformation, but the project has not documented this officially to date.

- With some similarities to **RIC4REC**, **Zaman Lebidi/Internews** is introducing a new medium for the transmission of weather and climate information though the radio and mobile phone rather than the television, democratising and decentralising access, making it much more available to a large number of people. It is possible that, in the next decade, the availability of this weather and climate information may radically improve the lives of many rural people in the country, given the wide scope and reach of the radio to many communities. This trend needs to be monitored over the next few years.
- **PRESENCES** builds on momentum from the Adaptation Learning Mechanism of 2012, with its participatory scenario planning for disasters and climate change. This is starting to embed weather information processing at government level, which, with further support, may be transformative if this can be taken more widely across regions in Niger. Anecdotal reports suggest significant improvement in farm yields at community level, but the transformational potential of this is still in its infancy.
- Finally, even in its early days since 2015, **SUR1M** considers the VSLA system potentially transformational. A total of 80% of beneficiaries think that women's investment strategies are improved as a result of VSLAs and financial training; the high rates of profitability are generating significant interest among communities and extension agents. Some groups are using their credit to buy crops when they are cheaper and to resell them when prices get higher to generate more revenue. How this transforms farming lives through increased incomes and more financial stability will be seen later.

5. IMPLICATIONS FOR FUTURE RESILIENCE PLANNING

This action research project set out to investigate the following questions:

1. How can interventions best be designed and implemented that will improve resilience to extremes of climate and long-term climate change in vulnerable communities?
2. What complexities or trade-offs arise around specific innovations that planners should be aware of in future?
3. How can we best measure how effectively innovations improve resilience?

Innovations have included methods of information-sharing, improving financial and social capital, improved planning and participation and technical advice and farm training for climate resilience. In their contexts, all of these are able to positively influence the climate resilience of the populations.

Marginalised groups will benefit from these innovations if tailored to their needs. But this is context-specific, and adjustments are needed throughout.

In examining innovations that range from early warning information systems to savings and loans groups in the Sahel, we found several lessons learnt that would be applicable to all innovations in these regions.

5.1 Building resilience – the design of appropriate innovations

Several points about the design of appropriate innovation were revealed that reflect back on the first two questions posed during this study:

1. **Finding the innovation 'sweet spot' of right time and right place.** An intervention may have a time-specific opportunity in a country or region. In Mali, the recent rapid spread of a mobile phone network is enabling an opportunity for tailored forecasts to share information that has long been present in well-serviced Kenya. Conservation agriculture projects have only recently been brought back to southern Sudan, because of post-conflict issues related to land tenure and safe access for project staff. Culture and society and wider technology availability play a part in the process of implementing potential innovative interventions.

2. **Quality or quantity?** This question came out particularly in the BRICS work – whether it should focus on getting good uptake and results with a few farmers to achieve deeper, potentially longer-term, improvements or whether it should instead aim for superficial exposure to new techniques that farmers may or may not implement on-farm.

3. **Low-hanging fruit to whet the appetite?** Some projects showed some 'low-hanging fruit' available for innovation, where benefits could be obtained quite easily in the short

term. The BRICS project showed opportunities for an initial engagement through some seed provision and composting demonstrations beyond the more in-depth project, which would be relatively low in cost. The RIC4REC project channelled climate information to communities at low cost; some farmers continued this of their own volition and spontaneous uptake may occur.

4. **Strong support needed especially at the start.** Innovations needed strong, experienced support and assistance through these projects. Without this context-specific, technical knowledge and face-to-face support, we cannot expect that resilience to climate change will be built successfully in these regions, given the number of other constraints experienced in these vulnerable populations. Zaman Lebidi's approach of problem-solving throughout the project was exemplary, creating new products and responses as needed for the benefit of those involved to ensure the project activities could reach their outcome.

5. **Whose resilience are we building? Accessing the most vulnerable?** Several approaches may be needed, and adaptations to context over time, to access the most vulnerable. BRICS used a vulnerability assessment to identify participants, and SUR1M's participants are mostly female. RIC4REC's mobile phone innovation cannot be used by illiterate poor women, who depend on their household's male (phone-owning) members for this information source or to pass information between families.

5.2 Measuring the impacts of innovations

Within the current development climate, the focus remains on how to measure project impacts on resilience-building at community and institutional level.

Measuring impact from innovations is a challenge in developing countries, particularly when trying to effect changes that are context-specific. Comparing across them is not possible – a project for strengthening climate resilience will develop different implementable actions. The priority in one location may be accessing information about high-rainfall events and reducing risk of loss of livestock in a flood; in other places, it may be building storage so that cereal crops can be bought cheaply in the harvest season and stored for lean seasons. BRACED projects developed very clear sets of context and project-specific indicators, which reflect these differences.

For specific innovations, impacts on resilience-building can be hard to measure. Sometimes there are several assumptions or steps towards changed livelihoods. This is most apparent in the case of access to climate information through radio or SMS, where the assumption is that behaviours will change and livelihoods will be improved. It is very difficult to measure actual changes, and perhaps even counterproductive; anything beyond the basic flood warnings/rainy season onset predictors would require close monitoring over a number of years to note changes in yields and family benefits as a result.

An innovation with directly applicable measurable benefits may seem simpler to evaluate, such as conservation agriculture or participation in scenario planning to plan future farm activities. Projects need to measure changes in yield or in farmer behaviours. However, these changes cannot be measured sometimes due to various reasons including lack of capacity of project staff or lack of physical access owing to rains or regional conflicts and insecurity.

Thus there remains a tension between the needs of time-bound, activity-specific project evaluation for development partners and the needs of individuals and communities to be able to choose and develop a range of methods, capacities and activities that may increase their resilience to climate change.

5.3 Recommendations

In examining innovations that ranged from early warning information systems to savings and loans groups in the Sahel, we found a number of lessons learnt that would be applicable to all innovations in these regions.

- Understanding communities' needs and responding to these is critical to build resilience to climate change in the short and long term.
- People need options to choose what is best for them and their families in their specific context; prescriptive project activities limit choice and livelihood opportunities.
- Future projects should be clear on social inclusion aspects when aiming to build resilience – whose resilience is being supported?
- Projects need to have built-in flexibility in fragile contexts, with the ability to add in and modify activities throughout.
- Building on existing partnerships and experiences and keeping continuity in successful projects and dedicated staff is important; new partnerships outside existing sectors take time to develop and maintain and need further resourcing for this.
- Projects need to have long-term M&E in place beyond the project life when 'slow-impact' activities are implemented.

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