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Framing innovations for climate resilience for farmers in the Sahel

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For farmers in the Sahel, innovating and adapting to variable environmental conditions have been part of life for centuries. This paper examines innovative approaches that have been adopted in four BRACED projects to build resilience to current and future climate risks.



Competition for on-farm resources is high; millet straw can either feed goats or be used for mulch. Most farmers in Chad put their livestock first.

KEY MESSAGES

- Farmers have innovated for centuries, as part of dynamic, informal processes of learning and responding to change. Innovation is central to efforts to encourage both economic growth and social development in rural areas.
- A grassroots, inclusive 'innovation' may have one or more of five characteristics: newness; adaptation from other efforts; collective and socially cohesive interactions; application of new knowledge content; and new or improved learning pathways.
- Climate-resilient innovation involves integrating what we know about the current and future climate into the design of the innovation so people are more able to anticipate, adapt to or absorb the effects of climate change.
- Innovations in climate resilience include changing practices (e.g. technical aspects of farm production), economic innovations (e.g. credit access and savings schemes) and social innovations (e.g. participatory planning and access to and integration of climate information by farmers). This paper analyses four BRACED projects that adopt these types of innovations.
- Measuring how far a specific innovation has strengthened climate resilience is challenging. BRACED measures existing levels of climate resilience and vulnerability, and accompanies innovations as they develop and embed in communities. Further research will investigate these.

1. INTRODUCTION

In many countries, agricultural growth has the potential to reduce poverty and hunger. A large part of such growth owes to remarkable periods of innovation in farming practices. Among themselves, farmers innovate, and have done for millennia.

Both successes and failures in agricultural innovations have been documented in the past 25 years. But, as a whole, the successes have been overwhelming. Global agricultural outputs have grown 2.5–3 times in the past 50 years, and enough calories are now produced per capita worldwide for the human population (FAO, 2011). Farmer innovation, mixed with more formal research and



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A beneficiary practicing zai technique in Koiria Haoussa village, commune of Kourtey in Niger.

approaches to innovation, fostered the Green Revolution of the 1970s, and huge efforts were made recently as part of the Millennium Development Goals to reduce the proportion of the population suffering from hunger from 23% in 1990/2 to 15% by 2010/2.¹

However, with the global population due to rise from the current 7 billion to 9 billion by 2050, and food demands increasing in a wealthier world, the heat is not off – quite the opposite. Food production needs to increase by 70% on 2009 levels, and production in developing countries needs to almost double by 2050 (FAO, 2009). The bold second Sustainable Development Goal emphasises this: 'End hunger, achieve food security and improved nutrition and promote sustainable agriculture.'

The focus now is on developing and leveraging all forms of investment, innovation and creativity with rural farmers and with the institutions serving them. In Africa, the Comprehensive Africa Agriculture Development Programme (CAADP) is now in its second decadal phase (2015–2025) of encouraging agricultural investment across the continent. The UN Conference on Trade and Development's (UNCTAD's) 2010 Technology and Innovation Report, focused on food security in Africa through science, technology and innovation. The spirited Africa Progress Panel spearheaded a renewed focus on food security and agricultural investment in the region, calling for transformation in agriculture

¹ www.un.org/millenniumgoals/pdf/Goal_1_fs.pdf



Zai technique: a small planting pit that catches rainwater, filled with fertile organic materials.

in finance for Africa's Green and Blue Revolutions in 2014.

Meanwhile, an increasing number of institutions are promoting agricultural innovation at different scales, including many non-governmental organisations (NGOs), the World Bank, the Rockefeller Foundation and the UN: the International Food Policy Research Institute (IFPRI), the Food and Agricultural Organization (FAO), the International Fund for Agricultural Development (IFAD). This comes alongside new public-private partnerships, building on longstanding work of the Consultative Group on International Agricultural Research (CGIAR) centres, national universities and public and private research organisations.

There is no doubt that climate change poses a severe threat to food security and to the crops, livestock and livelihoods of farmers. With the accelerating pace of climate change, climate variability in the Sahel is increasing, creating new

challenges for farmers and the institutions supporting them as they modify and change their practices to thrive, or simply survive, in changing conditions. Farmers autonomously innovate to enhance resilience to a range of shocks and stresses (Bahadur and Doczi, 2015), but externally-supported innovation is often also critically important.

'Climate resilience' is now a term widely used and variously interpreted (Schipper and Langton, 2015). It is understood as a measure of people's ability to adapt to, absorb and anticipate climate change within the BRACED programme (Bahadur et al., 2015).

BRACED research on innovative farming – which this paper introduces – aims to answer the following questions; 'What kind of innovations promote climate resilience?' and, 'How can the development of, access to and uptake of these innovations by marginalised groups be improved?'

2. THE SAHEL: A HIVE OF INNOVATION

'Experimentation, exploration and exchanges by, and among farmers themselves, is possibly the most vital lesson learned from the Sahel' (Reij et al., 2009a, p.6).

Never has there been a more difficult time in the Sahel than now, given the combination of challenges facing the region's current population of 150 million people. Deep, endemic poverty, a demographic explosion that will see the region's population double in the next 20 years and violent extremism are creating refugees of millions of people. This sits within the broader environmental framework of a changing climate that is bringing with it more extreme weather events and a long-term change in the sedentary and nomadic farming prospects for the whole region. More than 30 million people suffer food insecurity – a fifth of the region's population.²

The climate is naturally variable, and much of the Sahel is drought-prone; in the 1970s and 1980s, lower rainfall caused drought and food crisis; higher rainfall in the 1990s improved food security. Land degradation and desertification are ongoing issues. Recent analysis found there had been a significant decline in natural vegetation in the past 40 years in the Sahel (Reij and Winterbottom, 2015), and climate change and increased climate variability are exacerbating this in the short- and long-term.

Farmers have found ways to maintain and improve farming conditions, using a variety of soil and water conservation techniques including

terracing, contour stone lines, Zaï pit systems³ for plants and small-scale irrigation systems. Modifications to farm and water management techniques to increase productivity have been a staple of Sahelian soil and water conservation programmes for the past 30 years (IFAD, 1992). In recent decades, scientists have brought an understanding of agronomy – improved nutrient and moisture management and plant and pest biology – to efforts to reduce land degradation and improve crop productivity. Technological advances have supported soil fertility maintenance, agroforestry practices and grass strips for soil conservation.

But many technologically focused projects have failed in practice, despite their initial promise. People have learnt that existing techniques that people have developed and used over the years are often very effective, despite some shortcomings. Even 25 years ago, institutions assessing programmes and projects working in this region learned that 'blanket solutions do not exist' in the specific social and geographical contexts of the Sahelian region (World Bank, 2011). Top-down efforts have often failed to meet the needs of the poor (World Bank, 2011). Some 'grassroots' approaches have been more successful – where farmers have been supported and have taken forward and expanded initiatives they have seen to be effective (see Box 1). More recently, innovations in social institutions and

² <http://reliefweb.int/disaster/ot-2011-000205-ner>

³ This technique is traditional in the Western Sahel. Farmers in drylands fill these 20–30 cm deep and long pits with manure to improve soil fertility and production and catch rainwater.

organisational networks, information availability and access have received more attention. Multi-stakeholder platforms like Prolinnova build partnerships in agricultural innovation, engage in regional

and national dialogues, assist in reflection and local innovation processes and enhance the capacities of those involved in participatory approaches (Prolinnova, 2017).

Box 1: Regreening the Sahel – innovation on a grand scale

In Niger, farmers have 're-greened' 5 million hectares of land since 1985. They have doubled and tripled yields in fields through farmer-managed natural regeneration and improved land and water management practices. Households have had better food security and incomes, wind erosion has reduced, soil quality has improved, more fodder is available for livestock and incentives to out-migrate have reduced. Many farming communities have sustainably adopted these practices over a long period of time. Important components in this successful innovation have included the following:

- Farmer innovators have been leaders of change.
- Farmers have adapted techniques to their own situation and objectives.
- Groups and village associations have been supported through collective action.
- There has been NGO technical support and government support.
- Stakeholder lobbying has guaranteed rights of access through a change in forestry policy.

Source: Reij et al. (2009b).

3. CLIMATE-RESILIENT INNOVATION IN FARMING

'Innovation is the process by which inventions are produced – it may involve new ideas, new technologies, or novel applications of existing technologies, new processes or institutions, or more generally, new ways of doing things in a place or by people where they have not been used before' (Juma et al., 2013).

In investigating climate-resilient innovation in farming, we need to define our approach to innovation, and also to understand how climate resilience is built in agriculture.

Innovation

Innovation is not the same as invention, although the two are often conflated. An innovation may be a very simple stepwise change to an existing system, or may create a deeply transformational change.

This change might be anticipated or unanticipated, planned or experimental.

Innovations can be grouped around three main areas, often with overlap:

- **Physical innovations:** New technologies to adapt and improve production within a changing environment, such as Zai pit systems, small-scale irrigation

and the physical infrastructures of post-harvest crop protection;

- **Economic innovations:** New methods of accessing finance or credit for farmers, like credit groups, electronic rural banking and social protection schemes;
- **Social innovations:** Organisational changes such as cooperatives and improved inclusivity in local and national decision-making that improve the livelihoods of farming communities.

Many organising frameworks for innovations exist, most originating from business and science and technology backgrounds. More recently, some of these have been modified to examine social innovations, including development and humanitarian innovations (e.g. the Humanitarian Innovation Fund). It has been found that innovation plays a fundamental role in growth and in addressing the socioeconomic challenges of health and poverty reduction (OECD, 2012). Innovations in the Green Revolution in India during the 1960s raised agricultural productivity and improved food availability for the poor. In low-income countries, innovation needs to respond to local conditions, whether it involves external or domestic technologies.

An inclusive approach to innovation can reduce gaps in living standards between rich and poor, particularly appropriate for rural poor farming communities (OECD, 2012). Typically, this involves a different *product* – a lower-cost or specifically developed form of the technology or social innovation – and a different *process* – grassroots entrepreneurship that brings groups into economic activities from which they were previously excluded. Within many poorer farming settings, this approach to innovation focuses on improving welfare and access to business opportunities through external or local knowledge using technologies or social innovation (see Table 1).

Cozzens and Sutz (2012) propose a framework that focuses on informal dynamic settings, with an emphasis on 'grassroots', socially inclusive, processes. This corresponds well with the Sahelian farming context, challenges and changes over the years, as well as the BRACED programme's approach of focusing on the most vulnerable groups.⁴

Innovations in agriculture have an inherently political aspect in their development, dissemination, wealth generation and marginalisation. 'Inclusive' approaches to innovation should be (in simplified terms) socially inclusive in terms of the process, and the problems

4 In our review of innovation frameworks, we found that many innovation approaches deal 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 assessed a set of potential innovations relating to this. However, of the frameworks available, the Cozzens and Sutz approach is most appropriate for this programme due to its explicit focus on inclusiveness and grassroots community level innovation.

Table 1: Mechanisms of innovation in developing countries

COUNTRY CATEGORY	MECHANISM/ OBJECTIVE OF INNOVATION	TYPE/SOURCE OF INNOVATION	MAIN AGENTS INVOLVED	EVIDENCE/ EXAMPLE
Developing/ low-income countries and emerging and middle-income countries	Adoption requires adaptation: Innovation needs to respond to specific 'local' conditions for outcomes.	Incremental innovation based on foreign innovations and technologies.	Universities and research institutes, leading private businesses, especially those with exposure to foreign markets and businesses.	New plant varieties for agriculture. Efforts at developing methods for mineral extraction in the Chilean copper industry to satisfy local needs.
	Inclusive innovation: For/by low- and middle-income households to improve welfare and access to business opportunities.	Incremental innovation based on foreign technology and/or local, traditional knowledge generated 'out of necessity'. Social innovation helping introduce technical innovations in communities.	NGOs, small firms, public and private associations engaged in disseminating knowledge via networks, private, often large businesses.	India (nano cars; grassroots innovation). Mobil baking services.

Source: Adapted from OECD (2012).

and solutions to which they are related (Heeks et al., 2013).

In the BRACED programme, using this 'inclusive innovation' approach, we define innovations according to five characteristics of innovation, based on Cozzens and Sutz's framework, that are important in the informal, dynamic settings of most small farmers.

Climate resilience in agriculture

Climate resilience is often understood as the capacity to absorb, adapt and anticipate climate-related shocks and stresses (Bahadur et al., 2015). An approach called 'climate-smart agriculture'

has gained traction since 2009, promoting adapting and building resilience to climate change alongside increasing agricultural productivity and incomes, and reducing greenhouse gas emissions where possible.⁵ The aim is to support development and ensure food security in a changing climate.

Climate resilience in farming goes beyond on-farm adaptation techniques such as conservation agriculture, agroforestry and irrigation and improved use of climate information for seasonal farming decisions and severe weather event response. A broader range of interventions includes government policy and planning that integrates climate change considerations

⁵ www.fao.org/climate-smart-agriculture/en/

Table 2: Five characteristics of innovation

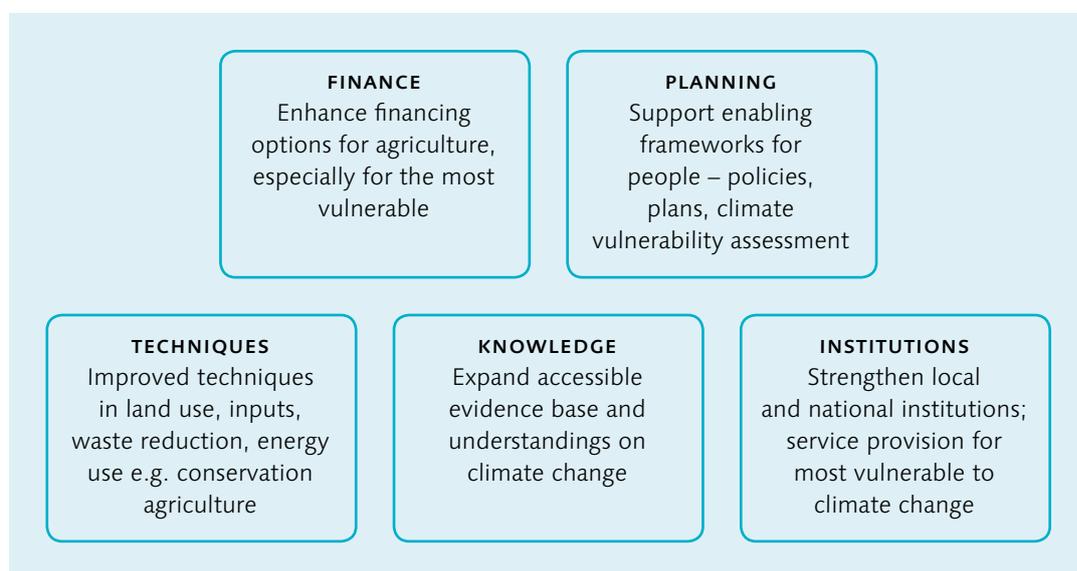
NEWNESS	An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption.
ADAPTATION	Imitating or adapting from other efforts at problem-solving, blending together.
INTERACTION	How interactive the innovation is with the people using it is very important. 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).

into agriculture, forest and infrastructure programming and social provision for the most vulnerable as part of building resilience to climate change (FAO, 2017).

These are considered fundamental building blocks of climate smart agriculture (see Figure 1).

Figure 1: Building blocks for climate-smart agriculture



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

4. TRACKING INNOVATIONS ACROSS BRACED PROJECTS

'People have been experiencing challenges like climate extremes for a long time,' said Melq Gomes da Silva, BRACED Coordinator in South Sudan, where 4.6 million people are in need of humanitarian aid. So they've already come up with ways to adapt, such as swapping crops in times of drought or, more drastically, leaving their homes. In places like South Sudan, resilience isn't about big ambitious programmes – it's the small victories' (Tabary, 2017).

BRACED projects aim to improve resilience of poor and marginalised populations to climate-related shocks and stresses (Silva Villanueva et al., 2016). Over 3 years, 15 projects are implementing a series of resilience-building interventions in some of the poorest regions of the Sahel, east Africa and Asia.

The process of innovation involves recognising a problem, creating a solution and practical actionable plans and guidelines and implementing and disseminating the innovation. However,

this process is not linear, and tracking innovation is often complex. Innovation processes are open, with many unexpected changes – an innovation includes iterative learning and impact, is user-driven in nature and leads to a step change or improvement in relation to current practice.

Because of the complexities involved in tracking innovations, researchers are working closely with BRACED project teams to gain insights into their design, development and processes of uptake.

Box 2: Methodology for research

Following an initial round of research and analysis, four BRACED implementing partners, along with members of the BRACED Knowledge Manager team, took part in a writeshop to reflect on the projects' innovations.

Participants discussed the definitions of innovation, and criteria as to how their activities were innovative. They also considered how their activities might be expected to build resilience, and the limitations and opportunities involved in this process. Group and peer learning was integral to this process, and enabled rich discussion around innovations and resilience with the team members involved.

Four case studies were produced, outlining the approaches to resilience-building through the innovations highlighted.

A second writeshop has been planned for July 2017, to which the implementing partners will bring results and analysis from the first two years of implementing the innovations, and to consider impacts of the activities, and how they have, or haven't, built community resilience as part of wider project activities. They will also present lessons learnt on inclusive innovations at the community level. Data gathered during the project's activities will be supplemented with interviews and 'action research' approaches during project implementation.



Farmers changing practices for improved soil quality. Although there is demand for harvest residues to be used for other purposes, some farmers try to leave stalks in the fields as mulch.

The BRACED programme considers that climate resilience can be built through tailored, climate-specific changes in:

- Knowledge and attitudes;
- Partnerships;
- Capacities and skills; and
- Decision-making processes.

BRACED has developed methodologies to gauge improvements on these four indicators related to whether households or populations are more resilient to the effects of a changing climate. Innovations identified within the BRACED programme are part of the broader set of project activities that are designed to improve resilience within target communities.

Four BRACED projects are involved in this research; Zaman Lebidi, SUR1M, BRICS and PRESENCES (see more

about the projects on page 20). Each one chose one innovation, or set of innovations, from their project to illustrate new approaches.

To date, these four projects have each produced a case study assessing how they understand their innovation and how they are monitoring its progress and influence on resilience-building through the course of the project (see Box 2 for methodology). The next section synthesises key points on understandings and drivers of innovation. We also reflect on how to measure impacts on resilience for the communities involved.

5. CASE STUDIES: INNOVATIONS IN BRIEF

Figure 2: Case study locations

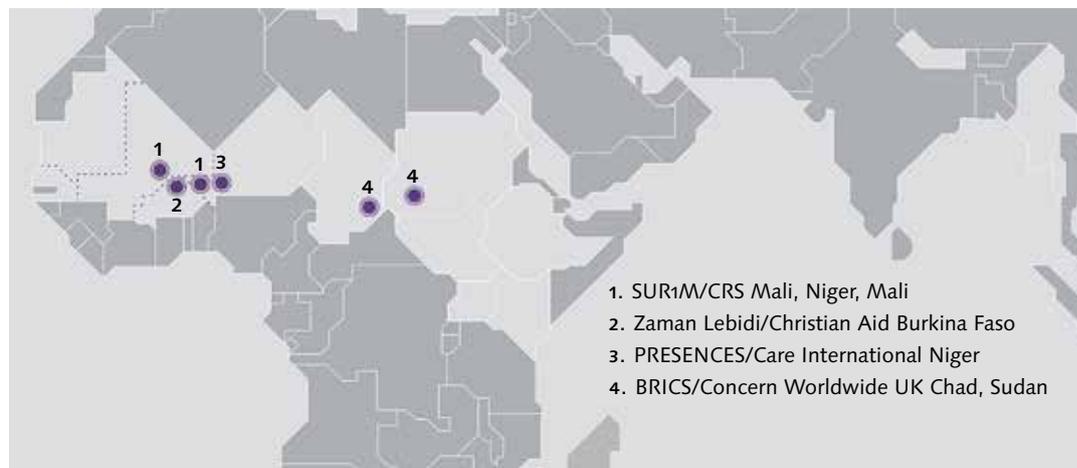


Table 3: Innovations in BRACED country case studies

BRACED PROJECT NAME	CASE STUDY AND COUNTRY	INNOVATIONS
BRICS: Improving community resilience through climate-smart agriculture, health and early warning systems	Agroecology and Conservation Agriculture – Sudan and Chad	<ul style="list-style-type: none"> • Co-developing improved and new techniques for better soil and agriculture productivity and resilience • Focussing on low-cost and participatory approach
Zaman Lebidi: Strengthening resilience to adapt to the effects of climate change	Integrating Climate Information into Community Radio – Burkina Faso	<ul style="list-style-type: none"> • Integrating climate information into local language radio programmes • Training broadcasters in climate information • Developing clubs of listeners to help embed the information and discuss and action responses
PRESENCES: Natural resource management and governance, climate-resilient livelihoods and improved climate information services	Community Planning with Vulnerability Assessment – Niger	<ul style="list-style-type: none"> • Introducing climate vulnerability assessment into existing community planning processes • Iterative, more fully participatory processes
SUR1M: Intelligent agriculture, savings [ircles, and radio messaging for resilience in the Niger River basin	Savings and Credit at Local Level (VSLA) – Niger	<ul style="list-style-type: none"> • Introducing local savings groups and access to credit • Increasing social capital and networks at community level • Train leaders to spread these groups privately, to achieve sustainability

Newness

The innovations in these four projects are new to the individuals, target communities and locations. The co-development of conservation agriculture techniques and experimentation in pilot plots will enable modifications as the project progresses.

The Community Radio project will coach and train existing radio programme producers in content that is educationally appropriate in local languages and generate small groups (clubs) of listeners that will digest information together.

Integrating a vulnerability assessment into community planning is one of a series of climate resilience integration programmes that will be introduced in local and regional government. A more participatory, socially inclusive process has been designed to improve outcomes for the marginalised.

Meanwhile, although village savings and loans associations (VSLAs) have existed for decades, this project will access new populations and improve on existing informal savings systems to make them more sustainable in the long term.

Adaptation

Two of the projects focus on adapting previous efforts. The conservation agriculture programme aims to adapt existing practices and build these into modified approaches to conservation agriculture alongside communities. The VSLA project aims to adapt existing local approaches to savings in the community to make them more transparent and better at mobilising savings when needed, to make it simpler to access credit and to provide a dependable source of 'insurance' for members in case of emergency.

Interaction

Community collective action and a strengthened web of social networks are important factors in increased resilience for people and communities in the face of shocks and stresses common in the Sahel. Community planning in the PRESENCES project will bring in staff from the meteorological office alongside decision-makers and the community to design processes to reduce vulnerabilities to climate change.

In the VSLA approach of SUR1M, the savings group is expected to enhance trust and partnership within the community, supported by trained field agents.

Training *in situ* of local producers is an innovative element in the community radio project.

The conservation agriculture project will increase interactions between local farmers, as some will co-develop and champion new farming practices and some will be trained by extension agents with expertise in conservation agriculture practices.

Knowledge content

New knowledge content is common to all the projects, as they share new information about climate change. In the conservation agriculture project, soil analysis that the project is now undertaking '*forms a basis for targeting specific agroforestry and other land management interventions... that can help in reversing the trends of land degradation in the area*', according to Ermias Betermaria from the World Agroforestry Centre (in Takoutsing et al., 2016). Understanding existing experience, and testing and evaluating external technologies in new contexts, is essential to the success of this project.

The PRESENCES vulnerability assessment aims to introduce new knowledge on current and future climate change to integrate into and modify existing planning ideas. The Community Radio project of Zaman Lebidi will spread knowledge about climate change through its radio programmes and through the community discussion groups linked to it.

But beyond this, innovation in knowledge content can be about new forms of organisation, better ways of participating and self-evaluation within the projects as they proceed. The VSLA project will develop ways for communities to better manage their savings, improve management rules, ensure inclusive participation in gatherings and enhance leadership, self-assessment and evaluation for those trained into responsible roles.

Most of the projects will elaborate their work in the local language, sometimes

using symbols to encourage greater inclusion of those who are illiterate. The vulnerability assessment project will develop iterative processes for discussion, enabling ongoing inclusion in the process of planning for future change.

Learning, scaling-up and diffusion

Finally, projects will consider how they foster learning and diffusion. The VSLA project will adopt a strongly innovative approach to scaling-up, by training individual apprentices who will then act as private service providers, taking the VSLA concept to other communities, which will pay for their services. Learning within the projects will be encouraged through iterative processes, including monthly trainings, follow-ups, critical evaluations and monitoring. Diffusion and scale-up for most of these projects is planned for Year 3 and beyond, after they are well embedded and initial learning and modifications are in place.

6. TRACKING AND MEASURING THE CONTRIBUTIONS OF INNOVATIONS TO CLIMATE RESILIENCE – PATHWAYS OF CHANGE

In tracking how innovations improve climate resilience, we need to combine measurements of climate resilience with measurements of how innovation works and succeeds.

A successful innovation, ultimately, is one that is widely adopted, with significant improvements noted for the beneficiaries and those involved (Warner, 2017). Successfully adapting this to resilience and climate change means:

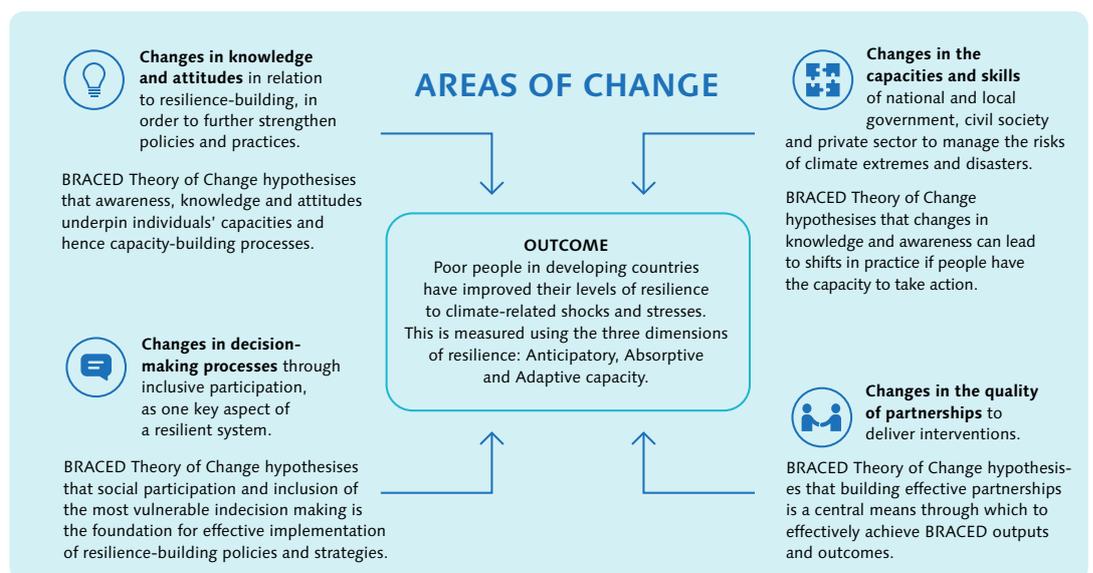
- These innovations have been adopted and demonstrate changes in one or more of the areas of change towards climate resilience.
- The innovations are considered to be improvements to the previous

or current solutions used by the communities.

- The evidence base and knowledge around climate change adaptation and resilience have been improved as a result.

Building resilience to climate change is dynamic and iterative. The BRACED programme has developed conceptual 'pathways to resilience' – areas of change towards an improved outcome that can be used and measured (Silva Villanueva et al., 2016). The pathways of change towards improved ability to anticipate, adapt to and absorb climate shocks and events include changes in knowledge and attitudes, capacities and skills, partnerships and decision-making processes.

Figure 3: BRACED areas of change



Source: Silva Villanueva et al. (2016).

Working hypotheses of successful innovation for climate resilience

BRICS: Conservation agriculture techniques for resilience

Hypothesis: Soil and water conservation, agroforestry techniques and improved farmer extension work will improve capacities and skills alongside knowledge of climate change and resilience. In the BRICS project, this is carried out through techniques for better soil water retention on farmland and in the wider landscape, rehabilitating degraded soils and improving families' food security by increasing the diversity of crops planted. The project will help farmers better understand how climate change will affect farm production, and will encourage changes in behaviour.

Zaman Lebidi: Community radio for building resilience

Hypothesis: Zaman Lebidi expects uptake and changed understandings and behaviour as a result of the community radio programmes that include aspects of climate change. Knowledge and attitudes towards understanding climate change may improve, and the project will monitor if and how this changes behaviours on-farm to improve resilience to climate change.

PRESENCES: Integrated vulnerability assessment

Hypothesis: This is expected to improve knowledge and attitudes,

widen partnerships to include meteorological offices and develop the capacities and skills of communities and their leaders around climate change.

SUR1M: The village savings group approach

Hypothesis: VSLAs have long been shown to help participants absorb shocks when in crisis. In addition, villagers could use credit access to better anticipate and build buffers against future climate shocks and change (such as silos to store harvests to protect against flood) and to adapt to changes occurring (by investing in better water management systems on-farm or job training to secure future incomes).

In each of these case studies, there are drivers that encourage the uptake of these innovative paths, and also constraints or potential limitations. Each of the projects has set out a plan for monitoring and evaluating implementation from 2015 to 2017, and in late 2017 will consider the nature of the innovation and its uptake, areas of change and impacts in terms of building resilience to climate change. This will include consideration of progress in activities and changes to assumptions, key actors, engagement and leadership; the innovation's characteristics and how these have changed or adapted over time; and how the project has built resilience in expected or unanticipated ways.

7. CONCLUSIONS

Innovation is recognised as an essential part of poverty reduction and economic growth in developing countries. It has been an integral part of Sahelian livelihoods for centuries. The Regreening of the Sahel in Niger shows that farmer uptake and sustainability of impact can be very high when the conditions are right, with a significant impact on livelihoods and impacts for thousands of people (Reij et al 2009a,b). However, very little detailed research has been undertaken into how specific innovations build resilience to climate change among the poorest populations.

The approach taken in this work entails use of a framework designed for inclusive innovations and marginalised populations that emphasises aspects particularly important to innovation in these settings, including interactions and local adaptation critical for sustainable uptake and diffusion of the innovation.

Action research alongside the partners and communities involved in this programme will allow us to track progress in the development and implementation of the innovations and to highlight ways to create the 'small victories' needed to better build climate resilience in vulnerable communities.

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FURTHER INFORMATION ON PROJECTS

BRICS: Improving community resilience through climate-smart agriculture, health and early warning systems

Countries of operation: *Sudan, Chad*

Concern Worldwide and its partners are running a programme focused on building community resilience among 280,000 people to the effects of regular droughts in West Darfur and Eastern Chad. Key components include increasing access to basic services, climate-smart agriculture and the development of early warning systems. The programme aims to produce evidence on effective strategies to support building resilience, in support of existing policies, and providing information to contribute towards policy formulation at national governments. www.braced.org/about/about-the-projects/project/?id=db586dc7-4407-444a-87c7-40f1f1768dd4

SUR1M: Intelligent agriculture, savings circles and radio messaging for resilience in the Niger River basin

Countries of operation: *Niger, Mali*

SUR1M builds resilience to climate extremes at scale through a gender-responsive, community-centred disaster risk reduction and climate change adaptation approach, fostering women's empowerment by promoting savings and internal lending communities and increasing demand for good governance and access to improved seeds and other technologies through market engagement, radio messaging and targeted advocacy. www.braced.org/about/about-the-projects/project/?id=cef9556d-162b-4102-8b47-5299bdc2cca9

PRESENCES: Natural resource management and governance, climate-resilient livelihoods and improved climate information services

Countries of operation: *Niger*

PRESENCES supports over 400,000 vulnerable women, children and men in Niger to adapt to climate extremes. www.braced.org/about/about-the-projects/project/?id=dfcc7770-b851-48c5-80c7-912088aaaf69

Zaman Lebidi: Strengthening resilience to adapt to the effects of climate change

Countries of operation: *Burkina Faso*

The programme aims to build the resilience of vulnerable communities to climate extremes and disasters in high risk locations of Burkina Faso. These include droughts, floods, extreme temperatures and extreme precipitation.

It works in a consortium of 10 partners to:

- Improve access to reliable climate information;
- Improve local capacity through strategies for market diversification, such as home gardens, a broader range of irrigation systems and development of lowlands;
- Better understand the specific impact of climate extremes on women and girls. www.braced.org/about/about-the-projects/project/?id=c086852f-3625-488d-83cc-a16dc6d9f1eb

ACKNOWLEDGEMENTS

The authors wish to thank partners in Zaman Lebidi, SUR1M, BRICS and PRESENCES. We also thank Aliou Diouf, Margot Steenbergen and BRACED Knowledge Manager Engagement Leads for their involvement and co-learning throughout this project.

In addition, we thank the reviewers of this document for useful comments on previous drafts of this paper: Magdalena Banasiak, DFID; Ann de Grande, World Agroforestry Centre (ICRAF); Ali Issaka Mamane, Catholic Relief Services CRS; Steve Wiggins, ODI and Emily Wilkinson, ODI.



The BRACED Knowledge Manager generates evidence and learning on resilience and adaptation in partnership with the BRACED projects and the wider resilience community. It gathers robust evidence of what works to strengthen resilience to climate extremes and disasters, and initiates and supports processes to ensure that evidence is put into use in policy and programmes. The Knowledge Manager also fosters partnerships to amplify the impact of new evidence and learning, in order to significantly improve levels of resilience in poor and vulnerable countries and communities around the world.

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