Climate Change and Variability, Energy and Disaster Management:

Produced Risks without Produced Solutions – Rethinking the Approach

Geoff O'Brien, Northumbria University
Professor Phil O'Keefe, Northumbria University and ETC UK
Joanne Rose, Northumbria University and ETC UK
Leanne Wilson, ETC UK
*Corresponding author e-mail and telephone:geoff.obrien@unn.ac.uk and +44 191 227 3745
phil.okeefe@unn.ac.uk and +44 191 227 3747

Introduction

Accelerated climate change and increasing climate variability present very serious global risks that demand an urgent global response (Stern, 2006). The risk types likely to occur are known, but only in broad terms. That they are produced by human action is accepted (IPCC, 2007). But their scale, severity, longevity and frequency are not known. The risks generated by climate change and increasing variability can be termed 'produced unknowns', driven by human actions and, at this juncture, with unknown outcomes.

Produced unknowns are a category of 'wicked problems' where answers are incomplete, contradictory and set against changing requirements (Richey, 2007). There are no direct solutions to the problems of produced unknowns. But there are approaches that can build effective responses to produced unknowns. That shift is to a focus on preparedness which requires recognition of the need for change and a change in mindset and behaviour. It is the nature of the shifts and the principles needed to shape the process that are evaluated in this paper. The threat to global welfare is real and there is recognition within the sustainable development, climate change and risk reduction discourses of their common interest in risk reduction. What is lacking is a unifying conceptual approach. Resilience can be used as a tool for policy development for effective and comprehensive responses to produced unknowns. Resilience is not argued as a paradigm but as a tool or common reference point. Conceptually, resilience can be used to develop a set of principles for building responses to produced unknowns. Adaptation is the starting point for this process.

Conceptualising the Argument

Addressing climate change should be an integral part of sustainable development policies, as should disaster risk reduction. This is not yet the case. However, a common feature of the sustainable development, climate change and disaster risk reduction discourses is doing things differently or

change. Change is advocated as being purposeful and promoting positive outcomes, for example, to the energy system to mitigate climate change and within sustainable development to enhance human well-being. This argues that it is desirable to develop an approach that provides a bridge among disaster management, sustainable human development and climate change mitigation and adaptation. Change can often be disruptive and, in such complex areas, there may be fundamental barriers that do not allow, or militate against, change. Conceptually, resilience best captures the process of purposeful change in challenging circumstances, as at its core resilience expresses the ability to respond to and recover from disruptive challenges. In geography resilience was first addressed with reference to land systems (Blaikie and Brookfield, 1987). The resilience perspective as a response to disruptive challenges or contextual change has emerged as a characteristic of complex and dynamic systems in a number of disciplines including ecology, (Holling, 1973), economics, (Arthur, 1990), sociology (Adger, 2000) and psychology (Bonnano, 2004). Resilience as a concept is increasingly used within the disaster management community as a metaphor both to describe responses of those affected as well as responding systems (Manyena, 2006). A resilient system responds and adjusts in ways that does not harm or jeopardise function. Resilience is not a science, it is a process, using human capacity and ingenuity to mitigate vulnerabilities and reduce risks, both of which are socially constructed. Resilience has its focus on resources and adaptive capacity and acts as a counter, or antidote, to vulnerability (O'Brien et al., 2006).

Though the concept of resilience is articulated in all three discourses, it is defined within the disaster risk reduction discourse. The United Nations International Strategy for Disaster Reduction (UN/ISDR) defines resilience as:-

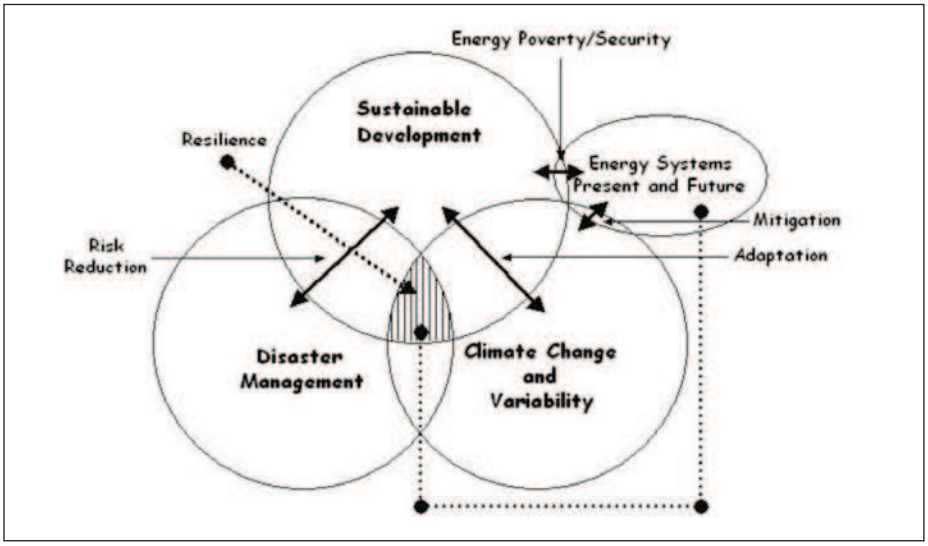

Figure 1. Conceptualising Resilience

The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures(UN/ISDR, 2004, Annex 1).

This definition does not advocate a solution or outcome but a process of learning and change. Conceptually resilience is seen as the overlap between the three discourses as shown in **Figure 1.**

Resilience is not argued as a fixed concept but as process. The shaded area in **Figure 1** can be seen as the resilience 'tool-box' where actors from different discourses are able to draw on the principles established in this submission for policy development. There is also an implicit feedback mechanism. None of the discourses are static and actors can feedback their learning and experiences of what works and why.

Resilience building enhances adaptive capacity through learning that enables positive responses to change; a proactive as opposed to a reactive approach. There is knowledge of this process, but only at a small-scale. Scaling-up is an urgent priority, but local governance structures, in the main, are designed to deliver top-down solutions, not encourage bottom-up engagement. Within the technological context of mitigation, resilience building argues a different

structural approach to energy system development, one that is not wholly source and transmission focused, but has the capacity to adapt to new sources while meeting the objectives of improving energy security and reducing energy poverty. The challenge is not a lack of technological know-how but whether or not there is sufficient political will for purposeful interventions that would shift the focus of energy system development.

Though resilience, conceptually, is being argued within the sustainable development, disaster risk reduction and, more recently, the climate adaptation discourses, there is little evidence of meaningful progress. There is clear need for a policy framework built on developing resilient social responses to cope with future challenges. Resilience, as a bridge building tool between the discourses, requires an enabling framework that encourages bottom-up responses. A focus on building the capacity of people, communities and the systems that support human well-being are needed. What is lacking is a clear, cohesive and comprehensive framework for resilience building. The starting point for analysing this problem is within the sustainable development dialogue and this shows that the pre-dominant approach to sustainable development is governed by economic considerations. Solutions are dominated by technology, often without sufficient recognition of technology as the cause of the problem. This is a weak approach to sustainable development with interpretations dominated by the OECD (Organisation for Economic Cooperation and Development) perspective as shown in **Figure 2**.

(Giddings et al 2002; Hopwood et al 2005). The dominant view OECD has influenced the development of other global dialogues.

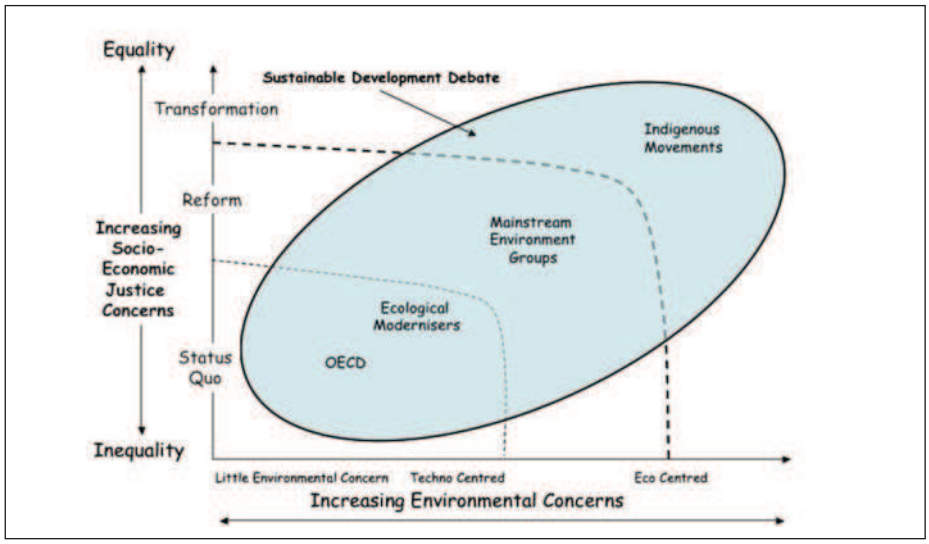

Figure 2. Mapping Sustainable Development

Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) approaches climate risk reduction from two perspectives; first, mitigation or reduction of greenhouse gas emissions to stabilise concentration levels at a safe level; second, adaptation, or adjustment to, climate driven change. Mitigation aims to reduce future climate risk. Adaptation aims to reduce current climate risk. Mitigation as a strategy has dominated the climate debate, whilst adaptation has received, comparatively, less attention. The focus on mitigation is not surprising and, similarly, focuses on technological solutions. The dominant OECD world-view has clearly steered the way in which the Convention addresses the climate problem.

Though TAR did bring about a shift in views of many Convention signatories as shown by arrow 1, the Fourth Assessment Report has brought about a global consensus that a real shift in thinking is needed as shown in arrow 2 (IPCC, 2007). The culmination of this is the Bali Roadmap agreed at COP 13 (Convention of the Parties) (UNFCCC, 2007). This is the first hesitant step to finding a successor to the

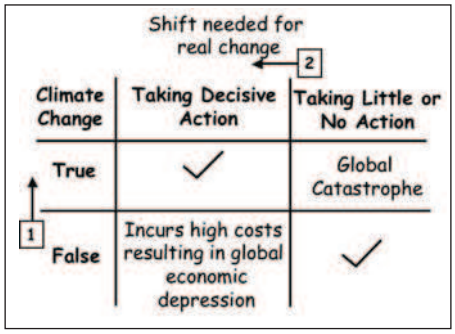

Figure 3. Decision Grid

Kyoto Protocol, but more importantly it signifies a global consensus of the need to fight climate change. The key areas in the Bali Roadmap are recognition that deep cuts in global emissions are needed to avoid dangerous climate change, measures to enhance forests, support for urgent implementation of adaptation measures for poorer nations along with disaster risk reductions measures and consideration of methods for removing obstacles and the provision of financial and other incentives for scaling up the transfer of clean technologies. A more detailed agreement is expected for the 2009 UN summit in Copenhagen.

Learning the Lessons

There are questions surrounding institutional willingness to change that will need answers in the run up to Copenhagen. Using energy as an example it is clear that fundamental reform is needed. The dominant energy model is technically complex and capital intensive and has inherent technical vulnerabilities (Perrow, 1999; Lovins and Lovins, 1982). This is compounded by geopolitical uncertainties of security of supply and more recently to instrumental threats (O'Brien & O'Keefe, 2006).

Renewable resources are diffuse and intermittent and usually have lower energy densities. As opposed to supply on demand, a renewable approach requires "capture-when-available" and "store-until-required" strategies. There are exceptions, such as hydro-electric schemes, but typically renewable systems function best at small-scales near to point of use. They are not focused on a particular fuel type but use indigenous resources (O'Brien et al, 2007). Though a renewable approach is vulnerable to source intermittency, its does not have the same system vulnerabilities associated with the dominant model. For example top-down interconnected electrical systems are vulnerable to cascading faults, a regular occurrence in Europe and North America. Small-scale and distributed systems can be interconnected but the direction is typically horizontal, a structure not prone to cascading faults. Use of indigenous resources minimises geopolitical risks. This implies a very different structure to the current system as shown in **Figure 4.**

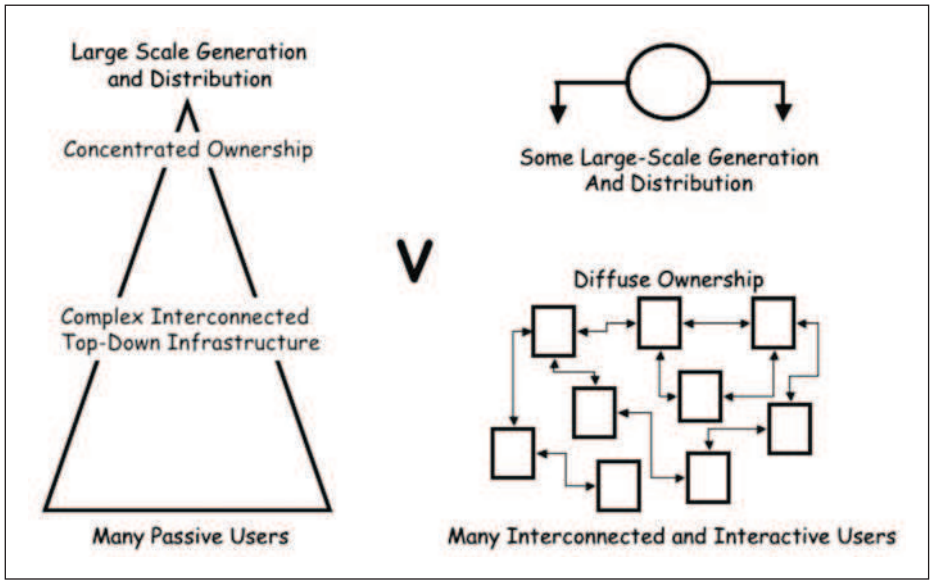

Figure 4. Contrasting Models of Energy System Structure

As Figure 4 suggests, there is considerable opportunity for a mix of scales and there is no suggestion of total abandonment of large-scale systems provided they are appropriate. But what is clear is that technological innovations are driving the development of smaller and more flexible energy technologies and users are increasingly using them driven by fears of the vulnerability of sensitive systems to power failure interruptions or prolonged failure (O'Brien et al, 2007). There are many renewable technologies and new technologies being developed and it is possible that a new energy carrier such as hydrogen will become commonplace. The question however, is what is needed to shift the direction energy system development to a more sustainable basis?

Without a shift in public attitudes towards the environment then technology cannot solve the interrelated problems of energy and climate change (IEA, 2003). Addressing energy system development requires purposeful intervention to guide the development as well as re-connection of the

user with the energy system. Where such interventions have been used the results have been impressive (O'Brien & O'Keefe, 2006). Reconnecting users encourages active participation in tackling the problems we face. This is best realised in a top-down enabling environment that encourages bottom-up innovation. This embeds resilience.

Disaster Management

To respond to current and ongoing risks requires building resilience into adaptation and disaster response and preparedness platforms. The Hyogo Declaration of the United Nations International Strategy for Disaster Reduction (UN/ISDR) recognises the linkages between disaster risk reduction and sustainable development (UN/ISDR 2005). The Hyogo Framework for Action (HFA) posits resilience as a key attribute in building communities able to withstand and cope with adverse events. The starting point for resilience building is vulnerability (Hyogo, 2005).

Within the global discourses of reducing the risk of produced unknowns, resilience building, particularly for poorer and vulnerable communities, is seen as a means of helping them to help themselves. At the core of this discourse is recognition, though not stated, that in the event of multiple simultaneous disaster occurrences, response capacity would be overwhelmed. The international disaster community has called for resilience building along with the establishment of disaster management platforms. The focus of disaster management is risk reduction of all hazard categories; a generic or "all-hazards" approach (Quarantelli, 1992; Sikich, 1993; Alexander, 2005). This generic approach is a feature of disaster management in the developed world and is effectively the dominant model. There is a considerable literature describing this approach to disaster management. It can be characterised as legally based, professionally staffed, well funded and organised. It aims for a return to normality, that is, to re-establish conditions as they were prior to the event (Perry and Peterson 1999; Alexander 2000, 2003; Schaafstal et al 2001; Paton and Jackson 2002; Cassidy 2002; Perry and Lindell 2003). **Table 1** typifies the dominant model. Though resilience and preparedness are embedded within the terminology of the dominant model the reality is that the focus is on institutional resilience and preparedness (O'Brien & Read, 2005). This top-down structure is incompatible with the notion of resilience building. Furthermore, in many cases, it will not be appropriate to promote a return to 'normal' conditions, for example where people are concentrated in unsafe slum areas that are vulnerable to a range of hazards.

Recently the approach in Europe and North America towards disaster management has been skewed towards a securitisation agenda stemming from the September 11th 2001 terrorist attacks and in the USA and the London (2005) and Madrid (2004) bomb attacks (O'Brien & Read, 2005; O'Brien 2006). It is the duty of government to protect the public. But too great an emphasis on one source of threat can divert attention, both of government and the wider public, from other pressing problems. The current focus and emphasis needs to change to reflect the wider agenda of preparedness. It is this aspect of raising awareness, public education and risk communication that is lacking in the way the dominant model as typically practised. In the UK, for example, little has been done in this respect (O'Brien & Read, 2005). In terms of

Table 1. Technocratic Model of Disaster Management

Dominant Paradigm	Comment
Isolated event	Disasters usually regarded as unusual or unique events that can exceed coping capacity
Risk not normal	Risk is socially constructed and risk management aims to reduce risk to within proscribed levels realised through governance structures
Techno-legal	The legislative framework, regulatory system and the technologies used for risk reduction and disaster response
Centralised	Realised through a formal system such as a government department or state funded agency
Low accountability	Typically internalised
Post event planning	Internal procedure for updating and validating plans based on lessons learned
Status Quo restored	The overall aim – a return to normal

Source: Adapted from O'Brien & Read, 2005

the risk management chain an important actor, the public, has been distanced. This is the antithesis of resilience building.

Linking Disaster Management and Adaptation

Effective preparedness is a partnership between government strategies and individual and societal behaviours (Berman and Redlener, 2006). Effective preparedness is the key to resilience building. Essential to effective resilience building is an enabling environment that assigns local communities an active role as agents of change in their own right such as assessing priorities, scrutinizing values, formulating policies and carrying out programmes (Sen, 2005).

Applying this rationale more broadly to disaster policy response to climate change depends on a number of factors, such as institutional and social capacity and willingness to embed climate change risk assessment and management in development strategies. These conditions do not yet exist universally. Reducing vulnerability is a key aspect of reducing climate change risk. To do so requires a new approach to climate change risk and a change in institutional structures and relationships (O'Brien et al, 2006). A focus on development that neglects to enhance governance and resilience as a prerequisite for managing climate change risks will, in all likelihood, do little to reduce vulnerability to those risks.

Where there has been a willingness to re-think responses to disastrous events the results have been positive. For example storms in 1970 and 1991 in Bangladesh resulted in deaths of 500,000 and 138,000 respectively. Following the 1970 disaster, the government along with agencies initiated the Bangladesh Cyclone Preparedness Programme, a bottom-up programme aimed at reducing the vulnerability of communities and resilience building through social learning processes. This strengthened self-help capacities based on indigenous knowledge of vulnerabilities and using participatory methods to develop programmes such as community training in disaster preparedness (Yodmani, 2001). This exhibits willingness at the institutional level to undertake a new approach and to learn from experience. This is institutional learning. Examples of the measure implemented are Early Warning Systems, evacuation procedures and shelter provision. In the 1991 cyclone fatality rates were 3.4 percent in areas with access to cyclone shelters compared to 40 percent in areas without access to shelters. Because of improved preparedness during another strong storm in 1994, three quarters of a million people were safely evacuated and only 127 died (Schultz et al, 2005; Akhand, 2003).

Institutional learning explores how learning takes place in response to changing conditions. There are two forms of learning that are applicable to disaster management; single-loop and double-loop (Argyris and Schon,1996). Single-loop learning or adaptation is the adaptation of new knowledge to existing frameworks of objectives and causal beliefs. In essence, this is learning to do something better. Double-loop learning includes single loop learning but also questions the framework of beliefs, norms and objectives. It is about re-thinking the way things are done.

Single-loop learning is a predominant

Table 2. Characterising Adaptation as Disaster Risk Reduction

Adaptation Paradigm	Comment
Part of development	Adaptation is not an add-on but should be an integral part of societal development
Risk of disaster is an everyday condition	Climate change and variability is a known category of natural hazards amplified and accelerated by anthropogenic activities that will occur
Social capacity	Enhancing the ability of societies to both respond to hazards and adjust to change
Participatory	Learning to enhance capacity
Transparent	Undertaken in an enabling environment
Pre disaster plans	Aimed at prevention
Transformation	Move society to a new set of conditions – enhance coping capacity and improve baseline condition, for example, decrease levels of poverty

Source: Adapted from O'Brien, 2006

characteristic of disaster management within the developed world (O'Brien, 2006; O'Brien & Read, 2005). Whilst this embeds resilience within the disaster management function and acts to improve response capability and institutional capacity, there is a danger that this internal focus will not challenge culturally accepted beliefs, associated precautionary norms set out in laws or codes of practice and custom and practice. Failure to make these changes contributes to disasters (Turner and Pidgeon, 1977).

Learning can change the way in which responses to threats are constructed. Adaptation to current and ongoing climate risks can be more effectively developed within an enabling framework that recognises that local knowledge of vulnerabilities is the starting point for developing effective responses. Resilience building not only strengthens self-help capacity to respond to threats but also the capacity to plan for and undertake changes that will reduce risks. Planning prior to disaster occurrence can use adaptation to construct an effective response paradigm. This is illustrated in **Table 2.**

Constructing a global response model to the challenges of adaptation that embeds resilience argues for both top-down and bottom-up perspectives. The starting point for planning adaptation responses is vulnerability. Embedding resilience argues for a pre-disaster focus to ensure that effective responses are developed and that societies are able to adjust to change and recover from disruption.

Adaptation will be challenging. It is a long-term and costly process likely to result in disruption, for example, the relocation of people and infrastructure away from hazardous areas. In terms of scale adaptation requires decisions from individuals, firms and civil society, to public bodies and governments at local, regional and national scales. Building adaptive capacity will include communicating climate change information, building awareness of potential impacts, maintaining well-being, protecting property or land, maintaining economic growth, or exploiting new opportunities. **Table 3** brings together those aspects of the dominant and adaptation paradigms and develops a set of principles for adaptation planning and resilience building.

Failing to build a meaningful global response to climate change risks an unbalanced global response. **Figure 5** illustrates that linking vulnerability, societal resilience and burden-sharing provides a framework for learning at all levels that has the potential to lead to a fair and equitable climate agreement.

Table 3. Pre-Disaster Planning Principles for Adaptation

Pre-Disaster Planning Principles	Comment
Sustainable Development	An approach that focuses on reducing risk both now and in the future
Risk Avoidance	Developments should be evaluated from a risk reduction perspective
Embedded in Policy and Practices	Adaptation should be normalised
Distributed to the appropriate level	It is both top down and bottom up
Shared responsibility	The basis for renewing the preparedness partnership between government and people
Learning from scientific evidence, indigenous knowledge and experience	All knowledge is important, but of equal importance is effective communication and dissemination
Adjusting to changes	A recognition that the future may be very different
Organisational and Social Learning	Thinking differently and learning about how we approach problems related to adaptation should be the norm

Source: Adapted from O'Brien, 2006

Concluding Comments

There is a considerable evidence base that disaster risk is increasing and impacting the most vulnerable. However the 'democratic' nature of climate change and variability means that all populations throughout the world will be impacted in one way or another. Adaptation to the consequences of climate change and variability is an urgent priority for public policy. The challenge for public policy is on many levels; nationally within the developed world to develop sustainable responses; within the developing world to

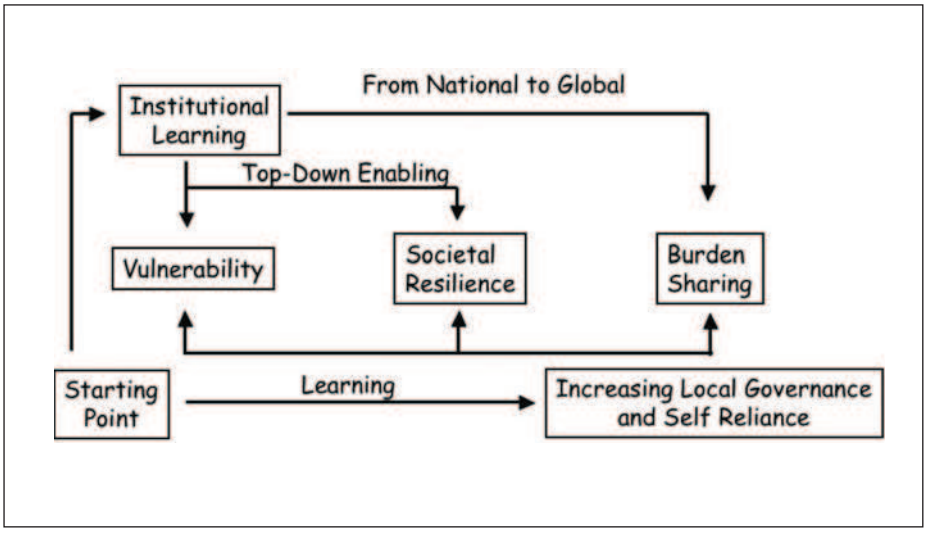

Figure 5. Linking Concepts for Climate Risk Reduction

enhance institutional and social capacity for disaster risk reduction; and for the international community to ensure that developmental policies are aimed at working to meet internationally agreed goals both for poverty reduction and climate risk reduction.

The agreement between UN/ISDR and UNFCCC to collaborate is welcome. Though there are concerns about the appropriateness of the dominant model of disaster management as an appropriate vehicle for resilience building, recent changes in UK government thinking in the National Security Strategy, indicate the potential for positive change (BBC, 2008). The new approach involves improving local resilience, building and strengthening local capacity and engaging households in preparedness strategies. This is the right rhetoric and is welcome. The challenge will be turning the rhetoric into reality.

Responding to produced unknowns driven by a changing climate requires resilience building. Resilience building is needed in pre-disaster planning and sustainable development in order to develop the social and institutional capacity to respond to produced unknowns. Resilience building is a process that aims to reduce harm, both now and in the future. The focus of resilience is on well-being. Resilience building is a learning process at all levels. Institutional learning empowers at the local level and strengthens governance. This is negotiation not imposition. Responding to the threat of produced unknowns require both current and future strategies. Strategies are needed to adapt to disruptive challenges generated by a changing climate. Strategies are needed to shape energy policy to minimise future risks. A focus on resilience recognises that there is no steady-state or end result. It is process without end that has, at its core, the notions of entitlements and governance.

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