

# Exploring the relationship between local institutions in SAT India and adaptation to climate variability

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**Abstract** This paper examines the relationship between local institutions and adaptation to climate variability in four semi-arid villages in India. Based on a qualitative survey, it draws attention to the constraints that farming households face, the role of institutions, and the implications for their capacities to adapt. Using an institutional framework, the study examines the role of local institutions in facilitating community adaptation to perceived climate variability. It was found that at the institutional and community level farmers rely on government schemes that provide social safety nets and the private sector such as moneylenders as sources of adaptation options regarding access to credit. Serious constraints emerged, however, in terms of adaptation to what may be a more challenging future. These constraints were further explored by means of grounded theory. The lack of collective feeling and action has hindered bargaining for better market prices and the development of alternate livelihood options. The need for better financial inclusion and access to more formal systems of finance is necessary to increase the overall adaptive capacity of households. During crisis situations or climatic shocks, the absence of these systems means the sale of household assets and resources especially among small and landless groups of farmers. Overall, rural households perceive that public, civic, and private institutions play a significant role in shielding them against the adverse effects of climate variability. The perceived importance of different institutions is, however, different across different categories of farmers, women, and labourers.

**Keywords** Climate change · Perceptions · Institutions · Adaptation behaviour · Adaptation constraints

## 1 Introduction

It is frequently assumed that if climate change is gradual, farmers will have little trouble coping with it. Smith (1996) argues, however, that agricultural systems do not evolve in

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response to changes in average conditions but to changes in variable and largely unpredictable conditions, including extreme weather events. Coping with these events is thus part of current and ongoing adaptation to climate variability and long-term change. Earlier studies in Africa have shown that farmers' perceptions of change relate to the increased variability and uncertainty of specific climatic parameters (Gumbo 2006; Mertz et al. 2009; Osman-Elasha et al. 2006; Thomas et al. 2005). Some of these perceptions include late onset of rains, shorter wet monsoons characterised by slight but intense rainfall, strong winds with excessive rains, more intense summer heat and unpredictability in the pattern of the seasons. In addition, through a pilot study conducted in two villages in the state of Uttarakhand in India, it was found that almost all the households interviewed felt that rainfall had declined in quantity and timely onset of monsoons could no longer be relied on. Respondents noted a decrease in scattered light rainfall, useful for percolation, and an increase in intense rainfall which destroyed crops and increased run-off rates as well as soil erosion. They also observed a decline in groundwater with increase in heat intensity (Kelkar et al. 2008).

Adaptation is a feasible option for increasing the resilience of marginalised communities, who have a high dependence on natural resources (Adger et al. 2003). Successful adaptation, however, depends on a variety of interrelated factors including farm-level conditions, institutional context, technological capacity and other socio-economic factors. Institutions and culture can determine the perceptions, subsequent adaptation strategies and resilience of a community to climatic shocks. The characteristics of adaptation are a product of the role and influence of institutions from within in determining environmental and social outcomes.

This study aims to explain the relationship between local institutions and adaptation to climatic shocks. It is based on a survey conducted in the four villages, Kanzara and Shirapur in Maharashtra state and Dokur and Aurepalle in Andhra Pradesh (AP) state, in the semi-arid tropics (SAT) of India. Community perceptions and actions in response to climate change and variability were elicited by a combination of focus group discussions and semi-structured interviews. Special attention was paid to constraints that emerged regarding the adaptation and institutional mechanisms that farming households employ to manage shocks. The study attempts to reflect the understanding of the farming community of the role of local institutions as an aid to adaptation to climate variability and the challenges facing them. This would help policy makers to enhance the capacities of these institutions and in mainstreaming successful adaptation strategies on the agricultural development agenda.

## 2 Vulnerability and the role of institutions in adaptation

### 2.1 Vulnerability

Vulnerability in the context of climate is the susceptibility of a community or an individual to the harmful impacts of disturbance in climatic conditions and weather patterns. Ecosystems in the semi-arid tropics (SAT) regions of Asia are characterised by extreme rainfall variability, recurrent but unpredictable droughts, high temperatures and low soil fertility (Dar et al. 2007; Bantilan and Anupama 2006). In addition to this, an individual's or a group's vulnerability to climate variability apart from rainfall and temperature is influenced by a complex array of socio-economic and institutional factors operating at various levels (Brooks 2003). For instance, existing evidence and lessons learned from

ICRISAT's Village Level Studies (VLS) since 1975 provide empirical proof of the vulnerability of the poor to various climate risks and shocks, as well as their lack of ability to access physical, financial and social resources and networks in the risky environments of the drylands (Bantilan et al. 2006).

Individuals and groups therefore rank risks in terms of their probabilities, their own coping strategies and ability and the willingness of the state to help them adapt and survive various crises and disasters (Parthasarathy 2009). Since their ways of life channel the thought and behaviour of individuals, they constitute a 'bounded rationality' or a self-explanatory system of mutually reinforcing beliefs, values, and social relationships (Douglas and Wildavsky 1983). Such systems also contain coping mechanisms to deal with threats or failure. This is done through developing institutions, social practices, and rules for dealing with problems and uncertainty (Sharma et al. 2009; Parthasarathy 2009). With this in mind, the established institutions need to be assessed in terms of their effectiveness in supporting adaptation practices and the challenges that farming communities face in deriving the intended benefits.

## 2.2 Adaptation

Adaptation includes actions and adjustments undertaken to maintain the capacity to deal with stresses induced as a result of current and future external changes. The United Nations Framework Convention on Climate Change (UNFCCC 1997) defines adaptation as the involvement of adjustments to enhance the viability of social and economic activities through passive, reactive or anticipatory response to possible adverse consequences to reduce the vulnerability of groups or individuals to climate change.

Adaptive capacity comprises preconditions that enable actions and adjustments in response to current and future external changes; these are dependent both on social and biophysical elements (Nelson et al. 2007 cited in Agrawal 2008, pp. 5). Adaptation in rural settings may be in different forms including mobility, storage, diversification, communal pooling, and market exchange (Agrawal 2008). The effectiveness of strategies for adapting to climate change depends on the social acceptability of options for adaptation, the institutional constraints on adaptation and the place of adaptation in the wider landscape of economic development and social evolution (Adger 2003; Adger et al. 2002, 2005a, b). Individual or collective entitlements within a community therefore shape its ability to adapt to shocks including climate change. These entitlements and the constraints that communities face in deriving benefits are worthy of analysis.

## 2.3 Entitlements and capability approach

The capability approach addresses this idea of self-determination through the argument that people have greater freedom than given by government or written on paper. The core characteristic of the capability approach is its focus on what people are effectively able to do and to be (Sen 1992; Nussbaum 2000). The importance of the capability approach in understanding adaptation to vulnerability in the SAT regions of India is crucial as the approach attempts to look at equity and justice issues of households who spend a major part of their lives collecting resources to meet their basic survival needs. Second, this approach addresses the role of institutions and individual behaviour and attitude (Liverani 2009) coupled with collective action (Ostrom 2000) as determinants of capacities to adapt and create resilience to climatic shocks. It is especially relevant in this context to understand whether the status of particular groups is responsible for providing them with access

to certain entitlements like financial, technological or even governmental schemes which can be facilitators of better adaptive capacity.

The ultimate aim of the capability approach is that the ends or goals of policies should be people's well-being that is capabilities<sup>1</sup> in all dimensions. It acknowledges human diversity and stresses that different people need different types and different amounts of capability inputs to achieve the same well-being (Chiappero 2008; Picchio 2003; Robeyns 2003).

This study applies the capabilities and entitlements framework to understand whether entitlements such as information and financial access, governance, technological inputs and infrastructure shape adaptive capacities and hence the level of resilience of particular groups against climate variability.

## 2.4 Role of institutions

The word 'institution' has been used to describe organisations, human relationships or the rules that are used in relationships between individuals (Goulden 2005; Jordan and O'Riordan 1995). North (1994) defines institutions as the rules of the game: the humanly devised constraints that structure human interaction. They are made up of formal constraints (such as rules, laws, constitutions), informal constraints (such as norms of behaviour, conventions, self-imposed codes of conduct), and their enforcement characteristics. They may be defined as the institutional framework (the totality of institutions) within which environmental decisions are made and as institutional arrangements (particular sets of rules) through which such decisions are implemented (Adger et al. 2003).

Social capital is made up of norms and networks that enable people to act collectively (Woolcock and Narayan 2000 cited in Adger 2003, pp. 391). It is a necessary element of economic transactions and collective action on scarce environmental resources (Ostrom 2000). The study of institutions and organisations can reveal information about the nature of social capital (Goulden 2005).

The process of adaptation is complex as it involves many interconnected actors and factors and their interaction with their environment including the resources available to them and the institutional set-up. The impact of institutions on environmental problems and decisions varies from one context to another. This means that generalisations from specific cases must be made with caution, giving adequate attention to their context (Edwards and Steins 1999 and Mehta et al. 1999, both cited in Adger et al. 2003 pp. 1100).

Given the importance of institutions to adaptation, it is critical to establish how they reinforce particular combinations of adaptation practices. Agrawal (2008) notes that external interventions can reinforce livelihood practices and local rural institutions by supplying the four types of support: informational, technological, financial, and leadership that reduces the costs of collective action. He further observes that institutions can influence adaptation and climate vulnerability in the three critical ways: (a) they structure impacts and vulnerability, (b) they mediate between individual and collective responses to climate impacts and thereby shape outcomes of adaptation, and (c) they act as the means of delivery of external resources to facilitate adaptation and thus govern access to such resources. Examining social vulnerability to environmental change through a comprehensive institutional approach therefore

<sup>1</sup> Where capabilities according to Sen and Nussbaum are defined as freedoms and functionings, the freedoms come in the form of freedom, economic facilities, social opportunities, transparency guarantees, and protective security. Functionings on the other hand include working, resting, being literate, being healthy, being part of a community, being respected, and so forth (Nussbaum 2000; Sen, 2009; Sen 1992).

entails a consideration of the role of social institutions in mediating vulnerability, how these institutions are contested and changed over time, and the wider political economy of their evolution (Adger 2000).

The success of adaptation practices depends on the links of households and communities with the institutions as well as the links between the institutions. Connections between local and higher-level institutions allow residents of a given locality to leverage their membership of local institutions for gains from outside the locality (Agrawal 2008). This interconnection is often lacking, both between national and local institutions and between relief and development programs. For instance, drought relief programmes in India are as old as the famine code devised by the British Raj in the 1880s, but relief strategies despite subsequent changes lack integration with development programmes (Jodha 1991).

In this study, we consider all the three types of institutions, namely civic, public, and private, that are necessary enablers of the capacity of households and social groups to deploy specific adaptation practices.

### 3 Study area and methods

#### 3.1 Study area

The study area includes farming groups in the four villages: two in Maharashtra (Kanzara in Akola district, Shirapur in Sholapur district) and two in Andhra Pradesh (Aurepalle and Dokur in Mahbubnagar district). These villages were originally selected as sites for the Village Level Studies of ICRISAT and are located in SAT India. Agro-climatologically, the study villages are situated in zones where the rainfall exceeds potential evaporation for 4–6 months of the year. Mean annual rainfall in these areas ranges from 400 to 1,200 mm, which is typical of regions in the semi-arid tropics.

Mahabubnagar is characterised by red soils, whereas rich thick black soils typify Sholapur and Akola villages. Rainfall is scantier and more erratic in Aurepalle and Shirapur, being unusually dry in most years. More than 90 % of the area is cultivated and planted during the *khari*f (rainy) season in the Mahbubnagar and Akola villages; erratic rainfall coupled with deep clay soils in the Sholapur village makes it more profitable for farmers to store precipitation in their deeper soils during the rainy season and cultivate crops under a regime of residual soil moisture during the *rabi* (post-rainy) season. The onset of the monsoons in all the regions of study is usually in the first week of June and continues to the end of September (Walker and Ryan 1990).

The poor in the villages under study are less educated, of lower caste, and have larger extended families, more children, higher dependency ratios, fewer economically active workers, less wealth, and less access to land, especially irrigated land. The non-poor are typically better educated, do not participate as actively in the labour market, and own more land than the poor, which is a definition of most Indian SAT villages (Walker and Ryan 1990).

A brief socio-economic profile of the study villages is provided below (Table 1).

With regard to education, since 1955 in Aurepalle, 1954 in Dokur, 1848 in Shirapur, and around 1905 in Kanzara villagers have had access to a primary school offering education up to fourth-grade. Infrastructure wise, though none of the villages are located on a paved road, the main road is a few kilometres away. All the villages have access to electricity, but relatively few of the households in each village receive it, especially in Maharashtra.

**Table 1** Socio-economic profile of the four villages as of 2009

Characteristics	Shirapur	Kanzara	Dokur	Aurepalle
Cultivable land (Ha)	1,069	539.61	1,303	1,300
Total number of households	571	319	519	766
Average family size	5.4	4.47	5	5
Literacy rate (2001–2004)	70	83.63	60	50
% Below poverty line	40	35	< 15	20
Average annual rainfall	545 mm (2005–2007)	654.7 mm (2001–2005)	627 mm (2001–2007)	790 mm (2006–2008)
Soil type	Deep black	Medium-black	Shallow and medium-deep alfisols	Red sandy
Sources of irrigation	Canals, wells, river. Bore well	Well and canal	Tanks & bore wells	Bore wells
Major crops grown	Sugarcane, sorghum, wheat	Cotton, pigeon pea, soya bean, hybrid sorghum, wheat, vegetables	Castor, paddy, sorghum	Cotton, pigeon pea, sorghum, millet, groundnut

Source: Rao et al. (2009)

**Table 2** Landholding size (ha) across the four study villages

Category	Shirapur	Kanzara	Aurepalle	Dokur
Small	0.2–2.0	0.2–1.8	0.2–1.2	0.2–0.9
Medium	2.0–5.3	1.8–5.3	1.2–3.2	0.9–2.1
Large	>5.3	>5.3	>3.2	>2.1

Source: Walker and Ryan (1990)

The electricity received is primarily used to pump water for agricultural purposes. One fair-price shop, also popularly called the Public Distribution System (PDS) shop, which sells subsidised kerosene, sugar, rice, or wheat, is located in each village. In each of the villages, there are also small private shops retailing a few inexpensive consumer goods. The adequacy of market links and marketing inputs, especially seed and fertiliser, leaves much to be desired, however (Walker and Ryan 1990).

As the topography of each of the study villages was different, landholding size was used to determine the different categories of farmers. A short summary of the handholding sizes is given in Table 2 for each of the study villages.

The objectives of the study were to identify:

- (1) community perceptions and actions regarding climate change
- (2) the role of local institutions in the community's adaptation strategy to climate change or variability.

The qualitative nature of the study was based on the premise that not many studies had been conducted in India focusing on the perceptions of farmers, especially with reference to climate change. The basic questions underpinning the study were:

- (1) farmers' perceptions of climate change
- (2) the role of local institutions in adaptation to climate change.

### 3.2 Methodology

Purposive sampling was used to identify different categories of farmers, women, landless labourers and other key informants and compare their perceptions of climate change and subsequent adaptation practices. The farmers were separated into large, medium, and small as described above. The categorisation was based on the understanding that each group had different levels of vulnerability and adaptive capacity based on their resource base and factors affecting the same. Focus group discussions (FGDs) and individual interviews were carried out with the guidance of semi-structured questionnaires. The information gathered was triangulated by means of narratives, timelines and transect walks. Initially, 20 FGDs and 52 individual interviews were conducted as part of the process (see Table 3). Based on the principle of theoretical sampling, an additional FGD was conducted in Shirapur to further explore the issue of constraints that had emerged from earlier interviews and FGDs. Since no new information emerged from this, the data were deemed “theoretically saturated” from the earlier designed FGDs and interviews.

The study began with a conceptualisation based on perceptions of climate change and the adaptation mechanisms as shaped by capability and entitlements and local institutions. In the process of analysis, however, the constraints to adaptation emerged as a critical barrier leading to vulnerability of different groups. A qualitative approach was used to further study these constraints based on information received from the field. The method of analysis used was based on grounded theory (Strauss and Glaser 1967). Although grounded theory was initially designed to develop theories and conceptual frameworks from a purely

**Table 3** Breakdown of FGDs and personal interviews

	Shirapur	Kanzara	Aurepalle	Dokur	Total
FGDs	Timeline	Timeline	Timeline	Timeline	
	Medium + large farmers	Medium + large farmers	Medium + large farmers	Medium + large farmers	
	Small farmers	Small farmers	Small farmers	Small farmers	
	Women	Women	Women	Women	
	Labourers	Labourers	Labourers	Labourers	
	Youth				
Total	6	5	5	5	21
Individual interviews	4 Large farmers	4 Large farmers	4 Large farmers	4 Large farmers	
	4 Medium farmers	4 Medium farmers	4 Medium farmers	4 Medium farmers	
	4 Small farmers	4 Small farmers	4 Small farmers	4 Small farmers	
	1 Key informant <sup>a</sup>	1 Key informant	1 Key Informant	1 Key informant	
Total	13	13	13	13	52

<sup>a</sup> The key informants were the village head or *Sarpanch* in the local language

inductive perspective, it has evolved to encompass a combination of both inductive and deductive approaches (Charmaz 1991; Strauss and Corbin 1998), also referred to as an abstractive approach. For this particular study, it was imperative to begin the research with an explorative and iterative approach to data collection. The gaps that appeared in the theoretical representation of initial interviews, documents, and observations were filled by follow-up visits and interviews. Adopting this approach gave the flexibility and methodological rigour needed to guide the research to fit the data collected in the field.

The interviews recorded during the process of data collection were transcribed verbatim. The coding process was the most important part of the analysis as it formed the basis of the emerging findings related to perceptions on climate change and its impacts, adaptation practices, institutional support and most importantly the institutional constraints on adaptation. Initially, open coding was used whereby each sentence or group of sentences was analysed and notes made to reflect the situation and meanings implied by the respondent. This was followed by axial coding from which different categories of constraints emerged such as access to technological inputs and information infrastructure and finance. The field notes served the initial memos which were integrated in the final stage of analysis as a way of filling the gaps (Emerson et al. 1995). The analytical process provided insights and provided an in-depth understanding of the issue by probing, clarifying, and listening to stakeholders talks about the topic in their own words. The process was iterative whereby attempts were made to keep clarifying the understanding of climate change by the respondents. It freely allowed the respondents to give their own interpretation of 'why' and 'how' the phenomenon was happening and 'what' they were doing based on this understanding. Four categories of constraints emerged from the analysis, namely financial, leadership/governance, infrastructure/technological and information access.

## 4 Findings and discussion

### 4.1 Community perceptions of climate change and adaptation strategies

In the four villages under study, it was established that farmers perceived and responded to climate variability and extreme conditions rather than the long-term change. The effects of climate variability were most felt in the villages of Kanzara in Maharashtra and Dokur in Andhra Pradesh. In the case of the two villages of Maharashtra, the farmers had increasingly noticed variability in climate over the past 5 years. Dokur, for instance, had been grappling with drought conditions for the last 18 years. Farmers felt that there had been an increase in temperature. The farmers also perceived that there had been significant variations in the quantity and distribution of rainfall over the years. They believed that the rainfall was more intense, with fewer rainy days, and had an extremely erratic distribution. Compared with the 1970s, when rainfall accounted for 68 days on average, it had currently reduced to an average of 45 days across the four villages.<sup>2</sup> Most of the respondents expressed concern about unseasonal rain in the months of May, September and November which was becoming common. For the villagers, the fact that the months of June, July and August did not bring much rain in terms of quantity and

<sup>2</sup> The perception of the farmers seemed quite accurate as this information was confirmed by the first-generation ICRISAT resident investigators. In addition, the climatic data obtained from the district level concurred with the description of the years of extreme events by the farmers.

distribution especially in the past 5 or 6 years indicated that climate had become more variable, rather than suggesting a consistent change.

Climate variability was perceived as presenting a risk to the farming communities amid concerns that income through agriculture had drastically reduced.<sup>3</sup> Concern regarding the availability of water for (1) household and drinking purposes and rearing livestock and (2) fields and crop production was evident. Farmers have had to resow seeds because of the uneven distribution of rainfall and delay in the onset of rains followed by dry spells. Sharp decline in the water table was observed across the villages for the last 20 years.<sup>4</sup> In Kanzara, water was provided externally for crops in the months of June, July, August, and September, which was unusual as irrigation in the past was required only during the *rabi* season. Increases in pest attacks and diseases were also attributed to the delay in the monsoons, increase in temperature, less water availability and subsequent delay in sowing. The attacks were further escalated by humid and cloudy conditions.<sup>5</sup>

Farmers expected a good harvest if the onset of rains was timely and crops were planted at the right time. The indigenous variety of cotton was felt to yield hardly any worthwhile production in the current situation. The availability of fodder was seen to be decreasing over the years, thus affecting the production of milk and the capacity of the animals to work in the fields. Higher temperatures were also seen to cause second-order impacts. With the increase in temperature, some of the micro-organisms which were there in the soil and were useful for the health of the crops had been killed. Women in Kanzara expressed concern that, because of higher temperatures, grain that was stored in the houses was beginning to spoil at a much faster rate than previously.

Medium farmers observed that one bad year<sup>6</sup> actually meant 2–3 years in the regular life of a farmer. In addition, if there was an absolute need to build a house or to perform any social duty like a wedding, this compounded the problem and spilled over to the next year as well. Suicide was not infrequent when they had run out of all other options for coping with a bad year.

For a farmer, the whole of his livelihood depends on that one or two months of good rain that comes. All throughout the year the farmer waits for the rains to come and when it doesn't, he doesn't have the money he requires for taking care of other things besides his livestock and farming requirements. It is on that 20–50 bags of Gahu and Jowari that he grows and when the rains don't come all his hard work of cultivation, sowing and doing everything that it takes goes for nothing  
Shirapur farmer

<sup>3</sup> In 2009, farmers in Kanzara lost about 70 % of *Kharif* crops, the worst sufferers being the farmers without irrigation. There was little or no production of the subsequent *Rabi* crops, which also meant loss of work for the labourers.

<sup>4</sup> In Aurepalle, open wells were reported to be completely dry as were 75 % of bore wells. In Shirapur, farmers had to dig bore wells up to 400 feet deep to get water compared with 10 years ago when water was available at 100 feet.

<sup>5</sup> Mealybug pest, and a disease identified as *Karbya Rog* on soya bean in Kanzara, in the last five or six years; a new kind of pest on BT cotton and castor in Dokur.

<sup>6</sup> Where bad year is defined as a year where the rains are not up to the expectations of the farmers in terms of onset, quantity and distribution; there is poorer crop production than expected; there are floods; water shortage either for agriculture or for drinking or both; labourers find it hard to get farming work inside the village.

The labourers observed that because of increasing variability and lack of water, finding fairly paid employment in agriculture was difficult. Therefore, they were looking for non-agricultural income sources outside the villages and in nearby cities.

Farmers have coping strategies which have evolved as long-term adaptation mechanisms to shield themselves against climate uncertainties. Diversification in terms of producing short-duration crops, commercial crops like sugarcane and soya bean along with experimenting with vegetable growing, indigenous methods of soil conservation, the involvement of women in farm activities, and caste-based professions have emerged as effective strategies that have come to be accepted socially and culturally at the local level. In severe conditions, however, as a last resort, the small and the landless group of farmers sell their household assets and resources. Though livestock was not a very significant asset for households in the study villages (Rao and Kumara Charyulu 2007), it was one of the easiest assets to dispose of during a crisis.

Climate, alongside market demand, has played a role in the shift from food crops to shorter-duration cash crops, which raises concerns regarding food security. The emphasis on water conservation practices by the farming and the non-farming community is evidence enough to suggest that farmers are ready and willing to work towards it, assuming they have definitive guidelines and capacities.

#### 4.2 Institutional support for adaptation

To understand the perceptions of the importance of institutions in climate change adaptations, focus group discussions were held with each category of farmers, women and labourers. The respondents were asked to rank the institutions in order of importance with the help of institutional Venn diagrams. In the analysis, ranking was high (for the most important), medium (for moderate use and importance) and low (for those institutions which the groups perceived as being of no use or help to them at all). This was carried out across groups and for each village. The results were then summarised on a scale of zero to four to reflect the number of villages where a certain institution was perceived to have either medium or high importance by a given category of respondents. Table 4 summarises the perceptions of different categories of interview subjects of the importance of different institutions in the adaptation process.

‘External interventions can reinforce livelihoods practices and local rural institutions by supplying the four types of supports: informational, technological, financial, and leadership that reduces the costs of collective action’ (Agrawal 2008 pp. 3). These categories of support were considered in the context of the study villages to establish how different kinds of institutions emphasise certain adaptation practices.

### 5 Financial

Crop insurance was acknowledged by the respondents as a good safety mechanism against the increasingly erratic and uncertain weather conditions. The farmers still lacked proper understanding of the implementation process. The uptake of crop insurance, mainly by the big and the medium farmers, was higher in the Mahabubnagar villages than in Akola and Sholapur.

Women, irrespective of socio-economic status, were observed to be highly dependent on self-help groups (SHGs) not only for financial assistance but as a platform to mediate access to technology and credit, especially in the Mahabubnagar villages. In the case of

**Table 4** Perceptions of the importance of institutions in climate change adaptation across groups

Groups	Public					Private				Civic	
	PDS	NREGA	*Banks	KVK/Agri Dept	Gram panchayat	Private seed companies	Money lender		Family/relatives	SHGs	Co-operatives
B Farmers	1	2	4	2	2	4	0		4	4	4
M Farmers	1	2	4	2	2	4	0		4	4	4
S Farmers	4	4	0	1	2	4	3		4	4	0
Women	3	3	0	0	1	0	2		4	4	0
Labourers	4	4	0	0	2	0	4		4	4	0

Source: FGD with farming and non-farming groups in Kanzara Shirapur, Aurepalle, Dokur 2009

\* Banks are categorised as public institutions since most of the banking services available to farmers in the rural areas are provided by nationalised banks

Shirapur, SHGs were mainly exploited for the purposes of acquiring credit for non-farming activities such as meeting household expenses and starting a small business, whereas in Kanzara, the credit was used for farming activities. This reliance on SHGs seemed important despite the fact that they were not run as efficiently as they should have been, compared with those in Dokur and Aurepalle. The importance of SHGs was echoed by all categories of respondents.

It was interesting to note that only Aurepalle had a microfinance institution (MFI), SKS Microfinance.<sup>7</sup> The MFI gave loans which ranged from Rs. 10,000/- to Rs. 40,000/- with a weekly collection of Rs. 225/- over a maximum of 50 weeks.<sup>8</sup> Though the loans were given for farming activities, most of the respondents used them for non-farming activities like meeting household expenses.

Moneylenders continued to be quite popular in the villages among both the labourers and the small farmers since they did not ask for collateral. Even though the interest rate was as high as 36 % p.m., almost 50 % of the village community obtained loans from them.

Generally, immediate financial assistance in the case of a climatic shock was sought mainly from family and friends, rich farmers and moneylenders, as the respondents claimed that the government programmes took time to implement. Co-operatives also played a vital role in financial assistance for the farming community, especially for the large- and medium-sized farmers in the four study villages.

## 5.1 Governance

The Indian government operates several social protection programmes to reduce risks like food insecurity faced by vulnerable groups and assist them to graduate out of poverty. Like many rural development programmes, they are prone to governance challenges such as leakages, especially in terms of procurement, human resource management issues and biased targeting (Raabe et al. 2010). Effective implementation of these programmes requires good leadership and transparency on the part of central government, state government and the local level. The government programmes in the AP villages, Aurepalle and Dokur, were perceived by labourers and small farmers to be running more efficiently than the two Maharashtra villages.

The labourers and the small farmers stated that during the time of climatic shocks as well as in normal years, they relied on government schemes like the Mahatma Gandhi National Rural Employment Guarantee Act<sup>9</sup> (NREGA) for work and the public distribution system (PDS<sup>10</sup>) for supply of food grains. The PDS, known locally as the 'control shop', was regarded as quite important by labourers as it offered Below Poverty Line (BPL) cards that gave access to essential food grains at below market prices. During a bad year or an extreme event, essential food grains were sometimes even provided free to this group, depending on the severity of the event. NREGA seemed quite important among not only to

<sup>7</sup> Started as an NGO in 1998, SKS is a for-profit NBFC (non-banking financial corporation) regulated by the RBI. SKS uses the group lending model whereby poor women guarantee each other's loans.

<sup>8</sup> The loans are from \$ 200 to \$800 with a weekly repayment of \$ 4.5 over a maximum of 50 weeks.

<sup>9</sup> Aims at enhancing the livelihood security of people in rural areas by guaranteeing a hundred days of waged employment in any one financial year to a rural household whose adult members volunteer to do unskilled manual work.

<sup>10</sup> An Indian food security system that distributes subsidised food and non-food items to India's poor through a network of public distribution shops (PDS) established in several states across the country.

the labourers but also the farming community and the women. In 2008, some of the medium farmers in Dokur constructed bunds on their fields under the Employment Guarantee Scheme. The scheme is believed to have reduced migration from the villages.

It was worth noting that though the labourers and the small farmers in all villages relied on the NREGA and the PDS, the medium farmers in both Aurepalle and Dokur were also using and benefiting from the same. This was assumed to be a particular intervention of the government given the persistent drought conditions, particularly in the case of Dokur. Another likelihood is that the community themselves, irrespective of socio-economic status, use government programmes as a long-term adaptation strategy.

The women perceived that apart from their SHGs, the school, the PDS and the Anganwadi<sup>11</sup> centre were very important to them as they were not only a source of education for their children but also provided meals during good and bad times alike.

The government has also taken initiatives in natural resource management. For instance, there are some restrictions on the felling of trees, along with promotion of tree planting from time to time. The scheme 'Pani Aarwah aani Paani Jhirwa' (Stop Water Conserve Water) in the Maharashtra villages was believed to be helpful in increasing the water table, as it promoted bunding and field ponds.

The respondents pointed out that during a climatic shock, the Gram Panchayat mainly served as an agent of the Zila Parishad<sup>12</sup> for distribution of food and subsidies provided by the government.

## 5.2 Technological inputs and infrastructure

The increased use of sprinklers and drips in recent years was attributed to government subsidies and promotion of horticulture. The uptake of drips and sprinklers, however, was still restricted to only some of the big and medium farmers who were using it on an individual basis. The government was also providing loans at cheap or subsidised rates to small farmers to dig a well or deepen an existing one.

Dairy farming was emerging as a potential source of livelihood in the study villages. In the case of Shirapur, an entrepreneur in the village who had established a milk dairy for collective marketing was offering loans to the small farmers which were paid back through delivery of milk. In Dokur, some of the existing dairy farmers had started the process of establishing a milk co-operative by collecting and disseminating information amongst fellow members. It was foreseen that the co-operative would be a means of representing the interests of both male and female dairy producers.<sup>13</sup>

The villagers in Dokur felt that the revival of the watershed project, which was suspended in 2003, would go a long way towards solving water shortage problems at least with respect to farming. The suggestion of pricing water to ensure optimal use of the same in Shirapur was evidence enough of the consciousness of the need for judicious use of water.

<sup>11</sup> Anganwadis are defined as play schools for children aged from two to five.

<sup>12</sup> Zilla Parishad is a local government body at the district level in India. It looks after the administration of the rural area of the district and its office is located at the district headquarters. The Hindi word *Parishad* means Council and *Zilla Parishad* translates as District Council.

<sup>13</sup> There is a milk co-operative which is about 5 km away from the village. The milk is sold to the nearby hotels for Rs. 15/- to Rs. 12/- per litre depending on the fat content. The quality of milk is measured by its fat content. The villagers sell the milk directly even to those traders who come from the cities.

Farmers of Shirapur and Kanzara saw the water distribution system from the canal as critical in terms of supplying water to their fields. The farmers explained that they got the water from the canal by paying for it, and the price per acre was fixed depending on the crop. Though the water supply was primarily meant for farming purposes, it was also used for industrial purposes and drinking water needs. During an unfavourable year, water was released into the canal on emergency grounds to ensure certain minimum water availability for farming activities. This, however, depended on the levels of water available in the dam.

The construction of the airport near Aurepalle and the presence of industries like the sugar factory and the MIDC (Maharashtra Industrial Development Corporation) in Shirapur have led to traditional coping strategies being integrated with diversification in alternative occupations.

### 5.3 Informational

In the context of getting information, the second-generation farmers in Dokur and Aurepalle went to the market themselves and acquired information from traders on an individual basis or at the most in groups of two. The first-generation farmers along with the rest of the farming groups asserted that they relied more on the Agriculture Department than the private companies for information regarding agricultural inputs and market conditions. There was a lot of enthusiasm among the second-generation farmers in Dokur regarding dairy farming, as they had obtained information regarding the same from a private dairy company which was close to their village. There was, however, no mention of seeking any form of assistance from the Krishi Vigyan Kendra (KVK)<sup>14</sup> in either of the two villages.

All categories of farmers (small, medium, large) considered private seed companies as important since they were the primary source of improved seed varieties that were high-yielding or could survive extreme climatic conditions. They also considered KVKs (Krishi Vigyan Kendra) and agricultural departments as useful for acquiring information on agriculture-related issues but not as important as seed companies. Where Kanzara and Shirapur were concerned, most respondents got their information and purchased inputs from the private seed companies. Their main source of information regarding prevailing market conditions were the shopkeepers that sold the seeds, the middlemen and sometimes the television. Eighty per cent of the farmers acquired agriculture-related information from private agencies. The marketing of produce was done on an individual basis by the farmers through middlemen. Unlike in the AP villages, the second-generation medium farmers in Kanzara were forthcoming about approaching the KVKs, though the first choice for advice on agricultural inputs and crop varieties was ICRISAT.

The interviews established that social networks were an important factor in all four villages when it came to the adaptive capacity of a group or individual as (1) they were a means of accessing alternative livelihoods through migration to cities and other places outside the villages, (2) when there was a bad year or a climatic shock,<sup>15</sup> people's first reaction was always to approach the people they trusted most, that is friends, relatives, parents and even local moneylenders. Large and medium farmers, especially those with

<sup>14</sup> Krishi Vigyan Kendra (KVK) is a project of Indian Council for Agricultural Research for testing and transfer of Agricultural technologies to bridge the gap between production and productivity and to increase self-employment opportunities among the farming communities. The trainings offered here follow the principles of "Learning by doing" and "seeing is believing". As per the mandate of the ICAR, KVKs are supposed to be present in every state and every block in India and in close proximity to villages in the particular block. The translation of the same would be Farmer Science and Training Centers.

<sup>15</sup> Where climatic shock is defined as extreme events such as a drought or a flood.

**Table 5** Institutional facilitators and constraints on adaptations

Areas	Facilitators	Constraints
Financial	Loans from banks and co-operatives, SHGs for agricultural inputs, including moneylenders Crop insurance	Lack of access by women and small farmers to formal financial services because of need for collateral and discrimination by bank officials Lack of resources of the Gram Panchayat makes it ineffective during a climatic shock
Leadership/ governance	NREGS and PDS seen as the main form of assistance and support for small farmers and labourers and some medium farmers in AP villages. Government programmes for planting of trees and conversion of water	Gram Panchayat inefficient regarding the implementation of the NREGA Grains provided in the PDS shops are of questionable quality and sometimes non-consumable Benefits received by those with influence and political connections rather than those in real need
Infrastructure/ technological	Increased use of drips and sprinklers because of government subsidies Use of the water distribution systems with mechanisms for pricing water for agricultural use	Lack of storage facilities, so farmers have to sell their produce immediately after harvest No fodder depot in the village Availability of electricity for 8 h only rather than the promised 16 h
Information access	Source of information mainly the private seed companies, shopkeepers, mediators or television Second-generation farmers enthusiastic about approaching extension services like KVKs	Labourers' limited information and knowledge base regarding government programmes and schemes Lack of information and formal guidance on short-duration or drought-resistant seeds and other farm inputs Lack of government initiatives in terms of providing information on the above

*Source:* FGDs with farming and non-farming communities in Kanzara, Shirapur, Aurepalle and Dokur in 2009

additional occupations like teaching, were generally better connected to networks both within and outside the village.

#### 5.4 Constraints on adaptation

Opportunities in the form of financial and information access, technology and leadership and their adequate utilisation depend to a large extent on the will and efficiency of the local administration along with the conditioning socio-cultural factors. These can also constrain the capabilities of individuals or groups to adapt. The four categories of such constraints emerged; financial, governance, infrastructure and information access (Table 5).

## 6 Financial

With regard to access to formal sources of finance, apart from Aurepalle, none of the villages under study had microfinance institutions or private bank establishments. In addition, the need for collateral and the negative attitude of the bank and co-operative officials towards small farmers, labourers and women emerged as deterrents in terms of

approaching these formal institutions for credit. The lack of access to formal financial sources and inadequate information about the schemes and benefits available made the labourers and the small farmers dependent on middlemen and moneylenders who more often than not led them into farming and non-farming practices which were detrimental to their livelihoods, making them susceptible to future climatic shocks. The women and labourers relied on their SHG since there was no need for collateral. The assets of the household were mostly in the name of the husband, making it difficult for women to gain access to formal sources of credit. The interest rate charged at the SHGs was 3 % p.m. for both farming and non-farming activities, the latter being activities like setting up small businesses. It was, however, observed that the SHGs were being managed better in the AP villages than in the Maharashtra villages.

The need for better financial inclusion and access to more formal systems of finance especially for women is pertinent not only to increase their capabilities but also the overall adaptive capacity of the household, as the woman plays a major role in household management especially during crisis situations or climatic shock.

With regard to dairy farming as an alternate livelihood, respondents in Kanzara felt that the venture was taking some time to be accepted because of the requirement for high initial investment and subsequently the care and maintenance of the animals. In addition, the lack of willingness to work collectively had prevented the villagers from starting a milk co-operative. Similarly, though a co-operative had already started in Dokur, insincerity and lack of commitment on the part of the community were cited as the reasons for its failure in the past.

Sheer lack of resources and inadequate funds prevented the Gram Panchayat from carrying out substantial interventions at both the farm and non-farm level during climatic shocks.

## 6.1 Governance

The issue of poor governance emerged very strongly in Kanzara with respect to the functioning of the Gram Panchayat, as it was considered to be of very little service when it came to agriculture, especially during climatic shocks. This criticism was also apparent, though to a lesser degree in the other villages. In Aurepalle and Shirapur, it was pointed out that the probable reason was the limited resource base that the Gram Panchayat had access to, which did not allow it to aid farmers adequately. The labourers accused the Gram Panchayat of being inefficient regarding the implementation of the NREGA.

The medium group of farmers, especially in the villages of Kanzara, Shirapur and Aurepalle, felt that the lopsided preference<sup>16</sup> of the government with regard to providing subsidies and benefits was an impediment in working towards better preparedness to meet the challenge of increasing climatic variability. In the case of Kanzara, it was felt that there was a strong probability that the medium farmers would be the next group to slip into the high-risk zone as they depended purely on their own resource base without any external help from the local government structure.

In Andhra Pradesh, the schemes promised by the former Chief Minister (Y.S. Rajasekhara Reddy) were not implemented after his sudden death even though he belonged to the ruling

<sup>16</sup> On the one hand, medium and large farmers feel that the government is favouring small farmers and the landless, but this is ok from a pro-poor perspective; on the other hand, some preferences based on political parties. For instance in Kanzara, the local and the state ruling parties are different, and this is perceived to hamper co-ordination in service provision.

party. The community attributed these failures in assistance to the lack of political will and prevalent corruption in the existing system. In Dokur, the watershed programme that was started by the government in 1999 was stopped in 2003 without any plan to revive it. The farmers were also concerned that they were not getting any subsidies on fodder.

Even though Shirapur seemed to have the most advanced sources of irrigation, there were complaints of malpractices and mismanagement of the water distribution. In spite of representation at the local level in the Water Users' Association, the respondents felt that the influence of the central authorities usually conflicted with the needs of the locals, determining the allocation of water from the dam to the canal and its diversion for industrial use. There was a feeling among the respondents that because of the politics of water distribution, there could be an adverse effect in the near future on the production of sugarcane, which was the major crop in Shirapur.

The issue of poor governance was a key concern with political connections and influence acting as major factors that determine whether community members will derive benefits from existing opportunities and entitlements. Although inherent capabilities exist, external factors like lack of accountability and the politics of distribution have become major impediments to the development of a community's adaptive capacity. This is exemplified by the contrast between the Maharashtra and the Andhra Pradesh villages in terms of implementation of government schemes, the latter being much more effective in supporting villagers across socio-economic groups. The capabilities are understood as both mutually supportive and of central relevance to social justice (Barnett 2009).

Governance and allocation of resources are an especial concern in a country like India, where political connections and influence act as major factors in determining the development of an area. This is particularly important when certain groups are largely dependent on provisions made by the government and look to it to safeguard their adaptive capacities against uncertainties such as increasing climate variability.

## 6.2 Infrastructure

Another key factor that emerged as a constraint on adaptation was the lack of institutional arrangements for providing access to input and output markets. It was mentioned that each farmer independently sells their produce to the trader according to the prevailing market price: owing to the lack of storage facilities in the village and the need for finance they had to sell their produce soon after harvest and they did not have a co-operative of their own through which they could negotiate better prices. The reason for the lack of a co-operative and storage facilities was attributed to the lack of a collective will to create them. This is a typical problem in situations where many individuals would all benefit from a certain action, as there is no incentive for individuals to incur the associated cost, especially when there will be free-riders. Dairy farming was popular in Aurepalle, Dokur and Kanzara. Some form of collective action was observed among the farmers in Kanzara and Shirapur for the maintenance of the irrigation canals; otherwise, it would hamper water supply to the fields. Barriers to collective action in the villages were cited as mutual distrust and the fear of either exclusion of the most vulnerable or elite dominance of particular groups.

In the Maharashtra villages, the viability of agriculture as a profitable livelihood option was reported to be fading. At the same time, the lack of collective feeling and action hindered bargaining for better market prices and the development of alternate livelihood options.

The PDS unarguably emerged as one of the most important institutions contributing to adaptive capacity in all the villages through subsidised food especially during times of climatic shock. A point of concern in the four villages, however, was the varying quality of the food grains available in the shop. Since there were limited or no choices as regards the availability of subsidised food, the community had to accept what was on offer. This might also be a strategy of the government whereby the beneficiaries self-select as well-off households will not want poor-quality grains.

### 6.3 Information access

The respondents in all four villages complained that there was a dearth of formal information sources on the seeds available, such as shorter-duration and drought-resistant varieties which were better suited for adverse environmental conditions and yet profitable. There was an expressed need for government initiatives to provide proactive extension services. For instance, in Shirapur, one of the reasons cited for excessive use of chemical fertilisers and pesticides was the lack of guidance from formal sources on the appropriate time and quantity of application. The practice was thus harming the crops and soil rather than being useful.

## 7 Conclusion

For an understanding of the perceptions of farmers on climate change and adaptation strategies based on the same, it was important to begin the research with an explorative and iterative approach to data collection. The findings identified key institutional drivers of adaptation and several important constraints that worked as a barrier to adaptive potential and capacities.

The study of the four villages, Aurepalle and Dokur in Mahabubnagar, Andhra Pradesh, and Shirapur in Sholapur and Kanzara in Akola, Maharashtra, showed that climate variability is a major concern for the farming community. Farmers have been noticing variability in climate for at least 20 years, with this becoming more obvious in the past five or six. They see the climatic shocks that they have experienced over these years in the form of extreme events like prolonged dry spells or unprecedented floods as evidence of variability. As a result, the respondents felt that the viability of agriculture as a profitable livelihood option was decreasing. Nevertheless, they have developed coping strategies as long-term adaptation mechanisms to shield themselves against climate uncertainty.

Adaptation strategies at the institutional or community level were important in supplementing individual strategies and preventing farmers from disposing of their assets in desperate situations. Constraints were observed, however, in terms of adaptation through public, civic and private institutions to what may be a more challenging future because of climate change. Civic institutions based on the communities were constrained by the lack of collective feeling and action, particularly in the villages of Maharashtra, which hindered bargaining for better market prices and the development of alternate livelihood options. Social exclusion and capture of benefits by the middle-class and wealthy farmers who often dominate local institutions was a source of concern. Social resilience was evident in both positive and negative aspects of social exclusion, marginalisation and social capital (Hayami and Ruttan 1985; Stern 1995). Poor farmers and socially marginalised groups played a limited role in leadership, and representation of women was often poor except in their own SHGs.

These aspects of social marginalisation depend to a large extent on access to information. The minimal impact of information and communication technologies (ICT), as knowledge dissemination tools and means of communicating community concerns, even through toll free numbers,<sup>17</sup> was a source of concern to the farmers. Efforts towards better, accurate and formalised information dissemination have to be considered if the adaptive capacities of the farming community are to be improved.

The issue of poor governance, especially for the public institutions, emerged as a key concern with political connections and influence acting as major factors that determine whether community members will derive benefits from existing opportunities and entitlements. This is particularly important in a country like India, where certain groups are dependent mostly on provisions made by the government and look to it to safeguard their adaptive capacities against uncertainties such as climate variability. Besides challenges in targeting of beneficiaries for interventions like the PDS and NREGA, these programmes involved large procurements and were thus prone to leakages. The contrast between the Maharashtra and Andhra Pradesh villages in terms of implementation of government schemes demonstrates that, although inherent capabilities exist, external factors like lack of accountability and the politics of distribution are major impediments to the development of a community's adaptive capacity. This is important as capabilities are understood as both mutually supportive and of central relevance to social justice, which is determined by the availability of resources and crucially by the entitlement of individuals and groups to call on these resources (Kelly and Adger 1999). The concerns of the medium group of farmers in Shirapur and Aurepalle regarding the lopsided preferences of the government could be seen as a reflection of distributive justice which looks at welfare maximisation from the perspective that the most able adapt, though the most vulnerable are the ones who are prioritised (Nozick 1974).

Growth in industry and other sectors of the economy was seen to have significant effects on the rural agricultural community. For instance, the sugar factory in Shirapur and the international airport near Aurepalle have stabilised the livelihood options of most farmers and non-farmers. Nevertheless, this stability could be threatened if government policies such as the pricing of sugar are unfavourable. On the other hand, government efforts to develop infrastructure and systems that reduce transaction costs will provide incentives for the private sector to enter rural communities. It needs to be reiterated that there is an urgent need for better financial inclusion and access to more formal systems of finance not only to increase the capabilities of women, small farmers and labourers but also the overall adaptive capacity of the household. The key challenge for agriculture is the inherent spatial and risk characteristics that influence rural insurance and financial intermediation (Binswanger and Rosenzweig 1986). For instance, banks would face a challenge in terms of balancing deposits and borrowings since farmers in a particular rural community harvest at the same time and would thus prefer to save at this time and take loans in the planting season.

Despite the observed constraints, institutions played a key role in adaptation to climate variability through provision of options such as credit and crop insurance, and mediating access to technologies to support adaptation. The community members also formed their own institutions such as SHGs and co-operatives. Private individuals like moneylenders, relatives and friends also stepped in when formal institutions were not available to provide

<sup>17</sup> There is a toll free number issued by the Department of Agriculture India, 1800-180-1551 to enable farmers to access Kisan Call Centers (KCC) through landline and mobile network of both public and private telephone service providing agencies. KCC is functioning since January 2004. Kisan is the local term used for Farmers.

these services or when the bureaucratic procedures, rules and attitudes were not favourable to the farmers. Programmes established by the Indian government to support poor rural households, for example the public works programmes and food subsidies, also doubled up as mechanisms that supported farmers during climatic shocks.

The capability approach was useful in eliciting the kind of coping mechanisms that respondents of the study villages were willing to explore and adopt, assuming they had the required institutional support. It was used as a tool to address the role of institutions, individual behaviour and attitude coupled with collective action to see whether these are becoming determinants of the increased potential of a particular group or individual to adapt to a given situation; in this case, increasing climate variability. It was seen that entitlements like financial and information access, technological inputs, and infrastructure support were not easily available or accessible to rural communities. The small farmers group and the women, either because of the lack of a resource base or the faulty implementation process of the government schemes, were seen to be the most affected. At the same time, because subsidies to the medium farmers were being cut, the potential for increasing their adaptive capacities was being jeopardised to the extent that they were contemplating giving up agriculture and seeking other sources of livelihood like manual work, which was against their cultural standing in the social hierarchy.

The cultural context of institutional adaptation and the differing conceptions of human-environment interactions within different knowledge systems are key to the resilience of institutions (Gadgil et al. 1993; Blaikie et al. 1997). Access to instrumental freedoms, namely political freedom, economic facilities, social opportunities, transparency guarantees, and protective security (Nussbaum 2003; Robeyns 2005), is necessary for a better quality of life and acquisition of the capabilities needed to build better resilience to climatic shocks. Therefore, it would be worthwhile developing an understanding of how many of the freedoms mentioned are accessible to certain groups, if they differ depending on socio-economic or cultural background and how they determine and influence coping mechanisms and adaptive capacities.

Further, it needs to be acknowledged (1) that farmers have developed coping strategies as a shield against climate uncertainties, and (2) that a better understanding of farmers' needs and their current and past adaptation measures and constraints is required for a sustainable system. This will entail further studies and documentation of innovations in the given social system at both the technology and institutional level aimed at better agricultural practices.

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