



Centre for Liberal Arts and Social Sciences

Resilience: An Interdisciplinary Dialogue



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**School of Humanities and Social Sciences,
Nanyang Technological University**

INTRODUCTION

Resilience: An Interdisciplinary Dialogue

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This workshop – ‘Resilience: an interdisciplinary dialogue’ – brought together 26 Singaporean and overseas participants for two days of discussions and reflections at the School of Humanities and Social Sciences of Nanyang Technological University in June 2011. The ‘think pieces’ that were written before and fine-tuned since the workshop are collected together in this booklet and represent the distilled thinking of the participants particularly with regard to three resilience themes: resilience and spatial and temporal scales; resilience and governance; and resilience trade-offs. In addition to these think pieces, the booklet is topped-and-tailed by an introductory summary and, finally, a consideration of the particular place of resilience in the context of the challenges (and opportunities) facing Singapore.

The participants in the workshop came from a variety of disciplinary and applied background and, inevitably, brought to the workshop a range of not always compatible views, conceptual framings, and objectives. The full list of participants and their affiliations is recorded at the end of this booklet. Suffice to say that we welcomed natural scientists, political scientists, geographers, development specialists, historians, film makers, civil servants and anthropologists. In light of these diverse backgrounds, the participants ‘approached’ the issue and question of resilience from different vantage points. Some counted themselves as resilience specialists; others as scholars and practitioners who considered resilience from the standpoint of an interest in sustainable livelihoods or sustainable development, or from a concern for risk and vulnerability in the face of natural hazards. As a result, we sometimes found ourselves struggling to engage in a dialogue. Some of the participants were happy to explore, in quite an open-ended manner questions like ‘resilience for whom?’ and ‘time-scales for resilience’. Others wanted a more focused engagement with the policy challenges of resilience, and were somewhat frustrated when we circled and re-circled the wagons, in the process – as they saw it – making little headway.

This, of course, is one of the great challenges of interdisciplinary work which is so often lauded, particularly by practitioners, but rarely achieved. As Brewer (1999) memorably put it in his paper “The challenges of interdisciplinarity” (in *Policy Sciences* 32[4]), “The world has problems, but universities have departments.” As a group, we often found ourselves engaged in what might be best termed a ‘multidisciplinary dialogue’ where we juxtaposed disciplinary positions, rather than an ‘interdisciplinary dialogue’ that combined and therefore transcended disciplinary positions. To be fair to ourselves, however, and bearing in mind that this was the first time many of us had met, and then only for two days, perhaps this was setting the bar rather high.

Notwithstanding our struggles to go beyond multidisciplinary discussions, this booklet does collect together a diversity of views and approaches to resilience thinking, and as such is a useful compendium that highlights points of intersection and resonance, and

areas of difference. The fact that the think pieces are short and sharp also makes the discussion here approachable and digestible. In addition, we have added a short consideration of themes that we thought were of importance for Singapore, and I hope these might then be taken forward in the form of a more substantial research initiative.

The workshop would not have been possible without the institutional and financial support of the College of Humanities, Arts, and Social Sciences and the Centre for Liberal Arts and Social Sciences at Nanyang Technological University, the administrative efforts of Ang Wee Li, and the encouragement of Professor Alan Chan, Professor KK Luke and Dr Monique van Donzel.

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Resilience: An Introductory Note

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Resilience: The wider picture

'Resilience' has become a key term that connects the social and natural sciences, connects disciplines, and connects the academic and applied and policy-making worlds (Table 1). In the media, in policy debates, and in scholarly debates, the use of the term resilience is widespread and growing. It has been very widely employed, for example, across disasters response and management (where it is often paired with vulnerability), physical infrastructure design and maintenance, emergency planning, livelihood analysis, and community resilience. There are a number of global concerns that go part of the way to explaining why 'resilience' is currently in vogue: in particular, the challenge posed by climate change and the increasing frequency and intensity of natural hazards and the impacts these are having (and will have) on human and animal populations from maintaining biodiversity to livelihood sustainability, anticipating and managing global migration streams, and ensuring infrastructural stability. But resilience debates have extended further than just climate change; we see resilience cropping up in connection with the challenges posed by regional and global economic and financial crises, and with the War on Terror, for instance.

Table 1: The worlds of resilience

Resilience concerns	Disciplinary fields	Application and policy concerns
Community resilience	Sociology, anthropology, geography	Natural hazard impacts and responses, economic transitions and turbulence
Infrastructural resilience	Engineering, computer science	Stability and security of water, communications and energy infrastructures
Resilience in biological and ecological systems	Biological sciences, ecology	Climate change, biodiversity, food security; ecosystems research; sustainability
Economic resilience	Economics	Insurance, economic crises and stability
Corporate (business) resilience	Business studies, economics	Strategic thinking in the face of an uncertain world; planning for the untoward
Security and resilience	Security and military studies	Terrorism, emergency planning, military resilience and defence
Livelihood resilience	Development studies	Climate change, livelihood vulnerability

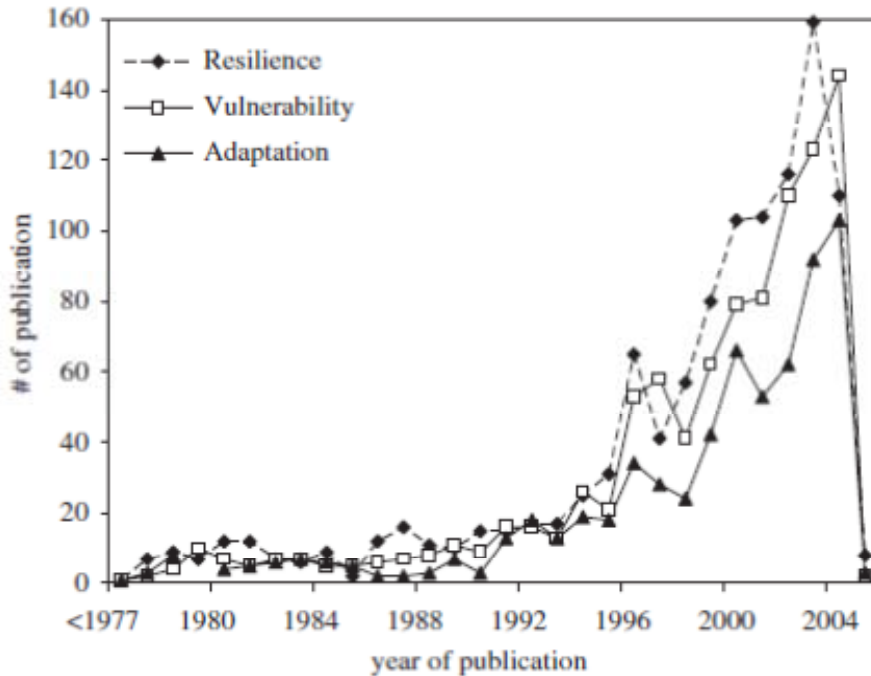
Resilience in the face of natural hazards	Earth sciences, geography	Hazards and resilience
Psychological resilience	Psychology	Human resilience; post-traumatic stress

Resilience: Defining terms

The term ‘resilience’ has become popularised across the natural and social sciences (Figure 1). Beginning with the work of Holling (1973) on resilience in ecological systems in the early 1970s, it has since been embraced by a broad spectrum of the natural and social sciences. Before Holling’s work, the term had mainly been used in psychology and psychiatry, particularly with reference to children’s responses to traumatic events (Manyena 2006, 433). The term is not infrequently linked to two other terms, ‘vulnerability’ and ‘adaptation’ (or ‘adaptive capacity’) (see Gallopin (2006) and the papers in GEC 2006). For all three terms, there is no consensus on their definition and, moreover, whether this can be counted a strength (widening the scope of debate and interest and permitting interdisciplinary dialogue) or a weakness (leading to fuzziness, where the absence of a clear definition means lack of clarity in conceptual terms).¹ That said, the growing need to adopt an interdisciplinary approach to understanding and enhancing resilience makes it important to review and compare disciplinary frameworks and working definitions, the different means and methods employed to research, understand and enhance resilience, and the policies that emerge from such debates.

¹ There may be talk of a resilience ‘paradigm’ but this has “gained currency in the absence of philosophical dimensions and clarity of understanding, definition, substance, and most importantly, its applicability in disaster management and sustainable development theory and practice” (Manyena 2006, 435).

Figure 1: Papers published in the 'knowledge domains' of resilience, vulnerability and adaptation per year (Data for 2004 and 2005 are incomplete.) Source: Janssen et al. (2006, 243).



International research programmes and initiatives on resilience

March of this year saw a major international conference on resilience ('Resilience, Innovation and Sustainability: Navigating the Complexities of Global Change') with some 700 participants (see <http://resilience2011.org/>). The stated aim of the conference was:

“to advance understanding of the relationships among resilience, vulnerability, innovation and sustainability. It will do so by bringing together scientists to share their work on the dynamics of interconnected social-ecological systems. Conference attendees will include people from the government, business, NGOs and academic sectors concerned with resource governance, and economic and social development. A key outcome of conference discussions will be the development and refinement of new ideas for meeting the challenge of global change.”

In addition there are numerous research programmes oriented around the theme of resilience such as the UK's Natural Environment Research Council's (NERC) *Increasing Resilience to Natural Hazards in Earthquake-prone and Volcanic Regions* (<http://www.nerc.ac.uk/research/programmes/resilience/>), the Resilient and Sustainable Infrastructure Network (Resin) at Berkeley (<http://ccrm.berkeley.edu/resin/>), and the UK's EPSRC and ESRC recent call for interdisciplinary work on resilience (see <http://www.epsrc.ac.uk/funding/calls/2009/Pages/generation.aspx>). The Stockholm Resilience Centre (<http://www.stockholmresilience.org/>) coordinates research on the

'governance of socio-ecological system'; at the grassroots there are groups such as the Resilience Alliance (<http://www.resalliance.org>), while in international development the dual theme of vulnerability and resilience threads itself through much academic and applied work.

The scope of the workshop

It was never intended that the workshop at NTU would review the term resilience, and its evolution and development. That has already been done and there are a number of excellent over-arching review papers which do just this (see Manyena 2006; Adger 2000; GEC 2006). Instead the workshop aimed to focus on three linked areas of emerging discussion and debate, namely, the questions of:

- (i) resilience and scale;
- (ii) the trade-offs between and within scales; and
- (iii) the governance of resilience.

The participants were asked to address one or more of these themes and while the think pieces that follow this introduction do this in different ways and to different degrees, they provide a valuable set of inter-linked insights.

With regard to the issue of resilience and scale, there are important questions concerning at what 'level' we analyse and thinking about resilience. As Nelson, Adger and Brown (2007) argue, "...reconciliation of actor- and system-oriented approaches represents a major challenge" to resilience studies. While "actor-based analysis looks at the process of negotiation and decisions...systems-based analysis examines the implications of these processes on the rest of the system" (399). The questions that participants were asked to consider included:

- What are the scale footprints of our units of analysis (individuals, space economies, households/families, ecosystems, villages, societies, economies, countries) and how do these change, particularly with development processes?
- How does spatial scale link to time-scales of interest? Does the resilient livelihood of one generation compromise that of the next?
- Can knowledge across scales ('local' knowledge, 'global' knowledge) be productively linked?
- Can we use a scale approach to reconcile the individualised and actor-oriented approach of adaptation studies with the system-focus of resilience studies, where the concern is on the feedback implications of activities on the system?

These questions concerning the scale(s) at which we think about and study resilience raise the issue of resilience trade-offs. Walker et al. (2006) highlight the way in which high levels of 'adaptedness' in one location can undermine resilience in another location or region. This highlights the need to bring a spatial lens to our understanding of resilience, and to consider resilience systems as spatially 'nested' or interlocking. More generally, although not often explicitly linked to resilience concerns, scholars have

worked on the relational aspects of social, economic and environmental change. Moseley's (2005) work on the political ecology of smallholder cotton farming in southern Mali, for example, illustrates how the actions of relatively richer farmers, as a group, compromised the livelihoods of other farmers. Because these richer farmers could afford to prepare their land using plough and oxen, they were able to extensify their cultivation onto more marginal, village lands.

Some of the germane questions concerning resilience trade-offs that we asked participants to consider included:

- What are the resilience and vulnerability trade-offs within and across scalar systems?
- Can ideas of social capital (linking, bridging and bonding) be usefully brought to bear in thinking about resilience trade-offs?
- Can highly adaptive systems undermine or compromise resilience?
- What are the links between inequality, poverty and social exclusion (social cleavages), and resilience?

Finally, there is the issue of the governance of resilience, on which there has been relatively little work. Partly this stems from the belief in some quarters that resilience cannot be 'built' – it is inherent in systems, societies, communities and individuals. But immediately once one begins to 'build' or 'create' resilience, there is a tendency for top-down management and governance approaches to be put in place. This then transforms resilience from an inherent system that naturally operates and reproduces itself to one that is planned for.² As Adger (2006) writes:

“The policy implications of vulnerability and resilience are profound and contested. Policies and strategies, which reduce vulnerability and promote resilience change the status quo for many agencies and institutions and are frequently resisted” (278).

This theme addresses not only Governance – i.e. state-orchestrated attempts to promote resilience – but also community governance systems; this therefore links governance with both issues of scale and the trade-offs between scales. Some of the initial questions that participants were asked to consider were:

- Is it possible to build (or enhance) resilience? What are governance opportunities and issues?
- What is the role of institutions in resilience ('adaptive governance')?

² As Manyena (2006) writes: “...broad-scale community involvement is not part of the United Kingdom government's resilience strategy. In the event of disasters that will overstretch emergency services, responses will 'naturally' become the responsibility of affected communities. Some see the resilience programme as a new version of the paternalistic civil defence approach employed during the Cold War (Alexander 2002) and applied in the wake of more complicated terrorist threats” (438).

- Can we identify resilience ‘thresholds’ (tipping points) and can those thresholds be altered to widen or enhance resilience?
- What are the data deficiencies that make governance difficult?
- Can we focus on community governance as a way of localising the building of resilience?
- What are the policy lessons of dealing with adaptive social-ecological systems that are in “constant flux, highly unpredictable, and self-organizing with feedbacks across multiple scales in time and space” (Folke 2010, 1)?
- What are the links between democracy (or political systems and cultures) and resilience?
- What are the links between resilience and the quality of institutions? (Is an autonomous bureaucracy [embedded autonomy], for example, necessary to deal with shocks?)

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RESILIENCE 'THINK PIECES'

Socio-Technical Resilience: A Concept

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We live in a vulnerable world. Natural disasters such as tsunamis, earthquakes, floods and volcano eruptions are frequent happenings that take lives and cause profound damage to socio-economic systems. Impacts of these disasters are augmented by our failure to build strong foundations in the artificial environment that our modern society has created using scientific technology. The increased frequency and intensity of catastrophes that we have seen over the past decades shows that the world we live in is not as safe as we have assumed. What is more striking is that technology that supposedly plays a significant role in maintaining the safety and security of our society has instead contributed to the rising scale of disasters and calamities that we are having to deal with. Nuclear meltdowns, transportation accidents, high-rise collapses, and acts of terrorism are some of myriad examples that indicate the vulnerabilities in our socio-technical systems that can transform these systems into killing machines, taking many lives and causing considerable socio-economic losses.

This does not mean that we should abandon altogether what modern society has accomplished in producing technology undoubtedly useful for our life. What we need to seek at this critical moment are new methods and approaches that enable us to build socio-technical systems that are safer, more secure, and sustainable. Engineers around the world have attempted to produce better technological systems that are more resilient in the face of undesired situations. The problem is that engineers are inclined to neglect the social dimensions that are tightly embedded in technological systems. Thus, the aspects of organization, coordination, communication, social structures, cultures, and the like are excluded in the equations engineers use in building complex technologies and infrastructures. This is the main entry point to which this paper is intended to contribute.

At the heart of our societal architecture are technical infrastructure systems, which govern our existence. The complexity of the infrastructure systems presents only one side of their complexity generally, which also includes their technical frailties. In both systems numerous actors are involved in planning, operating, managing and regulating the infrastructure, at the national level, and at international and supranational levels. The networks of actors in complex infrastructure systems present another dimension of systems complexity. In recognizing this combination of physical and social network complexity, we are in fact considering infrastructure systems as socio-technical systems. Single plants, firms or entire industrial sectors constitute socio-technical systems. In such a system, technological components and social arrangements are so intertwined that their design variables would require joint optimization of both sets of variables.

A vital question arises here: are our technological systems responsible for the manufacturing of systemic risks and vulnerability? It is a characteristic of the systems around us or embedded in our ethos, as nature herself is an analogous set of large-scale, interconnected systems. Natural systems are highly structured, being the long-lived products of competitive survival – the inheritance of evolution. And the interconnections between the systems are highly structured themselves, often for similar evolutionary reasons. Fragility is hidden from us because it is emergent. The more structured and sophisticated a system is, the more fragile it will be. Such a system is tightly coupled, so the failed singular component cannot be isolated as in a linear manufacturing chain, and hence triggers a cascade leading to systemic failure. This is the paradox in organizational decision making in complex socio-technical systems: it has to be decentralized but yet centralized in a tightly coupled system. This analysis leads us to a unique sort of globalized, infrastructure-oriented construct for capturing the essence of fragility and weakness, which is apt for our wired world around us, which we can call ‘Socio-technical Vulnerability’. The antithesis of vulnerability is resilience.

Science and Technology Studies (STS) scholars have aptly pointed out that technology is always part of society, and vice versa. Building technology without taking into account social dimensions only leads to the high possibility for failure and dysfunction. To overcome the shortcomings in existing socio-technical construction, I offer the notion of ‘socio-technical resilience’ as a new framework to understand the vulnerability of complex socio-technical systems. This paper defines socio-technical resilience as the ability of complex socio-technical systems to withstand shock and crisis and to bounce back in the event of natural or man-made disaster. Combining insights from STS and resilience studies, this paper emphasizes the necessity for the design of socio-technical systems to be arranged in such a way that they do not separate social elements from technical elements, for both are inextricably intertwined, thus equally defining the level of resilience of the systems. Resilience is a multidimensional and multi-scale concept that can facilitate the understanding of various complex interactions among a diverse pool of stakeholders. Resilience is seen as a dynamic process and may change over time. Resilience includes a community’s capacities to advance those development processes, social networks and institutional partnerships that strengthen its ability to anticipate, cope with, resist and recover from disaster.

Highlighted publications

- Beck, Ulrich. 2002. *Risk Society: Towards a New Modernity*. London: Sage.
- Perrow, Charles. 1999. *Normal Accidents: Living with High-Risk Technologies*. Princeton, NJ: Princeton University Press.

‘Resilience’ in the Public Discourse: Representation of Natural Disasters in Australian Newspapers 2006-2010

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In recent years, resilience has emerged as a framework for conceptualizing and navigating change of various types – environmental, economic, political, cultural, etc. (Walker et al. 2002, Folke 2006, Walker and Salt 2006). The concept of resilience is also gaining currency in the public discourse as a lens for interpreting change and uncertainty.

Natural disasters in Australia have received significant local, national and even global media attention, and the word resilience has frequently appeared in the media in connection with these events. This raises an important question: what are the messages being conveyed about resilience and what makes communities – and the larger social-ecological systems they are embedded within – more resilient to disasters?

News media has considerable power in society (Parenti 1993; Carvalho 2007); it is able to inform and shape public opinion, and reveals perspectives across various scales and political and cultural contexts. Natural disasters are particularly ‘media-ripe’ because they are rapid onset events, and compared to slow change, such as drought, they are characterized by more visible thresholds, are easier to link to societal perceptions of risk, and often highly emotive due to significant losses of life, property, or livelihoods. Disasters appear to be increasingly visible in the media in recent years due to a combination of driving forces (e.g., climate change, population pressure) and the fact that the capacity of authorities to manage disasters has often not kept pace. Nevertheless, natural disasters also provide opportunities to influence public perceptions of the environment through the media (Ashlin and Ladle 2007).

Key questions explored in this research are:

- How is ‘resilience’ constructed in the Australian media in relation to natural disasters?
- How similar or different is this from more academic concepts of resilience?
- What does this imply for the messages being communicated about resilience to disasters amongst the wider public, and for building resilience to disasters?

We undertook a media analysis of Australian newspapers to explore how resilience has been used in relation to natural disasters during 2006-2010.³ We analyzed data using a frequently-cited definition of resilience on the Resilience Alliance (RA) website (e.g., Walker et al. 2002, 1) The amount of change a system can undergo and still retain the same controls on function and structure; 2) The degree to which the system is capable of self-organization, as opposed to being dependent on feedback introduced by managers; 3) The degree to which the system expresses capacity for learning and adaptation. We also inductively identified other themes in the data.

We found that the usage of the term resilience in newspapers has some parallels with the academic (and particularly RA) version of resilience, but has a wider range of meanings, which are not always consistent or precise. Variation may be attributed to the user (which included journalists, community leaders, politicians and other spokespeople), the type of article and stage in the news or issue-attention cycle (Downs 1972; Crawley 2007), with usage of the term in later stages of the cycle often conveying a greater sense of reflection and deeper meaning.

Insights from our data include: emphasis is given in articles on rebuilding, resisting, returning to pre-disaster state, while aspects of structure, function, identity might need to change if found to erode resilience (i.e., riverside living in Brisbane); there is frequently an expectation of assistance that limits self-organization; discussions of learning and adaptation often focus on the importance of experience in contributing to resilience; learning and adaptation are more prevalent in anniversary articles, though despite use of the term “learning” there is not clear evidence of it occurring, and even less of adaptation. Other themes included: new system configurations and shifting baselines (a “new normal”); resilience as a latent property that emerges from disasters; and the political usage of resilience (i.e., “praise” bestowed on communities for their resilience).

Our analysis of five years of Australian newspaper reporting of disaster events provides insight into the public construction of resilience in a disaster context, resulting in two major outcomes, one theoretical and one practical. Theoretically, the results force us to revisit concepts of resilience used by the Resilience Alliance and other scholars and their applicability in a disaster context. Our analysis was novel in its investigation of news media, a largely neglected data source and method to probe resilience theory and thinking (but see Galaz et al. 2009). Practically, this work may help apply resilience thinking in a disaster context, by delivering new ways of conceptualizing disasters that may resonate with practitioners involved in disaster management. For example, the term a ‘new normal’ has a parallel in the concept of alternative basins of attraction that describe alternative social-ecological system regimes (Scheffer 2009); however, a ‘new normal’, like ‘shifting baseline’ may be more accessible to a non-scientist audience.

The scope of our analysis (i.e., nation-wide over five years) enabled a broad perspective on disaster events. There is a need for future research that focuses on these and subsequent

³ This analysis does not include events that occurred in 2011, which are the subject of a separate study. The advantage of defining the past five years as our scope of analysis is that we are able to capture a longer cycle of news following the disasters.

disaster events in more detail, including the role of attention cycles, learning from the past, and use of imagery as well as text in news media. In particular, knowledge is needed on how discourse around disasters and resilience changes over time, with respect to single disaster events but also from cumulative experience with disasters. Do media representations change public perception of disasters and societal resilience to these events, and if so, what are the most effective mechanisms for using media to achieve positive change?

We suggest that there is much utility in media analysis for disaster management. This analysis can provide a foundation for as well as complement other research, such as multi-method studies of resilience to disasters (e.g., Aldunce in prep). In addition, better understanding of the divergence of scientific and media discourse on resilience to disasters can help communicate this concept at the science-policy interface, particularly in current and upcoming disaster planning and policy processes in Australia and beyond.

How presentation relates to workshop themes

Resilience and scale

Self-organization is a key attribute of resilience (e.g., Walker et al. 2006). In terms of natural disasters, we define self-organization as the ability of the affected community to respond to, and recover from, a disaster drawing on its own resources as opposed to relying on external assistance. However, this may be compared with other definitions that suggest a disaster is an event a community cannot recover from without outside assistance (Etkin and Dore 2003), which would suggest the community is inherently not self-organizing when faced with a disaster. A question remains regarding the level of external assistance that is 'right': where is the threshold beyond which the community is no longer self-organizing, and hence resilient?

The trade-offs between and within scales

The discussion above about self-organization is relevant to the notion of trade-offs between scales. Trade-offs within scales relate to structure, function and identity: when do these contribute to resilience and when do they erode it because, for example, community identity does not promote resilience to natural disasters (building in bushfire- or flood-prone areas)?

We note that Templeman and Bergin (2008) define a resilient community as one that *“has the capacity to withstand a disaster and its consequences, return to its pre-disaster state quickly and learn from the disaster experience to achieve higher levels of functioning.”* In some cases, however, the pre-disaster state may have contributed to the disaster (e.g. building on floodplains or in fire-prone areas). Consequently, rather than functioning at “higher levels”, however, it may be more appropriate to change function if function is found to erode resilience.

The governance of resilience

Governance relates to self-organization, and to learning and adaptation. A key question raised is who/which agencies can and should be capturing learning through the building of institutional memory, and which should be supporting adaptation? This invokes scale issues as well, in that governance structures exist at different scales.

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Debating Resilience: Temporal and Spatial Scales

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In the autumn of 2009 I, Katherine Gough, submitted a paper to *International Development Planning Review* entitled “Resilience and Adaptation of Home-based Enterprises: A Longitudinal Study from Accra, Ghana.” In this paper I explored how home-based enterprise operators fare over time. The paper built upon longitudinal data on home-based enterprises collected over a decade in Madina, a suburb of Accra. By tracing the experiences of home-based enterprise operators, the paper showed that the fortunes of the enterprises varied but that many displayed a remarkable ability to survive with their operators being highly resilient to constantly changing circumstances. As I showed, far from being temporary, rather insignificant income-generating activities, home-based enterprises made important contributions to household livelihoods and often continued operating for many years. In some cases young people are taking over the enterprises from their parents, thus continuing the business across generations.

In the paper I used the concept of resilience to refer to what I saw as the impressive ability of these small business owners operating from the home to manage to survive when faced with numerous obstacles, such as falling demand due to changes in taste/fashion, increased local competition, and competition from foreign goods following liberalization of the economy. Whilst some of the enterprise operators were running the same business, others had changed the nature of their business, and a few had managed to expand. When I received the comments from the reviewers, however, one of them objected to my use of the term resilience in this context. To satisfy the reviewer I replaced the term *resilience* with *continuity* so that the final paper became “Continuity and Adaptability of Home-based Enterprises’ (Gough 2010). On reflection, I am rather frustrated that I changed the terminology in the paper in this way. Continuity and resilience are not the same – the former implies that something is the same over time and is a rather passive term, whereas resilience includes agency and suggests the ability to ‘bounce back’, thus emphasising a reactive stance (Manyena 2006).

Why is it that the term resilience can result in such strong reactions and why is it no longer possible for scholars of all disciplines to use the term without engaging in a major conceptual debate? As Manyena (2006) found out, most scholars he contacted believed that resilience should have a wider application than is currently the case. Methodologically, longitudinal studies which trace individual behaviour over time, as in my study, could provide valuable insights into resilience in a wide range of contexts, thus widening its application. It ought to be possible to use the concept of resilience without having to refer to the ecological aspect of resilience.

Also in Ghana, but in the rather different context of the north, Mette Fog Olwig aims to use resilience as an analytical term without engaging its ecological heritage, while also studying the concept empirically. She has examined the notion of building resilience following severe flooding in 2007. The fieldwork for her PhD project has entailed conducting interviews and engaging in participant observation at multiple sites. At the global level, donor, fair trade, international development and humanitarian relief organizations have been interviewed in Washington, DC, New York and Copenhagen. At the regional level, local development practitioners operating in Bolgatanga, northern Ghana have been interviewed. And at the local level, 'recipients' in both an urban and rural area affected by the flooding have been interviewed.

Analysis of these interviews has revealed how local and global understandings and practices of resilience in times of climate change are mutually constructed through multi-sited processes, with consequences often quite different from those imagined by both local and global actors. When global donor organizations deploy the idea of 'building resilience', it reflects their expressed desire to incorporate local agency. The study of resilience as an empirical object, however, has shown that many donor organizations play an important role locally and the power dynamics that arise result in global organizations inadvertently influencing local recipients' perceptions of their own resilience, thereby limiting, as well as creating, new spaces for local agency. Local resilience, therefore, cannot be disentangled from global understandings of resilience. Analytically, resilience is not merely a locally produced characteristic that can be measured, tapped into and improved by focusing on a discrete local system. Mette's study does not employ ecological notions of resilience nor discard the notion of resilience but rather focuses on its ability to emphasize local agency.

Mette's project is part of a larger ERC funded research project entitled "Waterworlds: Natural Environmental Disasters and Social Resilience in Anthropological Perspective," run by the Danish anthropologist Kirsten Hastrup. Early on in the project Kirsten edited a book entitled *The Question of Resilience: Social Responses to Climate Change*. Social resilience was, in the original ERC proposal, pursued as a non-mechanical concept which focuses on human agency as the basis for people's quest for certainty in exposed environments. Resilience was understood to be "an emergent quality of all responsible social action; it is the rule and not the exception of social life, given that all societies must demonstrate a degree of flexibility to operate and ultimately to survive" (Hastrup 2008). Resilience has subsequently been rendered problematic in light of its excessive use, derived from the natural sciences, as a measurable characteristic of an enclosed system. As Frida Hastrup (2008) comments:

"...even if the recent reconceptualizations of resilience mentioned above reject the idea of a social-ecological equilibrium, they still appear curiously devoid of people from an anthropological view. A 'social-ecological system' is portrayed as playing the leading role, to begin with as that which is disturbed and surprised by an unexpected event and, in consequence, as that which displays a more or less elaborate capacity to adapt and reorganize" (115).

Mette's project maintains a focus on resilience but in light of the critique of resilience increasingly focuses on the concept of resilience itself, as it is applied in development discourse and practice, and hence as an empirical epistemological object.

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Documenting Resilience: The Volcano Princess

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Introduction

Much of my work for the last couple of years has been inspired in one way or another by the impact of natural hazards throughout Southeast Asia. I am a practicing artist and filmmaker and, since 2009, I have been Artist-in-Residence at the Earth Observatory of Singapore (EOS). The mission of EOS is to improve the lives of communities throughout Southeast Asia or, as stated in its website, “to conduct fundamental research on earthquakes, volcanic eruptions, tsunami and climate change in and around Southeast Asia, toward safer and more sustainable societies.”

I have participated in a few scientific expeditions throughout the region, and developed art and media projects working alongside, and sometimes in collaboration with, scientists. Three of my recent projects deal with resilience. *Mayon: The Volcano Princess* is a documentary about the resilient communities that live around the most active volcano in The Philippines. *People–Coral–Mentawai* is a short documentary film that deals with the resilience of biological life along the Sumatra fault. *Sudden Nature* is an art project about the uneasy but resilient relationship between Man and Nature, and it encompasses several media: a live-action fiction film, an animated film, and an art installation. This short paper focuses on the *Mayon* documentary.

Mayon: The volcano princess

The documentary presents the resilience of the people who live around the Mayon volcano in the Bicol region of The Philippines. It presents how they cope with the uncertainty of living next to a source of constant danger, and also some of their experiences during and after deadly lahars, pyroclastic flows and eruptions. It also presents some of their strategies for dealing with volcano disasters and with the evacuation dilemma. The film is the product of an interdisciplinary experience, and contains interviews with local residents, officials, and scientists. It also contains an animated recreation of the tragic legend of Princess Magayon, a legendary Bicol character, who is believed to be buried under the volcano.

The Mayon Volcano is the most active and most destructive volcano in The Philippines. It is located in the Bicol region, Albay Province, 300 kilometers southeast of Manila. This stratovolcano has an elevation of 2.46 km, and a base diameter of 20 km. Mayon's first recorded eruption dates back to 1616, and there have been 49 recorded eruptions between then and 2010. The volcano displays multiple types of hazards including lava flows, pyroclastic flows, lahars, and rock fragments. It is estimated that the overall known death toll from Mayon activity, during and between eruptions, is between 4,000 and 5,000 casualties. About 1,200 casualties are from the 1814 eruption (most from pyroclastic surge),

and about 400 from the 1897 eruption (mostly from pyroclastic flows). The destructive lahars that happened after the eruptions of 1875 and 2006 together produced around 2,500-3,000 casualties.

Research and the creative process

The story of the Bicol people and their Mayon Volcano is a fascinating one. Starting from the early stages of this documentary project, I decided to let the subjects speak for themselves as much as possible. It was obvious that the people who live around the volcano had many first-hand experiences to tell. There were also many interesting facts about the volcano and the region that I wanted to include; but I was wary of burdening the project with too many technicalities. The challenge was finding the right balance between human drama, testimonials of resilience, poetry of life, and technical information. I spent months digesting the history and geological characteristics of the volcano, and familiarized myself with some of the social and economic issues that exist in the Bicol region.

Pre-production for this project started in mid-2009, and our expedition took place in October – the documentary had its Singapore premiere a year later. All throughout the project we were a small team and we followed the independent production model: constantly keeping our scope to something manageable. The main creative challenges of the projects were established during the research and development phase of this project. Some of these include: language and emotion; tone, style and structure; the role of music; and the princess legend.

All along the development process there were two questions that kept surfacing in my mind; and both directly addressed the issue of resilience. Why do the locals continue to live around the volcano, in the face of so much danger? Why don't they move elsewhere? The answers to these questions were varied but had a common thread. The people who live around the Mayon volcano have a very strong sense of place and identity. They are proud of the idyllic beauty of "their princess." They feel that they "are from there" and "have nowhere else to go." These communities are also aware of the threat of sudden destruction. They understand that, in order to survive and continue to live in their ancestral lands, they must understand the signs of danger and react very quickly. Theirs is a humbling testimony of the resilience of humankind.

Language and emotion

Before our 2009 trip to The Philippines, I knew that some of the people to be interviewed would speak English, but many would not. Many spoke just Bicol (the local dialect) or Tagalog (The Philippines' national language), and sometimes a little English. Creating an emotional bond during an on-camera interview is a challenging art, one that is particularly complicated when the interviewer and the interviewee do not speak the same language. During production I adopted different techniques as we went along, and tried to adapt to the personalities of the interviewees. With some individuals I was able to ask the questions sitting next to the translator, with others I had to hide behind the translator so that the subjects' gaze would not shift between the translator and I. Having the answers translated back to me proved undesirable as it broke the emotional concentration, so I decided to do

without it and guessed the subjects' answer by their body language, tone of voice and facial expressions. It was challenging at times, but fun, and ultimately it worked. Many of the interviewees felt comfortable and relaxed and opened up emotionally in front of the camera, which is not an easy thing to do even for professional actors. We got plenty of compelling testimonials once the emotional trust was created. That is mostly what directing an engaging documentary film is about.

I believe in the power of language and in the specific words that we use to describe experiences, beliefs, and sensations. And so we started the Herculean and time-consuming task of translating and subtitling over a dozen hours of interviews. This was necessary to be able to understand text and subtext, and to be able to do fine editing. I believe that this overall methodology allowed us to distill the emotion and depth that this topic deserves.

Structure, tone, and style

Most people without professional filmmaking experience believe that making a documentary is about pointing a camera at someone and asking questions. But I believe that it is just about 10%. Figuring an honest tone, and adequate style and structure constitutes, in my opinion, more than half of making a successful documentary. Capturing emotion and communicating knowledge does not happen automatically just by pointing a camera at someone's face. For this project I wanted a tone that was as human as possible, sympathetic and without gore. Something that the locals could relate to and be proud of and, at the same time, something that people from other places could understand and be touched by. My guiding thought was: "Will the locals understand and appreciate this when they watch the documentary?"

In terms of style I avoided anything reminiscent of a TV news style, like shooting a barrage of direct personal questions, as I believe that this technique predisposes subjects to answer with clichés or to shut down emotionally. I chose a minimalist narrative style for two reasons. First because I wanted to let the subjects do the talking. Second because I didn't want to overload the viewer with information that would dilute the main issues at stake.

I chose to write a voice-over narration that consists of less than 30 modules, each between one and two sentences. Crafting these concentrated units of meaning was closer to writing poetry than to writing technical prose. The goal of the minimalist voice-over was to evoke specific feelings, to contextualize, and to tell the story using the storytelling techniques of anticipation or suspense. The voice-over is meant to complement the voices of the people from Mayon, and the overall narrative moves back and forth between active narration and objective commentary.

After much debate, I decided to structure *Mayon: The Volcano Princess* into nine distinct sections, each with its own title card. At first this approach seemed too didactic, but it ended up offering a clear structure and making the documentary easier to watch, especially for a general audience. The closing emotions of each section and the music bridges between sections were instrumental in unifying the sectioned structure. The nine sections were: Introduction, Staying Ahead, Pyroclastic Flows, Preventing Disaster, Volcano Sounds, Lahar

Nightmares, Recovering from Disaster, The Princess Legend, and The Road Ahead. Each section was meant to address specific issues relevant to the Mayon story.

The role of music

Film is an audiovisual medium; and much of a story can be told through sound. I am a great lover of music and wanted to create original music that expressed the drama and lyricism of the Mayon Volcano. This music had a key role in the project, especially since the voice-over was so minimal. I wanted to use musical counterpoints throughout the narration. In researching the local music I soon realized that much of what is considered local music derives from Spanish guitar ballads, and that close to nothing of the ancient local music has been preserved. So I opted to develop a sound that incorporates regional voices within European-style music. I was fortunate to work again with film music composer Sergio Moure. The working relation between a director/producer and a film composer is usually a challenging one, but our collaboration was a joy and a success.

I provided seed music ideas as starting points for sequences that were roughly edited, and the composer translated that into musical themes based on MIDI (Musical Instrument Digital Interface) samples. I would then offer suggestions regarding tone, tempo and instrumentation, and this conversation continued until we had to record the soundtrack in time to meet our production schedule. Starting the music early in the process allowed us to end up with something that was a few notches above ordinary background music. Much of our communication took place by email and video teleconferencing, including my virtual presence in the sound booth during the recording of the final music.

Production notes

The production was a collaboration between EOS and PHIVOLCS, The Philippine Institute of Volcanology and Seismology. We documented the area for about two weeks. The production crew was small, and our production office was in the van that took us around different *Barangays*, districts within a municipality, in the region: Santo Domingo, Legaspi City, Daraga and Guinobatan. We used three cameras, a Canon 5D Mark II with three lenses (a 24-70mm f2.8, a 70-200mm f2.8, and a 100-400mm f4) and two Canon H1 cameras with wide angle lenses. Still photos were taken with a Panasonic Lumix DMC-LX2 camera. We had cloudy weather during the first days and were afraid that we would be unable to get a full shot of the volcano. Fortunately the weather changed as it frequently does in that region aptly named the Typhoon Corridor. We digitized dailies in the field using two laptops, and we did dailies reviews and selects using Quicktime and Final Cut Pro software. Our lighting package consisted of two ARRI 300W, two 650W, plus Dedolights. We were able to find electrical power in some but not all the interview locations. We recorded sound with an Audio Technica corded lapel microphone, and a Sennheiser 416 boom microphone. ProTools software was used to create the final sound mix in stereo and 5.1, and After Effects software was used to create some animation graphics.

The princess legend

The Mayon Volcano gets its name from Magayon, a legendary princess who lived in the Bicol region. I was fascinated by the dramatic story of Magayon from the moment I heard it. I was also struck by its similarity with another volcano legend, one that I grew up with as a young child in Mexico: the legend of Popocatepetl and Iztaccíhuatl. After considering many options, we settled on something that I thought the small, young and dedicated animation team could produce with a high artistic level in spite of the limitations. I decided to keep the animated legend under 3 minutes, and go for an anime-inspired style with limited animation and painterly backgrounds. The first challenge was to distil the convoluted legend into a much simpler 3-minute version. The second challenge was to find a narrative style that could address both the fairytale beginning of the story as well as the violent ending. I chose to tell the first half of the story in a traditional storybook voice-over style with explicit Disneyesque overtones, and to let the anime style images, dramatic music and sound effects tell the disturbing second part.

Resources

The *Mayon: The Volcano Princess* website is at: www.thevolcanoprincess.com

The *Sudden Nature* website is at: www.suddennature.com

Adaptive Cycles, Transience and Equilibria in Coupled Human-Environmental Systems

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In their 2009 *Nature* paper on “Early Warning Signs for Critical Transitions,” Scheffer et al. asked whether it is possible to detect critical thresholds or “tipping points” in complex systems. So far, the empirical work on this topic has focused on ecosystems like lakes and grasslands, which have been shown to sometimes undergo abrupt regime shifts. As Scheffer et al. (2009) show, “certain generic symptoms may occur in a wide class of systems as they approach a critical point” (53). The best-known examples show that lakes may respond differently to environmental perturbations depending on which regime they are in. Can these methods be adapted to investigate the resilience of social-ecological systems? The case I will discuss involves centuries-old Balinese institutions called *subaks*.

Subaks are practical institutions that seek good harvests through the control of water and the performance of agricultural rituals. From one year to the next, they need to be able to cope with a range of both environmental and social conditions. This requires investment in the subak, which typically includes a heavy burden of ritual obligations as well as agricultural labor. Too little investment could cause crop losses, angry neighbors or, indeed, the wrath of the gods, but too much might incur the wrath of one’s family. A good measure of the resilience of a subak is its ability to vary or increase these investments, as conditions require. Thus, while low investment could mean that a subak is close to collapse, it could also mean that the farmers are enjoying a period of low stress, which may or may not be an equilibrium state.

Case studies of subaks suggest that despite their reputation, they may not settle down into permanent patterns of strongly pro-social behavior. If so, this would have significant implications, because nearly all theoretical models of pro-social behavior assume that time is irrelevant; in other words, that near-equilibrium solutions will inevitably be found. But the “resilience” perspective enables us to consider other possibilities, from purely stochastic variation to adaptive cycles. Conceivably, as a result of their different histories of local adaptation, institutions like subaks might vary in their resilience. Lansing et al.’s (2008) studies of the historical demography of eight subaks along the Sungai river in Bali (Figure 1) showed that farmers in the four upstream subaks are much more closely related to one another than farmers in the four downstream subaks. A pilot study was conducted to test the intuition that the upstream subaks may be more resilient than their downstream neighbors, and respond differently to social and environmental stress.



Figure 1: Map of the locations of the eight Sungai river subaks in the pilot study

Surveys were administered to ten farmers in each of the eight subaks. In addition, the farmers played the “Dictator Game”, in which five randomly selected farmers in each subak were given a day’s wage and told that they could share as much or as little of the money as they liked, with an anonymous fellow member of their subak. The two groups differed strikingly in their response to variation in the overall state or condition of their subak, as shown below (Figure 2). In the upstream subaks, the worse the state of the subak, the more generous the offer in the Dictator game ($r=-0.95$). For the four downstream subaks, the opposite pattern holds: the worse the state of one’s subak, the lesser the gift ($r=0.84$). These results suggest that the older and more closely related upstream subaks responded to problems by increasing their investment in the subak, whereas their downstream neighbors did the opposite.

These preliminary results suggest that subaks may inhabit different regimes, and vary in their resilience to external changes. Thus it is interesting to ask whether the methods developed to analyze the resilience of ecosystems like lakes and grasslands can also shed light on coupled social-ecological systems. It has been shown that dynamical systems nearing a critical threshold such as a bifurcation undergo critical slowing down, where the dominant eigenvalue characterizing the rates of change around the equilibrium approaches zero (Wissel 1984). Because slowing down causes the intrinsic rates of change in the system to decrease, the state of the system at any given moment becomes more and more like its past state. Hence there should be an increase in the autocorrelation of the state variables. Analyses of simulation models exposed to stochastic forcing confirm that if the system is driven gradually closer to a catastrophic bifurcation, there is a marked increase in autocorrelation that builds up long before the critical transition occurs. Scheffer et al. review evidence for this effect from both simulations and spatially detailed ecological studies. In the case of the subaks, if appropriate time series data can be obtained for a relevant sample, this prediction can be tested. The methods are straightforward: for example, lag-1 autocorrelation can be interpreted as slowness of recovery in such regimes undergoing perturbations (see Ives 1995; Van Nes and Scheffer 2007; Dakos et al. 2008). But to apply these methods, it is necessary first to discover whether different regimes exist, and if so, what the relevant state variables are.

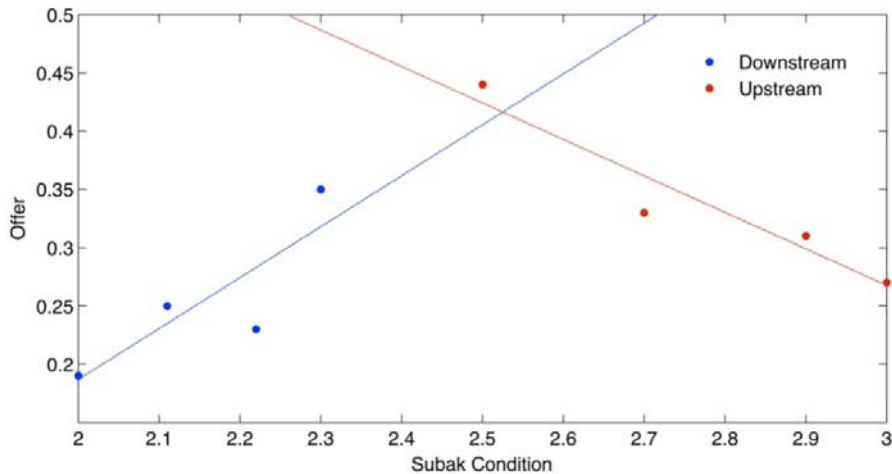


Figure 2: Regression of offers (gifts) in the Dictator Game (Y axis) on the overall estimated state or condition of one's subak (X axis). For upstream subaks, adjusted $r^2=0.87$, $P = 0.044$. Downstream subaks: adjusted $r^2=0.56$, $P = 0.159$.

Tentative conclusions and questions:

- The resilience perspective offers an alternative to game-theoretical or equilibrium models of cooperation and pro-social behaviour
- We have very little information about adaptive cycles or the structural features that may confer resilience on coupled social-ecological systems
- Much of the literature on the resilience of social-ecological systems is based on analogies to concepts in dynamical systems theory
- Why not try some quantitative, empirical comparative studies?

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Social Resilience: Local Government Planning for Sea Level Rise

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Problem context

Climate change transcends all the activities of local government. For many local councils, however, a lot of adaptation activities can be considered extensions of their existing 'sustainability' framework. That said, some aspects of climate change, such as sea level rise, require substantial changes to coastal institutions. I argue that there is a need for a transformation in how the coastal zone is managed, developed and governed. My specific interests focus on:

- how different types of knowledge are integrated into the planning process;
- and how community values and aspirations for the coastal zone are expressed, negotiated and incorporated into local government planning.

Methodological challenge: How do you investigate these types of issues in small communities in conflict?

Resilience issues

Transformability is the capacity to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable (Walker et al. 2004). Transformations occur when thresholds, which can be social, ecological or economic, are crossed or social goals change: they can be inadvertent or deliberate (Nelson et al. 2007). Folke et al. (2010) suggest that "the capacity to transform at smaller scales draws on resilience from multiple scales, making use of crises as windows of opportunity for novelty and innovation, and recombining sources of experience and knowledge to navigate social–ecological transitions" (1).

Sources of experience and knowledge

Local governments play an important role in supporting their community's resilience to climate change. They are emerging as boundary organisations that need to broker community and government ways of knowing about risks and potential responses to climate change. To do this, councils need to facilitate and coordinate knowledge and action between the community, industry, research agencies, and others tiers of government. They must function as an intermediary between both the producers and users of knowledge while recognising the cultural limitations and constraints of all (Gurlan 2001; McNie 2007). Often they do this within an organisational environment which may not share a consistent view on climate change. This study looks at how local councils access, integrate and translate information to inform local planning and decision making.

While resilience theory acknowledges the need for learning and adaptation in considering 'knowledge', it is useful to draw on other literatures such as environmental planning theory, science and technology studies and the sociology of knowledge. These literatures consider that there are many sources of knowledge (Rydin 2007), knowledge is co-produced (Fischer 2000) and this is negotiated in the nexus between science, society and politics (Gibbons 2000; Nowotny et al. 2003; Jasanoff 2004).

Questions

- How do different actors articulate and /or frame the need for change (or transformation)?
- How does knowledge (and uncertainty and power) influence the transformation process?
- What conditions would support transformation of the coastal zone? (c.f. incremental change)
- Focusing events such as crises or disasters are catalysts for transformation but how do you ensure that these produce change that is adaptive and not maladaptive?

Resilience in Government: Building a Whole-of-Government Response

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*“If you know the enemy and know yourself,
you need not fear the results of a hundred battles” - Sun Zi*

Context of complexity

It is an oft-stated truism that real security begins with threat assessment. In a game of professional football, the opponent's best offensive players are identified and whole defence strategies are built around restricting their movement. Likewise in government, since resources are scarce, government agencies need to identify, prioritise and build defences against the most probable threats. Undergirding this risk assessment approach to security is the assumption that we can actually “know the enemy” well enough to gauge its apparent threat to our way of life.

The problem, of course, is that we can't. Good security professionals are masters of improvisation. Plans often change at the point of execution simply because threats do not manifest in expected trajectories. Risk and threat assessments are good but, at best, arbitrary guides. Furthermore, in an interconnected world where local conditions can potentially trigger off events/movements with global ramifications, it is difficult to really assess the threats we face. Beyond just grappling with *when* and *how* a threat or any modern day phenomenon would manifest, modern day societies struggle even to identify *what* challenges there are in the horizon.

The Arab Spring of 2011 is a particularly instructive example. The desperation of Mohammed Bouazizi, a Tunisian food peddler angered by the confiscation of his wares, led to his self immolation (Jan 2011) and launched a wave of revolutions in the Arab nations. Spurred on by social media, it rapidly caught on across North Africa and the Middle East. Its influence gained a global resonance quickly and sparked copycat riots in the Far East. Not only were these events largely unforeseen, it was the speed and reach of the riots that demonstrated how 21st century economic, technological and social mediums and tools had radically transformed the way security challenges manifest.

So why is it so difficult to “know the enemy” in our time? I suppose much can be explained in the term *complexity*.⁴ As the world becomes increasingly interdependent, the threats we face adopt the attending characteristics we have come to associate with

⁴ Broadly, complexity is often tied to the concept of an ecosystem, whereby a set of parts or elements that have relationships among them is differentiated from relationships with other elements outside the relational regime.

Globalisation and the Information Technological revolution. More and more, threats are marked by two traits known very well to complexity theorists: broad inter-linkages across domains and rapidity of manifestation. It was impossible, a century ago for political revolutions in the Middle East to have caused nervousness in China. With the internet and social media, this is the “new normal” – *an interconnected world with tight linkages, where threats are difficult to assess and where events in one area can be rapidly modelled in another.*

Government’s response – Resilience

In such a world, if we were to accept the advice of the much acclaimed and rather idiosyncratic military strategist Sun Zi, the failure to gain a comprehensive knowledge of the enemy would significantly reduce the probability of successfully overcoming modern day challenges by 50 percent. Indeed, while governments can no longer prevent every threat from manifesting, it can, with the right strategy, stop these attacks from succeeding. This puts to odds traditional security doctrines of resistance and robustness. Traditional security mantra dictated that where there was potential of security risks, government should invest resources to prevent its manifestation. A resistance strategy required governments to develop robust defensive measures at the point of prevention and response. However, in the event that a threat successfully breaches the defences, the consequences tended to be catastrophic. Given the complexity we face, a resistance strategy is no longer tenable. A new strategy of resilience that encompasses a full gamut of responses – prevention, response and recovery – is needed. Compared to a resistance strategy, the doctrine of resilience accepts that some threats would eventually manifest, but society would absorb the stress and recover rapidly. Allocating resources for rapid recovery as well, rather than prevention alone, becomes essential.

Yet a strategy of resilience is not new and had long gained credence in academic literature dealing with disaster prevention, emergency preparedness, environmental sciences and even social psychology. Security professionals only began to consider it seriously after 9/11, when the developed world realised the threats to national security had become multi faceted, amorphous and essentially complex. Since then, a number of countries have infused resilience into their broader national security strategies. For example, in Obama’s National Security Strategy (NSS) in 2010, resilience was instituted as a key strategic pillar. In Singapore the National Security Coordination Secretariat (NSCS) coordinates security resilience across the whole-of-government. Guided by the Strategic Framework for National Security, enacted in 2004, resilience is placed at the heart of Singapore’s strategic response to national security threats. This greater emphasis on resilience has bred a number of advantages. For one, resilience serves as an effective deterrent. Nations which are able to respond rapidly to a terrorist attack and recover quickly tend to dissuade terrorists from mounting another attack due to low psychological payoffs. Furthermore, resilience has also become a “competitive differentiator for companies and countries alike, (as) advancing resilience almost always provides a positive return on a relatively smaller investment” (U.S. Department of Homeland Security 2010, 15, 61).

Challenges in building resilience

Yet beyond this broad acceptance of resilience, there remains a number of challenges that face policymakers. First, there is no common lexicon for resilience. In a study on the confluence between Risk and Resilience concepts, the Homeland Security Studies and Analysis Institute (HSI) discovered 119 different definitions for resilience. From the resilience of a child's psychology in educational theory to the resilience of metallic elements in physics, there is rarely any convergence in the use of the term. Even amongst governments, there is no accepted understanding of what resilience means. In Israel, resilience is understood to be the ability of the populace to deal with the day-to-day harassment from terrorist groups and the existential threat of military invasion. In Australia, resilience is used in reference to the ability of communities to recover after an environmental disaster. Given the variety of thought in understanding resilience, each country must then be left to develop its own resilience mantra – based on its indigenous characteristics.

Second, resilience is faced with the difficulties of measurement and assessment. To date, there is almost no way to assess how resilient a society is. This is compounded by the reality that resilience is often threat specific. A society may be resilient to a terrorist attack but not against a pandemic. In addition, the institutional capabilities required for inculcating resilience against any of these threats are dissimilar. Certainly there is a distinction between “evergreen resilience virtues” and “threat specific” resilience virtues. For example, regardless of threat type, leadership is often cited as a necessary condiment against any threat. However, even these virtues are notoriously hard to measure, what more inculcate. As such, it is well that resilience is only known once it is actually tested.

Finally, resilience requires structural and conceptual shifts that are difficult for government to execute. There were historical roots to this. In the cold war era, the threat of nuclear war diminished any sense of ownership one had for one's own security as the spectre of total annihilation made any individual effort meaningless. Security became the purview of the government. This led to the professionalization of security work within vast national bureaucracies, and reduced and even outsourced the need for citizens to take responsibility of the security of their communities. However, 21st century threats are of far lower intensity and greater unpredictability. One of the reasons why resilience is apt for our time is that it adopts a whole-of-society approach to security, blending government, local communities, the media, religious organisations and NGOs. Yet, given that government bureaucracies were woven and built in response to Cold War related threats, structural and conceptual challenges of expanding its reach to include all of society remains challenging.

Building resilience in government – Intellectual concept

Given that governments face these challenges in constructing resilience, how should resilience be built from a strategic level? I would argue that this has to be accomplished on two levels; first, the conceptual/intellectual level and second, the capabilities level.

Conceptually, each country needs to build its own indigenous lexicon of resilience and expand it into other spheres beyond the traditional realms of security and emergency

preparedness. This is premised on the fact that the threats facing each country and the traits that determine resilience in each society are rarely similar. Furthermore, resilience is grossly incomplete without engaging the complex social and economic realities that affect the outcomes of a crisis. Resilience, as such, should not be seen as an outcome that is affected by a series of policies, but a doctrine of governance that encompasses a wide variety of socio-economic and security policies that undergird a society in peacetime and in crisis. Positioning resilience as such provides the philosophy with a number of advantages.

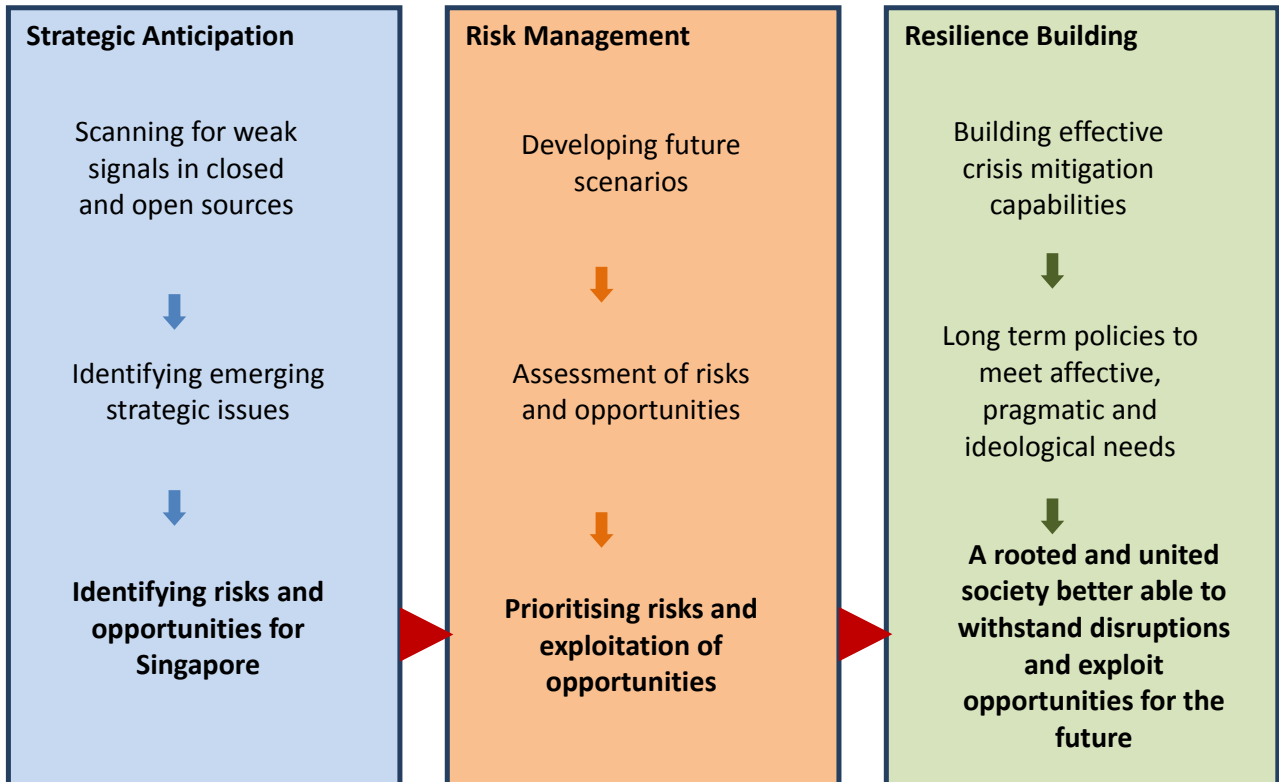
First, government will have to move beyond mere operational exigencies during a crisis to consider the society's unique social-political values that may serve to build resilience in the face of unexpected change. This carries resilience further than just *crisis management* to *change management*, a crucial paradigm for resilience to work. For example, a number of countries, in a bid to build resilience, have established emergency preparedness clubs within local communities to respond to threats. However, during the occurrence of threats, these have proven to be less successful than previously envisaged. Resilience once so explicitly organised, tends to be problematic. Experience has shown that local communities were likely to band around established organisations of interest, like community clubs, business associations and religious organisations, places they had a clear affective inclination towards. Proximity of affection – in organisations with which friends and family had built strong linkages – was demonstrated to be more important as people looked first to communities they found historical resonance with for leadership, aid and resources in the face of change. Such realities require conceptual shifts in government thinking. Instead of building social institutions to serve crisis-response, governments can seize the opportunity to harness existing community organisations to accentuate the values that aid in change management.

Second, a broad conception of resilience imbues government policies with the principles of change management. For example, if a society were to be resilient, it might need to hedge against over specialisation and over concentration of resources. In international trade, efficiency is gained when a nation produces in the products which it has comparative advantage in. Certainly that would maximise productivity. However, if resilience were to be incorporated as part of the overall philosophy, a balance requires to be struck between diversification and specialisation to protect a country from unexpected changes in the global economy. A broad conception of resilience then acknowledges the trade-offs that is required to be made from loss of efficiency, but generates latency to fend off any uncertainty that might arise from the prevailing risk landscape.

Finally, going through the process of devising a broad and national definition of resilience, pushes public servants to identify the intangible values and principles that inform the national psyche of the country. Typically public servants have been more accustomed to quantitative measurements of a country's economic and social well being. However, to build resilience, public servants need to question and identify the fundamental and often intangible traits of society that allows it to falter or survive or even thrive in the face of a crisis. As in the seminal book, *Built to Last*, such intangible values once enunciated and built upon has the powerful effect of bringing a country to "greatness," even in the face of broad sweeping change.

Building resilience in government – Capabilities

From an institutional standpoint, resilience has to be firmly located in the broader process of policymaking with undergirding capabilities to harness it (see Figure below).



As part of the broader policy process, resilience is the natural strategic response that arises from good strategic anticipation and risk management. Strategic anticipation is needed to determine what are the challenges or broad forces that might catalyst change in the horizon. That is then translated into a risk assessment map to prioritise the risks that the country faces. From there, resilience is seen as the strategic response to change – where governments harness the national values of the populace and any existing government or non-government institutions to overcome and thrive in the face of these challenges.

To support this process, 4 capabilities need to be established: Policy Coordination, Strategic Engagement, Research, and Crisis Management. Briefly, these are the function associated with each of these capabilities:

Policy Coordination – For resilience to be imbued into the psyche of policymaking and the society, policy has to be coordinated from the centre to ensure coherence. More and more, as resilience gains ascendancy in governance, a centre to direct and synchronise aims as well as the lexicon of resilience is needed. This does not negate the ground-up and organic process by which resilience is often nurtured, but instead ensures that government agencies have clarity and coherence at the heart of resilience policy making.

Strategic Engagement - Government have to move beyond strategic communications to strategic engagement. Communications have the connotation of speaking to the populace, whereas engagement is about partnering the populace. This is particularly crucial in resilience building as resilience is about building networks between government, the general populace, businesses, non-government organisations and religious organisations.

Research – In every society resilience needs to be studied and measured. In particular, research teases out the traits that make up a resilient society and informs policy options. Measurement tools, though often arbitrary provide useful guides to policymakers.

Crisis Management – Part of building resilience is ensuring that government has strong crisis management systems. Strong crisis resilience builds strong peacetime resilience and vice versa.

Conclusion

In retrospect, in the face of tremendous change in our world today, governments need to build resilience. Having gained ascendancy in the security and emergency preparedness circles, resilience should move beyond these realms and inform the philosophy of governance. Its applications may reach into the social, economic and political spaces, and aid in a nation's management of change. At its heart, resilience is not resistance. It does not resist change but instead harnesses it to allow a country to thrive. In order to accomplish that, governments need to have the right capabilities and appropriate levers to build resilience. Only then, are we able to know ourselves, face up to an amorphous enemy, and increase the chances of victory.

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Building Resilience to ‘Natural’ Hazards: A Question of Scale?

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In this paper, I wish to reflect on my experiences of undertaking research on vulnerability and resilience in both developing and, more recently, developed country contexts. For this I will draw on examples from three projects: my PhD research on landslide vulnerability in Nepal; a NERC/ESRC-funded scoping study on ‘Building Resilience In Seismically Active Areas’; and an EPSRC-funded project on ‘Built Infrastructure for Older People’s Care in Conditions of Climate Change (BIOPICCC)’ in the UK. In all three projects I have engaged with interdisciplinary teams of researchers, from geologists, seismologists and engineers, to development geographers and community development workers. I have worked with academics, practitioners and communities ‘at risk’. Here I consider three linked areas of emerging discussion and debate within the resilience field: resilience and scale; resilience trade-offs and the role of social capital; and the governance of resilience.

Defining and conceptualising resilience

In my research, I define resilience as the ability to bounce back (or forward) following a shock (Wisner et al. 2004; Thywissen 2006; Cutter 2008a). Like Birkmann (2006), I see vulnerability and resilience as explicitly linked, with resilience encompassing susceptibility, coping capacity, adaptive capacity, exposure and the interaction with perturbations and stresses. Resilience can be applied to many systems (social, natural, economic and engineering) and at different units of analysis (individual, household, community, regional) (Cutter et al. 2008b). The aim of my research is to explore ways to increase the resilience of individuals and communities to geophysical hazards, or older people’s health and social care services (including social and engineered systems) to extreme weather events. While I would argue that there is a certain level of resilience inherent in systems, it is possible to enhance resilience in general, and to specific shocks. For example, identifying the ‘pinch points’ in the infrastructure system supporting older people’s health care delivery and building in redundancy. Or by addressing the gaps in local knowledge around rare, high magnitude events which have not previously been experienced, and about which there is little or no indigenous/inherited knowledge, could help households and communities prepare for, and respond to, such events in the future. The question is *how* to do this effectively? The key here, I argue, is linking knowledge across disciplines, sectors and scales. This is a challenge my research seeks to address.

Resilience and scale

The science of natural hazards focuses in general terms on high magnitude, low frequency events and as a result is often removed from the community context. Our NERC/ESRC scoping study questioned whether this was the most appropriate scale in

terms of building resilience on the ground. High frequency, low magnitude events can have a greater cumulative impact in terms of loss of life and livelihood than more infrequent catastrophes. In addition, engaging communities in discussions around temporally unpredictable events about which there is little intergenerational knowledge, and which are deemed beyond their control, may not be the most effective way to build resilience.

Instead, high frequency, low magnitude landslides were identified as an appropriate entry point for discussion and resilience building activities. Such events are experienced every year, causing loss of life and livelihoods. Households were found to have a good understanding of the causal factors and triggering mechanisms of landslide activity and were able to identify areas that have been or could be affected by landslides in the future. Engaging communities in slope monitoring activities, undertaking micro-scale landslide hazard assessment, and developing low-technology early warning systems, introduce communities to earthquake effects as well as specific activities that can be undertaken to increase resilience. Monitoring ground deformation and developing probabilistic models for earthquake forecasting will undoubtedly provide useful information but for whom? What kind of scientific information (and at what scale) is useful for building resilience on the ground?

Similar questions have emerged in the BIOPICCC project. Here the scale footprint is local authorities (local government areas) in England. For this study we engage with older people and their carers; and service providers to identify the key infrastructures supporting older people's health and social care. Engineers then model these infrastructures including people's homes, care homes, hospitals and the transport, water, gas and electricity networks supplying these infrastructures. The challenge is linking knowledge across scales: older people tend to focus on the micro-scale, their home and immediate surroundings, while engineers consider the macro-scale infrastructure networks. The services provided to, and accessed by, older people are managed by multiple agencies and across multiple scales – from a local voluntary community transport service to county wide social care services. Not only are the macro-micro linkages important for effective resilience building but also a coordinated, joined-up approach by the service providers and emergency planners.

Resilience trade-offs

My research takes a bottom-up approach to understanding vulnerability and resilience. I am interested in the decisions made at the household and community level (but also increasingly within governments and humanitarian organisations) regarding which risks to avoid and which risks to manage. As noted by Hall (1999), vulnerability (and resilience) may be perceived and experienced differently by the vulnerable people themselves. Livelihood-based decisions to occupy physically vulnerable locations for the livelihood opportunities (employment opportunities, access to schools and health care services) may leave people susceptible to landslide and debris flow hazards, highlighting a key vulnerability and resilience trade-off at the household and community scale.

Similarly, at the national scale, governments and humanitarian organisations may prioritise other development-related issues over comparatively infrequent geophysical

hazards. The expansion of the road network in Nepal is a case in point. Here, access has been a key development concern since the early 1990s but, as reported by Petley et al. (2007) this is the likely cause of the observed increase in fatal landslide activity. Similarly, an international humanitarian organisation working in Haiti prior to the 2010 quake prioritised sanitation and health care over earthquake resilience – a reflection of their in-country hazard and risk assessment. My research has shown that understanding and, where possible, reconciling the differences in the spatial and temporal scales of concern between scientists, practitioners and communities ‘at risk’, is a key step towards effective resilience building.

Resilience trade-offs have also been observed in the BIOPICCC project. The personalisation of health and social care, whereby older people manage their own care budgets, is one such example. For the service providers interviewed as part of the project, personalisation presents both challenges and opportunities for resilience building. On the one hand, local authorities may have less control over the health and social care workforce than under a more centralised care delivery system making emergency and contingency planning more complex in the event of a heatwave, coldwave or flood. On the other, personalisation could lead to a more localised workforce (with older people employing neighbours, for example) that is better placed to ensure continuity of care during extreme weather events. Personalisation gives older people choice, but what impact does this have on the resilience of their health and social care services?

The role of social capital in understanding resilience

Social capital (taken here to mean community and wider social ties on which individuals and households can rely (Ellis 2000)) has been a useful lens through which to study the vulnerability and resilience of individuals, households and communities to extreme weather and geophysical hazards. For example, comparing rural, ‘close-knit’ communities with localised workforces and high levels of informal care, with urban settings will be an interesting feature of the ongoing research being undertaken through the BIOPICCC project. The importance of social capital has been highlighted in studies elsewhere. For example, Browning et al. (2006) explore the impact of the 1995 Chicago heatwave, where heat-related mortality was found to be highest amongst older people in poor neighbourhoods. Browning et al. note that more deprived individuals may be less able to protect themselves from extreme weather due to poor housing stock, reduced access to healthcare and the absence of informal social networks.

My PhD research in Nepal explored the links between social cleavages (in this case, poverty and caste/ethnic group) and vulnerability. I found landslide prone areas to be occupied by relatively rich and relatively poor households of high caste, occupational caste and hill tribe ethnicity with little correlation between caste grouping and poverty level. In addition, based on an exposure assessment alone, the impact of landslide hazard was found to be universal and unspecific. In part, these findings challenge the work around environmental justice which tends to associate high risk areas with poor, disenfranchised communities. However, what I did not see was an equal sharing of risk burdens between exposed households and this largely reflected the inequalities in coping capacity and resilience. While the links between poverty, social exclusion and

vulnerability may seem self evident, not all rich households within the socio-political mainstream are resilient.

The governance of resilience

My final thoughts are concerned with the governance of resilience. Governance approaches need to be flexible and able to deal with the complexity and uncertainty associated with climate change and seismic hazard. For the BIOPICCC project we are developing a tool kit targeted at local authorities who are responsible for climate change adaptation, emergency planning, and adult social care at the local level. Here there are a variety of local governance structures to work through which are guided by central government and involve key stakeholders (primary care trust, third sector agencies e.g., Age UK, and older people themselves). The challenge, then, is developing a tool kit which can be rolled out nationally, but which can be adapted to meet the needs of individual localities.

The governance issues emerging in our research in Nepal are at first sight more dysfunctional. We began by focusing on community governance as a way of localising the building of resilience (in the absence of local government following the decade long civil conflict, village clubs, women's groups and forestry groups at the community scale seemed the most suitable conduits for resilience building activities). But, how do you move beyond a small case study and roll out resilience building activities nationally and regionally? As failed development activities in the past have shown, what may work in one community, may not work in another. Similarly, state orchestrated attempts to promote resilience may work in some countries, but for failed states/countries where the governance landscape is not coordinated, alternative approaches may be more appropriate. An adaptive approach to the governance of resilience building activities is therefore required.

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Risk, Resilience and Vulnerability in Asia: A 25-year Village Study from Thailand

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In 1982 when Jonathan Rigg first visited the villages of Ban Non Tae and Ban Tha Song Korn, the population were largely 'poor', subsistence farmers. Nor were the development prospects of the villages in this marginal region of Thailand, with its capricious climate, particularly bright. This is not to say that villagers in the region were destitute; they may have led meagre lives, they may even have been poor in the way in which the development industry has been intent on counting, describing and categorising the poor; but the inhabitants of Ban Non Tae and Ban Tha Song Korn were not destitute in the sense of being without food, shelter and clothing.

In the early 1980s, the key risks facing rural households in the Northeast of Thailand related to the possibility that their subsistence wet rice crop might fail. Fields were rain-fed and, with a seasonal and highly variable pattern of rainfall, the chances of individual crop failure were high. Indeed, the core of the subsistence strategy of villagers revolved around how to maintain output in such a context and this involved planting a range of rice varieties across different agro-ecological niches, all with a view to maintaining a certain minimum level of output, and thus ensuring subsistence. A 'safety first' principle prevailed. This picture of the risks and vulnerabilities facing rural people in a subsistence world resonates with much of the classic literature, exemplified by R.H. Tawney's well known reflections on China in the early 1930s:

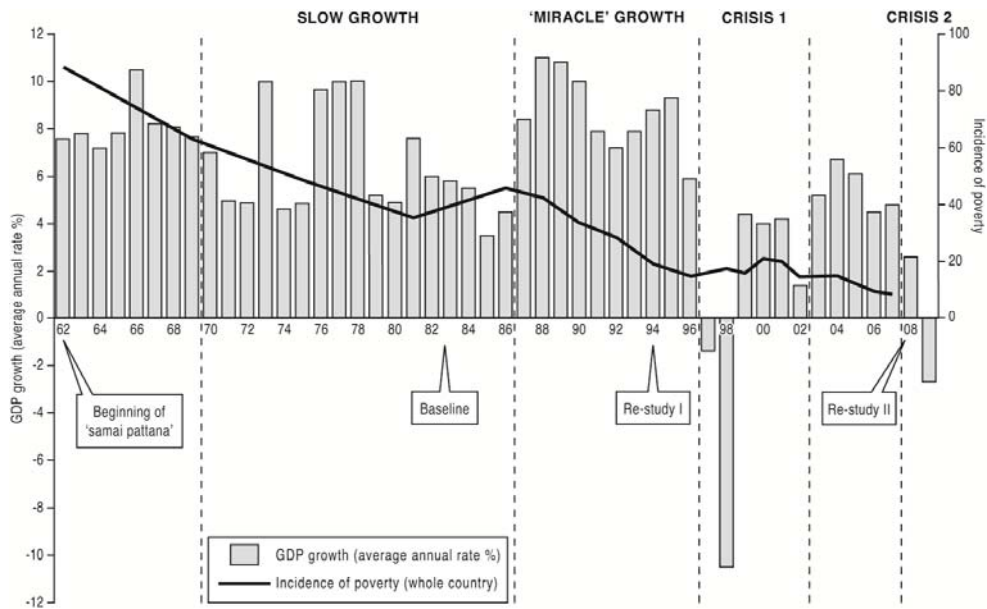
There are districts [in China] in which the position of the rural population is that of a man standing permanently up to the neck in water, so that even a ripple is sufficient to drown him (Tawney 1932, 77; see also Scott 1976)

In addition to household 'strategies' being finely tuned to juggle environmental risk against subsistence necessity, the villages of Ban Non Tae and Ban Tha Song Korn also supported a set of social practices and community arrangements – a 'moral' economy – that served to provide additional support when household and family subsistence strategies came under pressure. Friends, neighbours and relatives would share work and reward, assist during times of crisis, and provide a community safety net which further underpinned individual household strategies.

Asian miracles and crises, Ban Non Tae and Ban Tha Song Korn (1982-2011)

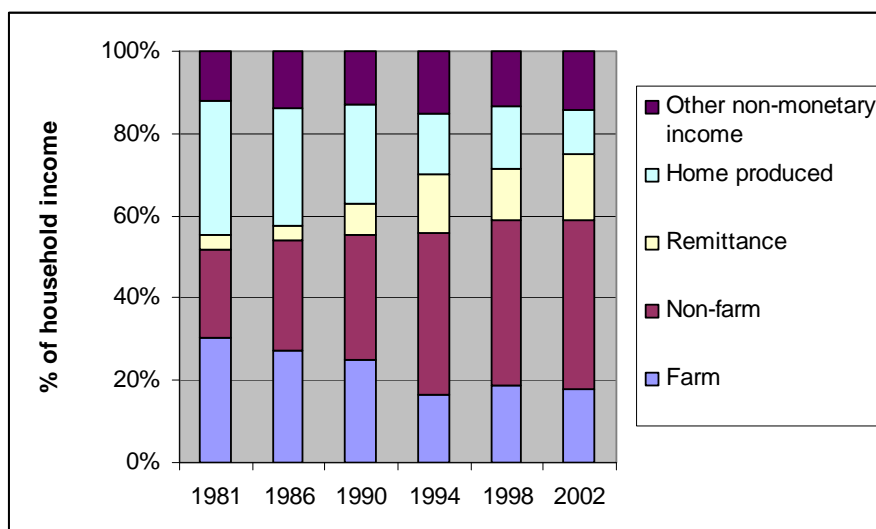
Between then and now, the waves of wider social and economic change have washed across the shores of Ban Non Tae and Ban Tha Song Korn. *Samai pattana*, or the development era, has served to shape the way people live their lives, and reshaped the patterns of risk and vulnerability – and of opportunity (Figure 1).

Figure 1: Growth and poverty in Thailand (1962-2009)



Broadly-speaking, living has made the transformation from farm to non-farm, from in-situ to ex-situ, and from community to individual (Figure 2).

Figure 2: Share of northeastern village household income by source (1981-2004, %)



Source: Grandstaff et al. (2009, 302)

Risk and vulnerability in 2008-09

In the villages of Ban Non Tae and Ban Tha Song Korn today, many of these approaches to managing livelihood risks are either no longer possible, and/or no longer desirable. Households generally do not own land ranged across different agroecosystems; the carefully selected rice varieties attuned to the specific environmental conditions of different ricelands are largely forgotten; the wildlands of the 1980s have been decimated and denuded; the extension of childhood into the late teens means that children are not available as an economic resource; and community practices of self-help and community support have largely dissolved and disappeared.

This does not mean, however, that life has become riskier. While the villages are just as unequal places as they were, they are also materially richer – and richer across the spectrum. At its simplest level, the spectre of hunger has been banished. Today, no one goes hungry in Ban Non Tae and Ban Tha Song Korn. More obviously, but less significantly, it can also be seen reflected in consumerist markers of status: in the ownership of televisions, mobile phones, motorbikes, pick-up trucks, microwave ovens, refrigerators, and electric rice cookers.

From local environmental to extra-local economic risk

The changing approaches to making a living outlined above also reflect a change in the location and nature of risk. In the 1980s, risks largely revolved around locally experienced environmental perturbations. Some of these may have arisen from regional-level events – flood and drought, for instance – but the impacts and responses were local. There were other crises, to be sure. Historical accounts recount disease and conflict sweeping across the region from time to time. But there was little that villagers could do about these in terms of strategising. With the integration of villagers into broader national and international circuits of production, consumption and exchange, so the threats – and the solutions – to livelihood crises have similarly been ‘scaled up’.

The 1997-98 Asian financial crisis led to millions of Thai migrant workers being laid off, often with little or no severance pay. Housed in dormitories or rented rooms close to the factories and building sites where they worked, many returned to their villages in rural areas – villages like Ban Non Tae and Ban Tha Song Korn. Just as the farmers of the early 1980s were held hostage by the vagaries of climate and the marginality of their environment, so the farmers-cum-workers of the 2000s are held hostage by the dependencies linked to Thailand’s thorough-going and enthusiastic engagement with the world economy.

Dealing with crisis: social capital and the dissociation of the village community

One outcome of the processes described above is the ‘dissociation’ of the village economy. This is mainly described in economic terms: the village as a container of economic and livelihoods practices has partially dissolved. There have, though, also been social implications. In particular, the ‘social capital’ which went some way to regulating and patterning inter-household and intra-village relations has been devalued. Villagers are less likely to resort to community support mechanism to tide them over periods of crisis and shortage; they are also, for that matter, less likely to be offered such support.

Vulnerability and resilience in a post-community rural world

'Communities' are usually seen in this literature as spatially situated and resilient communities are "inextricably linked to the condition of the environment and the treatment of its resources" (Cutter et al. 2008, 601). When this community of intersecting social and environmental capitals is unpicked – as they certainly are in Ban Non Tae and Ban Tha Song Korn – then vulnerability is seen to ensue. Thus, in their work on vulnerability and adaptation to climate variability in Uttarakhand, India, Kelkar et al. (2008, 571) reflect that "as they move towards non-agricultural jobs in the city...many [villagers] are becoming more vulnerable due to dislocation and disruption of their familiar way of life."

The experience of Ban Non Tae and Ban Tha Song Korn over a quarter of a century of perturbation offers a rather different view of vulnerability, resilience and adaptation, at least in this small corner of Northeast Thailand. To begin with, the idea of a spatially situated community is problematic when mobility, migration, shadow households, remittance landscapes and dispersed livelihood footprints are defining features of life and living across much of rural Asia. Resilience, it seems, is not to be uncovered in communities but in the spatially distributed networked lives that increasingly rural Thais – and many others – live, not because they are forced to as a result of livelihood failures 'at home', but because it is in the combination of local and extra-local, farm and non-farm that resilience is to be found.

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Minimising the Threat of Natural Disasters: Some Thoughts on Understanding and Measuring Resilience

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Natural disasters and their effects are a growing concern made even more urgent by trends that indicate an increasing number of disaster events and increasing losses in terms of economic damage, injuries, and human suffering. Recent statistics indicate that Asia suffers disproportionately from natural disasters by all measures.

The natural aspect of disasters, in terms of their location, intensity, and frequency cannot be avoided, for the most part. Still, a country can make efforts through appropriate policy measures to prepare for, cope with, and recover from disasters; and this is where resilience thinking comes in. Unlike the early focus of disaster management on relief, reconstruction, and recovery efforts aimed at reducing disasters' impacts after their occurrences, there is now a greater emphasis on resilience building to improve capacities of nations and communities. Resilience, in this context, refers to the capacity of a system (nation, community) to withstand and recover from the effects of a catastrophic event. Resilience emphasises resource strengthening and capacity building measures applied before, during and after a disaster. Resilience, thus, places greater emphasis on societies'/nations' behavioural and institutional aspects; reflecting the wider understanding that disasters' consequences are the results of natural and man-made behaviour.

The operational aspect of resilience, however, can be complex. What are the factors that resilience depends on? What makes a country more or less resilient? What are the avenues that policymakers should consider? The answers can be complex.

In the national context, resilience – expressed in terms of a nation's ability to manage and sustain basic functions and structures, and recover after a disaster occurs – can be understood by examining its state of natural environment, physical infrastructure and lifelines, economic development, social development, and institutions, which can be collectively referred to as the five dimensions of resilience.

The natural environment determines the extent to which a country faces different types of natural hazards (earthquakes, typhoons, floods, etc.). A country with a well-developed physical infrastructure designed to sustain the forces imposed by all the natural hazards affecting it is better able to withstand these events and their resulting effects, and is thus considered resilient. The contrasting situations in Haiti and Chile, both hit by major earthquakes in 2010, underscore this point. A country with a higher level of social development is more likely to have citizens with better knowledge and skills to understand disaster-related risks, and therefore, take measures to better protect themselves. Greater economic development strengthens resilience through solidifying economic stability and ensuring resource availability, whereas sound institutions are

essential for an economy to function, manage and govern properly. In situations where good governance and rule of law are missing, a large disaster might lead to economic and social disorder.

Following the recent thinking on disaster literature, three common elements of resilience are identified, based on which resilience is defined as a country's ability to withstand or resist disaster impacts; bounce back after being impacted; and modify its behaviour/structure to adapt to future disaster threats. Only through assessing a country's degree of resilience to disasters, might we be able to understand the extent of preparedness should a catastrophic incident occur.

One way to understand resilience would be to undertake an empirical assessment of the country's resilience to disasters and develop a methodology to build a Disaster Resilience Index (DRI) useful to understand, monitor and compare the extent of resilience within and across countries. Developing a general methodology to compute a DRI can be particularly useful in light of evidences that Asia suffers disproportionately from natural disasters in terms of number of disasters, loss in human lives, and economic damages.

The empirical part, however, can be much more challenging. In order to build an integrative DRI, say, for each of the major dimensions of resilience (physical, economic, social, institutional and natural), a set of indicators need to be identified that empirically defines variables influencing a country's resilience to disasters. Identification as well as finalization of the indicators should rely both on sound theoretical framework and empirical data based on survey outcomes. Next, sub-indices will have to be constructed for each of the resilience dimensions. Prior to constructing the sub-indices, raw data values should be transformed into comparable scales (for example, utilizing methods like percentages and/or normalization procedure based on GDP, land size, population). As each indicator could have a different degree of contribution towards its respective resilience dimension, a weighting system for each indicator may be required. The weighting criteria should rely on either theoretical knowledge and/or empirical insight. Once the sub-indices are computed and finalized, they should be combined to construct a composite index, say, a Disaster Resilience Index (DRI). The process will involve a range of data and methodological issues commonly encountered in index building exercises.

Apart from data issues, the task of understanding and measuring a nation's resilience to disasters will raise a number of questions, some of which include:

- i) What are the dimensions that need to be considered to characterize and measure a country's disaster resilience?
- ii) What are the variables and indicators that characterize each of those dimensions that capture the extent of disaster resilience?
- iii) Once the variables and indicators are finalized, how do we determine their relative significance to the respective sub-index and, in turn, the DRI?
- iv) Based on the indicators identified, how can a sound methodology be developed to construct a national level measure (for instance, a Disaster Resilience Index)

that enables assessing, monitoring and comparing disaster resilience across various countries?

An attempt to grasp a full understanding of disaster resilience requires understanding each component of resilience dimensions, which in turn, depend on a host of other factors. This is what makes understanding, applying and measuring resilience a challenging task. Only by establishing the factors and identifying appropriate indicators to measure their contributions will policy makers be able to properly manage the threat of natural disasters, and therefore, strengthen resilience. The growing impacts of natural disasters necessitate Asian governments to better understand resilience in its entirety in order to devise effective resilience-strengthening policies and minimise the threat posed by natural disasters.

Governance (and governance) of Resilience in Singapore


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governance (ɡʌvənəns) 

Collins English Dictionary - Complete & Unabridged 10th Edition 2009

— *n*

1. government, control, or authority
2. the action, manner, or system of governing

resilience (ri-zil-yuhns) 

Dictionary.com Unabridged 2011

— *n*

1. the power or ability to return to the original form, position, etc. after being bent, compressed, or stretched; elasticity
2. ability to recover readily from illness, depression, adversity or the like; buoyancy

Thomas Hobbes writes of anarchy and discord in *The Leviathan* (1661):

In such condition, there is no place for industry; because the fruit thereof is uncertain: and consequently no culture of the earth; no navigation, nor use of the commodities that may be imported by sea; no commodious building; no instruments of moving, and removing, such things as require much force; no knowledge of the face of the earth; no account of time; no arts; no letters; no society; and which is worst of all, continual fear, and danger of violent death; and the life of man, solitary, poor, nasty, brutish, and short.

Social capital and social resilience

The existence of voluntary social relations among individuals, or civil society, might be seen as ‘small g’ governance in contrast to the ‘capital G’ Governance of the state, needed to counteract the dystopia envisaged by Hobbes. The existence of social capital, expressed through voluntary associations, groups and institutions as expressions of shared interests for mutual benefit, translates as an indicator of social wellbeing that is *enhanced*, rather than being depleted, *by regular and persistent use*. Social resilience, being the ability of human communities to withstand and recover from stresses, such as

environmental change or social, economic or political upheaval, is arguably strengthened by the existence of broadly inclusive, participatory communities (see Rodrik 2007). Such resilience is crucial in maintaining options for positive human development in the face of rapid change within our increasingly complex and seemingly vulnerable economic, political and social systems.

Southeast Asian urban context

Southeast Asia has historically been marked by ethnic diversity, a cross-cultural crossroads which has seen population migrations, the rise and decline of kingdoms and super kingdoms, maritime empires, colonial incursions, invasions and occupations (see Tarling 2001).

In the postcolonial context, the newly emergent states have managed their inevitably plural societies in various ways but, invariably, nationalisms have been constructed with reference to indigenous majority groups, rather than through the political inclusion of marginalised minorities or regional outsiders such as the ubiquitous Chinese and Indian populations. In such contexts, social stability has largely been achieved through economic growth and wealth creation rather than through ethnically pluralistic fully representative governance (see Ooi 2006).

Resilience then has been created in a 'top-down' fashion through governance systems based upon continued material rewards rather than community consensus. Dating from colonial times, labour solidarity has been in thrall to ethnic identity, and when economic conditions have deteriorated, as in 1969 and 1997, thresholds of tolerance have quickly been breached in 'racial riots', thus exposing the fragility of ethnic management through economic consensus (see Ibrahim 2004).

Conceptual notions

A recent publication by Wilkinson and Pickett (2010) convincingly argues the case for equality, deeming that 'more equal' members of the world's richest group of countries perform much better than their 'less equal' counterparts on a wide range of social and economic indicators. This analysis is successfully extended to the fifty US states. It would appear from this analysis that community resilience is enhanced within egalitarian societies.

Within the world's 'rich-group', Wilkinson and Pickett identify Singapore as arguably the most unequal of countries with a Gini coefficient score of 42.5 in 2009, whereby the richest 20% of households command nine times the wealth of the poorest 20%. Singapore Governance with a capital G is associated with the second highest levels of incarceration (after the US) and second lowest levels of 'trust' (after Portugal) within the rich group.

Singapore, as the only Southeast Asian state with an ethnic Chinese majority, is officially a 'multi-cultural, multi-racial, multi-religious, multi-lingual secular society' (4Ms) but at the same time a place where racial ascriptions inform every aspect of people's lives.

Resilience has been achieved through unprecedented economic growth and an apparent political continuity which belies the frequent policy shifts instigated by the dominant People's Action Party (PAP) (see Barr and Skrbis 2008).

To what extent might we speak of Singapore Exceptionalism? Professor Kishore Mahbubani at the Lee Kuan Yew School of Public Policy declares that "Singapore is quite simply the most successful society in the history of humanity" (Kampfner 2010, 15).

Singapore resilience as 'tahan lasak' or 'exceedingly hardy'

The entire hagiography of the 'Singapore Story' is one that is framed as a siege or bunker mentality of a vulnerable nation susceptible to myriad forms of threats to its security. Geopolitical situational considerations, social-political policies and cultural societal socialisation had facilitated and replicated this psychological and operational paradigm. However, Singapore 'Exceptionalism' is essentially no different from other communities' or nations' capacity for adaptation for a certain discernible degree of survivability. The unequivocal success of this 'accidental nation' since 1965 underlines the conclusions of Singapore's national resilience as having not only survived but thrived to become a "hugely wealthy state" (BBC on 9 May 2011) together with a reputation for strict, conservative political social controls and close management of private and public behaviour.

This 'top-heavy' approach, complemented by a 'hard multiculturalism' approach to its management of ethnic diversity, meant that new forms of 'official' resilience, apart from natural socialisation practices of a multiracial society before 1965, were created and grafted to the existing society to steer the country since 1965. The products of the 4Ms and other politically motivated actions since then had been predicated on the fundamental pact between the citizenry and the government: selected tradeoffs between certain aspects of personal life for the general good of economic prosperity, societal stability and a promising future for succeeding generations and for all communities. This 'prosperity consensus' had indeed worked well as testified by consistent, enviable socio-economic statistics.

Definitely, this technical approach to 'create' resilience from the 'top-down', as opposed to the natural, organic evolution from the 'bottom-up', meant a transformation of 'natural' resilience to one that is functioning within a framework of boundaries, limits and, with that, possibly sub-optimal outcomes. Undoubtedly, resilience the 'Singapore Way' with its claims to a 'Singapore Exceptionalism' has been tested by the multifaceted processes of globalisation and the inevitable changes brought upon by demographic changes linked to that much evoked word during the recent general elections: "landscape."

'Manufactured' resiliences are inevitably tested by the passage of time and changing expectations especially if measured by an attending scales of interest to an individual, his or her (ethnic, religious, economic) community, his or her economic well-being or the concept of 'Singapore' itself. Much can be made and has been said on the critical questions emerging from Singapore's 'resilience', witness the forcefully articulated

debate prior to the recent general elections, in particular younger people's concerns over 'merit' with the constant reminder on the dominance and impact at the polls of the younger generation (those below the age of 50): "a generation that does not remember" (Lee quoted in *The Straits Times* on 9 May 2011).

Significantly, the 'ominous' post-election comment might underline a generational gap or perception marked as a case of youthful folly versus experienced wisdom. Ultimately, however, the impact of this demographic change, together with other expressed grievances with the ruling government merely surfaced as a delicate expression of 'natural' 'bottom-up' resilience: one that is not akin to the current 'Arab Spring' as some critics hoped it would be. It is however a 'Singapore way' of resilience: a rebuke articulated not enough to overwhelm the current political system that had indeed been positively transformational since 1965, but to express heartfelt, genuine concerns with the promises of the 'prosperity consensus' pact.

Notwithstanding the contested narratives both before the elections and still currently ongoing, particularly in cyber space, the election results are positive indications of a robust democracy in action with delicate expressions of 'small g' and 'Capital G' resilience in action. If past carefully calibrated actions towards 'managing' Singapore and its people are any indications, there will be myriad social and economic responses to the results of the morning of 8 May from both the government and the people. Whether these might be just temporal venting of significant pressure points or structural reforms to address the bottom-up grievances of 'heartlanders', renewed confidence or improved positive perception of the government, remains to be seen in the next few years and until the next general elections.

Resilience and exceptionalism in the particular and maybe peculiar Singapore way have indeed been responsible for its breathtaking success since 1965 though not necessarily enough to qualify itself as the most successful community in the history of humanity. It has however the combined organic and official legacies that have managed rather delicately the past and the present, but it is not without uncertainty, possible tragedy or growth inevitability. In this, as the narratives continue in the 'Singapore Story', it is not vaulting ambition to suggest that Singapore 'resilience' is best expressed in the Malay phrase encapsulating endurance, substance and quality ...as *tahan lasak*.

Some thoughts

- How can the nature of resilience be best placed somewhere between order and anarchy?
- Is there evidence of a decline in political participation in the West at the same time as political resurgence in the East?
- Are democratic representation and public participation not needed in the resilience equation?
- How will the 'new media' provide alternative avenues for expression and participatory democracy?

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- To what extent can and should 'freedom' be sacrificed in the search for prosperity?
 - Do we just need Governance with a capital 'G'?

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Space, Scale and Time in Regional Economic Resilience

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Introduction

In Australia, as in other parts of the world, there has been growing interest in notions of resilience within the academic and policy discourse on regional development. At the heart of this policy and research agenda is an effort to better understand the social, economic, political and institutional ingredients that enable places to withstand and/or respond to shocks and disturbances. Moreover, within the context of economic geography there is a growing interest in the temporal and spatial dimensions of resilience (Hassink 2010). Regional and local economic development is far from an orderly and spatially even process, and is subject to a range of disruptions and disturbances that operate across multiple scales and in geographically complex ways. This short commentary considers the extent to which ideas about resilience represent a useful means of understanding regional economic development, or if they simply represent yet another example of the 'fuzzy concepts' that are all too common in regional studies (see Markusen 1999).

Regional evolutions and resilience

The emergence of metaphors around resilience has been paralleled by an increasing interest in 'evolutionary thinking', particularly with regards to the development of regions (see Simmie and Martin 2009). In essence, this 'evolutionary economic geography' draws on evolutionary economics (and, indirectly, evolutionary biology) to interpret processes of uneven development (see MacKinnon 2008). While evolutionary economic geography is a rather diverse field of thought, it incorporates notions of: variety, novelty and selection in shaping the development of regions (a 'generalised Darwinism'); regional path dependence, focusing on notions of historical continuity, 'lock in' and path creation; and complexity theory, drawing on ideas about self organisation and adaptive growth. There are a number of reasons these evolutionary perspectives have gained traction, though two are particularly relevant here. The first is that they contain a recognition of *the importance of time*. In other words, historical context and temporal scale are important in understanding the development of regions. The second is that there is an explicit *focus on geographic space*.

In terms of resilience, there are clearly some common grounds here. While the use of ecological metaphors is certainly one area of commonality, so too is the notion of time and space. While some of the work on adaptive cycles (Holling and Gunderson 2002) gives some consideration to the question of time, it would be fair to say that neither the temporal and spatial dimensions of resilience have been given adequate conceptual attention. Yet, as Martin (2010) reminds us, the Latin root of resilience, *resilire*, meaning

to leap back or rebound has a clear temporal dimension. This then raises questions about the temporal scale around which we consider resilience. The focus on 'shocks', such as recession or disaster, tends to imply relatively short timescales. However, when set within the context of longer development trajectories, resilience may prove to be an equally helpful concept. For example, in my own research on the development of Australia's broadacre grain belt, there has been a gradual process of economic and social change, leading to the contraction of local economies, depopulation, service withdrawal and social malaise (Pritchard and Tonts 2011; Davies and Tonts 2010). Pendell et al. (2008) refer to this as a 'slow burn' in which regional economies are slowly corroded over time. Such long-run processes clearly speak to questions of resilience, and how regional systems have coped with and adapted to deep structural shifts in the global economy. Further, the long run development of these regions is often punctuated by short run disturbances and disruptions that alter development pathways. Understanding how these various temporal scales operate and intersect within the context of resilience would seem to be important not only in conceptual terms, but also from a policy perspective.

The issue of space also looms large here. Research in rural Australia, and elsewhere, shows that the combined physical, economic, social and political characteristics of particular localities help shape their development pathways. In the research I have conducted in the Western Australian wheatbelt, these spatial variations are highly evident, and help underpin patterns of uneven development. Moreover, it is apparent that communities are often in competition for regional trade, resources, infrastructure and people with the outcome being a pattern of 'winners' and 'losers'. These intra and inter regional interdependences also form an important part of the resilience question, and arguably need further exploration. One might also argue that resilience needs to be viewed as a multiscale concept by considering how resilience varies across spatial scales. Moreover, how do processes operating at different scales interact and possibly affect one another?

Complexity, panarchy and regional evolution

In a number of recent contributions to debates about evolutionary economic geography, Martin and colleagues (see Martin and Sunley 2007; Simmie and Martin 2009) have begun to consider the value of complexity theory and panarchy in connecting geographical and temporal scales. This offers an explicit link between notions of resilience and 'adaptive cycles'. Here the focus is on the extent to which systems have functions and relationships that operate at multiple scales in highly connected and often in non-linear ways. The boundaries around such systems are highly fluid and difficult to define. Such systems are also 'self organising' with the capacity to adapt their structures and dynamics. In terms of resilience, it is this adaptive capacity that is seen as crucial (see Sunley and Martin 2007).

In terms of understanding regional economic evolutions, this model may hold significant conceptual value, since it incorporates the key elements of time, space and scale. There would be strong grounds for arguing that regional economies are complex, adaptive systems, since they are characterised by functions and relationships that are distributed

across system components at a range of spatial scales and in geographically uneven ways. Moreover, the boundaries between regions are not fixed or easy to define, and there is a high degree of emergent behaviour and self-organisation. While understanding regions from such a perspective is still relatively embryonic, there does appear to be some potential here. Of course, there are potential problems, such as the extent to which ecological approaches can be readily transferred to assemblages of human actors and institutions that are able to learn and modify behaviour even in the absence of major shocks and disturbances. Perhaps the real value may lie in the capacity of this perspective to generate new hypotheses and research questions, rather than as a unified theoretical framework.

Final thoughts: The politics of resilience

An area that I have given relatively little thought to, but that in writing this short piece became a concern, is how the discourse around resilience might play out in political terms. In recent years, concepts such as 'social capital' and 'community capacity' have been used as a convenient means of underpinning neoliberal policy agendas. For example, the programmes focused on social capital in rural communities have often been used as a means of reducing state support in areas such as economic development and service provision. The emphasis is often on how social capital might provide a resource underpinning self-help, competitiveness and local development. Under such a scenario, those communities that faced economic or social difficulties might be expected to resolve these 'from within'. Those that failed to do so were problematised as having 'low social capital' or 'social dysfunction', and in some quarters it was at this level where much of the blame or explanation might lie for underperformance. One might argue that notions of resilience hold similar risks. Embedded within some of the policy discourse around resilience is commentary on the need for 'flexibility', 'self help', 'creativity' and perhaps most disturbing of all, 'competitive fitness'. This begins to raise questions about the extent to which such a concept might result in any significant shift in policy thinking, or simply be used to reinforce established positions.

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Resilience and National Security

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The term *resilience* has increasingly become ubiquitous in describing cities and communities that overcome a crisis. For example, owing to their stoic response to terrorism in their respective cities, Mumbaikars and Londoners have been described as resilient while New Orleans, by overcoming Katrina, has been dubbed a resilient city. With its etymological roots in the Latin *resilire* – meaning to jump back and recoil – the employment of the term in these instances does appear accurate.

However, beyond its descriptive value, it has come into vogue to employ resilience as a paradigm when thinking about national security. Subdivided into technical and social resilience, the concept becomes a way of both framing and studying technical measures – such as increased surveillance in response to the threat of terrorism – and social programmes – such as the support for inter-religious dialogue to foster greater community cohesion – put in place by governments to prevent and prevail against national security challenges.

Of note is that the understanding of resilience here diverges from most mainstream understandings. As illustrated above, resilience is traditionally understood as the ability to recover from a crisis. However, the employment of the term in national security expands the semantic domain to include the preventing of a crisis from occurring in the first place (Menon 2005; CENS 2011). Hence, employed to matters pertaining to national security, to be truly resilient, one is both able to prevent a crisis and prevail when the unpreventable takes place.

The problem with resilience vis-à-vis national security

The first issue regarding the employment of resilience as a paradigm to understand national security is the ambiguity surrounding the proper noun “one” in the previous statement. Echoing the issues raised with regard to securitization found in the literature on International Relations (Ullman 1983; Brown 1989; Nye 1989) when security is discussed, discussions on resilience are unclear on its referent object. Several problems arise from this. Firstly, is it the state, government, nation, community or individual who is expected to be resilient? Traditionally, national security has been under the preserve of states and the responsibility of the prevailing government (Khong 2001). It is the duty of those in authority to ensure that the population is secure and protected from adverse circumstances. In considering a resilience paradigm, where should the concept reside?

Should it be focused on the governments and institutions tasked to preserve national security or should it be within the domain of the nation or wider community? Secondly, would resilience in one of the spheres be to the detriment of the rest? Both these issues are inextricably linked to the idea that making one sphere more robust and resilient has the potential to cause other spheres to become less resilient. This trade-off makes the case for the promotion of general resilience of the system as a whole instead of focusing on the specified resilience of certain spheres. The argument for promoting general resilience is strengthened when one considers the current complexity of the global environment today where threats are increasingly unpredictable.

The second issue stems from the multifaceted nature of national security. The traditional concept of national security has been generally centred on the use of the armed forces to secure the state with threats to national security almost exclusively identified as external military forces seeking to subvert a country's stability and sovereignty. However, in recent years, the concept of national security has by and large been expanded to encompass a very wide threatscape to include threats to "human security" relating to the economic, food, health, environmental, personal, community and political spheres (UNDP 1994; Khong 2001). With such a wide threatscape, would resilience, if possibly cultivated, in one sphere carry over to another? The interdependence and tight coupling of the various spheres and scales in complex social systems may preclude planners from focusing on the resilience of only one sphere. This goes back to the idea above of promoting general resilience. Resources are however not unlimited and there is the propensity of those in charge of national security to focus on risks that are known and assessable. While this is an understandable compulsion, it is not advisable in this context.

Thirdly, what form should resilience take? Should it take on the characteristics of the resilience of conservatism or be dynamic in nature? The first, also commonly referred to as engineering resilience, involves systems with properties that are able to return to a pre-determined specification or design or are able to function within specifications in the wake of a disturbance. An example of this type of resilience can be seen in computer systems which are designed to return to or function under pre-determined specifications; its resilience is therefore measured in how fast the system can return or the number of conditions under which it will still continue functioning. Expressed in another manner, this conservative form of resilience is buoyed by a desire to return exactly back to the way things were (Longstaff 2010). The second form of resilience is dynamic and has been referred to as ecological or adaptive resilience. This type of resilience is suited for systems that experience frequent surprises and takes into account the increasing levels of complexity and uncertainty which dominates today's societies. It therefore works under the assumption that the option for returning to a pre-determined state or condition may not be possible or even desirable. Expressed in another manner, this dynamic form of resilience is comfortable with adaptation in order to ensure survivability where life will carry on but it will do so through change (Longstaff 2010). Given the multifaceted threats under the national security rubric, it is not immediately clear which is the preferred option. On the one hand, in certain circumstances, preservation of the *status quo* is seen as vital for a nation's security, for example, maintenance of the functioning of critical infrastructure. However, a major criticism of conservative resilience is the fact that it does not capture the complexity and dynamism present in social systems, such as the modern state. A disaster affecting a complex system may create a

situation in which returning to the *status quo* may no longer be a viable option. A country that is dependent on a certain infrastructure – for example nuclear energy – may find that in the aftermath of a disaster, this no longer represents a secure source of energy. In such situations adaptation in the form of a dynamic approach is necessary in resolving the problem. It is this understanding of resilience that is being formulated as a possible approach in dealing with unknown threats in national security and disaster management areas.

Finally, and perhaps most often highlighted, can resilience be cultivated and where exactly does it emanate from? On the one hand, a top-down approach to resilience may perhaps lead to over-orchestration and would limit the high level of ingenuity *a la* Thomas Homer-Dixon required for complex problems to be solved. With resilience being steered from the top down rather than percolating up from the larger reservoir of ideas that is wider society, the development of social resilience and, hence the ability to prevent a crisis or prevail in one may be retarded. On the other hand, in increasingly atomized post-industrialized societies, if resilience is not steered from the top, it may never be arrived at. There have been suggestions that a combination of a top-down and bottom-up approach is needed (Walker and Westley 2011). This appears to be a logical resolution of the above conundrum but it is argued that this combined approach would be difficult to manage in practice given that most countries have centralised governance and decision-making systems. Where should the lines be drawn between the roles and responsibility of a government and its people? What happens if differences appear between both sides? Creating a working system that is able to encompass both calls for a solution that transcends present day governing, social structures and ways of thinking.

Conclusion

In sum, highlighted here are arguably several of the main issues that appear when considering resilience within the national security domain. Traditional national security thinking resulted from past dealings with threats that were mainly military in nature. There is therefore the tendency to look towards hard measures in defeating often known and anticipated enemies. Today's threatscape is markedly different. The emergence of new threats in an increasingly globalised and inter-connected world necessitates a change in security strategies. Firstly, the threatscape has expanded to include what is commonly referred to as non-traditional security issues; as mentioned above, this includes threats involving the environment, health, food, and water. Secondly, there is now more urgency for governments to find ways of dealing with and managing unknown or unpredictable threats that befall their society. Given today's increasingly complex world, there is tacit acknowledgement that past strategies of managing risks are inadequate in such a context. The idea of resilience provides an alternative framework in dealing with present day crises, especially those that are unexpected. However, much remains to be worked out in developing an operating framework that sees the resilience paradigm fit comfortably within a country's national security structure.

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Appendix 1: List of Participants

	Participant	Resilience interest
1.	Amir, Sulfikar: Assistant Professor, Division of Sociology, Nanyang Technological University	Socio-technical resilience, the sociology of technology, technological politics, the sociology of risk in Southeast Asia
2.	Bohensky, Erin: Social and Economic Sciences Program, CSIRO Ecosystem Sciences, Townsville.	Alternative perspectives on resilience; media representation of resilience in Australia and Asia-Pacific region
3.	Chin, Yolanda: Associate Research Fellow, CENS, S. Rajaratnam School of International Studies	Social resilience and national security
4.	Dewa Ayu Wiwik Darmiasih: Stockholm Resilience Centre.	Creation of a Governing Assembly for the proposed UNESCO World Heritage Cultural Landscape of Balinese subaks
5.	Elshafei, Yasmina: School of Earth and Environment, University of Western Australia, Perth, Australia.	River basin management and the environment in Vietnam
6.	Gough, Kate: Geography Department, Loughborough University, UK.	Urban and rural livelihoods with a particular focus on gender and generational dimensions
7.	Ismail, Rahil: National Institute of Education (NIE), Singapore	Urban sustainability and resilience
8.	Kerlow, Isaac: Professor, Earth Observatory of Singapore (and Art, Design and Media)	Media, representation and engagement
9.	Knetsch, Jack: Professor, Division of Economics	
10.	Lansing, Steve: University of Arizona, USA	Resilience in biological and ecological systems, with particular focus on Balinese subak
11.	Leitch, Anne: Social and Ecological Systems, Social and Economic Sciences Program, CSIRO Ecosystem Sciences, James Cook University, Townsville	Community resilience and climate change
12.	Leong, Lena: Senior Researcher, Centre for Governance and Leadership, Civil Service College	Resilience and governance in Singapore
13.	Neubronner, Stephanie: School of Earth and Environment, University of Western Australia, Perth, Australia	Cosmopolitanism in Singapore
14.	Ng, Charles: Assistant Director, National Security Coordination Centre, Prime Minister's Office, Singapore	Resilience and security; resilience, policy and governance

15.	Olwig, Mette Fog: University of Copenhagen	'Social resilience in northern Ghana'
16.	Oven, Katie: Institute for Hazard, Risk and Resilience (IHRR) and Geography Department, Durham University, UK	Knowledge and governance of risk and resilience at community and national levels in the context of landslides in rural Nepal
17.	Rigg, Jonathan: Geography Department, Durham University, UK	Livelihood resilience, particularly rural and cross-scale resilience practices
18.	Sharma, Suman Kumari: Lecturer, Division of Economics, HSS, Nanyang Technological University	Understanding resilience in view of growing threats of natural disasters
19.	Shaw, Brian: School of Earth and Environment, University of Western Australia, Perth, Australia	Urban sustainability and resilience
20.	Singh, Bilveer: Acting Head, Centre of Excellence for National Security (CENS), S. Rajaratnam School of International Studies, Nanyang Technological University	
21.	Toh Boon Kwan: Centre for Governance and Leadership, Civil Service College	Resilience and governance in Singapore
22.	Tonts, Matthew: University of Western Australia, Australia	Community, regional and rural resilience, with particular focus on rural resilience and decline in Western Australia
23.	Vasu, Norman: Deputy Head, CENS, S. Rajaratnam School of International Studies, Nanyang Technological University	Theories and practice of multiculturalism, transnational communities, nationalism, national security and social resilience
24.	Yeap Su Yin: Associate Research Fellow in the Social Resilience Programme at the Centre of Excellence for National Security (CENS), S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University, Singapore.	Governments and communities in planning and managing resilience within their society

Appendix 2: Key Sources on Resilience

In preparation for the workshop, we asked participants to highlight a paper or publication that had particularly influenced their thinking, or which they regarded as seminal in their field of study. These papers are listed below.

- Adger, Neil. 2000. "Social and Ecological Resilience: Are They Related?" *Progress in Human Geography* 24(3): 347-364.
- Birkmann, J. and B. Wisner. 2006. "Measuring the Un-Measurable. The Challenge of Vulnerability." *SOURCE*. No. 5. UNU-EHS. <http://www.ehs.unu.edu/file/get/3962>
- Cutter, S.L., L. Barnes, M. Berry, C. Burton, E. Evans, E. Tate, and J. Webb. 2008. "A Place-Based Model for Understanding Community Resilience to Natural Disasters." *Global Environmental Change* 18(4): 598-606.
- Manyena, S.B. 2006. "The Concept of Resilience Revisited." *Disasters* 30(4): 433-450.
- Martin, R. and P. Sunley. 2007. "Complexity Thinking and Evolutionary Economic Geography." *Journal of Economic Geography* 7: 573-602.
- Redman, C. L. and A. P. Kinzig. 2003. "Resilience of Past Landscapes: Resilience Theory, Society, and the *Longue Durée*." *Conservation Ecology* 7(1): 14.
- Scheffer, Marten, Jordi Bascompte, William A. Brock, Victor Brovkin, Stephen R. Carpenter, Vasilis Dakos, Hermann Held, Egbert H. van Nes, Max Rietkerk, and George Sugihara. 2009. "Early-Warning Signals for Critical Transitions." *Nature* 461: 52-59.
- Schipper, L. and M. Pelling. 2006. "Disaster Risk, Climate Change and International Development: Scope for, and Challenges to, Integration." *Disasters* 30(1): 19 -38.
- Van Nes, E. H. and M. Scheffer. 2007. "Slow Recovery from Perturbations as a Generic Indicator of a Nearby Catastrophic Shift." *Am. Nat.* 169: 738-747.
- Wilson, G. 2010. "Multifunctional Quality and Rural Community Resilience." *Transactions of the Institute of British Geographers* 35: 364-381.