Use and Communication of Climate Information to Support Uptake of Adaptation Action in the Semi-Arid Regions of Africa and Asia

CARIAA
Collaborative Adaptation Research Initiative in Africa and Asia

ASSAR
Adaptation at Scale in Semi-Arid Regions

About ASSAR Working Papers

Use and Communication of Climate Information to Support Uptake of Adaptation Action in Semi-Arid Regions in Africa and Asia

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Table of contents

List of Acronyms

ASSAR	Adaptation at Scale in Semi-Arid Regions
CARIAA	Collaborative Adaptation Research Initiative in Africa and Asia
CBO	Community Based Organization
GCM	Global Circulation Model
ICT	Information Communication and Technology
INTASAVE	Inter-Sectorial Approach to Vulnerability and Resilience
NAPA	National Adaptation Plan of Action
NC	National Communication
NCCAP	National Climate Change Action Plan
NGO	Non-Governmental Organization
RCM	Regional Climate Model
RDS	Regional Diagnostic Study
RRP	Regional Research Programme
SARs	Semi-arid regions
START	global change system for analysis research and training
TSP	Transformative Scenario Planning
UK	United Kingdom

Executive Summary

Africa and Asia are among the continents most vulnerable to the impacts of climate change. This vulnerability is further worsened by the poor state of their socio-economic development and low adaptive capacity. Hence the states within these two continents face a serious challenge in providing sustainable livelihoods for their populations, especially in the vulnerable and fragile ecosystems of their respective semi-arid regions. There is therefore a critical need for the development of adaptation policies, strategies and plans in response to the changing climate. To develop effective adapation policies, strategies and action plans, however, it is necessary to have a comprehensive and multi-sectoral understanding, communication and use of weather and climate information. The Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA) aims to build the resilience of vulnerable populations and their livelihoods in semi-arid regions of Africa and Asia by supporting collaborative research to inform adaptation policies and practices. To realize this research goal, CARIAA has developed the Adaptation at Scale in Semi-Arid Regions (ASSAR). One of the research activities funded within this program is research on the factors that shape understanding and use of weather and climate information as well as challenges to and opportunities for effective communication of climate information in semi-arid regions of Asia and Africa. This research is structured in three overlapping but complementary phases: (1) Regional Diagnostic Study phase (RDS); (2) The Regional Research Program (RRP), and (3) Transformative Scenario Planning (TSP) and Knowledge Synthesis and Sharing phase.

This paper reports on the findings of the first phase of the research. This phase involved a desk study to examine how weather and climate information is understood, communicated and used in semi-arid regions of Africa and Asia and the challenges and opportunities that could support effective communication and use of weather and climate information in semi-arid regions of Africa and Asia. Specifically, this diagnostic study phase addressed the following questions, to inform the next phase of the resarch:

1. What factors shape understanding and use of weather and climate information in semi-arid regions of Africa and Asia?

2. How is weather and climate information communicated and used in semi-arid regions of Africa and Asia?

3. What challenges and opportunities could support effective communication and use of weather and climate information in semi-arid regions of Africa and Asia?

The study found that understanding and use of weather and climate information in semi-arid regions of Africa and Asia is influenced by both intrinsic and contextual factors. The intrinsic factors that influence weather and climate information understanding and use include the communication channels, forms, and formats used to communicated the information. Contextual factors include community's cultural practices and religious beliefs; community's indigenous knowledge; community's social structures and networks; locality i.e. rural versus urban settings; community livelihood practices and experiences; and gender. Although both intsrinsic and contextual factors influence understanding and use of weather and climate information, the study noted there is little research that examined exactly how these factors enable or hinder adoption of adaptations actions.

In this regard, the study has identified several research questions that could be explored in the next phase.

The study also identified several challenges and opportunities that could support effective communication and use of climate information. In particular, the study found that models that facilitate co-production of weather and climate information enable better understanding and use of climate information by different users. The study also noted that the combination of both people-centred and technology-centered communication approaches enable better understanding and use of the communicated climate information. However, the study noted that while weather and climate information co-production models facilitate better understanding and use of information, how this information co-production is governed has not been addressed in the current literature. Yet, addressing governance aspects of weather and climate co-generation and communication could help address the trust issues that were also found to hinder use of climate information. The study has therefore raised research questions on governance aspects of climate information generation and communication that could be explored in the next phase.

Introducing the Regional Diagnostic Studies Report

Introduction

1.1. ASSAR AND CARIAA

Adaptation at Scale in Semi-Arid Regions (ASSAR) is one of the projects funded under the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA). CARIAA aims to build the resilience of vulnerable populations and their livelihoods by supporting collaborative research to inform adaptation policies and practices. The ASSAR project is being implemented by a consortium of five institutions, namely: University of Cape Town, South Africa; University of East Anglia, UK; The International START Secretariat, US; Oxfam UK; and The Indian Institute for Human Settlements, India. Within this context, INTASAVE leads research on climate change the factors that shape understanding and use of weather and climate information as well as challenges to and opportunities for effective communication of climate information. This research is structured in three overlapping but complementary phases, namely:

1. The Regional Diagnostic Study phase (RDS)

2. The Regional Research Program (RRP)

3. Transformative Scenario Planning (TSP) and Knowledge Synthesis and Sharing phase

In phase 1 – the Regional Diagnostic Study Phase – INTASAVE conducted a desk study to examine the factors that shape understanding and use of weather and climate information and the innovative climate information generation and communication models that could ehance understanding and use of climate information in semi-arid regions of Africa and Asia.

1.2. Objectives

The regional diagnostic study aimed to examine how weather and climate information is understood, communicated and used in semi-arid regions of Africa and Asia and the challenges and opportunities that could support effective communication and use of weather and climate information in semi-arid regions of Africa and Asia.

This general research objective was operationalised into three main research questions, namely:

1. What factors shape understanding and use of weather and climate information in semi-arid regions of Africa and Asia?

2. How is weather and climate information communicated and used in semi-arid regions of Africa and Asia?

3. What challenges and opportunities could support effective communication and use of weather and climate information in semi-arid regions of Africa and Asia?

1.3. Methodology

Data for this study was collected through a systematic review. Three data sources were used: i) peer-reviewed literature i.e. journal papers ii) grey literature including working papers, organisational and project reports and case studies iii) national adaptation, strategy documents and national communications (such as NAPAs, climate change action plans; and national communications to the UNFCCC). The bibliographic databases searched included Web of Science, Scopus, IDRC library, UCT library, Google Scholar and Google search engine. The search was conducted in the following three stages:

- Stage one involved searching for literature on understanding of climate information and the communication approaches used across scales in semi-arid regions. Search terms included: 'climate change communication'; 'Africa'; 'Asia'; 'semi-arid'; 'understandinding'; 'climate adaptation'; 'climate change perceptions'; 'climate change beliefs'; 'climate change experiences'; and 'semi-arid'.

- Stage two involved searching for literature relevant to innovative communication approaches used to communicate climate change information in Africa and Asia. Search terms here included: 'climate change communication'; 'innovative communication'; 'information technology communication (ICT)'; 'adaptation'; and 'semi-arid'.

- Finally stage three involved searching for literature on communication and understanding of climate change in national and regional governmetal agencies and institutions using the Google search engine. Through this strategy, National Adaptation Action Plans (NAPAs) and National Communications (NCs) to UNFCCC of ASSAR project countries i.e. Burkina Faso, Ghana, Mali, Niger for West Africa; Ethiopia, Kenya and Uganda for East Africa; and Botswana, Namibia and South Africa for South Africa and India for Asia were downloaded from the UNFCCC. Other search terms used in google included: climat change communication; opinion leaders; governments; Africa; Asia.

These were combined using baloon algebra AND and OR and were varied using the wildcard *. The initial searches resulted in about 140 downloads out of which 48 were excluded using the following inclusion/exclusion criteria: i) focus on Africa or Asia, ii) focus on semi-arid regions, iii) focus on climate change adaptation action and practices iv) focus on communication approaches; v) focus on perception, beliefs or experience on climate change and climate change adaptation action, vi) published in English. A total of 92 pieces of literature were analysed which included 35 peer reviewed literature, 45 grey literature and 12 national adaptation strategies and communications.

General literature on climate change adaptation and climate communication was used to frame the study from a global perspective. All downloaded literature was collected and sorted into one of three separate templates. For literature on understanding and communication approaches, the template included a description of the paper, type of climate information, perceptions and understanding of climate information, climate information communicated, the source of information, communication channel used, effectiveness and limitations. To collect data on innovative approaches, the template consisted of the innovative approach mentioned, how it was used and its effectiveness and limitation. Finally the template on national and regional level communication included the type of institution, the type of climate information communicated and the communication channels used. Data was analyzed qualitatively using a thematic content analysis

approach, as described by Braun & Clarke (2006) to come up with themes that formed the basis of the discussion in the subsequent chapters.

Box 1

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Definition of terms

Actor is used here to include government, private (e.g., industry), nongovernmental organizations (NGOs), expert communities (e.g., scientists), and the media (Romero-Lankao et al., 2013).

Adaptation is the process of adjustment to actual or expected climate and its effects, which seeks to moderate harm or exploit beneficial opportunities (IPCC, 2014)

Arid and semi-arid regions (SARs): Arid regions are characterized by pastoralism and no farming except with irrigation. For the most part, the native vegetation of arid zones is sparse, with of annual and perennial grasses and other herbaceous vegetation, and shrubs and small trees. There is high rainfall variability, with annual amounts ranging between 100 and 300 millimeters. Semi-arid regions are zones that can support rain-fed agriculture with more or less sustained levels of production. Sedentary livestock production also occurs. Native vegetation is represented by a variety of species, such as grasses and grass-like plants, forbs and half-shrubs, and shrubs and trees. Annual precipitation varies from 300-600 to 700-800 millimeters, with summer rains, and from 200-250 to 450-500 millimeters with winter rains (FAO Forest Resources Division, 1989). SARs cover approximately 40% of the world's land area, and support two billion people, 90% from low and middle income countries. For a location of SARs in Asia and Africa see map 1. (http://www.iisd.org/casl/asalprojectdetails/asal.htm).

Climate change: the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'.

Climate information: this refers to climate scenarios, climate projections, traditional and modern seasonal outlooks and climate impacts, risks and consequences, climate advisory services, and modern and traditional climate adaptation practices (Carter et al., 2001; Füssel, 2007; Lumosi, 2014; Osbahr et al., 2008; Tall et al., 2014b). In these study, these will be labelled weather and climate information.

Issue of concern refers to the area (e.g., climate change) upon which weather and climate information is generated and adaptation responses are undertaken, i.e., the domain in which the actors are, or could be, acting (Romero-Lankao et al., 2013).

Vulnerability: the propensity or predisposition to be adversely affected (IPCC, 2014)

Weather is what individuals see outside on any particular day in terms of temperature and rainfall. So, for example, it may be 20° degrees and sunny or it could be 0° degrees with heavy snow. Climate is the average of weather. Climate records also include extreme values such as record high temperatures or record amounts of rainfall (www.noaa.gov)

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Figure 1

Global distribution of Semi-Arid Regions (MEA, 2005)
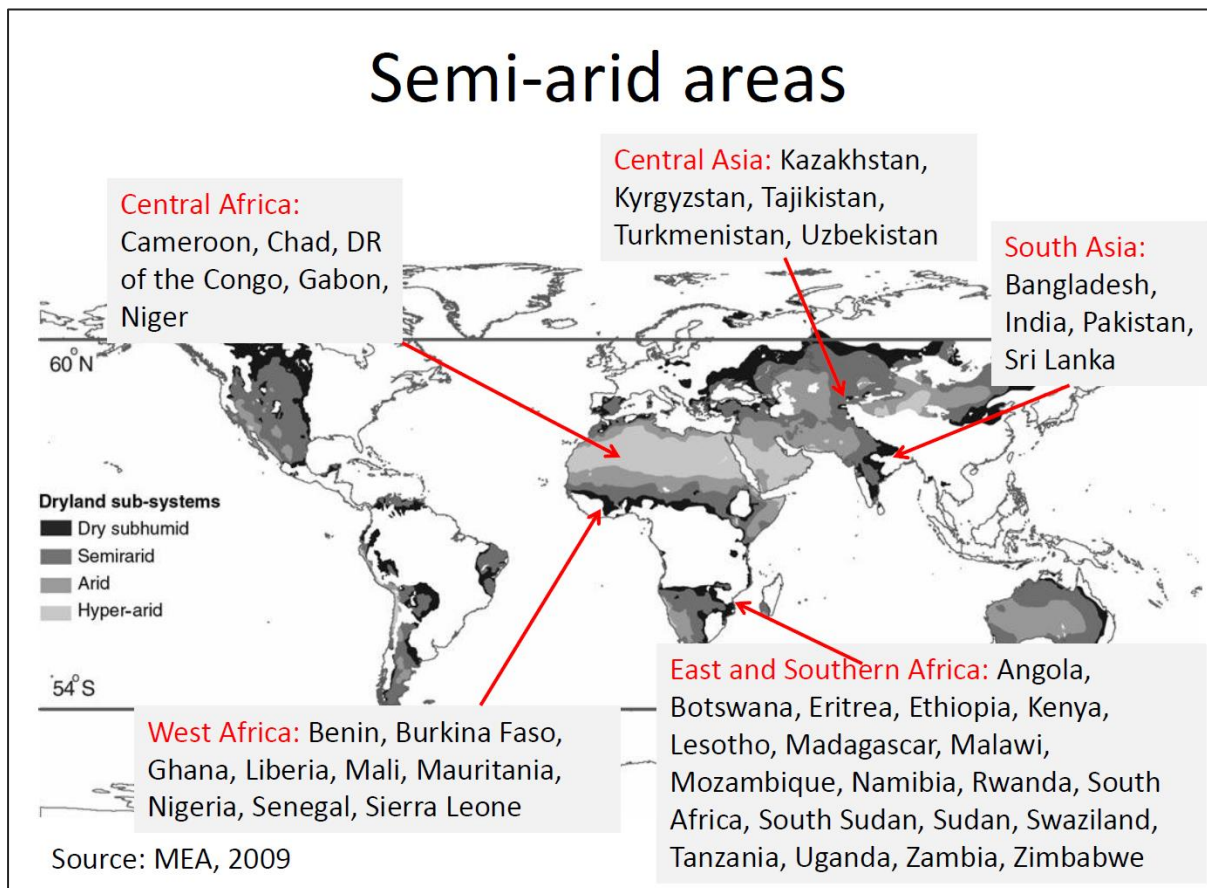
1.4. Africa and Asia: vulnerability and adaptation to changing climate conditions

Weather and climate in Asia and Africa are changing at unprecedented rates (IPCC, 2014). Precipitation is getting more errant and intense; snow and ice caps are melting, affecting the quality and availability of water for irrigation, human consumption and natural protection; increases in sea levels are affecting coastal areas where 466 million Asians and 56 million Africans live, according to data from 2000 (Mcgranahan et al., 2007). Therefore, climate change is not a hazard for some far-off polar bears years from now. In fact, the dangers of a warming Earth are immediate and very human. Climate change is not just about melting ice, threatened animals and plants. We are some of the first species to be listed as threatened by global warming. Climate change is about the very immediate human and everyday concerns of livelihoods, wealth, quality of life, disease and safety becoming worse with climate change.

Impacts from such climate relevant extremes as the tropical cyclones, and of the droughts affecting their arid and semi-arid regions, reveal significant vulnerability of people, places and ecosystems that provide water, food and flood protection. We define vulnerability as susceptibility of people and places to the impacts of droughts, floods and other climate hazards (Romero-Lankao et al., 2013). Vulnerability is a relative property defining both the *sensitivity* and the *capacity* to adapt to that stressor. Vulnerability can be thought of as conditioned by an array of social and biophysical factors. These factors include a population's capacity to perceive climate risks and to avoid or lessen the

negative consequences of the hazards they are exposed to. Individual characteristics can make household members sensitive (e.g. age, medical conditions). Capacity is determined by household and community level access to resources, assets, and options such as education, income, house quality, infrastructure and services, and social capital (e.g. individual levels of social trust, participation in networks and family support) (Romero-Lankao et al., 2013).

A series of adaptation initiatives, measures and actions are underway in Asia and Africa to reduce the vulnerability of people, places and ecosystems to the actual or expected impact of climate change. These actions, as identified in our research and practice, range from short to the long-term and vary widely in their effectiveness and outcomes. Some examples include the following domains (Romero-Lankao et al., 2015):

1) *Understanding of the problem*: through assessments of the climate risks populations, economic activities, infrastructure and ecosystems may face under a changing climate. Here is where climate and weather information is paramount.

2) *Incremental responses*: e.g., adaptation actions that build on ongoing disaster risk management and community based efforts seeking to reduce vulnerability.

3) *Broader scope, longer-term responses* seeking to alter infrastructures, institutions and behaviour:

   a) Actions and infrastructural investments that discourage growth in risk-prone areas, and protect or restore the ecosystem functions and services such as infiltration, flood and surge protection, and temperature regulation. These may shape the vulnerability of individuals, populations, and sectors to climate hazards;

   b) Actions that build capacity by enhancing the assets and options afforded to individuals from diverse socioeconomic groups to adapt to the impacts of climate change;

   c) Actions that reduce hazard exposure including risk mitigation (e.g., through engineered protection systems such as dikes and barriers).

4) *Transformative responses* that contribute to profound changes in land use regimes, growth ethos, production and consumption, lifestyles and worldviews (Field et al., 2014). Some of these actions target the underlying drivers of vulnerability, such as systems of production and consumption, and social inequalities that give rise to the coexistence of sub-standard housing, illiteracy, and poverty alongside wealth related consumptive patterns that are at the heart of our civilization's crisis. As such, transformative actions hold the potential to trigger a broader shift towards sustainable and resilient development pathways (Shaw et al. 2014; Burch et al. 2014).

Adaptation responses are undertaken by state, community and private sector *actors,* operating at multiple sectoral and administrative levels. We define actors as individuals, communities, organizations and networks that participate in decision-making related to adaptation (Biermann et al. 2009). Such actors are involved both in defining the issue of concern and in seeking adaptation solutions. As such they hold varied and often conflicting values, interests and visions about the best course of climate change action. For example, whereas some urban actors might consider hard

infrastructures a feasible option to provide fresh water and sanitation and protect coastal areas from sea level rise, other actors might see these as poor choices (Romero-Lankao and Gnatz 2013). These differences result in competing discursive and material constructions of *adaptation action*s and the potential for resulting fragmented or conflicting policies (Pelling and Manuel-Navarrete 2011).

1.5. Usability of weather and climate information for adaptation

The social and ecological impacts of climate change and the need to foster the capacities to adapt to changing climate condition, heighten the need for different kinds of knowledge and climate information that can increase our understanding of droughts, floods and other climate hazards, as well as opportunities and options to inform adaptation. However, researchers and decision makers point to the urgent need to address the persistent gap between the generation of weather and climate information and knowledge and their *usability* (NRC 2009). All user-inspired knowledge is useful in concept, but not always usable in practice. *Usability* is defined both by actor's "perception of usefulness and the actual capacity (e.g. human and financial resources, institutional and organization support, political opportunity) to use" forecasts, hurricane warnings and other information products (Dilling and Lemos 2011: 681).

Figure 2

Models of Science-Society or Science-Policy Interaction (Source: Dilling and Lemos, 2011)
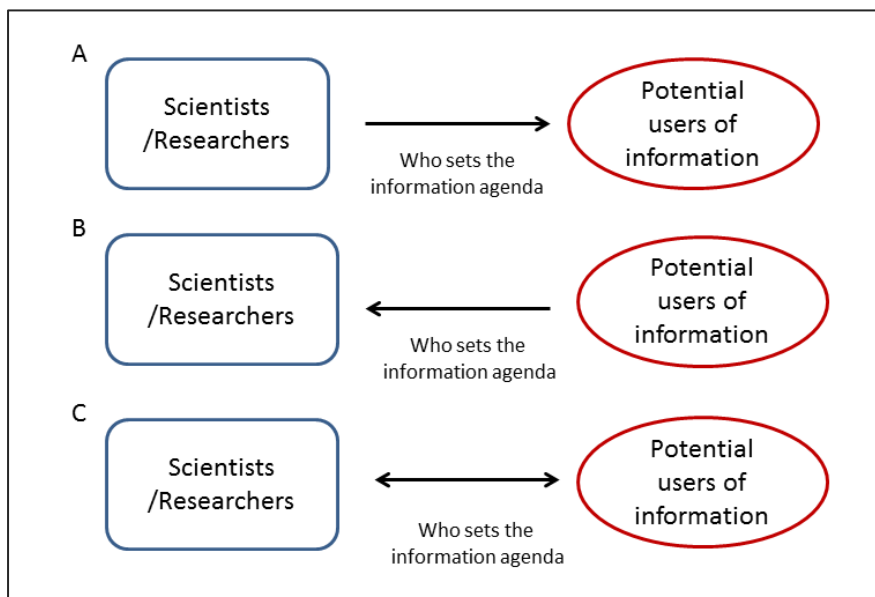
A long tradition of scholarship exists on the models of science and knowledge creation and its applicability to such challenging problems as climate change (see Figure 1). In the first model, also called the "science pull" model (A), the generation of scientific knowledge is driven by the pursuit of knowledge itself. Although the application of this knowledge is a desirable outcome, it is not a requirement for its funding. The second model (B) is defined by a "demand pull", whereby science is commissioned by its users to pursue the solution of a problem. In the third approach, a co-production model (C), the adaptation research agenda is shaped in an iterative way by both

researchers and users. Frequently, co-produced knowledge has shown to better fit user needs than that generated by more traditional models of science society interaction.

Both *contextual* and *intrinsic factors* bear on the usability of weather and climate information. *Intrinsic factors* relate to the perceived technical quality or credibility of information, i.e., to whether it is perceived to be valid, accurate, tested or, more generally, at least as likely as alternative views to be "true" (Cash et al., 2003). They also refer to the *salience* or perceived relevance of information to users' needs, in a form and at a time that they can use it. In short, users are more likely to use such products as hurricane or heatwave warnings if they perceive them to be accurate, reliable, relevant, credible, and timely (Pagano et al., 2001, Rayner et al., 2005). Previous negative experience and the perceived risk of deviating from established information creation, communication and use become barriers to the usability of information (Kirchhoff 2010). Of not least importance is whether information is accessible to users and communicated using a language and communication style users can understand and find relevant to their decision making context.

Information is created within the context of the socio-institutional or organizational culture *(contextual factors)* shaping decisions about information needs, communication and expected use. Institutional capacity factors that may increase the usability of hurricane warnings and weather and climate forecasts include:

- The flexibility of decision-making frameworks such as rules and regulations around land and water allocation and drought, flood risk management.

- Human and technical capacities to access and use information in a timely and effective manner,

- Previous positive experiences with innovation in the use of information; and

- Perceptions of need based on some level of understanding of vulnerability to hurricanes, drought and other hydro-meteorological hazards.

The quality of usability is also defined by the action-ability of the information, however, and the availability of realistic alternative courses of action will be key in determining whether information is usable. If, for instance, potential users lack access to assets and options to implement adaptation alternatives such as seeds, water resources, shelters and cooling centres, information regarding droughts, hurricanes or extreme heat events will be of little value (Romero-Lankao et al., 2014).

Factors shaping understanding and usability of weather and climate information in the semi-arid regions of Africa and Asia

Factors shaping understanding and usability of weather and climate information in the semi-arid regions of Africa and Asia

This chapter reviews literature on the *contextual* and *intrinsic factors* that shape the usability of weather and climate information in SARs of Africa and Asia. In doing so, the chapter identifies perceptions, values, beliefs and experiences related to climate information among individuals, communities, organisations and collective groups at the national, regional and local level.

The usability of climate and weather information in SARs in Africa and Asia is largely shaped by such intrinsic factors as the communication approaches used (channels, forms and formats); and by the following contextual factors: community's cultural practices and traditions (including religious and non-religious beliefs); community's indigenous knowledge; community's social structures and networks; locality i.e. rural versus urban settings; community livelihood practices and experiences; and gender. These factors are discussed below.

2.1.   Communication approaches

The type of communication channels used to disseminate climate and weather information influences its usability. The different channels include: radio, television, on-farm field demonstrations, community gatherings/ forums (barazas, mosques and churches), face to face interactions and more recently mobile phones and social media (BBC World Service Trust, 2010; Gambhir & Kumar, 2013; Kalungu et al., 2013; Mamun et al., 2013). The intrinsic characteristics of these information channels, forms and formats affect their usability (Moser, 2010). For example, the review found that when climate information is communicated to local communities in official national but not local languages, it is difficult for communities to understand and relate to the communicated information (Mamun et al., 2013; Roncoli et al., 2008; Simelton, et al, 2011; Muchunku et al, 2014; Singh et al., 2014; Khan et al., 2012).

Some of information communicated through these channels includes seasonal forecasts (e.g. onset of rains) targeting agricultural productions, early warnings of potential disaster events (drought, floods etc.) focusing on reducing disaster consequences, enhancing public awareness and triggering emergency responses (Luseno et al., 2003; Mokotjo & Kalusopa, 2010; Hansen et al., 2007). In many cases this information originates from the mainstream government and key national organizations such as meteorological centres and disaster management organizations (Mittal, 2012; Panos Eastern Africa, 2011).

Through the use of local languages, climate information is widely understood by the majority of recipients, with radios appearing to be the most common communication channel among local communities in SARs in Africa and Asia (BBC World Service Trust, 2010a; Churi et al., 2012; Kalungu et al., 2013). Climate and weather information communicated through face-to-face interaction forums such as workshops, community meetings (barazas and religious forums) or through use of intermediaries such as frontline extension workers enhances the usability of weather and climate information, however, the mechanisms by which this translates in adaptation actions are not addressed by this literature (Bisht & Ahluwalia, 2014; CARE, ndb; Roncoli et al., 2008; Saravanan, 2011).

Climate and weather information communicated through music, drama, and plays has been found to be more easily understood by local farmers, and to enable individuals to relate with the communicated information much faster (ALIN, 2013; BBC World Service Trust, 2010a, 2010b; Bisht & Ahluwalia, 2014; Ospina, 2012; Saravanan, 2011). For example, Bisht and Ahluwalia (2014) found that climate information communicated through radios, and in which the information is translated and communicated in local languages and dialects, and packaged using local metaphors and examples, and delivered through entertaining modes such as catchy songs, dramas or games, enable better understanding, learning and also help listeners to easily relate with the communicated information. By contract, seasonal climate forecasts communicated through radios but in which the information is communicated in official national languages are at times not easily understood by local communities due to the technical complexity of the information content, and use of technical terms and terminologies (BBC World Service Trust, 2010a; Luseno et al., 2003; Mpandeli & Maponya, 2013). The timing of climate and weather information announcement can also be critical for its usability (Cash et al., 2006; Lemos et al., 2002). This implies that many intrinsic features of climate and weather information matter: the channel through which it is communicated; the format used; the timing and level of specificity and the real possibilities people have to access this information.

2.2. Contextual factors

2.2.1. Community cultural practices and beliefs

The culture and social fabric of a community, characterized by their indigenous knowledge, traditional religious and non-religious beliefs, language, social structures, habits, music and arts, greatly influence their perception of climate and weather information (Moyo et al., 2012; Macharia et al., 2012; Ogalleh et al., 2012; Gbetibouo, 2009). Communities in the semi-arid regions have often passed rich indigenous knowledge from one generation to another through oral narratives and other cultural means (Speranza et al., 2010). Most communities have used this indigenous knowledge to understand and adapt to climate and weather events including drought, floods (Jodha et al., 2012). This, however, is not enough to enhance communities' capacities to adapt to climate hazards.

There are documented examples among communities of strategies for responding to weather and climate variability that are borne out of their indigenous knowledge. For example, pastoralists have in the past employed elaborate livestock management strategies to respond to weather and climate fluctuations, based on their indigenous knowledge and other cultural and traditional practices and strategies such as regular and circular migration in search of forage and water; herd splitting; rapid destocking; complex gift and loan systems, and raiding of other clans and ethnic groups (Luseno et al, 2003). Communities also monitor climate related events using traditional indicators such as studying of goats' intestines or birds movements in order to know which coping strategy to employ (Luseno et al., 2003; ALIN, 2013).

These traditional and indigenous indicators of climate events are, however, slowly losing effectiveness due to the magnitude, frequency and complexity of the drivers of changes in climate and weather. Communities are slowly integrating and embracing the use of modern scientific information, such as seasonal forecasts and annual temperature and rainfall data (ALIN, 2013). Nevertheless, communities' understanding of modern scientific information on climate events is still mediated by their indigenous knowledge, traditional beliefs and cultural practices. Hence,

communities' traditional knowledge, cultural practices and traditions still determine the type of adaptation strategies they adopt.

Communities' traditional religious and non-religious beliefs also play a role in shaping how community members understand and explain climatic events (BBC World Service Trust, 2009; Speranza et al., 2010; Moyo et al., 2012; Roncoli et al., 2008). In Ethiopia, for example, local communities have understood climate impacts of drought to be acts of God: "*weather changes and subsequent hardships are caused by God. The community believes that God controls weather and it is the source of drought*". "*The secret is with Allah. Allah brings the rain. The one who causes the drought, who sends us the drought is Allah,*" *(BBC World Service Trust, 2009, p. 3).* A similar study in Burkina Faso that aimed to understand how climate forecasts are applied in livelihood practices found that, local farmers were aware of the changes in climatic conditions and reflected this in their livelihood activities by adopting drought-resistant crops varieties. However, in reference to understanding these changes, farmers believed that these changes were acts of God as can be deduced from the excerpt below. Such religious beliefs not only shape how climate change impacts and risks are understood, but also influence the adaptation actions that a community may adopt (Kalungu et al., 2013). Therefore, understanding individual/community's religious and non-religious beliefs about climate events, is important in providing insight into their understanding of climatic events (Harvey et al, 2012b).

> *'Everything is in God's hands and […] only God knows what will happen*
> *("the weather people are not God")' (Roncoli et al., 2008, p. 16)*

In the above cases, it is these peoples' religious beliefs that shape their perceptions and therefore play a role in their adaptation responses (BBC World Service Trust, 2009; Speranza et al., 2010; Roncoli et al., 2008). Because climate change is perceived as an act of God, these communities often feel that there is little or nothing that they could do to change the situation. Therefore, when presented with climate information such as modern downscaled climate forecasts, these communities draw on these beliefs to determine their responses (BBC World Service Trust, 2009; Speranza et al., 2010).

2.2.2. Differentiated access to assets and livelihood practices

Communities livelihood practices and their long-term experiences influence the extent to which and how they use climate and weather information (Macharia et al., 2012). For example, a study by Macharia et al. (2012) found that farmers dependent on rain-fed agriculture in sub-humid agro-ecological zones do not always use scientific forecasts because they feel they are able to quickly notice and understand changes in the environment as compared to those dependent on irrigation schemes in humid agro-ecological zones. Rain-fed dependent farmers are well informed about critical environmental conditions for their daily livelihoods. Studies in semiarid South American lands offer other insights on the factors explaining the forecasts usability gap: the skill of the forecasts is frequently inadequate for the needs of farmers' decision making – e.g., on when to plant; the use of forecast information can be subject to political manipulation and to distortions that make farmers distrust these forecasts (Lemos et al., 2002).

Scholars have shown that usability of information in many SARs is still constrained by lack of access to information, but, more importantly, by the ability of potential users to respond to this information. For example, in Burkina Faso, farmers were limited in their ability to respond to

seasonal forecasts in the absence of additional assets and options such as ploughs, new crop varieties, and fertilizers (Ingram et al., 2002).

The review found that political influences, power inequality and ethnicity play a role in determining access to climate information. In a study to assess how climate forecasts were accessed and disseminated to local farmers in West Africa, for instance, Roncoli et al. (2008) found that local leaders had the power to select participants to attend meetings where these forecasts would be disseminated and discussed.

2.2.3. Access to community based organizations and social networks

The usability of information is shaped by the access that farmers, households and other information users have to community based organizations and social networks (Gbetibouo, 2009). Farmer groups greatly influence and support understanding of farmers' practices through the shared perceptions and values of the 'peer' groups and the local leaders farmers associate with. Similarly, Bisht & Ahluwalia (2014) found that organising farmers into listener groups to discuss climate change practices presented through community radio programmes, enables farmers to understand and effectively use climate and weather information in their adaptation actions.

> *Narrowcasting sessions [local level listener groups to discuss the show*
> *and its application] have proved to be successful in popularising climate*
> *change adaptation options' (Bisht & Ahluwalia, 2014, p. 19).*

Further, strong community linkage with local government leaders, opinion leaders and community leaders influences climate change understanding among community members (BBC World Service Trust, 2010a). However, the review by BBC World Service Trust (2010a) found that local leaders in Africa were the least informed about climate information. They concluded that the limited understanding of climate information among local leaders could negatively impact on the kinds of adaptation strategies adopted by local communities, as local leaders' understanding of climate information shapes the type of information they communicate to their communities in various community meetings. Most often these leaders, despite their influence in enhancing understanding of climate information, are largely driven by political considerations (BBC World Service Trust, 2010a).

2.2.4. Geographical location: urban verses rural settings

The review found that there is a difference in the level climate information understanding between rural communities and urban communities. Roncoli et al. (2008) noted that there are higher levels of climate information understanding among urban communities as compared to rural communities. The authors concluded that the geographical location of a community also play a role in supporting its understanding of climate information and determines the level of information access and awareness to which the community is exposed. Communities located in urban areas are able to access different communication channels (both in quantity and quality) such as television, workshops and the internet, and also have easier access to government programmes and services (Gambhir & Kumar, 2013; Luseno et al., 2003; Mamun et al., 2013; Roncoli et al., 2008; Saravanan, 2011). Access to these communication channels and resources is particularly influential in enhancing understanding of climate change impacts, risk and adaptation options (Roncoli et al., 2008).

2.2.5. Gender

Gender also plays a role in shaping the usability of climate and weather information for adaptation. Roncoli et al. (2008) noted that gender issues, especially those related to the roles of women and men in communities' social, economic and political contexts affect gender differences in access to climate information. Roncoli et al (2008) also notes that women's access to information needs to be supported, as it is critical in supporting the understanding and adoption of climate related information such as in disaster risk reduction, emergency response, agricultural production, health and nutrition.

In some places, households' adaptation responses to climate and weather include changes in gender roles. For instance studies by CARE (nda) and Kalungu et al. (2013) found that due to impacts of climate change on livelihood and household incomes, in some situations men had to migrate to look for work to complement family income, while wives assumed some of their husband's roles. This even resulted in female-headed households in some cases (CARE, nda; Kalungu et al., 2013). As the quote below demonstrates:

> *'Pastoral households are adjusted to the reality of drought and as such have well-developed coping mechanisms that they employ to manage these events. In line with the division of labour along gender lines, women and men identify different strategies for dealing with drought […] Women also highlighted the need to engage in income generating activities to supplement income in times of crisis. Activities currently practiced include vegetable trade, sale of milk and other dairy products and charcoal production and sale. Remittances from family members who have migrated for paid work also play an important role in keeping the family going during difficult times. (CARE, nda, p. 9)*

2.3.   Conclusion, emerging research gaps and recommendations

This chapter has explored some of the factors that influence the **usability of climate and weather information**. Cultural practices, indigenous knowledge and traditional religious and non-religious beliefs influence the usability of climate and weather information. Less understood is how and to what extent cultural practices, indigenous knowledge and traditional beliefs influence communities' adaptation decisions and actions. The review also found that gender inequality plays a role in determining one's access to climate information sources such meetings and community leaders. The level of understanding of climate change was also found to vary between rural and urban communities, with the latter being more informed on climate change issues. While research has examined differences in climate change understanding between urban and rural communities, similar research should be conducted to compare understanding of climate change between (nomadic) pastoralist and agricultural communities in SARs. Such research could be broadened to include cross-country examination of level of understanding between urban, pastoralist and agricultural communities. This could also explore how the adaptation practices adopted compare across countries between urban, pastoral and agricultural communities. There is also limited research that examines differences in understanding of climate information between different regions and countries, and between different urban settings.

CHAPTER 3

Effective communication and use of weather and climate information in SARs in Africa and Asia

Effective communication and use of weather and climate information in SARs in Africa and Asia

This chapter identifies and examines: (i) the users of climate and weather information; (ii) the contexts for communicating and using climate and weather information; (iii) the contextual factors (e.g. institutional settings and cultural) and intrinsic factors (e.g. spatial and temporal scales of weather and climate information) shaping the usability of information; and (iv) case studies highlighting the 'push', 'pull', and 'co-produced' approaches discussed in Chapter 1. Then, the implications of these case studies in the context of challenges and opportunities to climate information communication are discussed.

3.1. Societal actors: providers and users of climate and weather information

Closing the usability gap requires understanding of the context and characteristics of both information providers and users. Furthermore, it demands to understand the process that move information from what providers think is useful to what users know can be applied, based on their context specific requirements and needs and their societal contexts (Harvey et al. 2012a; Hine at al. 2014). Information users' culture, traditions, geographical location, language, networks, preferences, priorities, and level of education are of relevance here (Pidgeon & Fischhoff, 2011; Filho, 2009; Mpandeli & Maponya, 2013).

*Frequently, **research and scientific communities*** are the main providers of weather and climate information. Governmental and private organizations such as national and private climate and weather services and the media also function as information providers. Ideally, the main focus of information providers would be to enhance the intrinsic factors shaping the usability of information; identify knowledge gaps that can be resolved through research, and identify the most appropriate means to convey the findings of such research to the various information users. This might entail going beyond existing means typically used, such as peer-reviewed journal papers, reports, and publications to more actively informing and consulting with like-minded users (Goodwin & Dahlstrom, 2014; Moser & Dilling, 2012) and ensuring mutual understanding is enhanced through repeated interactions between researchers and potential information users (Hammer, 2000; Lemos and Morehouse, 2005). Recent research on water managers in the US Pacific Northwest and Southwest regions shows that higher levels of interaction between producers and users significantly increases rates of use of climate science (Kirchhoff, 2010).

This review identifies three main categories of potential climate and weather information users: (1) ***policy and decision makers,*** including heads of government ministries and agencies operating at different administrative levels. For this users, climate and weather information is intended to inform formulation and implementation of adaptation strategies and policies; (2) ***community members*** such as rural and urban populations, farmers, and workers. For these users, climate and weather information aims at creating awareness, and providing tools that support adaptation actions; and (3) practitioners such as extension workers, and those in non-governmental organisations or the private sector. Here, communication aims to advocate for and disseminate appropriate adaptation actions (CARE, ndb; CCAFS, 2013; GOK, 2010; Harvey, et al., 2012b). Table 2 summarizes the various users of

climate information, the communication channels used for each and the aim of climate information communication for each user.

Table 1: Tailoring climate and weather information usability to different users

USER	COMMUNICATION FORMS AND FORMATS	CHANNEL	AIM	SOURCES
Policy makers	**Form** *Written content:* • Policy briefs • Issue briefs • Position papers • Working papers	• Web content • Policy magazines	• Inform policy formulation • Influence adaptation and mitigation actions	(Katz, 1957)(Nisbet & Kotcher, 2009) (Hine et al., 2014) (Moser, 2014) (CARE International, 2014) (BBC World Service Trust, 2010a,b,c,d,e,f) (World Bank, 2011)
Community members	*Written content:* • Reports and magazines	• Community meetings and workshops • Intermediaries	• Inform and support behaviour change in communities • Inform communities about appropriate adaptation actions	(Kristjanson, Jost, Vervoort, Ferdous, & Schubert, 2014) (Bisht & Ahluwalia, 2014) (Moser & Dilling, 2012) (Nyamba & Mlozi, 2012) (BBC World Service Trust, 2010a,b,c,d,e,f)
	Verbal audio and visual content: • Plays and music	• Radio and Television • Farmer field schools • Mobile phones		
	Verbal face-to-face engagements:	• Community meetings and workshops • Intermediaries e.g. extension workers		
Practitioners	**Written content:** • Reports and other publications • Peer-reviewed scientific papers • Application tools e.g. vulnerability assessment tools **Verbal oral:** • Face to face communication	• Knowledge platforms and websites • Field demonstrations e.g. through farmer field schools	• To influence adaptation and risk mitigation measures • Inform and support behaviour change	(CARE International, nd)(ALIN, 2013)(Luganda, 2002)(Panos Eastern Africa, 2011)(Kristjanson et al., 2014)(Harvey et al., 2012) (Moser, 2014)(Moser & Dilling, 2012)(IFRCRCS, nd)

Potential climate and weather information users such as NGO practitioners, researchers and policy makers in Africa and Asia are now embracing the use of knowledge platforms and networks as a type of "community of practice" and as a way to disseminate adaptation actions and share lessons from ongoing climate change projects (Harvey & Mitchell, 2011; Jackson et al., 2014). Knowledge platforms such as SEA Change (An Asian community of practice on climate intervention) ('SEA Change', 2015), AfricaAdapt (an African knowledge sharing platform on climate change adaptation information) (Harvey & Mitchell, 2011) and weADAPT (an online platform supporting adaptation practices in developing countries) bring together practitioners, decision makers and even community members to share their adaptation practices through written stories, videos and geo-referenced case studies (Harvey & Mitchell, 2011; 'weADAPT', 2015):

'weADAPT is an online open space on climate adaptation issues which allows practitioners, researchers and policy makers to access, credible, high quality information and to share experiences and lessons learnt with the weADAPT community. It is designed to facilitate learning, exchange, collaboration and knowledge integration to build a professional community of research and practices on adaptation issues while developing policy-relevant tools and guidance for adaptation planning and decision making' ('weADAPT', 2015).

National and regional actors use these platforms to not only share information but also to learn from other practitioners, researchers and communities through interacting with tools, methods, case studies, videos and publications (Harvey & Mitchell, 2011; 'weADAPT', 2015).

3.2.   Contexts for climate and weather information usability

Both the generation and use of information do not operate in a vacuum but in a social context where different *actors* come together with varied and sometimes conflicting interests, values and visions of the nature, causes, and impacts of the issue of concern. These differences result in competing discursive and material constructions of adaptation policies and *actions.* Furthermore, with each vision being promoted by particular actors, the potential exist for a fragmented or conflicting execution of adaptation actions and policies. This might explain why, rather than a merely technical exercise involving information generation and insertion into adaptation processes, climate and weather relevant information is a politically contested and bureaucratically managed component of adaptive capacity (Romero Lankao et al., 2013). It might also explain why information about the risks and options presented by climate change may not always be readily available or used in decision making due to competing and conflicting priorities. These issues, however, were not identified in this review, which focused rather on the different kinds of knowledge and information (e.g., traditional and indigenous knowledge, seasonal forecasts).

3.2.1. Indigenous Knowledge Contexts in SARs

Different communities use different types of climate and weather information to support local adaptation actions (Luseno et al., 2003; Mittal, 2012; Tall et al., 2014b). The vast majority of SAR communities rely on their traditional indigenous knowledge. As the quote below demonstrates, this indigenous climate information is valued and preferred due to: its ability to predict localised events such as when the rains will start and end, and where it will fall; its relevance to livelihood practices e.g. when to plant or to migrate; its ease of accessibility e.g. by being passed down from father to son and through traditional weather men/diviners; because it originates from trusted sources such as diviners and weather-men who are known members of the community; and because it is easily understood by the community i.e. communicated in local dialects, using local environmental indicators (Anandaraja et al, 2008; BBC World Service Trust, 2010; Gambhir & Kumar, 2013; Speranza et al., 2010; Kanno et al., 2013; Luseno et al, 2003; Mittal, 2012).

'Indigenous forecasts are widely heard by east African pastoralists. […] more than 90% […] had heard some sort of indigenous forecast for the coming season. […] they also expressed considerable confidence in them. […]the timing of rains matters more to pastoralists than does the aggregate volume of rains over a season because migration patterns depend on when grass and water are available in different sites not on the average availability over a period' (Luseno et al., 2003, p. 1484).

The above excerpt suggests that traditional climate information is considered more relevant and important in supporting local short-term adaptation actions, such as migration for green pastures among pastoralists (Luseno et al., 2003). Such traditional climate information mainly includes information about current and near-future climate events such as when the rains will start and end, expected changes in seasons with regard to events such as drought and floods, among others (Anandaraja et al., 2008; Luseno et al., 2003; Mpandeli & Maponya, 2013). Pastoralists, for instance, use various traditional indicators such as: 'observation of clouds, lightening, wind; studying animal intestines; observing and studying the behaviour of plants or animals' to predict seasonal changes and to align their livelihood practices based on these changes (Luseno et al., 2003; 1483). However, while traditional climate information support uptake of adaptation actions, its ability to predict future climate change is increasingly being limited and undermined by the increased variability and uncertainty in climatic conditions (Anandaraja et al., 2008; Luseno et al., 2003).

3.2.2. Integrating Indigenous and 'Modern' Climate and Weather Information Contexts in SARs

To compliment traditional climate information and indigenous knowledge, local communities increasingly use modern seasonal forecasts from meteorological departments (ALIN, 2013; Tall, et al., 2014b,c). For instance, Speranza (2010) showed that households that have access to mass-media (e.g. radios) use modern seasonal forecasts alongside traditional forecasts (see quote below). Other authors note that these modern seasonal forecasts are sometimes co-produced and interpreted in combination with the traditional forecasts, or are used when traditional forecasts fail or become less consistent due to increased climate variability (Speranza et al., 2010; Luseno et al., 2003; Mpandeli & Maponya, 2013). Such modern climate information mainly provide information about future climatic events e.g. seasonal forecasts (Nderitu & Ayamga, 2013). The use of modern climate information is

mostly common among communities who have access to communication channels such as radio and television; those who are more educated; those engaged in trade and among those who have access to intermediaries such as extension workers and non-governmental project staff (CARE nternational, 2014; Luseno et al., 2003).

'Those households that have access to mass media (such as radio) consult seasonal forecasts (outlook) broadcasted by the KMD [Kenya Metrological Department] in addition to using IK [indigenous knowledge]' (Speranza et al., 2010, p. 309).

The extent to which communities can access and use modern climate and weather information is influenced by factors such as religion, culture and gender. For example, studies by Speranza (2010) and Luseno et al. (2003) show that Christian households are more inclined to use modern climate forecasts as opposed to traditional forecasts. At the same, however, strong cultural and religious inclinations prevent some communities from using modern climate information. In these cultures and religions, modern information sources are considered to be against acts of god and nature (ALIN, 2013; BBC World Service Trust, 2010a). Also, in cultures where women are regarded as inferior to men, and hence are not accorded access to certain resources such as education, radios or are restricted from interacting with 'external' people other than their own families (CARE, nda; Mokotjo & Kalusopa, 2010; Tall etal., 2014a,b), women's ability to both access and use modern climate information become limited (CARE, nda; Tall et al., 2014a,b,c).

The fact that local communities as climate and weather information users prefer to ask questions and discuss contents they may have heard, demonstrates the criticality of participatory and inclusive approaches to community meetings on climate information, where intermediaries such as extension workers, local community leaders, opinion leaders, religious leaders, research officers, input dealers, progressive farmers and local practitioners are involved (BBC World Service Trust, 2010; Bisht & Ahluwalia, 2014; Kristjanson et al., 2014; Mittal, 2012; Muchunku et al., 2014). This is increasingly being integrated with more modern ways of information sharing among communities in SARs in Africa and Asia via television, farmer field schools, newspapers, mobile phones, and magazine articles.

3.2.3. Information usability approaches and preferences among community members in SARs

Approaches to information generation and use within and among community members can entail both "science pull" or top-down models where information providers decide what information is needed and used by communities and "demand pull", bottom-up or community-based, where the communities shape of the production of information itself. Top-down communication entails communities receiving climate information and advisories from government department such as the metrological departments, agriculture extension workers and NGOs practitioners (Kanno et al., 2013). Bottom-up approaches can also entail communities contributing to the production of climate information in an iterative manner such as through indigenous knowledge, among other community members, through intermediaries like community radio call-in shows, extension workers and field experts (ALIN, 2013; Bisht & Ahluwalia, 2014; Speranza et al., 2010).

This review found that verbal oral communication of climate information is the preferred form of communication among local rural communities in SARs in Africa and Asia, with radio reported to be the most commonly used communication channel among local agricultural

and pastoral communities in SARs in Africa and Asia (ALIN, 2013; Bisht & Ahluwalia, 2014; Kangalawe & Lyimo, 2013; Luseno et al., 2003; Mittal, 2012; Shaka, 2013). Verbal oral communication will typically involve use of audio formats and face-to-face (Bisht & Ahluwalia, 2014; CARE International, nd; Hansen et al., 2007; Luseno et al., 2003; Njuki, 2013). For instance, studies by Churi et al. (2012) and Mittal (2012) reported that climate information such as modern seasonal outlooks is conveyed mainly through radios and mobile phones. Radios are identified as the more commonly used communication channel because their broadcast signals reach a wider range of users and because the vast majority of agricultural and pastoral communities own or have access to a radio (ALIN, 2013; Mittal, 2012), as the as excerpt below on Dakoro, Niger, demonstrates:

'information disseminated through community radios reaches almost all communities in Dakoro and neighbouring districts [in Niger]. The two community radio stations: Murya and Hadin Kaye, estimates more than twenty percent of the total population, are likely to receive information disseminated through community radios in 14 communities in Dakoro'(Ababale, 2013, p. 2).

Other types of information used include market information, agronomic information, information on pests and diseases as well as information on government-led schemes and programmes. Seasonal forecasts of climate are conveyed through radios as well as climate-smart agricultural practices, traditional and modern coping strategies and agronomic advisories (CARE, ndb; Mittal, 2012; Saravanan, 2011; Tambo & Abdoulaye, 2012). The integrating of forecast data with other types of climate information is done in order to both meet communities' information needs and to support their livelihood practices. Although radio is the most common channel used, other communication channels that facilitate face-to-face interaction and personal interactive feedback such as the use of intermediaries (e.g. extension workers and NGO project staff) and community meetings and workshops are also preferred and valued among local communities in SARs in Africa and Asia. This is because these channels promote direct engagement of community members with experts, scientists and practitioners and thus support and enable faster understanding and uptake of climate information (Bisht & Ahluwalia, 2014; CARE International, nd; Hansen et al., 2007; Luseno et al., 2003; Njuki, 2013). As the excerpt below illustrates:

'The area chief and two other members of the Nanighi community had attended a Participatory Scenario Planning (PSP) workshop held before the onset of the March to May rainy season, to learn and interpret the seasonal forecast with the meteorological services, local government and communities, in order to make informed plans and responses. […] During the PSP, [they] developed possible impact scenarios […] [they] shared [this information with pastoralists from Balambala community] that there was a chance of floods downstream of River Tana […]. When the floods came, the pastoralists were able to protect their assets by moving their animals to higher grounds early enough and harvesting their fodder. Losses were minimized and pastoralists are now taking advantage of the floods; instead of irrigation they are reseeding denuded areas and growing fodder using the available soil moisture as the floods recede. […]' (Nderitu, 2013, p. 6).

In summary, communities' preferences to climate communication often relate to:

- the content of the information communicated;
- the urgency of the communicated information;
- the scale and type of the information (e.g. seasonal forecasts at national or local scale);
- reliability and trust in information sources (e.g. some communities prefer the locally known and trusted intermediaries while others distrust information from meteorological officers);
- accessibility of the communication channel;
- the type of information communicated (CARE International, nd; Churi et al., 2012; Luseno et al., 2003; Mittal, 2012; Saravanan, 2011; Tall et al., 2014b).

More specifically, information communicated through cell phone short text message is preferred when used to disseminate timely and urgent climate information that enhance quick action, such as flood related information (Wickramasinghe, 2011). To support practical application of agricultural practice, a show-and-tell type of approach such as television reality shows and farmer-field schools have proven effective (Kristjanson et al., 2014; Saravanan, 2011). The nature of the message communicated often also determines the preferred communication channel. For example, dissemination of traditional and modern seasonal forecasts was often done through word of mouth, radio or television. However, when such information is combined with other relevant information such as information on cropping practices or growing drought resistant crops, multiple communication forms and channels were used to support greater and faster uptake of the message (ALIN, 2013;Speranza et al., 2010; Okonya & Kroschel, 2013; Saravanan, 2011). Combining different communication forms and channels and experimentation with each has proven useful in supporting understanding of the information communicated, winning the trust of the community and practically demonstrating and supporting learning as well as uptake of information (Bisht & Ahluwalia, 2014; Braun & Islam, 2012; CARE International, nd; Saravanan, 2011).

3.3.   Barriers and options for engagement on usable climate information

3.3.1. Barriers to usability of climate information among local communities in SARs

Communication of climate information to support adaptation actions in SARs is hindered by several contextual factors: social-cultural, content-related and technological barriers (described in Table 3). Building on the contextual barriers discussed in Chapter 2, social-related barriers include culture, gender, literacy level, religion and material access (CARE International, nd; Speranza et al., 2010; Kristjanson et al., 2014; Luseno et al., 2003; Tall et al., 2014c). Content-related barriers include communication formats, the language of communication and the terms/ phrases used in communication (Bisht & Ahluwalia, 2014; Harvey, 2011a; Ospina, 2012). Technology-related barriers include limited technological skills (such as internet-skills), digital divide (i.e. disparities between those with access to ICT verses those without) and scepticism (fear of using digital communication channels) as well as limited access to technology in order to support the use and application of the communication tool (Luseno et al., 2003; Mittal, 2012). For effective climate change adaptation to be realized, the barriers to effective communication of climate information

need to be addressed (Filho, 2009; Goodwin & Dahlstrom, 2014; IFRCRCS, nd; Moser & Dilling, 2012).

3.3.2. Barriers to a science-society co-production model

To date, most climate information communicated at local levels focuses on short- and near-term climate and weather information and less on long-term projections and impacts, often developed by the science community. This barrier to engagement on long-term planning is due to communities' preference for information that may have immediate correlation with their livelihood practices. Given the focus on short-term and near-term climate projections and impacts, the current information on climate at the local level often supports short-term adaptation actions, with limited attention to long-term climate projections and impacts. While long-term information might seem relevant in a general sense, it may be less usable as it competes with many other factors shaping decision contexts (Skolnikoff, 1999).

In addition, some actors have limited capacity to understand and apply climate information such as scenarios and global climate model projections. These actors often rely on other organisations or other organizations' websites to access and use climate information (Ziervogel & Zermoglio, 2009).

The language and terminology in which information is packaged, as well as how the information is framed has been cited throughout the literature as a key barrier (Filho, 2009; Goodwin & Dahlstrom, 2014; IFRCRCS, nd; Moser & Dilling, 2012; Moser, 2014). More specifically, climate information communicated through radios, in which the information is translated and communicated in local languages and dialects, using local metaphors and examples, and using entertaining communication modes such as music, catchy songs, drama or games to attract listeners, has been shown to enable better understanding, learning and help listeners to easily relate with the communicated information (ALIN, 2013; BBC World Service Trust, 2010a, 2010b; Bisht & Ahluwalia, 2014; Ospina, 2012).

Some organisations and government agencies lack the technologies and material resources such as those needed for downscaling of climate projections to specific locations (Ziervogel & Zermoglio, 2009). In terms of access, in some government agencies, access to climate information is restricted to only selected few individuals (BBC World Service Trust, 2010d; Muchunku et al., 2014). The excerpt from a Kenyan case below demonstrates some of these barriers to climate information communication.

'NCCAP [National Climate Change Action Plan, Kenya] states that even though significant climate change knowledge is currently generated by Kenyan institutions and individuals including government, research and academic institutions, civil society organisations (CSOs) and private sector companies, there is limited sharing of climate information and knowledge. Its access and use have been inhibited by factors such as language barrier, unsuitable mode of communication, poor infrastructure, and poor repackaging of the information (Muchunku et al., 2014, p. 2)'.

Table 2: Summary of barriers to effective communication of climate information

BARRIER		EXPLANATION	SOURCE
Social barriers	▪ Cultural barriers	▪ Reliance on indigenous/ traditional methods of climate forecasts	Mpandeli & Maponya, 2013; Luseno et al., 2003;
	▪ Material constraints	▪ Limited access to Radios, TVs, internet ▪ Limits access to other information sources	Mittal, 2012; Luseno et al., 2003; Saravanan, 2011;
	▪ Affluence and illiteracy levels	▪ Educated and urban communities are able to access and understand climate change issues better	Luseno et al., 2003; Saravanan, 2011; Karanaisos, 2011;
	▪ Low capacity to take up climate information	▪ Limited understanding of climate change issues ▪ Limited access to materials	Speranza et al., 2010; Mpandeli & Maponya, 2013;
	▪ Gender	▪ Gender roles and differences ▪ Women's limited access to information sources	CARE, nda; CARE International, nd; Tall, et al., 2014b; McOmber et al., 2013;
Content-related barriers	▪ Language barrier	Poor translations of climate change terminologies into local languages	BBC World Service Trust, 2010a; Bisht & Ahluwalia, 2014; Harvey, 2011;
	▪ Timeliness of information	▪ Pastoralists need information before the start and end of rain to decide when migrate	Luseno et al., 2003; ALIN, 2013;
	▪ Technicality of the message	▪ Framing of in a format and language that makes it difficult to understand by users	Bisht & Ahluwalia, 2014; Luseno et al., 2003; Mpandeli & Maponya, 2013; Njuki, 2013;
	▪ Remoteness of the area	▪ Limits access to climate information ▪ Pastoralists have little access to information except through radio	Luseno et al., 2003; Saravanan, 2011;
Technology related	▪ Digital divide	▪ Limited access to ICT e.g. internet	Luseno et al., 2003; Mpandeli & Maponya, 2013; Ospina, 2012;
	▪ Digital scepticism	▪ Fear/ lack of trust in ICT communication channels	ALIN, 2013; García de Jalón, et al., 2014;

3.3.3. Options for science-society engagement to develop usable climate-weather information

For future science-society engagement to develop usable and accessible climate-weather information, Dilling and Lemos (2011; outline that there is a need for:

(i)   specific interventions such as the creation of networks where scientists, climate and weather service providers and potential users can come together;

(ii)   user's to perceive specific benefits such as cost savings;

(iii)   organizational resources such as technical capacity to understand climate information (Beller-Simms et al. 2008; Everingham et al. 2008; Feldman & Ingram, 2009; Lowrey, 2009;

(iv)   the presence of institutional support for incorporation of climate and weather considerations into both short and long-term planning (e.g. in the water or agriculture sectors; (Kirchoff, 2010; Lemos, 2008;

Others have also cited two-way flow of information as an effective approach or opportunity (see Figure 1; (CARE, ndb; Harvey, et al., 2012a,b; Saravanan, 2011; Tall et al., 2014a,b;. Specifically, communication strategies in which information flow involves both top-down and bottom-up approaches in an iterative and collective manner (such as through the participatory scenario planning, PSP; were reported as facilitating the usability of information for adaptation actions (CARE International, 2014; CARE, ndb; Harvey et al., 2012; Kristjanson et al., 2014; Njuki, 2013; Saravanan, 2011; Tall et al., 2014a,b;. The reviewed literature further suggests that community members prefer using multiple communication channels and formats such as combining ICT (Information Communication Technology; communication channels such as television, radio, internet and mobile phones with non-ICT communication channels such as community meetings and workshops. Indeed several studies showed that the combination of different channels, forms and formats enabled communication, and usability of information for adaptation (Braun & Islam, 2012; Karanaisos, 2011; Mittal, 2012; Saravanan, 2011; Yonazi et al., 2012; Nyamba & Mlozi, 2012;. The two excerpts below from different studies illustrate this observation:

'[Through the use of ICTs] farmers [could] get access to information and services 16 times more quickly, […]   eArik [project] did not rely on a single channel in order to communicate[…] eArik used both people and multiple ICTs. Thus awareness raising occurred through farmer facilitators and radio and TV. And demonstrations of new agricultural technologies were undertaken by visiting agricultural experts and through video. This multichannel approach increased the scope and depth of communication, and – through reinforcement –helped ensure that messages were received and were turned into actions. […]' (Saravanan, 2011;.

'Listening to the Shubh Kal radio shows, a few farmers have adopted 'no cost adaptation options' such as field bunding, line sowing, (…;. Narrowcasting sessions [local level listener groups to discuss the show and its application] have proved to be successful in popularising climate change adaptation options and increasing the visibility of radio stations especially in those villages where the radio broadcast reach is not effective and amongst those farmers who missed hearing the shows at the time of the broadcast' (Bisht & Ahluwalia, 2014, p. 19;.

Finally and perhaps critically important on two-way flow of information are studies by Harvey (Harvey, 2011a; Harvey, et al., 2012; whose findings show that key intrinsic factors

and options for increasing usability of climate information include relating the communicated message to user's needs and practices; recognising user-specific contexts; and translating information to knowledge through practical demonstrations.

3.4. Case studies on the challenges and opportunities for supporting the usability of climate information for adaptation in SARs in Africa and Asia

3.4.1. Case Studies Highlight the Contextual and Intrinsic Factors Shaping Usability Challenges

This section highlights case studies on the challenges and opportunities in supporting the usability of climate information in SARs in Africa and Asia. These case studies highlight key contextual challenges:

- **Technology factors** such as lacking access or quality access – e.g. related to power-cuts and failure of equipment (Bisht & Ahluwalia, 2014; Saravanan, 2011;. This can be overcome by using back-up power sources or having hard copy of printed materials (Saravanan, 2011;. Other technology related challenges included digital scepticism, limitation of network signals and digital divide within a population.

- **Social factors** such as gender-differentiated roles and responsibilities and vulnerabilities. In some communities the roles of men and women are distinct. In a Somali community for example, women's access to information and ability to take decisions and actions is limited due to their weak social status in the community (CARE International, nd;. This can be overcome via increasing literacy and technological skills allowing for increased access to technology-centred information sources (Saravanan, 2011;.

- **Economic / political factors** shaping resource constraints for access and ownership of technology-related communication tools such as radio, television, among others (Kristjanson et al., 2014; Saravanan, 2011;.

In addition, the intrinsic factors shaping the challenges for information usability that come up in the case studies include the perception on the accuracy and authenticity of information communicated as well as the timeliness of the information. For example, a study that examined the use of seasonal forecasts to support pastoralist communities in adapting to impacts of climate change noted that the seasonal outlook from the metrological department arrived about a month late and hence was not useful in supporting pastoralists to take-up prompt adaption actions such as migration (Luseno et al., 2003;.

3.4.2. Case Studies Highlighting 'Push', 'Pull', & 'Co-Produced' Models for Knowledge and Action

Opportunities for addressing the factors shaping usability of climate information identified via case studies are divided into three categories – technology-centred, people-centred and mixed approaches. These approaches all relate in one way or another with the 'push', 'pull' and 'co-produced' models discussed in Chapter 1, with most focusing on opportunities for 'co-production':

Technology-centred approaches ('Push' Model;: characterized by the use of ICT-based technology particularly community radios and mobile phones as the main communication

channel. These communication channels incorporate both oral and written forms of communication such as text messages and stories, and are used because they can reach a wider group of users and can be used to convey information faster (Mittal, 2012; Yonazi et al., 2012;. Other ICT-based communication channels include reality television shows, agro-based SMS systems, ICT-supported extension services, knowledge centres, ICT-supported plant mobile clinics, cell broadcast, crowd-sourcing and GIS mapping networks, as well as online knowledge sharing platforms (Bisht & Ahluwalia, 2014; Chohan et al., 2011; Haq et al., 2011; Harvey & Mitchell, 2011; Kristjanson et al., 2014; Ospina, 2012; Wickramasinghe, 2011; Yonazi et al., 2012;. These technology-centred communication channels convey information in different formats such as 'show-and-tell/ listen-and-tell', use of songs, music, drama, radio plays and games. These formats are particularly common with (community; radio and television programmes and are used to attract and maintain users' attention, to support learning, and to show practical ways of applying adaptation practices (Bisht & Ahluwalia, 2014; Kristjanson et al., 2014; Saravanan, 2011;. The technology-centred communication approaches often incorporate top-down communication flow methods, in which information flows from the 'owners' of information to the 'users' of information (Madari, 2012; Wickramasinghe, 2011;. For example, the use of online knowledge sharing platforms such as AfricaAdapt and online community of practice such as 'Sandbox' are common technology-centred communication approaches used to communicate and share knowledge among practitioners at national level (Harvey & Mitchell, 2011; Jackson et al., 2014;. Technology-driven approaches often involve multiple actors including practitioners, government agencies and donors (Harvey & Mitchell, 2011; Jackson et al., 2014;.

People-centred approaches ('Pull' Model; – emphasizes the use of non ICT-communication channels and forms such as face-to-face interactions (Bisht & Ahluwalia, 2014; CARE, ndb; Harvey, 2011;. These people-centred approaches tend to focus on a two-way communication flow (Bisht & Ahluwalia, 2014; Harvey, 2011;. They involve intermediaries visiting the field to discuss and understand farmer's needs, farmers narrating their information problems/ needs, and intermediaries collecting information and relaying to this to relevant people/ institutions (Bisht & Ahluwalia, 2014;. Intermediaries can be NGO project staff, government extension agents, trained radio presenters, educated youth, input dealers and progressive farmers, among others. The information delivered by intermediaries is often preferred by communities because intermediaries are known and trusted by community members (Bisht & Ahluwalia, 2014; P. Braun & Islam, 2012; CARE, ndb; Mittal, 2012; Ospina, 2012; Saravanan, 2011;. Additionally, these people-centred approaches also use other communication channels such as social networks e.g. farmers' groups and women groups to support information collection and dissemination.

Mixed approaches ('Co-Produced' Model; – involve the combination of both technology-centred and people-centred approaches (Bisht & Ahluwalia, 2014; Harvey et al., 2012; Saravanan, 2011;. More specifically, the simultaneous use of both technology-centred generation of scientific knowledge and people-centred pursuit of solutions whereby science is commissioned by its users can result in better understanding, wider uptake and usability of climate information that can be a better fit for user needs. For example, a study conducted in India to assess how modern ICT supports small holder farmers in risk management concluded that ICT-based communication channels were effective in supporting risk management when the information communicated through ICT channels was complimented with non-ICT communication channels such as meetings, since the latter

allowed for a two-way communication loop (Mittal, 2012;. Similarly, a study conducted in Garissa, Kenya to support communities in adapting to climate-induced vulnerabilities noted that disseminating climate information through a combination of technology-centred and people-centred communication channels (such as through community leaders and women groups; enabled better uptake of climate change adaptation practices among different livelihood practices and gender groups (CARE International, nd;. The excerpt below further illustrates the superiority of a co-production model:

'Information received through mobile phones [with call in and discussions] plays a complementary role to existing extension activities, and has a greater impact than other one-way information sources (e.g. radio, television, newspapers etc.;' (Mittal, 2012, p. 32;

Case study examples of different forms of 'co-production' approaches for increasing the usability of climate information among local, regional and national actors in SARs in Africa and Asia are reviewed in Table 4 below, with four of the case studies described in more depth (Boxes 1-4;. These co-production approaches are deemed innovative since they turn more traditional models and 'normal' dissemination channels (e.g. radios and intermediaries; into multiple dissemination and iterative approaches. They also support dissemination and uptake of climate information by (i; directly relating the content of the information to the community's needs and livelihood practices; (ii; presenting the message in a simple, 'light' and easy to understand form, and directly relate the message to the community's needs and social context (e.g. through use of 'infotainment' radio presentations;; (iii; attracting listeners using infotainment and delivering the message in manner that allows for interactions and engagement and that encourages recipients to engage with the information; and (iv; by using several communication channels through combining both technology-centred and people-centred channels in order to enable active engagement with the message and thereby supporting learning, knowledge creation and turning knowledge into action.

Table 3: Science-society 'co-production' case studies for increasing information usability

SHORT TITLE	LOCATION	APPROACH USED	USER	REFERENCE
e-Arik project – Using ICT to facilitate Climate smart agriculture, using ICT supported agriculture extension services	India	Mixed	Local and national	Saravanan, 2011
ICT Enabled Knowledge Brokering for Farmers in Coastal Areas	Bangladesh	Mixed	Local	P. Braun & Islam, 2012;
eAdaptation within Agricultural Livelihoods in Colombia's High Mountain Regions:	Colombia	Mixed	Local	Ospina, 2012;
Using Radio to Improve Local Responses to Climate Variability:	Peru	Mixed	Local	Cabana, 2012;
An ICT Based Community Plant Clinic for Climate Resilient Agricultural Practices	Bangladesh	Mixed	Local and national	Haq et al., 2011;
Role of ICTs in Early Warning of Climate Related Disasters:	Sri Lanka	Technology-centred dominance	National	Wickramasinghe, 2011;
Using Mobile Phones to Reduce the Adversities of Climate Change	Nepal	Technology-centred dominance	Local	Giri & Malakar, 2011;
Pakreport: Crowdsourcing for Multipurpose and Multicategory climate reporting	Pakistan	Technology-centred dominance	National	Chohan et al., 2011;
Supporting Strategic Decision Making on Climate Change: The Case of ENVIS, - knowledge management system	India	Technology-centred dominance	National	Madari, 2012;
ICT Enabled Knowledge Sharing in North-South Partnerships: Lessons from the Africa Adapt Network	Africa	Technology-centred dominance	National and Regional	Harvey & Mitchell, 2011;
Combining Local Radio and Mobile Phones to Promote Climate Stewardship	Zambia	Technology-centred dominance	Local	Jones & Siemering, 2012;
Climate Change Social Learning SandBox - an online community of practice knowledge sharing interactive platform with practitioners, donors and government officials	Africa, Asia	Technology-centred dominance	National and regional	Jackson et al., 2014;
Participatory Scenario Planning (PSP; to support climate change communication among pastoralist and agro-pastoralist communities	Kenya	People-centred dominance	Local	CARE International, nd;
Shubh Kal: Community Radio and climate change communication	India	Mixed	Local and national	Bisht & Ahluwalia, 2014;
Climate Airwaves: Community radio, action research and climate justice	Ghana	Mixed	Local and national	Harvey, 2011;
Shamba Shape up: Promoting climate-smart agriculture through interactive reality TV show	East Africa	Technology-centred dominance	National and regional	Kristjanson et al., 2014;
Climate change adaptation through Community knowledge workers in knowledge centres	Uganda	People-centred dominance	Local	Yonazi et al., 2012;

Box 1: Communication approaches used among rural farmers in India

e-Arik: Using ICTs to facilitate "climate-Smart Agriculture" among Tribal Framers of North-East India

Location: Siang River valley and foothills of the Eastern Himalayas of N. East India

Description of population: 4/5 possessed a radio, 1/3 had a TV and a fixed phone line. Very few possess mobile phones, no computers and internet access. Small-holder farmers practicing slash and burn cultivation, 500 farmers from 12 villages

Aim of the project: To disseminate "climate-smart agriculture practices" to farmers; to support food security; to increase awareness of and capacity for climate-smart agricultural practices (primarily in mandarin and rice farming)

Brief description of the approach: The project established a village knowledge centre equipped with computers, internet, printers, scanners, phone and TV. Project facilitators included: agricultural professionals, computer instructor, and farmers. The project was aimed at providing farmers with information on crop cultivation and agricultural practices, market information and weather forecasts as well as baseline information on agriculture departments and government schemes such as farmer welfare programmes.

How it worked: Farmers could access information they needed directly from portal through support of facilitators at the centres. In addition the project staff took regular field visits to monitor the condition of crops, diagnose pests and nutritional deficiencies and other problems. This information was then digitally in the field e.g. by typing the information needed in a laptop or taking digital images. The information was then sent to the project research laboratory via email, the problem was then analysed by researchers in the laboratory and where necessary the researcher could visit the field for further clarification or information, then a recommendation was passed on to the village knowledge centres, by email. Then the information was relayed to the concerned farmers by phone or face to face through the famer facilitators and through local

How effective was it?

- 44% implemented information received via e-Arik on climate- smart farm practices on paddy rice, with 42% reporting increased production
- 92% of farmers implemented information received via e-Arik on climate smart farm practices on mandarin crops, with 29% of farmers reporting increased production
- 2 years after project initiation, 55% of farmers had moved from slash and burn system to settled system and they had developed new khasi mandarin orchards
- The e-Arik system was 3.6 times cheaper than the normal extension services and supported 16 times faster delivery of required information

What made it successful?

- Using trusted local intermediaries, i.e. use of local educated young farmers who acted as intermediaries e.g. farmer facilitators
- Use of ICT materials and non-digital material: i.e. combining mobile phone to record field data, radio and TV to raise awareness of climate change and agricultural issues, video used in the field to support specific guidance on adopting agriculture technology, physical publications to counter-act power outages and physical display of organic inputs at the knowledge centres to stimulate interest and raise awareness
- Using multi-media channel to reinforce face to face communication
- Partnering with different stakeholders who are locals as well as experts

Challenges include: Digital and project scepticism, financial sustainability of the project, technological and infrastructural challenges e.g. traveling to remote areas with port roads or roads washed out due to landslides

Adapted from: Saravanan, R (2011). e-Arik: Using ICTs to facilitate "climate-Smart Agriculture" among Tribal Framers of North-East India

Box 2: Communication approaches used to support climate-smart agriculture in East Africa

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'Shamba-Shape Up' TV show, supporting adaptation to climate change in East Africa

Location: Viewers in East Africa (Kenya, Uganda, Tanzania), estimated at 10 million in English and Kiswahili

Aim: Supporting farmers with climate- smart agriculture practices and technology

Brief description of the approach: Shamba Shape Up is an educational reality TV show that aims at promoting climate-smart agricultural practices among small-scale farmers. The show is hosted by presenters who visit small-scale farmers in their farms and attempt to understand some of the challenges the farmers are facing. The presenters engage experts in the field to support the framers with solutions and these solutions are then practically implemented. The presenters also follow-up to see how the farmers implemented the solutions provided by the expert, and how effective the solutions have been in supporting their farming practices. Information provided in the show includes climate-smart agricultural practices in view of climate change, market information, agro-metrological information and agricultural information.

How effective was it?

- 98% of viewers reported to have learnt something new from the show such as cattle rearing techniques, and practices that improve soil quality
- 87% of viewers incorporated the learned practices into their farms, these include: rain-water harvesting technologies, irrigation practices, agro-forestry
- Viewers mentioned sharing knowledge with neighbours and community members

What made it successful?

- Using a 'show and tell' approach, assessing the problem, communicating the solution through expert advice and implementing the solution to the problem practically
- Multi-stakeholder partnership between CCAFS, ILRI, ICRISAT, CIP in providing information and other technical support
- Viewers trust expert advice
- Using ICT systems to support an engaged audience. Using different digital media, TV, social network sites, recorded shows uploaded on the website, using SMS services to support follow up information

Challenges include: The show reaches those with TV sets or those who can access TVs, technology challenges in regards to power to support TV technology to disseminate the content of the shows

Adapted from: Kristjanson P, Jost C, Vervoort J, Ferdous N, Schubert C 2014. Moving from Knowledge to Action: Blogging research and outcome highlights. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Denmark: Copenhagen, Shamba Shape Up website: http://www.shambashapeup.com/ *and*

CCAFS website: http://ccafs.cgiar.org/blog/sacrificing-goats-and-cutting-down-trees-tale-climate-change-causes-and-communication#.VQWd8_mUem3

Box 3: Communication approaches used among rural communities in India

Community radios and climate change communication in Bundelkhand (Central India)

Aim: To support communities from drought prone area in adapting to impacts of climate change by sharing adaptation options via community radio, and to link farming communities with scientists, and policy makers

Description of population: Semi-arid area prone to recurring drought, erratic rainfall distribution and dry spells; among the most underdeveloped regions in India; project focused on regional farming communities

Brief description of the approach: The project – 'Shubh Kal – from information to knowledge and action – aimed at linking local communities with scientists and line government officials at district level (such as extension workers) through community radio. The communication model initiated in this project involved training the community radio reporters on climate change journalism to support knowledge exchange of climate change information at the grass roots level. This was done through interviewing farming communities to capture views and concerns of the farming communities and submitting farmer's queries to experts and collecting information on adaptation options and other government schemes. The messages were converted into an easy to understand formats and conveyed in local dialect by incorporating an 'infotainment' approach. This included interview sessions with farmers and experts, radio drama, jingles, folk songs and talk's shows. The shows were disseminated through radio broadcasts and by encouraging narrowcasting (i.e. small listener groups of farmers within a common area, this allows for face to face dialogue and feedback). Feedback from the narrowcasting sessions and broadcast sessions was then collected and submitted to scientists and government officials by the community radio. Thus this model provided a two-way communication approach in which information flowed from scientists and government officials to the community and from the community back to the scientists and government officials. Information shared included: climate resilient farming practices, communities perceptive and understanding of climate change, climate related impacts on agriculture, agro-metrological information adaptation practices such as rain water harvesting, crop insurance, agro-forestry among others

How effective was it?

- 64% of reporters who participated had a good understanding of climate change and could identify linkages between industrialisation and impacts of climate change
- Reporters enhanced capacity in interacting with stakeholders: 92% stated increased capacity in producing climate related programmes, 100% of reporters expressed confidence in reporting climate change issues
- Radio stations were able to link community members with government officials and scientists
- More community members understood climate change issues and tried out the farming practices and adaptation techniques presented through the radio programmes

What made it successful?

- Multi-stakeholder engagement approach, linking community with scientists and government officials, communities trusted information from government officials
- Trained radio reporters to collect information, engage with stakeholders and report information
- Narrowcasting sessions (listener groups support further understanding and uptake of information)
- Infotainment: incorporating entertainment e.g. jingles, drama and folk songs into the programmes
- Dissemination of information in an easy format in local dialects
- Incorporating two way dissemination approach, incorporating both farmers and expert information in the programme and incorporating traditional knowledge from farmers
- Incorporating radio and face to face interaction in information dissemination

Challenges: Need access to radio, face to face interaction requires time and resources

Adapted from: Bisht, H. & Ahluwalia, N. (2014). Community radios and climate change. Communication mapping grassroots experiences of the 'Shubh Kal' project in Bundelkhand Central India. Development Alternatives

Box 4: Communication approaches among pastoralists and agro-pastoralists in Kenya

Using Participatory Scenario Planning (PSP) to support climate change communications among pastoralist and agro-pastoralist communities in Garissa, Kenya

Location: Garissa County, Kenya

Aim: To support communication of climate information to communities in Garissa in order to facilitate community based adaptation to climate change

Description of population: Semi-arid region, prone to drought, community group consists of pastoralist and agro-pastoralists groups.

Brief description of the approach: The Participatory Scenario Planning (PSP) approach used workshop and stakeholder engagement approach to collect and interpret climate information, develop advisories that are relevant to community livelihood strategies in order to support informed decision-making and the up-take of adaptation practices. Through the PSP, forecast data, traditional forecasts and vulnerability data was collected and assessed. Stakeholders came together in a workshop set-up for 1- 2days, and included: metrological department, community leaders, agriculture and livestock extension officers, local NGOs and community members.

The PSP followings the following process:

1. Identify the meteorological services and forecasts available for the location where adaptation is being planned and plan the PSP workshop with them and key local actors, following good practice principles (See Box 2)
2. Invite participants from a relevant range of stakeholders, including meteorological services and local/traditional forecasting experts
3. Exchange seasonal climate forecast from local and scientific sources
4. Discuss and integrate the forecasts from the two sources
5. Participants interpret seasonal forecast into three probabilistic hazard scenarios, assessing risks posed by the hazards to develop impact scenarios. Opportunities in the coming season are also identified for each scenario
6. Participants discuss the local implications of the impact scenarios considering the status of food security, natural resources, livelihoods and sectors
7. Participants discuss and develop actions for each impact scenario, taking advantage of identified opportunities: What will communities, local government and local NGOs do? How will their actions be mutually supportive and respond to both the current situation and expected forecast in relation to livelihood and sector priorities?
8. Develop advisories from the actions discussed: Locally relevant and actionable information, with agreed responsibilities among local actors
9. Communicate advisories to users, for e.g. through radio, local monitoring or other institutional systems, religious leaders, chiefs, government departments, local groups, NGOs, media among others.

How effective was it?

- Better access to climate information to support planning for government officials
- Livelihood diversification is enhanced
- Informed decision making on adapting to drought by both agro-pastoralist and pastoralist

What made it successful?

- Multi-stakeholder engagement approach
- Using different dissemination channels
- Developing advisories based on livelihood needs and social networks (women groups)
- Incorporating traditional forecasts and modern forecast
- Participatory and inclusive approach for developing advisories and scenarios

Challenges: Gender constraints, affluent pastoralist are engaged in the PSP process, weak communication channels for nomad pastoralist

Adapted from: CARE International (nd) PSP, Case 3

3.4.3. Case Study Implications

These case studies highlight effective co-production models and approaches and illustrate three main factors that make these communication approaches successful:

Participatory approaches and social learning: The four case studies indicate that these approaches incorporate aspects such as collective information generation and a two-way approach to knowledge sharing. This combines the incorporation of both indigenous knowledge and modern knowledge in shaping and refining the content of the information in relation to a specific socio-political and economic context (Bisht & Ahluwalia, 2014; CARE International, nd; Harvey et al., 2012;. Such factors as social networks, culture, gender and traditions also played a role (Harvey et al., 2012;. This was evident through the PSP workshop [Box 4] in which members from the pastoralists and agro-pastoralists communities, metrological officials, local leaders and extension workers worked together to discuss seasonal forecasts by incorporating both indigenous forecast information as well as modern seasonal forecasting in order to generate advisories to support their livelihood activities within their local contexts (CARE International, nd;. These findings suggest the relevance of supporting a participatory and social learning approach of adapting community livelihoods while recognising the importance of social context (Harvey et al., 2012;. These findings also relate to previous literature suggesting that effective approaches require moving from a one-way communication flow to a two-way or social learning approach that understands and takes social context into account (Harvey et al., 2012; Harvey, et al., 2012;

Multi-channel and multi-stakeholder communication: This involves including multiple communication channels, both ICT and non-ICT based, as they play different functions in information generation and dissemination (Bisht & Ahluwalia, 2014; CARE International, nd; Saravanan, 2011;. The use of ICT communication channels supported faster and easy access to information (Saravanan, 2011;. For example [Box 1 & 2] radio and television were used as effective tools to create awareness due to their wider reach within the local context (Kristjanson et al., 2014; Saravanan, 2011;. Digital camera and videos were used by extension workers to support information collection but also to practically show how field solutions work (Saravanan, 2011;. Intermediaries such as extension workers, project staff, and reporters collected information from the field and relayed this information to experts and other stakeholders. This approach was preferred by local communities as it offered a face-to face interaction where farmers were able to clearly describe their problems or support in information and knowledge generation (Bisht & Ahluwalia, 2014; Saravanan, 2011;. Multi-stakeholder approaches incorporated all relevant stakeholders in the communication process, including local community, government officials, extension workers, and project staff members, among others (CARE International, nd;. All stakeholders had relevant roles to play in supporting information generation, dissemination, understanding and application of the knowledge to action. Other studies have found that the use of different communication channels, and the involvement of different stakeholders in the communication process, makes it easy for the uptake of climate change adaptation actions (ALIN, 2013; CARE International, nd; Harvey, 2011a; Harvey, et al., 2012; Kristjanson et al., 2014; Moser & Dilling, 2012; Tall, et al., 2014b;

Relevance of information to user's needs: This involved using relevant content that related to user needs and livelihood practices and an understanding of the social context that shaped these needs (CARE International, nd;. For example, [Box 1, 2, 3, 4] climate

42

information was often incorporated with agriculture, market and pastoralism-related information, in order to relate the climate information to the community's livelihood practices (CARE International, nd; Kristjanson et al., 2014; Saravanan, 2011;. Relevance of the communication content also includes more than communicating relevant content; it entails packaging the information in a format and language that is easy to understand, that relates to the user's social context and is integrated within existing communication formats (Bisht & Ahluwalia, 2014; CARE International, nd; Kristjanson et al., 2014; Saravanan, 2011;.

These formats entail use of 'infotainment' that incorporates information and entertainment communication forms such as use of songs, jingles, drama, folk songs and practical examples (Bisht & Ahluwalia, 2014;. For example, [Box 1 & 3] made use of radio as an information dissemination channel as it was widely used, easily accessible by the target user, had a wide broadcast network and could easily fit in the farmers' daily practices (e.g. farmers could carry/ walk along pocket radios to the field; (Bisht & Ahluwalia, 2014; Saravanan, 2011;. Furthermore, 'infotainment' in the form of music, jingles and drama was used to make the message 'light' and relevant for the listeners. By using this format, farmers were able to adopt climate-resilient practices and hence increase their farm productivity, as is illustrated in the below excerpt (Bisht & Ahluwalia, 2014; Saravanan, 2011;.

'During the production of radio shows on climate change, the radio reporters captured views and concerns of the farming community […]. This information […] was converted into easily comprehensible messages using an edutainment approach [such as] radio dramas, jingles, folk songs and talk shows' (Bisht & Ahluwalia, 2014, p. 9;.

These findings are in line with findings from Moser and Dilling (2012; and Dilling and Lemos (2011; which show that in order to close the science-policy communication gap, communication messages should be conveyed in a format, language and form that is captivating and easy to understand for the user and that it fits into the user's needs.

General Observations and Possible Research Questions for the Regional Research Phase

General observations and possible research questions for the regional research phase

This regional diagnostic study aimed to examine (1; the factors that shape understanding and use of weather and climate information in SAR of Africa and Asia; (2; how weather and climate information is communicated and used in SAR of Africa and Asia and (2; the opportunities that could support effective communication and use of weather and climate information in SARs of Africa and Asia. The overall goal, was to identify challenges and opportunities for effective understanding, communication and use of weather and climate information in semi-arid regions of Africa and Asia. From the review, it is clear that several intrinsic and contextual factors influence understanding and use of weather and climate information. The intrinsic factors include the communication approaches (i.e. channels, forms and formats;, used to communicate weather and climate information. Contextual factors include communities' cultural practices and beliefs, differentiated access to assets and livelihood practices, access to community-based organizations and social networks, geographic location and gender aspects. However, what is not known is how each of these intrinsic and contextual factors enable or hinder adoption of adaptations actions among different actors in semi-arid regions.

Therefore, the next step of the communication research could explore how the various intrinsic and contextual factors influence understanding and use of weather and climate information and hence adoption of adaptation actions. Specifically, the next phase could compare the level of adoption of adaptation actions across different weather and climate information communication channels, forms and formats. For example, the review noted that radios and mobile phones are the preferred channels for communicating weather and climate information in semi-arid regions of Africa and Asia. However, there was no indication about the extent to which these channels enhanced effective adoption of adaptation actions. Additionally, the review noted that the combination of technology-centred and people-centred communication approaches facilitate better understanding of climate information. But, does this enhanced understanding translate to increased adoption of adaptation actions at different scales?

The review also noted that cultural practices and religious beliefs influence how communities perceive weather and climate information. However, exactly how these cultural practices and religious beliefs impact use of weather and climate information and hence adoption of adaptation actions is not well understood. Therefore, the next phase could also examine how different cultural practices and religious beliefs enable or hinder adoption of adaptation actions. Here, research could examine the level of understanding and use of climate information by religious leaders. This would be a starting point for determining the possible role that religious leaders could play in communicating weather and climate information and facilitating adoption of adaptation actions to their congregations.

While the review has taken a general view of contextual factors, it is highly likely that the contextual factors in semi-arid regions of Asia vary from those of Africa. Given the contextual differences between Asia and Africa, the next phase could also explore how use of weather and climate information as well as adoption of adaptation actions compare between semi-arid regions of Africa and those of Asia. In the same manner, the next phase

could compare the level of use of weather and climate information and adoption of adaptation action between different localities (urban verses rural; and livelihood practices (agricultural verses pastoral;.

The review also observed that the level of trust in weather and climate information varies from one provider to another. This variability in level of trust in the weather and climate information being communicated affects both how it is understood and used. The next phase could therefore explore the level of trust in weather and climate information generated by different providers: research and scientific communities, governmental agencies, and private weather and climate information service providers, and how this influences the use and adoption of adaptation actions. Issues of trust also raise questions on how weather and climate information generation and communication is governed. While it is acknowledged that co-production models of weather and climate information generation and communication enable better understanding and use of information, there is limited research that looks at governance aspects of weather and climate information generation and communication. The next phase could therefore examine how climate information generation and communication is governed. Here, research could address issues of who is involved, through mechanisms and what are the decision making procedures.

The review also noted that gender inequality plays a role in determining one's access to climate information sources such as meetings and community leaders. In limiting marginalized groups' (e.g. women, pastoralist, less politically commented groups; to information, these inequalities also limit these groups' understanding and use of weather and climate information in mainstreaming their adaption actions. However, it is not yet known whether enhancing marginalized groups' access to weather and climate information could enhance their use of the same and adoption of appropriate adaptation actions.

The review also observed that while extensive literature has examined the understanding, communication and use of weather and climate information among government agencies and practitioners such as local communities and policy makers, there is hardly any research that examines how private sector organizations such as insurance and banking understand and use weather and climate information in making decisions. For example, while many insurance and banking companies in countries such as Kenya and Ethiopia provide crop and livestock insurance to both farmers and pastoralists, it is not yet known whether and how these companies use weather and climate information in making their decisions.

Lastly, the study notes that both the generation and use of weather and climate information is influenced by varied perspectives, interests and values of the different actors. This actor differences results in discursive and material struggles about both the meanings and values of weather and climate information as well as the appropriate adaptation actions to be undertaken in particular climate situation. To date, however, no studies have specifically examined the discursive and material struggles and contestations on the meaning and value of weather and climate information and the appropriate adaptations actions to be adopted. Therefore, the next phase could examine the different meanings and values that different actors attach to weather and climate information and how these actor differences influence both the use of weather and climate information and adoption of adaptation actions.

CHAPTER 5

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