# SOCIAL LEARNING AND ADAPTATION TO CLIMATE CHANGE[1]

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## 1. INTRODUCTION

The need to build adaptive capacity to climate change into project and policy planning is rapidly becoming a core concern. In the UK for example, recent statements by DFID (2004), GNAW (2001) and MAFF (2000) have highlighted the dual role of public sector agencies needing both to adapt their own goals and practices to take account of climate change, whilst also shaping the enabling environment to support the adaptive capacity of private, public and civil sector actors and individuals operating within their spheres of influence.

Research on adaptation has tended to focus on describing, categorising or analysing adaptive actions (Smit et al, 2000). This is work of fundamental importance. But here we argue for a parallel research agenda that seeks to understand the human behaviour that lies beneath observed adaptations. Existing work in this area has built on theory from social vulnerability and coping with risk developed within the human ecology tradition of natural hazards (e.g. Wisner et al., 2004). This has led to two contrasting but complementary analytical orientations. First, structural perspectives that have sought to explain adaptive capacity in terms of the social, political and economic structures that shape entitlements to assets and so determine adaptive capacity (Pelling, 1997; Adger 1999). Second, agency centred examinations of the unequal power relations and information asymmetries within organisations that shape decision-making and control the social and spatial distribution of adaptive capacity amongst leaders, members and non-members of organisations (Allan, 2003). There are also examples of work that has sought to integrate the two perspectives (Adger, 2000; Pelling, 2003). In this paper we propose a third line of enquiry. One that sees adaptive capacity as arising out of social learning embedded in social relationships. Power remains important to the analysis, but is conceived of as residing in the relationships between individuals and sub-groups that

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comprise organisations and administrative regimes rather than being held in structures or wielded by individual actors.

Stepping back from assessing adaptive actions to understanding the evolution of adaptive capacity within organisations responds to the need to develop generic capacity to act as a resource from which to build adaptations under uncertainty. Much work in crisis management has sought to push the boundaries of contingency planning by 'thinking the unthinkable' (Smith, 2004). Such output oriented responses to the threats of climate change map well onto existing expectations of organisations and can contribute a great deal towards building a proactive stance towards particular scenarios of climate change. But the act of codifying future hazards into defined risk scenarios will never capture every eventuality and can build resistance to accepting and responding to unexpected risks even whilst they are being felt. The complexity of interactions between physical and human systems operating at a global scale but with an infinite variety of local manifestations makes complete coverage of climate change risk impossible – there will always be some residual uncertainty.

Residual uncertainty means that crisis management must prepare the ground for the unimagined as well as planning for the unexpected. We argue here that a contribution towards this aim is offered by complementing an output-oriented strategy with one that focuses on inputs. In this paper we propose that resilient organisations which can cope with the unimagined are likely to have encouraged members to develop diverse social relationships and to allow the opening of informal space beyond corporate control for individuals or sub-groups within organisations to freely experiment, copy, communicate, learn and reflect on their actions. The countervailing imperative of efficiency within organisations, and the tendency for centralised and top-down contingency planning and decision-making are in danger of restricting incentives for experimentation, reducing flexibility and capacity to adapt under the uncertainty of climate change.

The following section develops a language and model for examining relational spaces as places of learning and adaptation within organisations. This is followed by a discussion built around interviews conducted with key informants from the Environment Agency, the Welsh Assembly and Grasshoppers a dairy farmers group.

## 2. PUTTING SOCIAL LEARNING IN ITS PLACE: A THEORETICAL CONTEXTUALISING OF LEARNING FOR ADAPTATION

This section synthesises a range of theoretical ideas to build a model to help trace where and how learning happens in organisations and begin to understand how learning for adaptation could be facilitated by opening informal and unmanaged space. The discussion draws from management science, systems theory, institutional economics, social learning theory, social capital theory and is framed by existing work on the social aspects of adaptation to climate change and natural hazards. Theoretical insights from these potentially diverse sources of theory are brought together where they share a common epistemological orientation in the conception of power as relational. This post-structural view of power has its roots in Foucault's (1977) argument that power exists in myriad social relationships and is normalised through and contingent on social context. We take a week interpretation of Foucault seeing power as relational within systems, but

acknowledging the influence of social institutions in sanctioning and legitimising the use of power between individuals and so adaptive outcomes.

## 2.1 Institutions

Institutions are the rules of the game (North, 1990; 2001) and provide common ground for negotiating and enacting power and influence in relationships between individuals and groups. They can be classified as either formal or informal. Formal institutions, including legislation, work-guidelines or job-descriptions are openly negotiated rules that constrain agency, whilst at the same time being amenable to change by the action of individuals or groups in society or an organisation. Informal institutions are found in cultural norms and values, and also have a dialectical relationship with agency, giving shape to, whilst being reproduced by, repeated rounds of customary behaviour. Work on place communities has highlighted the importance of institutional architecture in shaping adaptive capacity (Pelling, 1998; Adger, 2003), but how might institutions act to shape adaptation as it arises from within organisations? Can institutional architecture be arranged to maximise the adaptive capacity of an organisation or policy sector to the unknowable future hazards of climate change?

Similar questions have long exercised institutional economists and organisational theorists seeking to understand social behaviour within organisations (Vromen, 1995), here work has concentrated on formal institutions. Informal institutions are commonly seen as either too intractable to work with, or by their very nature - through lying outside of manageable space - as legitimising behaviour that can run counter to the professed aims of the organisation, for example through corruption (Ostrom, 1999; Lowndes, 1996). The uncertainty of climate change suggests it is worth re-visiting the possibilities of enabling internal dissent as a potentially positive force for local innovation and adaptation, particularly within large organisations. This is especially the case in public sector organisations charged with responsibility for advising or regulating actors in the rural economy, the water sector or public health. Here, local actions and experiences leading to horizontal and context rich learning amongst local and regional actors that goes beyond or counter to official policy but which has been legitimised by informal codes, might potentially complement more official but less flexible structures that feed generic information along vertical lines of command.

Arriving at a correct balance between formal (and informal) institutions that support official organisational aims and practices on the one hand and informal institutions that give legitimacy to alternative behaviour on the other is a holy grail of management theory. Drawing a metaphor from complexity theory, this balance has been called the ‘edge of chaos’ (Griffin et al, 1999), an ideal state lying at the boundary between stability and instability, regularity and randomness. This place of bounded instability allows novelty to emerge, but in a form that is at least potentially positive and with a sense of continuity to earlier innovations. A parallel exists in place communities where efforts to build local adaptive capacity by providing financial or other resources without community capacity building has frequently generated uncoordinated and often socially negative outcomes. This contrasts with over investment in building community capacity which has been seen to result in stasis though dependency on an external beneficiary on an internal leader (Pelling, 2003). Somewhere in between lies a space for bounded instability where diversity and competition are allowed but contained to facilitate innovative but socially constructive adaptation.

The space of informal interaction that lies outside of but interacts with formal institutions and relationships has been dubbed the shadow system by Stacey (1996). This represents an alternative view of the social architecture of organisations, focussing on the relationships that are meaningful to people rather than the formal, official relationships sanctioned by the management. However, this is not to say that if formal structures are not the whole story, then the solution is to extend management activity to the control of shadow systems. Instead, Stacey (1996) and Shaw (1997) argue that shadow systems might contribute most to learning and innovation in organisations when they are recognised but allowed to have a life of their own. Their very independence means that much effort must be expended in eradicating shadow systems, that respond to official management initiatives rather than being subject to them (Senge, 1990).

## 2.2 Social Capital and Communities of Practice

When social capital is discussed in the context of adaptation to climate change it tends to be synonymous with civil society organisation (e.g. and ref). But this emphasises only one of social capital's three aspects: social norms such as trust, interpersonal relationships, and formalised social organisation (Pelling, 2005). Identifying the contribution of trust and interpersonal relationships in shaping adaptive capacity is made difficult because these aspects are not easily surfaced or aggregated into indicators of adaptive capacity. But trust and interpersonal relationships need to be engaged with if we are to move from surface descriptions of adaptive behaviour, as indicated by external expressions of capacity such as the number of social organisations in a district or country, towards a deeper understanding of the social behaviour that constrains or enables adaptive thinking and action.

When looking within organisations it is the analytical focus on trust and interpersonal relationships that makes social capital useful. Though remaining a contested concept (ref), social capital offers meso-level analytical tools to begin unpacking the interplay of institutions and actors and to trace behaviour within the shadow system as it contributes to innovation, learning and adaptation to unexpected shocks and stresses. In particular, the distinction between relationships that tie individuals into communities or networks helps differentiate two key social resources for learning within the shadow system. Members of communities share common values and codes of behaviour providing places for reproducing knowledge and refining practice, members find communities visible and boundable. Networks are resources for the exchange of information. They are open ended, with well connected individuals being able to draw on the ideas and experiences and compare the values of diverse others. While a member of a network may only know a small number of other members, she potentially has access in turn to the networks and communities of these associates. These linkages can lie latent until some change in the needs of the individual stimulates a search for new information or other forms of support.

Communities and networks within the shadow system, as within place communities, can undermine as well as enhance adaptive capacity. Communities are spaces for the reinforcing of shared values and practices, but those norms being reinforced may not necessarily contribute to the organisation's (or even the community's) adaptive capacity. Examples may include communities that make virtues out of not learning and refusing to change or privileging scientific over lay knowledge against official policy. Elsewhere the phenomenon of groupthink has been observed (Janis, 1972; Griffin, 1997) where the social/institutional environment of a group fails to surface and act upon the knowledge of

its constituent individuals. Similarly, networks provide an informal vehicle for the flow of information in an organisation, for lobbying decision-makers, testing out new policy or influencing fellow practitioners, but this says nothing about the appropriateness of the message being conveyed. As with any resource the unequal distribution of social capital between groups and organisations will partly explain uneven geographies of adaptive capacity. Social capital helps to map the informal sites and routs for learning and influence in an organisation but can not help in making judgements on the appropriateness of the actions that result.

The relationship between learning, practice and social identity in organisational life has been most developed in the Communities of Practice literature (a formative text being Lave and Wenger, 1991). For Wenger, learning in a community arises through participation and reification, the dual modes through which meaning is socially negotiated. Participation refers to "the process of taking part and also to the relations with others that reflect this process. It suggests both action and connection" (Wenger, 2000a: 55). Participation is thus an active social process, referring to the mutual engagement of actors in social communities, and the recognition of the self in the other. Reification is the process by which "we project our meanings into the world, and then we perceive them as existing in the world, as having a reality of their own" (ibid, 58). Thus reification can refer to the social construction of intangible concepts as well as the meanings that members of a community of practice see embedded in physical objects.

Communities of practice are often not officially recognised by the organisations they permeate (Brown and Duguid, 1991). Their official invisibility too easily relegates them to the shadow system, which can be thought of being made up of constellations of communities of practice held together by bridging ties of social capital. The link between communities of practice, informal networks and un-official activity in organisational settings is an important association to make in tracing the workings of the shadow system in building adaptive capacity. The common theoretical ground between communities of practice and social capital has been made by Lesser and Prusak (2000) with Wenger (2000) using social capital to help define the characteristics of individual communities of practice, which, he argues, can be defined by a shared identity, and held together by bonding capital. Wenger proposes that connecting communities of practice into constellations is made possible by boundary people (with bridging ties) and objects (such as meetings or documents created with the purpose of bringing communities of practice together). It is the quality, quantity and aims of individuals connected together in communities of practice, and of their linking boundary people and objects that will determine the influence of the shadow system on adaptive capacity.

### 2.3 Adaptation and Social Learning

Adaptation to climate change can be seen in terms of the alteration in the state of a system that arises in response to the stressors introduced by changes in climatic conditions, and under which key variables are conserved or enhanced. The idea of conservation of key variables is important, because these provide the bottom line, the breaching of which we would see as degradation rather than adaptation. Our definition of climate change is constructed from the perspective of social systems so that it is felt as an economic, political, ethical or social challenge or stress and not a natural or physical one per se.

The systems view of adaptation has strong resonance with a view on learning developed in the context of sustainable development (High, 2002). This theory defines learning as a transformation in the potential for behaviour of an actor in response to experience, as seen from the viewpoint of an observer (after High, 1998; Ison et al, 2000). The actor in question could be an individual, a formal organisation, an informal group or even a non-human actant such as elements of technology or nature, as long as they are viewed as capable of changing behaviour in response to experience. This broad definition is deliberately designed to encompass a number of strands of learning theory, including those that situate learning outside of the individual and within social groups. This provides a link between social adaptation and the literature on social and organisational learning that we seek to include in our framework, as it enables a view of learning that transcends individual behaviour.

The judgement of an observer is important and has both epistemological and ethical consequences. In terms of stating whether learning has occurred, acknowledging viewpoint enables the delineation of a range of perspectives that (in their own terms) accept that learning has occurred (or not). Attention is therefore directed beyond simply what has been learnt, towards the institutional forces and actor attributes that direct capacity and ability to learn, and that determine who recognises whether learning has taken place. A learner's own perspective on their learning could be accepted, as could the views of others, which may differ.

The definition refers to changes in behaviour, a point of convergence between many different theories of learning (Ison et al 2000). However, rather than the behaviouralist (cf Gross 1996) focus on 'objective', externally validated, physical behaviour, we accept that behaviour in the widest sense as that which learners do. Following Maturana and Varela (1992) and Ison et al (2000), we accept the inclusion of internal actions as behaviour. That is, as humans, we can learn in relation to different modes of interacting with the world: emotional and conceptual as well as physical. Our learning corresponds to differences in the way that we act (consciously or unconsciously) within these modes, which in turn arise in response to our ongoing experience. The judgement of what constitutes behaviour lies with the observer in question, but the definition does not rule out internal and tacit activities such as conscious or unconscious cognition, emotional affect or the formation and operation of personal relationships, for example.

In terms of seeing adaptation as learning, this theory highlights both material adaptation and more intangible adaptation strategies too (Pelling, 2005). For example, an adaptive response that could be seen in terms of this definition of learning is where an individual works to promote changes in a discourse by joining an interest group or political party, or by contributing to the discourse in an individual capacity. Considering different viewpoints could also highlight situations where a discourse has changed, but material adaptation has not taken place. Following on from this is that we can see learning itself as a behaviour. This opens up the question of whether we can learn to learn (or learn to be adaptive), what Bateson (2000) calls deutero-learning. Thus adaptive capacity could also be increased by adaptations that increase flexibility, a more generic adaptive response than one that focuses on one particular stressor, possibly to the detriment of the capacity to respond to unexpected events.

Identifying different realms of behaviour is important in sharpening our focus on the site(s) where social adaptation can be observed; not only in material actions, but in

contrasting attitudes or views that have not been allowed translation into action. In this way Pred and Watts (1992) identify the behaviour of marginalized actors who need to keep low visibility in the face of surveillance by more powerful actors, and the potential importance of private language as a mechanism for resistance. But we are also interested in the extent to which hidden and silent behaviour is proactive rather than reactive, or an essential feature of social life within and between organisations, rather than an indication of resistance and struggle.

Our view of learning is further modified by reference to potential behaviour. Seeing adaptation in these terms means recognising that a system could be adapted to a particular stressor without actually being challenged by it. This could be constructed in terms of pro-active adaptation. However, we can also look at latent behaviour in terms of deutero-learning. In other words that the process of becoming more able to adapt can itself be a learning process, if we consider on-going adaptation to be part of the everyday behaviour of the system in question.

Constructing the learner as an individual or social entity links individual learning to social processes of change that emerge at the collective level – the adaptation of an organisation, family or nation, for example. Thus social adaptation can be seen as collective learning. This is not a claim that individual and collective behaviour are qualitatively the same, but recognises the interaction of learning and adaptive behaviour at these different levels. In this way, adaptation to climate change can be read at different levels of learning operating as a range of system-hierarchic scales: the behaviours of components and subsystems of the system, as well as changes to the emergent properties of the system, and this can be used to unpack different adaptive trajectories – international, national, local. It may be that adaptive behaviour emerging at one scale – say the local – is the result of learning that has been ongoing amongst a range of actors networked across a range of scales – say actors with a common interest arranged into an informal group but comprised of local, regional and national stakeholders.

Because we are interested in adaptation and how it is socially transformed or generated, we have chosen to draw on theories of learning that recognise a social dimension or context to learning, something that not all learning theories do (cf Jarvis et al, 1998). In the social sciences there are two ways in which learning can be considered social: first in the sense that individual learning is conditioned by its social environment; second, that social collectives such as organisations can be said to learn in their own right. These are considered below.

There is a longstanding interest in the social sciences in the extent to which learning is determined by culture and socialisation (Jarvis et al, 1998). Within climate change and natural hazards research there is much debate on the influence of social context, such as class, cast, age or gender, on constraining information flows and so opening or closing particular options for adaptation (Burton et al, 1993; Pelling, 1998 and others). In the organisational literature, this tends to lead to a focus on organisations as environments that enable or inhibit individual learning through their culture, structure or sanctioned practices (Wang and Ahmed, 2003). In seeking to understand adaptation to climate change social learning prompts a questioning of the social variables that affect the learning of individuals and how this relates to adaptive capacity. How does the learning capacity of individuals interact with the adaptive capacity of various types of social assemblages (e.g. organisations, communities, nations) operating across different scales

of influence? The education literature suggests that collaborative learning amongst peers can facilitate faster and deeper learning compared to receiving learning through the transmissions of an instructor (Joiner, 1989; Elwyn et al, 2001). This leads to the possibility that informal communities of practice can operate as vehicles for peer learning, and so facilitate rapid and committed learning and potential adaptation to compliment officially communicated or 'taught' adaptations to policy or practice.

Within the management literature it has been argued that organisations themselves can be thought of as learning. This is often expressed in terms of solutions to problems emerging out of joint action and innovation (Hutchins, 1996). From an analytical perspective there is a danger that accepting the possibility for organisations to learn might result in a loss of clarity by concealing the action of individuals operating within the organisation (Argyris and Schön, 1996). Discussing organisational learning, Argyris and Schön (1996) introduced the concepts of single and double loop learning. The former is about efficiency, learning to undertake activities with increased skill. The latter is concerned with changes in the governing values of an organisation, in strategies and assumptions. The difference is between "…doing things right and doing the right thing… The righter we do the wrong thing, the wronger we become" (Ackoff and Pourdehnad, 2001: 199). For climate change this might be the difference between investing to support marginal agricultural livelihoods with increasing costs and supporting diversification to support a rural economy and lifestyle while abandoning particularly marginal agricultural practices. Argyris and Schön consider double loop learning more difficult than single loop learning, because it requires changes to values. Individuals tend to avoid challenging established values. Argyris and Schön (1996) argue this is for three reasons:

- Individual risk aversion that leads actors to avoid direct interpersonal confrontations and public discussion of sensitive issues which might expose the actor to future negative repercussions.
- A desire to protect others by avoiding the testing of assumptions where this might evoke negative feelings and by keeping others from exposure to blame.
- A wish to control the situation by keeping your own view private and avoiding any public questioning which might refute it.

Changes in policy have also been explained in terms of learning by Sabatier and Jenkins-Smith (1999) through their Advocacy Coalition Framework. This has three levels of agency: the policy subsystem, the policy coalition and the individual. Within a policy subsystem, policy is contested by a set of policy advocacy coalitions made up of alliances of individuals with similar core beliefs. Advocacy coalitions, like communities of practice, are held together by institutions - shared values - and social relationships that vary in formality. Because advocacy coalitions take their identity from core beliefs, they are conservative of them and thus also of the policy positions they advocate. As Argyris and Schön (1996) have shown, changing values is far more difficult than changing practices. This can lead to core beliefs being maintained even in the face of mounting evidence that these beliefs lead to unsustainable or counter-productive actions. This can be seen clearly in cases of policy inertia in the face of new scientific evidence including the inertia surrounding the climate change negotiations. Conservatism leads Jenkins-Smith and Sabatier (1993) to propose that collective learning appears not from change within policy coalitions, but as a result of the changing influence of policy coalitions on the whole. Changes in policy come about when a dominant policy coalition that controls the agenda in a policy subsystem gives way to a previously subsidiary coalition.

Movement is argued to be stimulated by shocks and trends exogenous to the system – including wider political change, legislative reform or stressors such as climate change. In this model, the system learns without any learning on the part of policy coalitions or individuals. Social adaptation then, could theoretically take place at the systems level without any precursive adaptive change by individual policy makers. The policy-coalition framework is perhaps most important in emphasising the role that changes in power relations have in social adaptation again throwing into relief the interrelationships between structure, agency and institutions in shaping adaptive capacity and action through time.

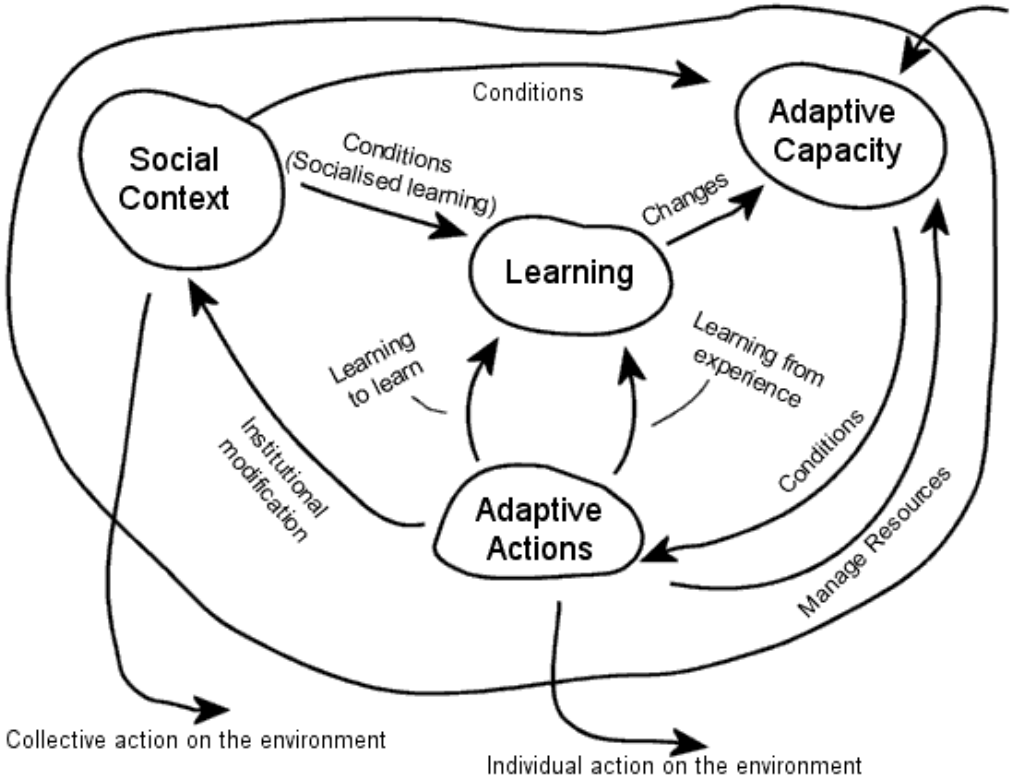
## 3. A SIMPLE MODEL TO HELP MAP ORGANISATIONAL ADAPTATION

Figure 1 offers a simple representation of the key relational features of an adaptive system as identified in the preceding discussion. It was used as one of several figures to focus conversations with stakeholders in the ground testing of concepts derived from the theoretical review. Some of the results of these discussions are presented below in Section 3. The figure is not meant to be an end-point or final product of research but rather a tool to stimulate discussion – where individual's feel the representation in the figure is incorrect is just as important as where it resonates with their experience. It has heuristic value here as a summary of our ideas and to stimulate discussion.

The figure shows a system of interest – for example a government department or a community based organisation but is focussed on the position of an individual within its interwoven official and shadow systems. Four key spaces of influence are proposed that shape adaptive outcomes: social context, learning, adaptive capacity and adaptive actions.

Social context can be unpacked further to identify an individual's membership of communities of practice and her or his use and command over bonding and bridging ties. Someone may think of themselves as a boundary person brokering new ideas, or as part of a community trapped in conservatism and group-think. The shape of social context will be influenced by and in turn influences institutions. These in turn determine an individual's entitlements to resources and so condition adaptive capacity. It may be that the capacity to adapt exists but that the decision to adapt is not made, or that the desire to adapt is not fulfilled because of a lack of access to resources, for these reasons adaptive capacity and adaptive actions are separated. The institutions that shape social context also influence individual learning. Individuals may not have the information needed to question values and undertake second order learning for example. However this can come about through an individual's independent agency and reflection on the kinds of adaptive action to undertake. Similarly, an individual can learn the virtues of having undertaken past adaptation and enter into a cycle of ongoing reflexivity (deutero-learning). Learning – either as part of the socialised social context or from an individual's independent reflections can lead to changes in the values placed on resources an individual commands for adaptation. Deciding that climatic warming makes tourism a more viable rural livelihood than vegetable production will mean an individual has to re-assess their skills and physical assets.

**Figure 1: A Model for Organisational Learning and Adaptation**




The figure identifies six kinds of adaptive action:

1. Learning to learn (deutero-learning) – learning to operate with ongoing adaptation.
2. Learning from experience (single/double loop learning) – reflecting on the merits of improving what is being done or doing something new.
3. Managing resources - to improve adaptive capacity.
4. Institutional modification - attempts to change the social context, for example by realigning their connections of social capital or by challenging or supporting particular institutions. This can also include lobbying on the behalf of a policy coalition.
5. Individual action on the environment - material adaptations.
6. Collective action on the environment - the can include group reappraisal of past actions, reflection on the use of resources, and changing institutions but these are not expanded on in this figure where the focus is on the experience of an individual acting within an organisation.

## 4. OBSERVING LEARNING AND ADAPTATION INSIDE ORGANISATIONS

Between January and June 2004 interviews and workshops were held with members of national (Environment Agency and DEFRA), regional (Welsh Assembly) and local (Grasshoppers, a dairy farmers group) organisations. These organisations share the goal of supporting clients in the rural economy. Respondents were presented with a climate

change scenario for which no contingency planning currently exists in the UK, that of warming for a further 20 years to reach a climate similar to that of contemporary southern France, followed by a rapid cooling over a subsequent 10 years to reach a new climatic equilibrium close to that of southern Norway. The likelihood of such a scenario is very low, but the potential impacts are high. The aim of using such a scenario is not to generate a contingency plan but to uncover the relational resources within the official and shadow system of an organisation from the perspective of an individual within an organisation that indicate some generic adaptive capacity. Respondents were also asked to identify past analogues for the climate change scenario and to reflect on the contribution of informal social relations and the ways that they experienced learning during and after such crises. This provided more concrete examples of the role of social relations in adaptation. The specific crises chosen by respondents differed but common examples were the foot-and-mouth outbreak in 2003, ongoing changes to European Common Agricultural Policy and the European Waters Directive, stressors which were felt to be wide-ranging and, to varying degrees, unpredictable in their ramifications for respondents.

### 4.1 Learning to adapt: a workshop discussion with members of the Grasshoppers dairy farmers group

Grasshoppers is a dairy farmers group that meets once a month and began six years ago. The group was formed by farmers to learn about a New Zealand grazing system. Since then the group has evolved a high degree of trust with members scrutinising each others strategy and budgets regularly. Having experienced a successful change in practices gave this group of farmers the confidence to face future rapid climate change.

"*We're dealing with a biological system… there is a flexible mindset. We have to adapt virtually on a day to day basis. Planning ahead all the time. This is very different to where we were 5 years ago [before joining Grasshoppers]: now we're proactive, then we were reactive*".

The group works well in feeding information to members. This is enabled though close internal bonding ties but also through bridging ties with external sources of information. The group provides a social context for group learning.

"*Sharing information is really key, something I realise from these other farmer groups [that do not do this] compared to us… Trust is very important to the group's functioning and this has taken time to build up*".

"*In terms of adapting to a different climate, you could go and look at places in the world where people already live with it. Now we have learnt from New Zealand, but if the climate cooled we would learn from other parts of the world*".

"*Discussion groups [like Grasshoppers] are the best way of learning – you can get to know each others businesses, better than a lecture theatre*."

But this solid base of trust is won at the expense of excluding others so that grasshoppers does not raise the adaptive level of farmers outside the group and potentially is a source for greater inequality.

"*The group is closed. If you do not cope with the group [culture of critical assessments of each others farming practices] then you would leave*".

Overall, the experience of having passed through one period of learning and change has left members hungry for further challenges and undaunted by a climate change cooling scenario. This is an important message suggesting that building confidence through deutero learning may be an important tool for sustaining rural economies.

"*There is confidence from past changes working. Have done it once, we could change again if we had to.*"

**4.2 Culture and the institutions of learning: a workshop discussion with Welsh Assembly scientific officers**

The following experiences were recounted as part of a one-day workshop hosted by the Environment Agency Wales in Cardiff. Participants included staff of the Environment Agency, the Welsh Tourist Board, the Welsh Development Association and the Forestry Commission.

There was a clear consensus that informal networks and knowledge were critical in responding to analogue crises, including foot-and-mouth and flooding. It was claimed that a Team Wales culture existed and preceded the establishment of the Welsh Assembly.

"*Regulation only happens when there is active consensus for it*".

*"There's a hell of a grapevine. It's much more effective than the official structures.*"

In some cases the gap between individual and organizational learning was apparent.

*"In the petrol strike, actions were effective, because of experience"*.

*"The plans to deal with the Sea Empress were based on the previous similar event, but things are never the same the second time around"*.

At the sharp end of a crisis, bringing different perspectives together is not always easy, but the experience past collaboration had built trust between actors, strengthening the social context for adaptation. This was demonstrated during the foot-and-mouth crisis:

"*Some experts weren't involved at first, but as the meetings went on, more people got involved. We began to develop mutual respect, even where we didn't agree, so we got better at making better decisions. Eventually, a balanced system of decision making evolved with more consideration of the points of view of others.*"

Informal systems for learning had been formalised which had increased the efficiency of the learning space but it was felt by some that there was a trade of in the loss of independence and ownership:

"*There was a Welsh initiative on health and the environment. The grapevine was very successful in bringing people together on a relatively informal basis. It was remarkably successful, but now we have formal structures.*"

It was also acknowledged that the strength of identity and social capital within Team Wales sometimes made new comers feel excluded so that the shadow system did have a negative side. As one respondent said:

"*What happens if you're not in the grapevine?*"

### 4.3 Community and learning: a scientific officer's view from inside the Environment Agency

The following views come from an interview with a scientific officer within the UK Environment Agency. He described environmental stresses such as those that might come from climatic cooling as being felt by officers as pressure from the public or politicians. Being a phone call away from the public has earned the Environment Agency a useful stock of trust particularly with those private sector organisations it regulates. However this is costly in officer's time. The Environment Agency has responded by establishing a call centre. This can be interpreted as a single loop learning response where business-as-usual has improved efficiency. The cost is to long-term trust as a route for building social connections between the public and officers is lost.

"*… a lot of the public trust that the Agency does engender, it does not engender a lot but, a lot of that is simply because the local officers know the local people and the local issues. So actually I fear that what we are doing is losing the connection. I think the call centre is going to make us become a big impersonal monster… It is a personal view this, I think we are losing an important part of our relationship with people… the personal relationship with the regulator is vital… That sort of delivery of service model [the call centre] is what the Agency's reorganisation is about, so it is successful in those terms – but, you know, not in terms of being in touch with the environment and people who are active in the environmental sense*".

The officer was very aware of the need to build social capital bridging links. His official post was clearly defined but he had gone beyond this and acted in the shadow system as a boundary person between the Environment Agency and external interest groups feeding information both ways.

"*The Association of Rivers Trusts, which is a national organisation bringing together the various highly successful river trusts across the UK have done a tremendous amount and in some instances the Agency is being perceived as an obstacle and in some ways it is being perceived as an ally, but there is a risk of that relationship being lost and because I am on the board of various other charities and I'm giving a key note at the ART meeting on Tuesday I've got a very direct personal relationship there and I'm publishing papers in my own name, not using work time whatever to get the learning from that, put it in the right literature so I can go to the policy people in the Agency to say LEARN, you don't have to trawl through grey literature, unpublished sources here is all the right literature put together – APPLY IT, DO IT please. So yes, I'm keeping doors open, but that is a personal mission and I don't expect that will be a particularly common occurrence throughout the organisation*".

He also used the freedom granted by informal social relations that had been built up over many years to try and influence strategic policy in the Environment Agency. In the quotations below the officer shows an instrumental use of informal social space but also

the importance of providing independent support to increase the impact of his views on policy-makers.

"*In terms of playing the corporate game, it is about knowing to put the right, copy the right people on emails, don't jump levels over and above bosses, all the basic hierarchical things that is the way it works formally. The way it works informally – having been around the organisation for a million years and knowing all the other people that have been in the organisation a million years you know that is what water coolers and coffee machines are for. So yeah formally, in the formal email, telephone whatever you play the game but you still carry out the learning stuff. If I see the head of conservation who I know very well and for many years I'll say 'Paul have you seen this paper' 'No I haven't actually' "Oh I've got a few on the line have you got a minute…' 'I've got this one on common law' you know 'I've got this one on economics' yeah OK lets talk about that that's really interesting blah blah. And then we get back in our boxes and I don't communicate with him because he is not part of my section you know what I mean*".

He is clear about searching out members of his own community in the shadow space:

"*There are other trouble makers out there that I tend to gravitate towards. My community is people often dressed as very establishment but who are basically in the organisation for their own agenda. In other words if someone really cares about social factors and sustainability and they have sought out a job in an organisation that can do something I will feel sort of attracted to spend time with them*".

## 5. CONCLUSION

The uncertainty that climate change brings alters the imperatives that drive organisations. Adaptive capacity needs to be seen alongside contingency planning as the two sides of proactive risk management, so that crisis management can prepare for the unimagined as well as planning for the unexpected. It is argued in this paper that building adaptive capacity in organisations can be enhanced by recognising and working with shadow systems. These are made of personal relationships and held together by cultural norms that cut across formal organisational structures and official rules of conduct. The importance of understanding non-official cultural norms and maintaining personal contacts in making change within organisations or in influencing policy enactment has long been acknowledged as an intangible but important element of organisational life. The challenge is to harness the positive power of shadow systems as a resource for innovation, information transfer and learning without destroying them through formalisation or undermining formal management capacity by placing too much emphasis on the informal.

The empirical observations made in this study support theoretical arguments for the contribution of relational qualities such as trust, learning and information exchange in building adaptive capacity. They also caution that social networks or communities of practice will always exclude some and should not be seen as a panacea. The theoretical and empirical identification of shadow systems as a contributing factor to the building of adaptive capacity has potentially wide ranging consequences for social policy and research on adaptation to managing uncertainty from climate change and other stressors.

At a strategic level the contribution of social relationships in building adaptation adds weight to calls for greater support for social development in organisational and in social life more generally. For organisational management two questions need addressing. First, can informal social relationships be embraced inside public sector organisations or are there intolerable conflicts between the informal social relationships of adaptive capacity and needs for transparency and vertical accountability? Secondly, to what extent might contingency planning to manage risk compromise or compliment efforts to build adaptive capacity to manage uncertainty? Finally, at a practical level what tools exist to facilitate the building and maintaining of constructive social capital and social learning.

The findings resonate with the identification of a broader skill gap in the UK and perhaps internationally. This is the lack of individuals who can operate at the boundaries of communities of practice and facilitate communication and learning. Strategically the deepest divides are between social and natural scientists and between scientists and policy-makers. Formal education and professional training direct people into ever narrower specialisms, with few incentives for hybrid professionals or generalists to emerge. This has hampered public debate and consensus building, and contributed to a lack of public trust in the ability (and even willingness) of science and politics to work for the public good. Modifying formal institutions to support motivated professionals in developing informal social ties and expanding their range of communities of practice to cross these and other divides – for example by providing time in everyday work routines for social interaction that may take many years to build up into productive networks of exchange – is one way of addressing this challenge.

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