# DIAGNOSING INTEGRATION:

## Applying complex systems thinking to develop practical tools for diagnosing institutional arrangements and their resilience in integrated water governance contexts

A Thesis submitted by

Sarah Olive Hood, B Sc, Grad Dip Ed, Grad Cert Eng,

For the award of

Doctor of Philosophy

2017

ABSTRACT

The developing water crisis is one of several emergent environmental crises that could produce catastrophic consequences for human health and wellbeing. Some biophysical scientists have described the world water crisis in terms of the resilience of various combinations of three problematic water management syndromes catchment by catchment throughout the globe, while some social scientists have described it as a crisis of governance.

In this thesis I provide new insights into the resilience of integration institutions within the context of the governance of the Condamine catchment, at the headwaters of the Murray Darling Basin in Queensland. I develop these insights by applying a complex adaptive systems framework of governance, integration institutions, resilience and power; developing contextual-historical understandings of which, how and why integration institutions are being produced in this context; and by experimenting with systemically aligned theories of power. In the process I develop practical tools for working on integration institutions whilst being located within complex water governance systems.

I apply combinations of five theoretical frameworks – complex adaptive systems; innovation systems; social-ecological systems; synchronisation framework; and, Foucault's theory of power as a system of subject making – across four investigations. I collected data through ethnographic methods of observation; interview; and, the retrieval of artefacts (i.e. documents, photos and posters etc), whilst employing either instrumental case study or participatory action research methodologies. I analyse this data using discourse analysis and network analysis, and report the studies in the form of four journal articles which are in various stages of publication from submission through to being accepted and published.

In this study I demonstrate the merit of thinking systemically about water governance institutions and the source of their resilience, and demonstrate the applicability of complex systems thinking. I reveal the fluid hybrid networks of actor relations that sustain governance systems, and show that the complex and dynamic interactions that sustain fluid hybrid networks are the source of institutional resilience. The results of the study challenges the use of short term interventions and innovation brokers within projects not grounded in systemic thinking.

As the study was exploratory in nature several future research opportunities within a broader thematic turn towards complexity thinking in water and environmental governance research can be identified. More experimentation with the use of these tools and theoretical frameworks is required. Finally the assertion that the use of short term interventions and innovation brokers within projects not grounded in complex systems thinking may produce counter-intuitive outcomes and therefore delay institutional change is worthy of further attention.
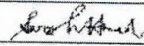
CERTIFICATION OF THESIS

This thesis is entirely the work of Sarah Olive Hood except where otherwise acknowledged. The work is original and has not previously been submitted for any other award, except where acknowledged.

Student and supervisors signatures of endorsement are held at USQ.

# CO-AUTHORSHIP DECLARATION

Declaration of co-authorship and contribution to papers included in this thesis

| Declared by: | Date | Signature |
|---|---|---|
| Sarah Olive Hood | 12th February, 2016 | *[signature]* |

| Title of Co-authored Paper: |
|---|
| Analysis of the role of an innovation broker appointed by a cotton industry environmental innovation partnership in Queensland, Australia. |

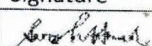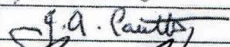Co-authors for the publication listed above contributed to its development in the following ways:

| Name | Contribution | Percentage/ Yes or No |
|---|---|---|
| Olive Hood | Scholarship: Conception | 100% |
| | Scholarship: Execution and interpretation | 80% |
| | Authorship: Reviewing and revising drafts | 80% |
| | Approval: Approved published version | Yes |
| Dr. Jeff Coutts | Scholarship: Conception | 0% |
| | Scholarship: Execution and interpretation | 10% |
| | Authorship: Reviewing and revising drafts | 10% |
| | Approval: Approved published version | Yes |
| Dr. Gus Hamilton | Scholarship: Conception | 0% |
| | Scholarship: Execution and interpretation | 10% |
| | Authorship: Reviewing and revising drafts | 10% |
| | Approval: Approved published version | Yes |

## Co-Author Declaration

We the undersigned certify that we:

1. Satisfy criteria for authorship by approving final version for publication and by having contributed to a part of the publication in one or a combination of the following ways: conception, execution or interpretation;

2. Are responsible for that part of the publication we have contributed, yet confer full responsibility of the publication to the lead author;

3. In relation to funding providers, publishers or the responsible academic institution have declared any conflicts of interest; and

4. Are the authors of this publication.

| Name | Signature | Date |
|---|---|---|
| Olive Hood | *[signature]* | 12/2/2016 |
| Dr. Jeff Coutts | *[signature]* | 12/2/2016 |
| Dr. Gus Hamilton | *[signature]* | 12/2/2016 |

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1 INTRODUCTION

The central issue addressed in this thesis is resilience of integration institutions in water governance systems. A Complex Adaptive Systems (CAS) perspective of governance and institutions has been applied to this issue. Tools have been developed that allow for different engagement with these systems and therefore different insights to be generated. Insights such as how and why actors whom locate themselves and others on various scales, levels and sectors of society co-produce relationships that are fragmented, disjointed or competing and are supportive of certain interests and relationships set and maintained in historically and contextually contingent power relations, despite their continued recognition of certain costs and problems thereby entailed, and their widespread commitment to the idea, and indeed the necessity of being better integrated.

Within Australian environmental governance contexts integration is accepted by the members of the community as an accepted normative goal. This thesis does not test the appropriateness of this goal, but examines the effectiveness of institutional processes and practices in achieving this shared goal. This thesis examines how attempts to achieve integration work in specific governance contexts. This examination is contextually grounded and investigates what people say they want to achieve in terms of integration and then what they are actually achieving. This thesis develops a framework and tools for those involved in messy and real attempts to achieve espoused integration goals. In doing so it develops tools for assessing activities aimed at achieving those goals within such contexts but takes these goals as given within and by communities.

Ethnographic material was collected through embedded research, carried out while performing various roles in a range of positions aimed at supporting integration within the complex sets of interactions that shape outcomes in the Condamine catchment at the headwaters of the Murray Darling Basin (MDB), in the state of Queensland Australia. This ethnographic data is analysed through discourse analysis and network analysis methods, by means of two focusing questions.

**Question 1**: *how can governance, understood as co-evolving, self-organising Complex Adaptive Systems (CASs) that sustain resilient emergent institutions, help those who are involved to better understand persistent integration outcomes?*

Starting with the premise that institutions, such as integration institutions, are emergent properties of governance systems construed as CASs, four frames of compatible viewpoints are applied to address this question: a systemic innovation framework (Hood et al 2014); network analysis (Chapter 3); a Foucauldian augmented synchronisation framework (Chapter 4); a Foucauldian-informed systemic framework of power (Chapter 5).

These Chapters progressively develop theoretical understanding of why and how integration institutions are being produced and  why  despite considerable well-intentioned effort and shared purpose across scales, levels and sectors of governance, the persistence of antecedent levels of fragmentation is the more likely outcome than a move towards the desired integration of water governance.

**Question 2**: *how can governance, understood as co-evolving, self-organising CASs that sustain resilient emergent institutions, help those who are involved to be better able to respond to persistent institutional outcomes?*

The four Chapters further develop practical tools for the diagnosis of the blocks and opportunities for transitions toward contextually relevant integration goals, for driving systemic change toward contextually desired integration outcomes, and for performing contextually espoused types of integrated water governance.

In this chapter I introduce the context for the research that is reported here.  I then examine complexity theory and define key terms used in this thesis.  Next from a complexity perspective I develop the theoretical framework of governance, power, integration, institutions and resilience that I applied in the research reported here. I follow the theoretical framework section with an overview of the data collection and analysis methods used in the research reported here.  Next I establish how I ensured that I produced ethical research of a high quality.  Lastly I close the chapter with an overview of each subsequent chapter and their contents.  First, however, the questions which are examined in the research address several practical and theoretical issues.

CHAPTER 1.1 SITUATING THE RESEARCH

The global decline in the condition of our environmental commons has caused several bio-physical scientists to assert that humanity's maintenance of problematic relationships with their environments and each other is increasing the future

likelihood of several interrelated and irreversible environmental crises (Rockstram, 2009; Rockstram et al., 2009; Steffen, Crutzen, & McNeill, 2007). The resilience of our biosphere is under pressure, with predicted catastrophic human health and well-being consequences (World Helath Organisation, 2005).

*Environmental governance*, construed as the governing systems which have co-evolved (Gerrits, 2008; Gerrits, Marks, & van Burren, 2009) amid the interactions between and within the social and ecological systems implicated in the production of these crises, is central to understanding the on-going reproduction of these trends. For example Srinivasan, Lambin, Gorelick, Thompson, and Rozelle (2012) have shown that the global water crisis is the product of the maintenance (i.e. reproduction) of one of the three types of inequitable, inefficient or unsustainable managing "syndromes" within contextually grounded human-water relations catchment by catchment across the globe (i.e. catchment based water governing systems).

Globally, as environmental decline has been identified and monitored, especially since the publishing of the 1987 Our Common Future report (World Commission on Environment and Development, 1987) and the staging of the 1992 Rio United Nations Conference on Environment and Development (United Nations Conference on Environment and Development, 1992), various environmental and water governance researchers, across a number of disciplinary areas have developed and trialled various localised yet integrated approaches aimed at mitigating the likelihood of the development of predicted environmental crises. The objective has been to variously institutionalise integration of differing viewpoints, sectors and levels of social and ecological scales for better environmental outcomes. See Biswas (2004) for a list of 35 aspects that researchers/practitioners under the Integrated Water Resource Management umbrella have variously focused on when considering what they think needs to be better integrated.

For example, the Common Property Resource (CPR) institutional researchers have theorised that the tragedy of our environmental commons may be averted by institutionalising *subsidiarity* and *polycentricity* (Coop & Brunckhorst, 2001; Pahl-Wostl, Lebel, Knieper, & Nikitina, 2012). *Subsidiarity* is defined as managing environmental issues in a collective fashion at the lowest level of social organisation possible (Marshall, 2008). *Polycentricity* is a concept that has developed over time,

as CPR researchers and also other environmental governance researchers increasingly recognised that the lowest level is not separate from other levels but interacts with them in multiple and dynamic ways (Fabinyi, Evans, & Foale, 2014). More broadly within the Natural Resource Management (NRM) research area the comparative concepts of *devolved* or *decentralised* and *integrated* or *collaborative* NRM have been experimented with and consequently developed and refined (Lane, Robinson, & Taylor, 2009; Margerum, 1999; Mehta, Leach, & Scoones, 2001). Within the Social–Ecological Systems (SES) adaptive governance research domain the concepts of *localised* and *co-managed* governance are relevant to this discussion (Armitage, Berkes, & Doubleday, 2007; Olsson, Folke, & Berkes, 2004). In the innovation systems research area (Hood, Coutts, & Hamilton, 2014), relevant to institutional innovation within in agri-ecologies, *organisational groupings* and *innovation partnerships* are commensurate concepts. Finally, in the water governance research area *catchment* based and *integrated* approaches for improved water governance, generally known as Integrated Water Resources Management (IWRM), expose a logic similar to that of the environmental governance research endeavours noted above (Bellamy, Ross, Ewing, & Meppem, 2002; Biswas, 2004; Dinar et al., 2005; Fischhendler & Heikkler, 2010). See Table 1.1.1 for a tabulated summary of this discussion.

What this discussion exposes is that across differentiated research domains within the integrated environmental governance research agenda similar ideas about how to institute integration can be identified (Table 1.1.1). In Australia these ideas have framed environmental governance practices such as the adoption of ICM in the management of Australia's MDB (Bellamy et al., 2002) or the adoption of NRM through national natural resource management strategies (Lane, Robinson, & Taylor, 2009). The research reported here crosses the research divides apparent in previous research, as it examines institutional resilience in varying contexts (Table 1.1.1).

While there has been a sustained, multi-decadal local to global discourse and action that ties environmental crises to attempts to institute integrated solutions, particularly in relation to water governance, fragmentation within environmental and water governance systems persists as a global problem. These observations lead one to the assertion that the interrelated reproduction of crises rhetoric, along with continued integrated and localised responses within the practical contexts of these crises,

identifies the resilience of integration institutions as a worthy research endeavour. Indeed, environmental governance scholars from all the areas mentioned previously (i.e. CPR, SES, NRM and IWRM) generally have found environmental institutions to be highly resistant to change. Environmental institutions, of which integration institutions are a subset, have been found to be "pathologically trapped" (Gunderson & Light, 2006; Holling & Meffe, 1996; Lambin, 2005), "sticky" (Duit & Galaz, 2008: 320; Ekstrom & Young, 2010; Galez, Olsson, Hahn, Folke, & Svedin, 2008: 320; O'Neill et al., 2013; Young, 2010: 379) or "inert" (Bellamy et al., 2002: 33).

Table 1.1.1 Demonstrating consistencies across integrated environmental/water governance research domains and the relationships between each domain and the four cases investigated in this thesis

| Broad Environmental Governance Research Domain | Embedding integration in the local, catchment or community context | Locating the local within a system of interactions that span other levels of social organisation | Identifying which chapters of this thesis are located in which environmental governance research domains. |
|---|---|---|---|
| CPR | Subsidiarity | Polycentric | Nil. |
| NRM | Devolved | Integrated | Chapter 4 examines institutional resilience in a case within Australia's globally recognised environmental governance experiment with NRM theories |
| ICM | Catchment based | Integrated (Basin Wide) | Chapter 3 examines institutional resilience in a case within Australia's globally recognised application of ICM to the governance of the Murray Darling Basin (MDB) |
| Innovation Systems | Organisational Groupings | Innovation Partnerships | Chapter 2 examines institutional resilience in an innovation systems case aimed at the rapid adoption of irrigation knowledge/practices. |
| SES | Localised | Co-managed | Chapter 3 applies those aspects of SES theory that help with explanations of institutional resilience within the Australian application of ICM in the MDB. |

It seems that governance and integration institutions are central constructs that are worth revisiting, both theoretically and practically, so that we can better understand their resilience and engage more critically with widespread implementation of integration initiatives in environmental governing contexts. Others have made a similar call for attention to this topic. For example, the world's water crisis has oft been referred to as a crisis of governance (Edelenbos, Bressers, & Scholten, 2013a; Mollinga, Meinzen-Dick, & Merrey, 2007; Rogers & Hall, 2000; United Nations Educational Scientific and Cultural Orgaanisation, 2006). Yet for these commentators in particular Edelenbos et al. (2013a) and (Mollinga et al., 2007) the "crisis of governance" rhetoric has been used to draw attention to theoretical and practical knowledge gaps. Firstly, the crisis of governance rhetoric is used to highlight a lack of general understanding of the social aspects of water governing and the social production of water outcomes. Secondly, the crisis of water governance rhetoric is also used to signal researchers' opposition to the common application of scientific-technical orientations to problem identification and solution within the water governance research domain. In sum, the extent and type of social science that is brought to bear on the problem is being critiqued by these scholars.

For example, in relation to the critical issue of integrated governing, the authors contributing to Edelenbos, Bressers, & Scholten (2013b) draw from experience across the globe to make a case for understanding the integration context (e.g. water governance) as a "complex and interconnected system" with profound influences on both the way we can study and respond to it. Mollinga et al. (2007) for their part reject what they term an "engineering perspective" within water management reform in the irrigation sector. Drawing from evidence across the canal irrigation sector, yet stating that this is pertinent to the irrigation sector in total, they assert that the main problem with typical engineering approaches are their failure to recognise the inherently political and complicated context (e.g. water governance) in which irrigation sector reform is attempted. Although they do not actually describe water governance as a "complex system" they could be said to be construing it as such by drawing attention to the "complex, non-deterministic and stochastic nature of social organisations" (Mollinga et al., 2007: 704).

What these authors have in common is a perspective, either explicit or implicit, on water governance as *Complex Adaptive Systems* (CAS) (Levin, 1998) of human-

water relations and on how this reality can be engaged with, understood and worked upon. There appears to be something of an emerging common ground in relation to these perspectives, with numerous researchers now arguing for the applicability (increasingly realised) of complexity theory to the field of water governance (Teisman, van Burren, Edelenbos, & Warner, 2013), environmental governance (Olsson, Folke, & Hughes, 2008) and governance within the public management research area (Teisman & Klijn, 2008; Teisman, van Burren, & Gerrits, 2009; Verweij, 2012). This body of scholarship suggests that *water governance* can be thought of as *multi-level and pluralised co-evolving self-organisation that is bounded by the judgments and actions of interacting entities (human and non-human) within contextually specific systems of social and ecological relations*. From this perspective, outcomes such as *institutions*, and in particular *integration institutions*, are the emergent products of interactions between co-evolving, self-organising agents that are continually making judgements about and reacting to evolving situations. As Teisman, Gerrits, and van Burren (2009: 5) state "complex systems must be analysed by studying their self-organising parts as well as their emergent properties that result from their co-evolution".

*Systems*, *co-evolution*, *self-organisation* (Teisman, van Burren, et al., 2009) and *emergence* (Elder-Vass, 2005) are therefore central concepts for a complexity informed framework for the study of governance, institutions and their resistance to change. These concepts are elaborated in turn in the next two sections. For now it is suffice to say that *emergence* refers to the on-going production of patterns in environmental governing contexts, such as institutional arrangements. *Self-organisation* pluralises the production of these emergent patterns and challenges theoretical constructs that work from the premise that the patterns can be easily de-stabilised and re-formed. *Co-evolution* replaces the time-asymmetrical notions of predictive science with recognition of emergent outcomes as inflected by contingency, and with what has come before, and thus displays a degree of arbitrariness. In sum, context and history matter but do not entirely lock in outcomes: CASs over time have an inherent capacity to produce surprising outcomes.

In relation to the specific governance issue of integration institutions some researchers have begun to apply the perspective sketched above. For example, Edelenbos et al. (2013b) develop the idea of *connective capacity* as a term that takes

notions of integration away from a planned intervention that can be rolled out to achieve specified outcomes, and from the idea that there is a known and knowable end point, and that critically engages with integration that is theorised to be the final and always positive solution. Connective capacity to these authors means that integration within complex governance systems needs to be construed as a process as dynamic as the situation itself. This ties in with the idea of *concerted action* (Collins, Blackmore, Morris, & Watson, 2007; Steyaert & Jiggins, 2007) that was developed by the soft systemic theorists involved in supporting social learning within the complex process of water governance in Europe. They employed this term in order to illustrate that integrated action can be thought about metaphorically as an orchestra where everyone is on stage but involvement ebbs and wanes; sometimes it is just the strings and at other times it is the strings with the wind instruments, and at other times there are other combinations. Innovation System scientists, within the agri-ecological knowledge management domain, also think systemically about how knowledge is developed in governance systems. *Synchronisation* theorists (Pel, Verkerk, van Burren, & Edelenbos, 2013; Teisman & Edelenbos, 2011; Verweij, 2012) have developed a theory about how types of concerted action, and propensities for certain types of connective capacity, are produced within given contexts by the selection and modification of boundary judgements and therefore associated recognition of interdependencies.

However, the challenge outlined by the two focusing research questions remains: there is no extant research that addresses in-depth the problem of the resilience to purposeful effort to change, in relation to existing patterns of concerted action and types of connective capacity, despite recurrent interrelated crises and the evident failures of institutional reform efforts. This thesis reports research that addresses the challenge and the research gap. It does so from four contrasting 'entry points' in order to generate different understandings of how to assess contextually bounded institutional arrangements and the sources of their resilience and therefore also the chances that different context relevant intervention approaches might or might not succeed.

This study is one of the first cross-scale cross, cross sector and cross level integration studies in a large environmental governance case context in which people are identifying and using many biophysical and administrative scales and levels (e.g. sub

catchment to basin wide). It is trivial to say that relationships are complex in such a setting. However to accommodate this complexity and develop practical tools is not. The way that I reveal through 4 different windows what the implications of the inherent complexity of these contexts for integrated management of environmental issues are and then develop practical management tools is novel.

This introductory chapter develops the theoretical and methodological choices I made when addressing the problems identified to the ends stated above. First complexity theory and the key concepts applied in this thesis are defined. Next a theoretical framework of institutional resilience is developed, working from the premise that governance systems are CASs. The theoretical framework is followed by an examination of the methodological choices that have been made in the design of the four studies. Next a broad overview of the research is provided. Finally the chapter closes with a summary of the thesis content.

## CHAPTER 1.2 COMPLEXITY THEORY RELEVANT TO THIS THESIS

In the previous discussion I have signalled that I and others think there is merit to applying complexity theory to gain insight into the problem of institutional resilience within environmental governance contexts; and to purposefully engage with this resilience from this different perspective. All complexity theorists are "concerned with how the nature of a system may be characterised with reference to its constituent parts in a non-reductionist manner" (Manson, 2001: 406). Yet complexity theory is not a unified research endeavour, so it is important to first locate my research within this field. Specifically this research builds upon the work of complexity theorists working in the public management domain who identify their work as critical realist (Gerrits, 2008; Gerrits & Verweij, 2013; Teisman, van Burren, et al., 2009; Verweij, 2012). In the next section I elaborate this viewpoint and its implications for research methods and outcomes.

## CHAPTER 1.2.1 WHAT IS COMPLEXITY THEORY

Complexity theory has developed over time, from a viewpoint that sees complexity as a "real, non-constructed, property of the world" (Gerrits & Verweij, 2013: 168). From a critical realist's standpoint the ontological position is that the world *is* complex regardless of people's interactions with and understanding of it (Denzin & Lincoln, 2011), and the epistemological position is that our understandings of this

complexity, indeed where we draw boundaries and the levels of complexity we enage with is a product of social construction.  Below I first elaborate what complexity theorists mean when they say something is inherently complex.

Complexity for complexity theorists is more than something that is difficult to manage or hard to work out.  It means that it confounds our abilities to know that bit of the world that is of interest at a particular moment,  in totality, or to find an enduring single solution to any messy governance problem (Ison, 2010: 4; Newman & Dale, 2005) or its institutional "complexes" (Young, King, & Schroeder, 2008). Foucault (1994b: 81-82) and others (Brady, 2011: 260; Li, 2007: 278) show that once studies of government move beyond governmental texts and arenas they encounter a "*witches brew*" of governing relations and practices.  Indeed Li (2007) adopts the term "*assemblages"* in order to develop governmental theory ethnographically from within the complex, multi-levelled, pluralistic and self-organising context of Indonesian community based forest management.  The term "*wicked problems*", often traced back to Rittel and Webber (1973: 173) also has been widely adopted (Agranoff, 2006: 63; Berkes, 2010: 490; Boully, 2007: 57; Edelenbos, Steijn, & Klijn, 2010: 47; Head & Alford, 2008: 2; Kallis, Kiparsky, & Norgaard, 2009: 636; Ryan, Broderick, Sneddon, & Andrews, 2010) in studies of environmental governance. These terms indicate that the phenomena of interest are the product of many different social and or ecological agents acting together in irreducible ways, which challenges research and management, and complicates the idea that any one solution could be found or would even be desirable.  Klijn (2008: 314) thus concludes that the "conceptual framework of complexity theory is suitable for so-called wicked problems".

For complexity theorists, something identified as complex means that it has the following characteristics:  real world phenomena emerge at the level of irreducible wholes and not through the aggregation of separable parts (Corning, 2002; Goldstein, 1999; Hodgson, 2000); causality is non-linear which means there is always uncertainty surrounding the future nature of current phenomena despite their seemingly intractable historical regularity (van Gils, Gerrits, & Teisman, 2009).  The ability to make predictions about the future of real world phenomena are diminished (Boulton, 2010);   and, research can only ever generate partial, provisional and temporary truths about the world and aspects of it (Byrne, 2005).

In this thesis I operate from the ontological position that the world is a complex adaptive system and that system boundaries are experientially socially constructed through interaction within nested sub systems.   The ontological disposition to view reality in terms of complexity is associated with a particular and consistent epistemology or, understanding of what can be known about the world and how to establish this knowledge. Complexity theorists understand that any form of research involves a reduction of complexity (Cilliers, 2001; Hodgson, 2000; Verweij, 2012), not least because, by definition, complexity confounds our mental and technical capacities to know it in total.  I propose a critical realist perspective that treats systems as both ontological entities and social constructs. By combining complexity theory with a critical realist ontology I put the epistemological focus on the social construction of system boundaries when actors come together with others in attempts to know and influence complex systems.

The way that reality is viewed impacts upon the way we act on it, and this in turn impacts how reality responds or is perceived to be responding. Therefore complexity theorists take care to be explicit and critical of these reducing steps both in theory and practice.  How complexity can be made tractable for research and practice (Ison, 2010) is discussed below.

CHAPTER 1.2.2 SYSTEMS

*The concept of systems*:  Teisman, Gerrits, et al. (2009: 5) notes that when people use the term complexity or add the adjective complex, they are talking about systems. What is a system?  The usual definition of a system is as a set of interacting parts. Backlund (2000) shows that the ambiguity of this definition excludes some systems (i.e. because not all parts are interacting with all other parts in the same way), and allows some situations to be described as systems when they are not (i.e. only a single part of a whole is involved).  But he then cautions that clarity about the types of interactions that constitute a system does not help, as any caveat on relational types soon becomes too restrictive.  He concludes that a system is a system if it satisfies two conditions:

1.      It can be said to have at least two parts

2.      It can be said that the parts identified are connected, although not necessarily through one type or reciprocated types of relations

He goes on to show how general system theory concepts, such as sub-systems and open and closed systems can be accommodated by this definition. For instance, a closed system is a system which has no relation to any other systems and an open system is not a closed system. For the purposes of this thesis, Backlund's (2000: 449) further suggestion is particularly helpful:

> "For any concrete system on earth, there must surely be a set of
>
> relations so that one could claim that everything on earth is related to
>
> at least one element in the system and vice versa, but what relations
>
> are considered depends upon the purpose of considering the system".

The concept of systems in this statement connects the ontological position that the world is a complex system with the epistemological position that the world is a set of nested open systems that we can attempt to understand by experiencing and observing interactions within and between systems over time. This requires critical attention to boundary making as those boundaries we actively assign influence our understanding of how phenomena are produced the potential for certain outcomes to be influenced and therefore the potential for complex situations to be transformed (Checkland, 1985, 1999; Ison, 2010; Ison, Röling, & Watson, 2007). . Byrne (2005: 97) proposes that systems research is based on "the interdisciplinary understanding of reality as composed of complex open systems with emergent properties and transformational potential". These authors (Elder-Vass, 2005; Verweij & Gerrits, 2013) investigate transformational potential of complex systems using the key concepts of co-evolution, non-linear dynamics and self-organisation. In sum complexity theory is founded on the concepts of co-evolution, self-organisation, non-linear dynamics and emergence (Manson, 2001).

CHAPTER 1.2.3 CO-EVOLUTION

The term *co-evolution* has its origins in the biological sciences (Teisman, Gerrits, et al., 2009). It means that systems are viewed as embedded in relations with other systems and as one system changes it influences all the others, such that systems are always in a state of interdependent flux. Co-evolution is used by complexity theorists to draw attention to the contextual and historical influences on complex phenomena with reference both to the physical, human and cognitive dimensions of

systems as well to the constructs about what it might be possible for humans collectively to develop through these interactions within systems over time (Gerrits et al., 2009). This is similar to the concept of "*path dependency*" which is used to describe the production of strong patterns from within CAS that can be related to history and context (Gerrits, 2008; Ryan et al., 2010).

The study of co-evolution requires embedded, historically informed and contextual accounts (Buijs, Eshius, & Byrne, 2009). Methodologically this means that interactions are observed in-situ and over time in order to produce in-depth accounts of the systemic sources of specified aspects of the system in focus. Grounded theoretical case studies, rich comparative case analysis, instrumental case study and ethnography can be considered appropriate methodologies (Buijs et al., 2009; Cresswell, 2013; Stake, 1995; Stark & Torrence, 2004; Verweij, 2012; Yin, 2009). Given the consistent methodological focus on the interactions between agents within systems over time, our attention can now turn to the concept of self-organising as it relates to complexity theory.

CHAPTER 1.2.4 SELF-ORGANISATION

If complex adaptive systems are made up of interactive co-evolving open systems that are themselves made up of interactive parts, then study of those parts and their interactions is important (Teisman, Gerrits, et al., 2009). If co-evolution is the interaction between systems over time then *self-organisation* is the interaction between the parts that make up the co-evolving systems. Self-organisation means that all parts are important to understanding how systems operate and the phenomenon they produce (i.e. structure). Teisman, Gerrits, et al. (2009: 9) say that the concept of self- organisation forces a focus "on how processes come about, develop and change. Processes evolve out of events, actions and interactions and build a structure that can later be defined in terms of inertia, stability, dynamics and vaporization". This understanding means that, from the perspective of complexity, the agency versus structure debate in institutional theory is non-existent (Hodgson, 2006). Agents interact to produce structure and structure interacts with agency to produce agents, in interactive relationships that result in institutional phenomena whose origins cannot be reduced to one or the other but at any time may be stable or unstable. As Teisman and Edelenbos (2011: 105) describe self-organisation is a "multi-sided interactional process" sustained by "several actors partially in charge".

CHAPTER 1.2.5 NON-LINEAR DYNAMICS

The study of dynamics in complexity theory focuses on the continual flux generated by the continual mutual adjusting between self-organising entities within sub-systems and between these sub-systems as they co-evolve over time.  Mutually adjusting and co-evolving entities tend to produce stability at the aggregate level, yet retain the possibility of instabilities at the aggregate level that cannot be traced to a single influencing source.

The concept of *resilience* emerged from the study of interactions within and between nested open social and ecological systems over time (Scoones et al., 2007). Resilience scholars observed that despite the internal dynamic between mutually adjusting agents and co-evolving open nested systems, at the aggregate level these systems maintain consistent sets of cycling emergent properties (Gunderson & Holling, 2002).  However, they also showed that such systems can lose resilience and produce periods of rapid and wide-spread instability, even collapse; this opens space for renewed system adaptations and emergence.

CHAPTER 1.2.6 EMERGENCE

The term emergence itself needs further clarification. It is a key term especially in developing tentative causal explanations within the field of complexity theory. Emergence as a concept has a long history, by some associated with Plato's assertion that "patterns can arise without design" (Boulton, 2010) or Aristotle's "whole before the parts" statements (Corning, 2002; Goldstein, 1999; Phelan, 1999).  Hodgson (2000) locates the concept more recently in Hegel, Marx, Engel, Comte and John Stuart Mill.  Whilst many researchers discuss emergence as a theory of causation, for complex system thinkers (Elder-Vass, 2005; Goldstein, 1999; Verweij & Gerrits, 2013) emergence is ontologically an extension of the idea that the world consists of complexly interrelated systems, in which each open system is both nested within and has nested within it open systems (Byrne, 2005; Gerrits & Verweij, 2013).  The patterns that emerge from the complex relations between nested open systems are contextual; temporal; non-transferrable; irreducible; non-linear; and time-asymmetric. For the purposes of the studies in this thesis, time-asymmetry is an especially significant feature.  If emergence is dependent upon contextually grounded interactions that are continuous and dynamic, then in these contexts "reality is

developmentally open", which means that it "causally un-determines or [is] undetermined by the existing realities of the present and open to contingencies of chance or choice" (Rescher 1995, p. 41). In concrete real world situations the "future consists of a number of possible future states, some more likely than others. The actual state depends upon the past and the occurrence of random or chance events'' (Gerrits & Verweij, 2013: 169). Patterns with these characteristics are known as *emergent patterns*, *properties* or *regularities*.

Some theorists have suggested that emergence is a heuristic device (Verweij, 2012). That is, as complexity theorists interact with the world that they observe, they produce formal frames of meaning about what they are observing that help them to understand what they are observing. Emergence as a concept is thereby the outcome of interactions. For example Collins et al. (2007: 675) define emergence as those "patterns arising from a set of interrelationships between the constituent and diverse elements of a system" that are not "reducible to individual elements". Here it is being made clear that emergence is the outcome of self-organisation. Self organisation is the process and emergence is the outcome. A further complication is that while the study of emergent patterns is achievable in many areas of research, including neural networks, insect colonies and the human brain (Johnson, 2001), systems researchers become divided when they study societal phenomena. Some consider that the concept of emergence adds rigour to the study of social systems and their interactions with the bio-physical world; others consider that such studies remain the poor cousin of positivistic explanations. Systems researchers are also divided between those who consider that emergence relates only to the production of systemically surprising behaviour; and those who consider that it relates to the on-going production of regular systemic behaviour that is sometimes surprising (Elder-Vass, 2005). Asserting that emergence does not imply a "discrete entity or phenomena that can be investigated under a controlled situation" Gerrits and Verweij (2013: 169) argue that none the less emergence serves as "an ontological vehicle for thinking about the nature of causation".

CHAPTER 1.2.7 SUMMARY

In summary complexity theorists construe an inherently complex world as *a series of contextually embedded messes re/created by co-evolving systems of interactive boundary making actors/agents that are characterised by their non-linear and self-*

*organising processes and that produce emergent properties over time.* Complexity researchers dive into the mess in order to experience and observe the interactions over time, the types of outcomes they are producing - and how they are governed.

## CHAPTER 1.3 GOVERNANCE, INTEGRATION INSTITUTIONS AND THEIR RESILIENCE, FROM A COMPLEXITY PERSPECTIVE

In this section I explore how the complexity theory perspectives sketched above can be used to develop theoretical perspectives of governance and integration institutions.

## CHAPTER 1.3.1 GOVERNANCE AS CAS

Complexity theory applied within the environmental governance research domain construes governance in terms of CASs. The basic interactive component of a governance system is the human actor (Verweij, 2012). However, depending upon the boundary judgements made by researchers and/or practitioners ecological entities can be included alongside social actors as interactive components of environmental governance systems (Blackmore, Ison, & Jiggins, 2007; Bodin & Tengo, 2012; Callon, 1986).

Researchers in this tradition argue for greater appreciation of the experiential reality of complexity within environmental governing systems (Berkes, 2006; Bovaird, 2008; Connick & Innes, 2003; Duit & Galaz, 2008; Lubell, Robins, & Wang, 2014). Ryan et al. (2010) and Ison et al. (2007) demonstrate that there is a disjunct between the simplified theoretical perspectives applied by environmental governance researchers and practitioners' experiential reality of complex governance contexts in Australia and Europe respectively. Gunderson and Light (2006) demonstrate the inability of approaches based in other traditions to influence chronic environmental issues, and the centrality of networks of actor interactions to governance outcomes. Teisman et al. (2013), working in the water governance research arena, call for a new scholarship that improves understanding of the fluid networks of actor interactions that are the source of (dis)functionality at the system level.

It is therefore not surprising that social *network analysis* is increasingly being used in governance research (Guerrero, McAllister, & Wilson, 2014; Lubell et al., 2014; McAllister, McCrea, & Lubell, 2014). *Network analysis* offers an opportunity to empirically discover patterns of relations in governance networks and draw

conclusions about these patterns in terms of governance dis-functionality (Bodin & Crona, 2009; Bodin, Crona, & Ernston, 2006; Guerrero, McAllister, Corcoran, & Wilson, 2013). Those who use network analysis in environmental and water governance domains argue that social networks are contextual, historical and change over time. Their research objective is not to develop universally ideal network templates but rather to develop network analysis as a tool able to be used in messy situations to improve understanding of the relationships between emergent network structures and the circumstances that they emerge from, and therefore the outcomes they produce (Bodin & Crona, 2009).

Actors participating in networks within governance contexts locate themselves and each other in different social sectors and different levels of social or ecological organisation. That is actors in governance networks co-create boundaries within and between groups of social and/or ecological entities in their management of complex situations. That is why the networks of actor interactions within environmental governance systems are variously said to be *hybrid* (Teisman et al., 2013) or *plural* (Morrison, 2006) *multi-scale* and *multi-level* (Berkes, 2008; Cash et al., 2006; Gibson, Ostrom, & Ahn, 2000). Which boundaries are being used and maintained is the focus of critical theorists. In fact, for Berkes (2008) increasing attention towards cross scale boundary making is moving common property research towards complexity theory.

I define *hybrid* or *plural* governance systems as systems which are sustained through the interactions of many actors whom locate themselves and others within multiple social sectors including non-governmental, governmental and quasi-governmental (Morrison & Lane, 2006; Teisman et al., 2013). I define *scales* as analytical and practical system boundaries with internal *levels* (Berkes, 2008; Cash et al., 2006; Gibson et al., 2000) that are assigned by those involved in the governing and/or researching of a governance context as they draw lines between open systems from differing viewpoints, such as hydrological or social, and therefore between sets of interactions that they discern to be significant by the recognition of certain relationships, distances and sizes.

Which sectors and which scales and levels that are involved in a given governance system, and how they are involved, is the institutional product of systems of boundary making agents. For now, I take this to mean that which scales, levels and

sectors are included in governance systems, and whichever linkages actors maintain across levels, scales and sectors, is an empirical problem to be determined in the process of research (Verweij, 2012).

When researchers apply a complexity framework of governance they seek to develop modest intervention strategies that are contextually grounded and informed about the processes and products of the governance system of interest. Grindle (2010) argues that the next steps in governance analytics should move beyond the pre-determined and post-assessed development and application of water governing "recipes" (e.g. Integrated Water Resource Management or decentralised Natural Resource Management, for example). For her, what is required is a "muddling through" research praxis that builds knowledge and solutions from within the complex and contextual reality of water governance praxis.

The research reported in this thesis draws these threads together to assess whether a systemic understanding can in fact improve our understanding of the central issue of institutional resilience within environmental governance systems, and in particular the resilience of integration institutions.

## CHAPTER 1.3.2 INSTITUTIONS AS RESILIENT EMERGENT PROPERTIES OF CASS

Generally speaking environmental governance focuses attention on institutions which involves theorising about what institutions are being produced, how they are being produced and how they may be able to be modified (Hall & Taylor, 1996; Woodhill, 2010; Young et al., 2008). Institutional theory is an integral component of governance research. This section, considers what institutions are, how they are produced and how they change, from the perspective of governance as CASs.

Numerous disciplines have contributed to the institutional research endeavour. Hall and Taylor (1996: 936) note that since the early 1960's political sciences have sought to uncover the "role institutions play in the determination of social and political outcomes". Edelenbos (2005) also charts an increase in the use of differing applications of institutional theory in the administrative sciences. From such descriptions (Edelenbos, 2005; Hall & Taylor, 1996) of various approaches I argue that sociological perspectives of institutions are best aligned with complexity frameworks of governance. In calling for a post-institutional turn in environmental

commons research Mehta et al. (2001: 8) argued for ethnographic accounts of institutions that built on new institutional theory by incorporating in analyses 'the dynamic interplay of history, socio-political and economic context, process, practice and agency".

Lammers and Barbour (2006: 358) also demonstrate the consistency of the sociological perspective in communication studies where institutions are thought about as the seemingly "fixed" or "enduring and established" historically contingent attributes of social situations that over time take on a "rule like status". From this perspective institutions can be seen as the observable regular ways of thinking and behaving within social contexts, which are, depending on where the line is being drawn, produced and maintained over time through networks of social **and** ecological interactions.

Woodhill (2010) and Hodgson (2000) reconcile these contributions and complexity theory, to define *institutions* as the emergent properties of governance systems, where governance systems are construed as CASs. For example Woodhill (2010: 53) argues that institutions are the product of "many agents ... acting in parallel, constantly acting and reacting to what other agents are doing". An expanded definition is that *institutions* are the product of complex co-evolving contextually grounded and historically influenced networks of actor interactions. It can be concluded that institutions as co-evolved patterns in thinking and behaving are difficult to change.

Hodgson (2006) takes this point further. Agents interacting within contexts in a historical trajectory produce observable institutional patterns (i.e. structure) that are socially moderated. Yet socially constructed and sanctioned patterns of thinking and behaving constrain and enable action, and therefore influence agents in ways that might lead to resistant or compliant modifications in agency amongst the interacting agents. Modifications in the agency of interacting agents may lead to maintained or renovated structure, in a dynamic that plays out unceasingly over time. However, Hodgson further argues (2006) that scholars have by focusing on formal institutions tended to miss the messy interactive on-going process between informal and formal institutions which also co-evolve over time. By focusing on formal institutions and structure, the genesis of institutional arrangements in agent interaction is overlooked, thereby weakening potential to explain institutional resistance or opening to change.

From a complex systems perspective, it is therefore understandable that much of the institutional scholarship in the environmental governance domain has described institutions as difficult to modify. This issue is significant for environmental governance. Environmental institutions have been described as "pathologically trapped" (Gunderson & Light, 2006; Holling & Meffe, 1996), "sticky" (Duit & Galaz, 2008: 320; Ekstrom & Young, 2010; Galez, Olsson, Hahn, Folke, & Svedin, 2008: 320; O'Neill et al., 2013; Young, 2010: 379) or "inert" (Bellamy et al., 2002: 33). Institutions positioned in the complex co-evolved reality of governance, it is said, rarely produce purposeful change and contribute to the on-going maintenance of the *status quo*.

Resilience theory (Carpenter, Brock, & Hanson, 1999; Walker, Holling, Carpenter, & Kinzig, 2004) offers a useful framework for thinking systemically about the stickiness of institutions and the interactive and therefore dynamic bases of this stickiness (Young, 2010). From a resilience theory perspective sticky or pathologically trapped institutions could be defined as the resilient emergent properties of labile networks of multi-scaled and levelled hybrid networks of actor interactions that sustain governance systems, and that therefore become resistant to change through continual adjusting between the communicating participants of these networks.

If institutions are resilient, than theories of power become important. Power research is focused on how regular ways of thinking and behaving are secured in social settings. Fabinyi et al. (2014) reviewed resilience theory from an anthropological perspective and argued that theories of power could augment its utility in social science domains. Lammers and Barbour (2006) note that Foucault (1973, 1975, 1998) in particular draws attention to the relationships between power and governmental institutions, governmental institutions that he termed governmentalities (Foucault, 1991), that are identifiable in the discursive systems produced by interactive agents in governing settings. This body of work has considerably influenced the studies presented in this thesis and is further explored briefly below.

CHAPTER 1.3.3 GOVERNMENTALITY

Lammers and Barbour (2006) have explored the relationship between sociological institutional theory and Foucault's governmentality work. They find that the two main connections are the social construction of knowledge and practice, and the role of discourse in such social constructivism. If institutions are emergent patterns of thinking and behaving in social settings and emergence is produced by the interactions between the participants in this setting, then it is evident that understanding institutions, how they emerge and how they are sustained indeed requires attention to the interactive discursive construction and maintenance of meaning in social settings.

*Governmentalities* are institutions of governance constituted in the way that government is enacted in governmental discourse and action (Stenson, 2008). *Governmentalities* can be observed in the rationalities (i.e. ways of thinking) and technologies (i.e. ways of acting) of governing actors (Dean, 1999: 36; Rose & Miller, 1992: 172). Governmentalities have been researched by interrogating texts and discourses for answers to the questions of who can govern, how and by whom and to what ends (Agrawal, 2005: 217; Bacchi, 2009; Cheshire, 2006: 26; Foucault, 1998: 137; Rose, O'Malley, & Valverde, 2006: 84-85). More recently anthropologists and ethnographers (Brady, 2011; Brady, 2014; Li, 2007; Stenson, 2008) have studied governmentality by embedding themselves in discourse and practices as it unfolds. According to Clarke (2008) Stenson's (2008) ethnographic application of governmentality analysis prior to the development and use of "tidy policy texts" (Stenson, 2008: 3) enriches "our understandings of governance, policy and practice" (Clarke, 2008: 1).

Foucault used the term *governmentalisation* to describe on-going adaptive practices that actors in governmental settings discursively undertake in order to continually secure patterns of thinking, acting and inter-acting within governing contexts that are somewhat contingent yet never settled (Foucault, 1994a: 220-221). However, as with the ethnographic applications of the governmentality concept, this is an innovative approach to theorizing and researching governmentalities through the incorporation of systemically aligned theories of power.

CHAPTER 1.3.4 POWER

Although the political nature of water governing is established (Mollinga, 2008: 7-10; Woolley & McGinnis, 1999) both governance and institutional research has been criticised as being 'power neutral' and 'apolitical' (Doubleday, 2007; Fabinyi et al., 2014; Mollinga et al., 2007; Torfing, Peters, Pierre, & Sorensen, 2012) by focusing on the tangible and the concrete (Woodhill, 2010).  Power researchers generally are interested in understanding from various perspectives how regularities in thought and action (i.e. institutions) *are* (critically), *can be* (instrumentally) or *should be* (normatively) produced in social contexts.  Foucault added a *radicalised* understanding of power (Cheshire, 2006) that is sketched out below.

Of the two major lineages in contemporary conceptions of power, Hobbes and Machiavelli arguably Hobbes has been the more influential (Clegg, 1989, p. 22).  However, Foucault drew from the interpretive frames and subjectivities of Machiavelli and also Nietzsche (Clegg, 1989).  Foucault pluralised or hybridised the concept of power, as signalled by his famous call for government theorists to cut off the king's head (Cheshire, 2006: 25; Dean, 1999: 25; Foucault & Gordon, 1980: 121; Rose & Miller, 1992: 174).  Foucault located power in everyone rather than in elites; better resourced or located actors; or in the institutions they endorse. He emphasised each individual's 'power to act' as opposed to looking at those who are seen to have 'power over' others (Sawicki, 1991).  In making power a productive, as opposed to a repressive notion, he upended traditional analysis and thereby drew attention to power as an interactional accomplishment between actors.  He also drew attention to the production of knowledge within these interactions, arguing that the limits of possible thought and action are tied to the limits of knowledge and how knowledge can be produced (Gordon, 1980).

His definition of government as the "conduct of conduct" (Foucault, 1994c: 341) is a systemically elegant acknowledgement that governmentalities (i.e. governmental institutions) are constituted in multisided and complexly networked interactions among actors whom serve to moderate each other's conduct.  There are different but interrelated modes of regulation at work here.  Broadly, there is the self-regulation and the regulation of others.  However, the regulation of others encompasses both those others that we seek to influence, and those others that we allow to influence us.  This regulating of selves occurs in webs of relations and therefore cannot be reduced

to individual components. That is, Foucault's understanding of power is systemic in that regularities at the aggregate level are thought to be the product of ongoing irreducible relations between actors seeking to conduct each others' conduct through networks of conduct and counter-conducts. To demonstrate, for example, from his perspective teacher conduct can be thought of as the product of irreducible relations of power, a "witches brew" that involve students, parents, principals, tuckshop assistants, other teachers and governmental officials and so on and so forth. Others too have also noted the systemic thinking in Foucault's work (Rempel, 1996; Scheurick & Mckenzie, 2005).

Agrawal (2005: 255) draws on Foucault to describe power as the interactive use of disciplinary mechanisms by actors interacting within systems of "*subject making*" Here '*subject*' is used with a plural meaning, involving both the subjectivities that are in use and the subjects who are using them. If subject making processes produce how people act and speak and the subjectivities they deploy, then a system of subject making can be read as a system for institutionalizing ways of behaving and thinking in a given situation. Systems of subject making, in this perspective, are driven by three interdependent disciplinary practices (Agrawal, 2005: 315; Foucault, 1994c), known as *dividing*, *self-actualizing* and *knowing practices*. *Dividing practices* include categorization and division of things in conversation (i.e. mad/insane, uniformed/informed, local/national); in diagrams (i.e. map boundaries, flow charts); or physically (e.g. who attends a meeting and who does not) (Bacchi, 2009). *Self-actualizing practices* are speech and behavioral choices made by actors that allow them to be identified as members of certain groups that maintain characteristic divisions and expectations. *Knowing practices* refer to the knowledge that actors bring to a situation when they are involved in dividing and self-actualizing. The power effects of disciplinary relations can be described as the emergent outcomes of the interaction between the categorizing, dividing and self-disciplining practices that polities use to regulate themselves and each other (Agrawal, 2005; Foucault, 1994c; Hacking, 1986; Sawicki, 1991).

In this thesis I draw together these conceptual areas into a framework of governance and institutional resilience grounded in CAS theory that combines the conceptual domains of institutions, governmentality and power (Table 1.3.4.1).

Table 1.3.4.1: Systemic framework of key relationships among the concepts of Institutions, Governmentalities and Power

|  | Emergent patterns in: |
| --- | --- |
| In social systems *Institutions* are: | Thinking and Behaving |
| In those social settings which are governmental, that is in *governance* systems, *Governmentalities* are | Rationalities and Technologies |
| *Power* or subject making systems produce | Subjectivities and Subjects |

The institutions, and related governmentalities and power relations, that are treated in this thesis focus on integration institutions in water governance. In the next section theory about integration institutions is examined.

## CHAPTER 1.3.5 INTEGRATION INSTITUTIONS

*Integration institutions* have a prominent place in environmental governance research and practice. The centrality of integration institutions in environmental governance and practice is evident also in the worldwide research and practices known as *Integrated* catchment based Water Resources Management (Biswas, 2004; Dinar et al., 2005; Fischhendler & Heikkler, 2010) or more broadly *Integrated* regional or devolved Natural Resource Management (INRM) (Lane, Robinson, et al., 2009; Margerum, 1999). The globalised attempt to institute integration exposes the normative goals of global integration initiatives that result in research and practice that retains a presumption that integration is always of positive value. This section will develop a complexity perspective of integration that challenges idealistic and static notions of integration for the explicit purpose of developing research that critically interrogates the resistance of integration institutions to change and therefore develops contextually cognisant diagnosing theories and tools for purposeful action within environmental governing systems in which integration requirements are never settled.

Integration institutional theory and practice generally lacks appreciation of the complexity of the situations within which integration institutions are maintained and where integration initiatives are expected to positively perform (Edelenbos & Teisman, 2011). However, some of those working on the connective capacity of organisational arrangements and networks (drawing on public administration theory), agricultural innovation (drawing on soft systems thinking), and integration efforts in water governance, provide some pointers and tools.

These studies have several viewpoints in common. First, they all start with the recognition that governance systems have competing, fragmenting, and integrating forces that never settle (Fenger & Bekkers, 2012). From this perspective the task is to develop understanding of what type of integration institutions are being supported and to identify opportunities for development of certain capacities to connect over time. Secondly, they recognise that governance systems produce complex institutional arrangements where context and history matter. In sum an integration research endeavour grounded in complex system thinking trades investigations of prescriptions about institutional arrangements and how they can be enacted for always positive outcomes for studies that nullify the divide between theory and practice and that are informed by iterative diagnosis, assessment and adaptation (Collins & Ison, 2010; Steyaert & Jiggins, 2007; Teisman, Gerrits, et al., 2009).

Here Edelenbos et al. (2013a: 7), definition of *connective capacity* as the connective institutions that actors produce in governmental or social contexts is appropriate. For example this allows integration to be construed as those institutions which can be identified in the patterns that actors within certain contexts produce when they keep or cross boundaries (i.e. political, scalar, and philosophical) when they link with others. Biswas (2004) acknowledges that water governance research has involved the study of one or more combinations of 35 boundaries crossed or linked by actors in dynamic relationships. Bekkers and Fenger (2012) consider fragmentation of actors, resources, policy processes, and governmental layers and across the public and private divide. Hence, integration institutions in any situation, like sectors, scales and the types of interaction between them, are not pre-determined and require diagnosis (Collins & Ison, 2010; Steyaert & Jiggins, 2007; Young, 2008). In Fact Collins and Ison (2010: 671) see integrated catchment managing "not as a predetermined notion or thing, but something which arises out of a set of practices for managing catchments in particular contexts". The next section demonstrates how the preceding sections have been brought together to develop an overall CAS framework for the study of governance and integration institutions.

CHAPTER 1.3.6 THEORETICAL FRAMEWORK

In the research reported here, environmental and water governance systems are viewed as CASs. Governance systems are sustained by the interactions between actors embedded in contexts that have specific histories. They locate themselves

within various social sectors and on multiple social and ecological scales and levels in relation to endemic environmental governing issues.

Complexity theory applied in water governance research seeks understanding of the fluid, adaptive hybrid networks of multi-scale and multi-level actor interactions that sustain dis/functional governance outcomes. Institutions are the emergent product of these co-evolving systems and display characteristics which are highly resilient to change. Governmentalities are governmental institutions which are discernible in the boundaries identified within the responses made by actors when they answer questions of what's the problem, how can it be governed by whom and to what ends in governance arrangements. Examination through a Foucauldian lens of relations of power in the fluid hybrid networks of actor interactions can shed light on how none the less purposeful change might be brought about.

Both qualitative and quantitative diagnoses and tools can be applied in research and practice to develop understanding of connective institutions and their resilience. Relevant tools encompass both practical and conceptual designs. Both are explored and applied in the studies in this thesis.

In summary, one of the strengths of this thesis is that combines through a complex systems perspective of governance and institutions several key social research domains as demonstrated by Table 1.3.4.1 on page 25. As summarised in Table 1.3.6.1 applications of the complex systems thinking concepts of emergence and self-organisation illuminates similarities across these conceptual domains and draws together a range of previously separated research projects such as synchronisation and emergence (Chapter 4), network theory and emergence (Chapter 3), emergence and power (Chapter 5) to better understand institutional resilience.

CHAPTER 1.4 METHODOLOGICAL CHOICES AND METHODS

My proposed theoretical framework of governance, integration institutions and their resilience necessarily influences my methodological choices. The data collection and analysis methods I select and apply need to be epistemologically consistent with my proposed research framework and be able to produce research that others can use with confidence (i.e. be credible, valid and reliable).

Table 1.3.6.1 Theoretical and methodological choices within each chapter

| Ch. | Broad thesis | Case Specific Integrated Environmental Governance Research Domain | Question Specific Research Domains | Case and Question Specific Method Choices |
|---|---|---|---|---|
| 2 | CAS framework of Governance, Institutions, Integration and Power | A project to drive innovation through an Environmental Innovation Partnership, Organisational Groupings and Innovation Brokers | Diagnostics -What Institutions are produced: Evaluate results of a of project aimed at driving innovation (i.e. institutional change) in a system using the incremental and revolutionary change framework | Case Study Action Research |
| 3 | | Australia's MDB has been described as an exemplary practical application of ICM/IWRM theories in practice. Examines 2010 reforms. | Diagnostics – What Institutions are Being produced: Assesses the institutional products of the initial phases of a reform program: Integrating CAS, SES and Network Analysis Theories | Case Study data collection methods and Network Analysis of data collected |
| 4 | | A project aimed at improving integration within Australia's practical application of NRM theories. | Diagnostics – Why institutions are being produced: The Synchronisation framework is used as a focusing tool on those rationalities that are relevant to which integration institutions are being produced within the case | Case Study, Reflexive Ethnography, Discourse Analysis |
| 5 | | Examines the development of a new industry within a catchment within Australia where relevant policies espouse ESD | Diagnostics – How Institutions are being produced: The systemic thinking in Foucault's government, governmentality and power perspectives are deployed to show how power works in institutional resilience within the case | Case Study. Ethnography, Discourse Analysis |

Tracy (2010) provided a model for addressing the ethical issues associated with protecting the situational and interpersonal vulnerabilities of the participants were protected, and SO THAT THOSE WHO MIGHT USE THE OUTCOMES OF THIS RESEARCH, CAN DO SO WITH CONFIDENCE. Like Beatriz and de Oca Barrera (2016), and LeCompte (1987) I am reflexive in my analysis by being openly critical of my own boundary making and biases . I elaborate on my use of LeCompte's approach in chapter 6.

In Chapter 3 I elaborate on my emergent, iterative, mixed method process approach to data collection. . These  approaches to data collection and analysis are ontologically and epistemologically consistent with my research frame and are flexible enough to respond to the interactions between research and practice.   While specific details of my approach to data collection and analysis emerged as the research unfolded, several overarching requirements  constrained the selection of methods.

Firstly data collection methods that allow the researcher to be necessarily placed within complexity were required.  Ethnography and participatory action research accommodate complexity by being immersed within it.   Both of these approaches to data collection provide for myself as the researcher being located within the complex interactions of interest, and allow me to generate embedded and descriptive accounts of interactive phenomena as they unfold and therefore able to provide me the researcher the freedom to move between observation, actor engagement, documentation (using a mix of techniques), 'engaged listening' (Paechter, 2013: 73), and informal and formal interview (Perakyla & Ruusuvuori, 2011). In addition, in keeping with the needs for analysing self-organisation by collecting data about the selection and maintenance of boundaries within dispersed systems of decision making, I employed "yo-yo field work" (Wulff, 2002) or "multi-scaled" and "multi-sited" ethnographies (Clarke, 2008), in which several different geographically dispersed locations were repeatedly visited over short and longer intervals.

Secondly data analysis methods are required which allow for patterns in meaning making amongst interacting actors within specific contexts over time.   Meeting these requirements the data analysis methods that have been used in this research, as discussed in chapter(s) 2,3,4 and 5, were able to recognise the patterns in the ethnographic data (i.e. discourse analysis  in chapters 4 and 5, social network analysis in chapter3). Discourse analysis was carried out manually, using protocols

described by Attar and Genus (2014) that interrogated talk and texts for patterns in words, phrases, themes and discursive exchanges. Network analysis was performed by applying the protocols outlined by Robins, Pattison, Kalish, and Lusher (2007) and Robins and Morris (2007).

Lastly, methods that support me to challenge my own meaning making as the research unfolds are also required. Therefore in the sub section below that is titled worthy topic and significant contribution I reflect upon how I chose this research topic and relevant biographical biases (LeCompte, 1987; Beatriz & de Oca Barrera, 2016). I also reflect on how these choices and biographical factors interacted with my research and my reporting in Chapter 6.5. In the next section I will detail how I plan to maintain the quality of my research product.

CHAPTER 1.5 QUALITY RESEARCH

In any purposeful research the researcher must consider the reasons why their research is worthy of others' attention (Tracey, 2010). Put another way, how confident am I that others or I can act on the research I am reporting in this thesis? This question especially applies in complexity studies that acknowledge at the outset that all representations are an approximation and therefore that there is always a level of uncertainty in the results.

Guba (1981) argues that criteria for research quality are needed that are relevant to the approach taken and theoretical framing of the research. For Tracy (2010: 839) these criteria are "(a) worthy topic, (b) rich rigor, (c) sincerity, (d) credibility, (e) resonance, (f) significant contribution, (g) ethics and (h) meaningful coherence". These can be collapsed further into four groupings: Worthy Topic and Significant Contribution; Rich Rigor and Meaningful Coherence; Credibility and Resonance; Sincerity and Ethics. The paragraphs that follow show how these criteria were realised in this thesis.

*Worthy topic and significant contribution:* According to Tracy (2010) a topic that is personal and/or politically relevant or has the potential to revise current theories is a worthy topic. Of these, the critical ingredient is that the topic is personally meaningful to the researcher. The research reported here grew out of the convergence of several personal and professional experiences. Prior to the initiation of this thesis I had spent several years working on the front line in agricultural water

policy development and implementation and had developed a series of theoretical and practical interests in water governance research. I was especially interested in the observed inability of environmental and water governance systems to transform themselves, despite the presence of well resourced, long term, rhetorically revolutionary programs for purposeful change that I myself had been a part of. These programs included Australia's experiments with decentralized Natural Resource Management (Lane, Robinson, et al., 2009) and Integrated Catchment Management in the Murray Darling Basin (Bellamy et al., 2002; Connell, 2007).

This experience provided a research focus drawn from practice that did not seem to be the subject of existing literature. I discovered that there were several components to this omission from the literature, such as an absence of complex systems thinking framework and a lack of recognition of the how these programs are imbued with power and therefore the role of power in program design and outcomes. However, these discoveries were made because of my problem framings that are influenced by my world views and practical experiences which have implications for the type of research I can do. Antecedent frameworks and biases include systems thinking; a deep ecological view of human-environment relations; and a view that integration is highly critical to environmental governance outcomes.

Firstly, as defined by Ison (2010) I am a systems thinker. I see even the most simplest of scenarios as embedded in interconnected relations of global reach. I am the ultimate "butterfly effect" proponent and subscribe to Fichte's (1848, p. 25) view that "you could not remove a single grain of sand from its place without thereby ... changing something throughout the parts of the immeasurable whole". As a systems thinker it is consistent that I would have a have a deep ecological (Capra, 1996) viewpoint of human-environment relationships. That is I see humans as connected to each other and their local environments and I see these localised human-environment relations as connected to others throughout the globe. Therefore I think that the way that people communicate and collaborate as they attempt to manage these systems is most critical to human survival. In sum, how people integrate in environmental governance systems understood as complex, multi-scaled and levelled systems is central to the types of environmental and social outcomes that such systems produce. I reflect upon these antecedent problem framings and my final research product in section 6.5.

*Rich rigour and meaningful coherence:* Research rigour and coherence is best managed by ensuring there are consistencies between and within the components of the overall research design, and by applying a mix of research methods appropriate to the theoretical framework, issues and context (Tracy, 2010). Component studies also can be judged by the level of consistency in these respects. Transparent care has been taken in the empirical studies presented in this thesis to meet these criteria.

Buijs et al. (2009) discuss how to develop complexity research that is epistemologically consistent. They set out three broad guidelines, and then add extra guidelines related to the object of the study. In general they propose that contextually cognisant, modest and mixed methods are required. By contextually cognisant they mean that the complexity scientist is required 'to be present' as things are developing in the given socio-physical context, accompanying people through the situation as it unfolds (Checkland, 1981; Verweij, 2012). This does not mean that cases cannot be compared. On the contrary, when resources allow, rich comparative case study is encouraged, with the contextual implications embedded in the resulting account (Gerrits & Verweij, 2013). In terms of mixed methods, they recommend that in order to generate an authentic account of complexity the researcher use various methods simultaneously and over time.

*Credibility and resonance:* A research is said to be credible if it enables people to act on its findings. Tracy (2010: 843-844) and Denzin and Lincoln (2011: 6) argue that researchers can build credibility through crystallisation. Crystallisation is the application of combinations of differing frameworks, methods and representations to achieve "more complex, in-depth, but still thoroughly partial, understanding" (Tracy, 2010: 844) of issues. As a an interpretive and methodological 'bricoleur' (Denzin & Lincoln, 2011: 4) I achieved crystallisation in the studies reported here through theoretically and methodologically plural framing, investigating and representing of institutional resilience. I borrowed from and augmented several research frames to achieve a deeper understanding of institutional stickiness. I used "member reflections" (Tracy, 2010: 844) in which actors in the study situation were invited to reflect on their experiences, and my interim findings and interpretations, to provide space for multiple voices and perspectives, in an inclusive fashion. The member reflections also proved valuable in terms of assessing how well the researching process and interim findings resonated with those in the same experiential situation.

*Ethical and sincere research practice:* Tracy (2010: 846-848) asserts that research should meet ethical criteria across the four categories of procedural ethics, situational ethics, relational ethics and exiting ethics. I received official ethical clearance for my proposed methods of data collection, storage, analysis and reporting from the University of Queensland Ethics committee. This clearance extended across the areas of achieving informed consent that can be revoked at any time through the use of forms to be cleared by participants during participant observations and interviews; maintaining participant confidentiality through full de-identification of participants; ensuring the data was kept in a safe place and making sure that my methods were culturally sensitive. This clearance deemed my proposed methods for gaining informed consent, maintaining confidentiality, collecting data, storing data, and re-presenting data were procedurally ethical.

Concern for procedural ethics is not sufficient, however, because they do not cover the requirements for situational ethics (Ellis et al., 2008) that arise in context-related action (Ison, 2010: 245). The situational ethical researcher throughout reflects critically on his or her own practice, and is prepared to adjust and revise researching practices and methods in the light of experience and subject's responses. As discussed in Chapter 6, I made several revisions in the course of my studies in relation to methods of data collection and how I represented the research.

Relational ethics refers to researchers' conduct in relation to others. Interpersonal relationships between researcher, researched, academia and funding organisations are relationally ethical if they are grounded in mutual care, dignity and respect. Exiting ethics relates to how researchers finish the data collection process and then go about presenting the results. The main role of the researcher in this process is to ensure that as much as they can the data is not presented in a way that may render informants or populations vulnerable. I have consciously endeavoured to be ethical at all times.

CHAPTER 1.6 RESEARCH AIMS

Globally a world water crisis coupled with a crisis of water governance is observed in both the relevant practical and theoretical texts and relevant contexts. The same could be said broadly for environmental commons and environmental governing systems in general. In the nexus between developments and responses within

catchments throughout the globe there has been a continued attention to and application of integrated catchment based governing solutions. Yet the continued call for action and continued application of the same types of responses highlights what institutional theorists have observed to be the propensity to produce pathologically trapped institutional arrangements in environmental and water governing contexts. These three interrelated sets of observations interact to produce what some bio-physical and social scientists have shown to be a failure of integrated catchment based governing. In this thesis I explore how the application of complexity theory within a catchment governance context may help to elucidate how failures to transform integration institutions are being produced.

Prior to initiating this study I had undertaken several roles within water and environmental governance contexts within Australia. Australia has been internationally lauded for both its water and broader environmental management approaches. In the roles that I had I observed and was a part of this continual effort to deploy integration approaches alongside a continual political and scientific rhetoric of less than optimal outcomes for water commons. This issue of problematic persistence of a set of crises within dynamic complex human-water systems whilst much effort and resources are being deployed there led to the development of my research questions (See page 1). In the next section I discuss how this document is structured and how chapters contribute to the achievement of my research aim and answer my research questions.

CHAPTER 1.7 STRUCTURE OF THESIS

This thesis is structured as follows. Following this introductory chapter, the contents of Chapters 2 through to 5 re-present four journal articles which have either been published (Hood et al., 2014), have been submitted to journals and are currently under review (Chapters 3 and 4) or have been prepared for a journal submission (Chapter 5). The four papers provide the results of geographically and temporally connected studies that were carried out between 2007 and 2011 in order to generate insights into the resilience of integration institutions from within Condamine catchment water and environmental governance system. The Condamine catchment is the headwaters catchment of the MDB and is located in the south east corner of the Australian state of Queensland (Figure 3.5.2).

Chapter 2: 'Analysis of the role of an innovation broker appointed by a cotton industry environmental innovation partnership in Queensland Australia' (Hood et al., 2014)[1], sets the scene for the subsequent papers. It is written from my perspective as the facilitator, or *Innovation Broker* (Koutsouris, 2012), within a project seeking to drive water management innovation through the integration of environmental knowledge within the Condamine catchment's cotton farming knowledge system. It is a reflexive piece that examines the ability of actors in the knowledge system to achieve incremental or revolutionary innovation in the Condamine catchment's cotton industry. It shows that rapid incremental change was achieved but that the resilience of existing boundaries around who can be connected in the knowledge system and how ensures that revolutionary changes were highly unlikely. The unlikelihood of institutional change is found to be further consolidated by the short time frame of the project (one year) and its inability to actualise the project's system thinking rhetoric. Short intervention projects not grounded in systems thinking are endemic in environmental governance contexts throughout the world. A key finding of this study is that social network analysis may be an effective tool for empirically and visually diagnosing connection patterns that are the object of such initiatives, and that this tool helps those responsible for effecting change to better understand what needs to change, and to assess how the system is changing over time.

Chapter 3: "Network analysis of cross scale integration institutions within a case study of a complex adaptive water governance system'[2], takes up the finding of Chapter 2 that network analysis be used to diagnose institutional arrangements. It presents a network analysis of the multi-scale and multi-level connections that participants - who locate themselves within a range of sectors within the Condamine catchment water governance system - are making during 2010. It reveals how the Murray Darling Basin (MDB), in which the Condamine catchment is located, in 2010 was experiencing the fourth attempt to renovate patterns of connectivity. It shows that the connection patterns identified at this time provide insight into how interactions are maintained, to block or promote purposeful change. This study

---

[1] Published in the 'Outlook on Agriculture' journal, September 2014.
[2] Submitted to the journal 'Ecology and Society' and is under review.

concludes that it is highly unlikely that this fourth phase will be any more successful than the previous three.

Chapter 4: 'Application of the synchronisation framework within an Australian environmental integration initiative'[3], re-orients the view of integration institutions that is applied in the previous two chapters. Chapters 1 and 2 are descriptive and empirical accounts of the interacting actors and contexts in which institutional change is being sought and of the behaviours of these integration institutions. Chapter 4 instead seeks to develop the synchronisation theoretical framework of integration as a practical tool for diagnosing the rationalities of the integration institutions, in the context of Queensland's environmental integrated governance system in which the Condamine catchment is located. The use of the synchronisation framework reveals that it is the boundaries and interdependencies that actors chose to recognise and maintain that drive the integration institutions that are produced in this context.

Chapter 5: 'A Foucauldian illumination of institutional resilience within an Australian water governance system'[4], turns the perspective on integration institutions again. Across the preceding three chapters it is evident that the integration institutions studied are sticky and that the projects that have been initiated to renovate them have produced only incremental changes within antecedent boundaries. It is predicted that institutional renovation will be highly unlikely. Where Chapter 4 focuses on why such regularities are maintained, Chapter 5 focuses on how these regularities are maintained. It does so by applying a Foucauldian framework of power in the context of a rapidly developing mining industry in an economically high value irrigated agricultural setting. Located within the Condamine catchment, the mining industry is both setting at odds established interactive relations and reinforcing defence of existing rationalities for action and boundary maintenance. It is concluded that in this situation there is little that supports achievement of the espoused goal of the institutional integration that would be necessary for Ecological Sustainable Development.

---

[3] Submitted to the 'International Journal of Water Governance' and is under review.
[4] Written for submission to the 'International Journal of Water Governance'.

In Chapter 6: 'Discussion and Conclusion', the results of the studies are summarised and synthesised, and discussed in the light of the two research questions that were set for this thesis. The synthesis outlines the scope for purposeful change through institutional integration, the processes which might advance this goal, and the reasons why facilitating the renovation of integration institutions will continue to be a difficult and often disappointing task.

CHAPTER 2 ANALYSIS OF THE ROLE OF AN INNOVATION BROKER
APPOINTED BY A COTTON INDUSTRY ENVIRONMENTAL INNOVATION
PARTNERSHIP IN QUEENSLAND, AUSTRALIA[5]

CHAPTER 2.1 ABSTRACT

The outcomes of agricultural innovation systems can be viewed as the emergent
product of multiple interacting, multilevel, concomitant initiatives of diverse
duration. The new language of environmental innovation partnerships,
organizational groups and innovation brokers (IBs) engages with this perspective. In
the cotton farming systems case analysed here, the participants developed what could
be considered to be an innovation partnership, stimulated by an agri-environmental
incentive scheme that supported on-farm implementation of environmentally
sensitized irrigation practices within a catchment. The participants pooled their
resources and appointed a short-term IB to facilitate the 'purchase of knowledge' by
local irrigators and their agronomic advisers, relevant to their self-identified
irrigation knowledge needs. The IB also facilitated linkages among the partners'
various irrigation, water, cotton and catchment initiatives. The partners hypothesized
that new or modified organizational groupings would emerge and that system-wide
practice changes would result, and that if the new organizational arrangements could
be sustained post-project, a legacy of ongoing capability for systemic change could
be achieved. This research shows that the short term objectives were met, but the
expected post-project legacy did not emerge. The paper discusses the implications
for innovation brokerage and evaluation of such partnerships.

CHAPTER 2.2 INTRODUCTION

Reviews of policy documents relevant to agriculture by Hermans et al (2011) and
Campbell (2006) reveal the complexity of agricultural innovation. On both
continents, agri-environmental outcomes can be viewed as the product of interacting,
plural (governmental, quasigovernmental, non-governmental) and multilevel (local,
state, federal) initiatives of varying duration. We define agri-environments as soft
systems (Ison et al, 2007; 202; Steyaert and Jiggins, 2007; Ison, 2010) whose

boundaries are (re-)constructed in purposeful multilevel interaction with agriculturally relevant ecologies.

Since the 1990s, systems researchers have developed intervention and innovation theories that utilize this perspective (Klerkx et al, 2012) and these over time have begun to inform agricultural policies and their implementation (ibid, p 54), such as the EU's Agricultural Environmental Innovation Policy (EIP-Agri; see EU, 2013). The kinds of innovation sought by the EIP-Agri 'goes beyond speeding up the transfer from laboratory to practice (referred to as the linear innovation model)' by seeking a more 'interactive innovation model' (EU, 2013). The EIP-Agri thus supports the development of organizational groupings (OGs) and the deployment of innovation brokers (IBs) to facilitate network linkages and organizational rearrangements that build ongoing societal capacity for innovation that 'will bring together farmers, researchers, advisers, businesses, NGOs and other actors to implement innovation projects pursuing the objectives of the EIP-Agri' (EU, 2013). IBs are defined as individuals who act as the 'go-between, discovering innovative ideas, connecting partners, finding funding sources and preparing project proposals. Ideally, IBs should have a good connection to and a thorough understanding of the agricultural world as well as well-developed communication skills for interfacing and animating.' (EU, 2013; Koutsouris, 2012). The systems perspective adopted in this model explicitly recognizes the importance of complex spatial and temporal contexts and actor relationships for innovation.

Research that helps us to understand this way of framing innovation processes better is overdue (IFSA, 2013). We analyse here the case of induced innovation in cotton farming systems in Queensland driven by a short-term initiative developed by a multilevel environmental innovation partnership (EIP) that aimed to assist actors in the irrigated cotton value chain in one catchment to shift to ecologically sensitized management.

CHAPTER 2.3 METHODOLOGY

Our research is grounded in a view of social phenomena as emergent systemic properties of irreducible sets of context-specific social variables in interdependent interaction (Yin, 2009; Stake, 1995). The context addressed here is an irrigated cotton catchment. The lead author of this paper acted 'within the case' (Robson, 2002, p 317) as the IB; the data for our analysis draw on the research activities

carried out in performance of this role, and include: (i) field notes, documented for the purposes of reflexive managing and reporting; (ii), participatory action research (Dick, 1993); (iii) individual and group farm visits, at which participants presented their own knowledge development plans (including training and service certification, requests for specific advice); (iv) written reports and multi-media publications generated by the various partners; (v) external evaluations; and (vi) unstructured interviews (Robson, 2002, p. 270) carried out by the IB with each participating grower and agronomic consultant at the end of the project. The second and third authors acted throughout as mentors to the IB, and in doing so, supported her reflexive praxis. They also took various reporting and evaluation roles within two of the partner organizations. In the next section, we re-present this body of data as a rich description, within Stake's (1995) framework for representation of case research.

CHAPTER 2.4 THE CASE

CHAPTER 2.4.1 ENTRY VIGNETTE

This section describes the agri-environmental context of the case, constituted geographically and socially in the water interactions of the cotton catchment and bounded temporally by a short-term (one-year) initiative that aimed to drive innovation. When the initiative was being designed, the consultant–farmer interface was identified as key to the knowledge system of the cotton industry (Callan et al, 2004). Several ongoing projects aimed to enhance knowledge development through support to the quality of this relationship; this involved reassigning the roles of private agronomic advisers and public extension agencies and changing the way that the cotton industry interacted with water resources in general.

It was in this context that, with hindsight, what could be considered a multilevel environmental innovation partnership (EIP) began operating (akin to the types of European Innovation Partnerships that are currently expected to develop under the EIP-Agri programme for sustainable agriculture in EU member states). The intention was to develop an organizational grouping of actors that included farmers and their agronomic advisers, as well as other actors in various levels of governance and administration in the cotton value chain and in water management. To ensure that the process of knowledge development by these organizations was coherent and structured, participatory action research (PAR) was built into the project milestones.

One of the partners was already operating an agri-environmental incentive (AEI) scheme that aimed to stimulate adoption of improved on-farm practices to deliver public outcomes, including clean water, improved soil management and increased biodiversity. Previous research had shown that such incentive schemes could stimulate the rate and reach of adoption of practices that provide such public goods (Coutts and Samson, 2008). The EIP decided to augment and redirect the funds available under the incentive scheme to fill self-identified knowledge gaps (rather than invest in delivery of predetermined 'best practices' and infrastructural changes). This was a novel departure from standard operating procedure at the time. Building on evidence from studies of 'research pull' (as opposed to 'research push') projects (see Klerkx et al, 2012 for use of this terminology) and evidence of increased rates and reach of adoption of innovations under agri-environmental incentive schemes (Coutts and Samson, 2008), the EIP reasoned that new cross-level, cross-sector organizational arrangements would deliver rapid innovation that was more likely to be sustained. To increase further the likelihood that knowledge development would be rapid and sustainable, the EIP decided to secure a facilitator who could support the organizational actors to identify their knowledge needs, facilitate rapid linkages between these organizations and other actors, encourage novelty in solution finding and administer project delivery in the one-year time frame.

CHAPTER 2.4.2 IDENTIFYING AND FRAMING ISSUES

What design attributes were of mutual interest and how could these be researched and evaluated? The main design features were the appointment of an IB, the deployment of the IB to facilitate PAR, research pull coordinated by the organizational grouping, and financial incentives to drive 'soft' knowledge development. The main process features were, following Klerkx et al (2012), articulation of problems and possibilities, network building and supporting negotiation and learning networks. It was expected that these process roles would be performed by the partners and facilitated by the IB.

This design posed a challenge to evaluators. In an era of privatization, dis-investment in public delivery of services in agriculture, specialization and fragmentation of extension services, such short-term interventions in complex contexts are widespread. Our case offered an opportunity to evaluate the application of innovation system theory in practice. Brunori et al (2013) suggest that innovation can be evaluated in relation to its ambition level, from incremental to revolutionary.

Incremental innovation is observed when something is being done differently. Revolutionary innovation is observed in a complete restructuring of the arrangements for knowledge development and application (Steyaert and Jiggins, 2007; Hounkonnou et al, 2012). How issues and solutions are identified and framed by participants, it is suggested in this paper, can thus be considered by evaluators as key indicators of the degree and ambition level of innovation.

CHAPTER 2.4.3 FINDINGS AND REFLECTIONS

(i) Facilitation of learning. The project achieved the organizational participation and adoption targets that the partners had articulated at the outset of the project (Hood, 2008). This included 25% of the agronomic advisers of cotton growers within the case catchment participating in the project. The advisers partnered with farmer clients, who together managed 31% of the agricultural area in the catchment and approximately 10% of groundwater resources used each year for agriculture. The new knowledge generated by these adviser–farmer relationships was valued at Aus$130,000, resulting in Aus$390,000 worth of new infrastructure and on-farm works that together saved 700 megalitres of water a year by preventing or reducing seepage and evaporation.

Compared with previous adoption rates, the uptake of the various measures that generated these outcomes was rapid and widespread, and therefore seen as an indicator of successful project delivery. However, the partners were less certain about the longer-term impacts. For instance, although the growers' investments in water-saving measures continued without further co-investment from the organizational partners, it was found that the growers' investments would not continue post-project. The post project development of additional water-saving measures, skills and knowledge was deemed unlikely by the participating growers and agronomists.

The project proposal had stipulated that the IB should utilize PAR to structure the joint learning process, supported by the delivery of monetary incentives (CCCCRC, 2007, p. 3). The IB's field notes document the difficulties. The process of facilitating the members of a new OG through iterative cycles of joint learning was structured sequentially, from problem identification, research design, implementation, observation, reflection and through to re-identification of emergent problems. The experience in practice, however, became a process of supporting the reflexive praxis of each actor. Diagrammatically, this approach would resemble a

mess of learning cycles of varying membership, which sometimes operated in isolation, were sometimes stagnant, sometimes hidden, and at other times converging or diverging (King, 2000).

From the post-project interviews with consultants and growers, along with an external evaluation of the project (Coutts, 2008b), it was evident that this approach to PAR was a key factor in the project's success. As one agronomic consultant stated, 'It is important to be in a group and talk about things and learn in a group actually doing stuff as you go. The fact that we planned stuff, went out and did it and then were able to talk about our experiences was really helpful' (Hood, 2008, p. 23). However, the results also show that although the PAR process effectively coordinated rapid knowledge development among all project participants, growers' and advisers' motivation to participate was clearly stimulated by the monetary incentives, although there were differences in how they used the incentives available. For growers, the incentives were a major factor in their participation, with one stating 'I would not have paid for it'. The consultants agreed that the incentives were 'most helpful' in engaging their grower clients. One said, 'Incentives helped get a few guys who probably would not have done it otherwise,' and another, 'Economic investment helped in selling it to clients'. We thus consider that both the PAR and the incentives were critical to the degree of engagement, learning, adoption, dis-adoption and non-adoption that were documented. However, as the next section shows, the facilitation and mobilization of linkages within knowledge networks were also considered an important factor, although our data show that these linkages can be read as an indicator of the limits to achieving sustained 'revolutionary' innovation in short time frames.

(ii) Network building.

There was a strong emphasis in the project proposal on the development and consolidation of partnerships to facilitate immediate and ongoing co-innovation (CCCCRC, 2007). Specifically, the project sought to support the creation of new networks or new links in existing networks to increase the connectivity between the cotton industry and environmental organizations, as well as among the independent agronomic advisers, which could be sustained post-project. According to one agronomist, the project 'has given us another network to consult with' (Coutts, 2008a). Another commented, 'It was good to be able to work in small groups. It gave us one on one time and the opportunity to access information from researchers'

(Coutts, 2008a). That is, it was the working together in a joint activity that 'forged the links'. Examples of new network linkages include those between researchers funded by the cotton industry who discovered mutual research interests with the agronomic consultants and growers, and between irrigation engineers who were linked to the Cotton Collaborative Research Consortium partners and who had previously worked with a few agronomic advisers in the catchment, who became linked into the wider network that developed among the agronomists and the farmers involved in this project.

When we investigated more closely the relationships that were quickly operationalized through facilitation of networking, stimulated by the PAR-identified knowledge needs and the provision of monetary incentives, we found that the adviser–grower linkages that were made within the catchment served to reorganize the relevant parts of the long-standing cotton research, development and extension network, more than drawing in the project participants positioned in networks external to the field situation and this triad of interests. The insularity (or relative autonomy) of established networks and networking was highlighted in an industry publication (QG, 2009) by a consultant: 'it was really good to be part of a team of interested consultants, extension personnel and researchers to address these issues together'. This triad is historically at the centre of knowledge development in the Australian cotton industry and notably does not include the environmental organizations that in turn have developed their own network links and relationships. In social capital terminology, the relationships made were more bonding than bridging or linking types (Pretty, 2003).

Regardless of the type of connections made, the networks that were created in this project were not sustained post-project. The agronomic consultants in the final stages of the project did consider the merit of post-project collaboration. They requested that an economist, whose services had been built into project delivery by the EIP, should assess the cost–benefit of various options for new business delivery. The options included a group or one consultant developing specialist irrigation and environmental advisory service and the others utilizing this service with their own clients; developing partnerships with existing specialist consultant advisory services; or offering new environmental advisory services on an individual basis. Following these deliberations, it was decided that 'business as usual' was sufficient: that is, the

services they currently delivered had been enhanced by their participation, and individual or collaborative business development of new service areas was not feasible. The economics of delivery and lack of evidence of clients' willingness to demand and pay for such services were the main determinants. The IB's own reflections based on her experience led to these inferences:

• The bridging and linking relations (with other industries or interest groups) were not immediately (short-term) identified as relevant to agronomist–farmer knowledge needs.

• The ease with which new connections were made was related to the professional relationships the IB had already established with advisers and growers, with other actors in the cotton industry and in the social life of the catchment. The positive side of the 'bonding networks' is that they allowed rapid incremental innovation.

• However, as Pretty (2003) observes, the dark side of bonding relations is that they tend to consolidate internally palatable problem frameworks and reinforce relations that share these frameworks. In this case study, we found that they limited the ability of the IB to create or make links with other types of networks. Further, antecedent discontinuities between some groups and others were reinforced.

• The time was too short to create opportunities to challenge established views of the problems, and to engage participants in learning cycles that could analyse the frameworks within which the identified research issues were located (Steyaert and Jiggins, 2007). Providing the time and opportunity for participants to work on such learning tasks has been shown to be critical for 'revolutionary innovation' (Hounkonnou et al, 2012).

(iii) Articulation of problems and possibilities.

Discussions regarding the project illustrate the partners' broad environmental objectives: that is, to improve outcomes for water at the industry and catchment level. The project proposal includes the following specific objectives: 'increase the adoption of water use efficiency practices that deliver on industry and catchment natural resource targets' and 'coordinate and facilitate the delivery of natural resource management outcomes through best management practice in Water Use Efficiency'(CCCCRC, 2007). The challenge comes in translating such broad aims into responsible stewardship of water resources by cotton farmers in the context of highly competitive cotton farming within the catchment. That is, there was a mismatch between the scale at which project outcomes were desired, and the

44

outcomes of any practical measures taken by individual farmers, which had to pay off in terms of the commercial outcomes of a farm business. Moreover, use of the term 'natural resource' instead of environment or ecological management positioned the problem as an issue of management in individual private enterprises, although the desired impacts were articulated as public good outcomes at environmental, ecological or catchment scales. The regenerative capacity of water and soil systems was reduced to questions of resource use.

The project experiences had some effect on how the issues, activities and learning processes were subsequently defined. For example, in a paper delivered at a national cotton conference after the project had been finalized, it was stated that the project had allowed the cotton industry and its partners to 'collaborate to improve water management and achieve both production and environmental outcomes. Improving water use efficiency leads not only to decreased deep drainage, reduced water logging and reduced risk of salinization from a catchment health perspective, but also to the production of more bales per megalitre and compliance with industry best practice guidelines' (Spanswick and Jones, 2008, p 6). In this statement, rates of adoption within catchments of on-farm 'best practice' are constructed as a proxy for 'catchment health'. Ultimately, the relationship between improved farm practice and catchment health remains diffuse and is not easily measured (common proxies, such as level of salinization risk reduced, rely on reasonable causal assumptions as well as on proven and tested measurement). In contrast, the relationship between improved farm management and private economic benefit (expressed, for example, as more bales per megalitre) is measurable and indicative of enterprise-level impacts.

The partners continued to aspire to systemic impact, evidenced in the desire of the EIP to allow theory to inform practice, to consider the opportunities rapidly to drive innovation that could lead to ongoing change, and to reflect upon this by explicitly requesting documentation of the results of such experiments. However, the successful delivery of targets related to incremental change such as numbers participating, distributional effects and megalitres saved overshadowed the purposeful consideration of how the project had contributed to systemic change within the catchment management regime (Birner et al, 2006).

CHAPTER 2.5 DISCUSSION

The context of our case is relevant to sustainable management of contemporary agri-environmental systems throughout Europe and Australia. The short duration of interventional action is endemic within these complex and dynamic arrangements. Here we have shown that through purposeful design, rapid incremental innovation can be facilitated in such contexts. However, we also show that such efforts may be at risk of failing to stimulate revolutionary systemic innovation capability; this may require broader reorientation of policy and markets. Nonetheless, we consider that introduction of extension and evaluation methodologies to support both incremental and revolutionary change, which has a post-project legacy, is possible.

We have shown in our case that knowledge development and practice change were rapid and that this was an outcome of purposeful design choices: shared knowledge development on the basis of PAR; recruitment of an IB with the requisite knowledge, skills and legitimacy among prospective participants; research pull stimulated by financial incentives; and active stimulation of new network links and organizational arrangements. However, knowledge development was bounded, network connectivity reinforced bonding rather than bridging or linking connections, and the networks created were temporary and truncated by project finalization. The stronger and wider links that were formed through on-farm experimentation between growers, advisers and researchers stimulated research pull, but also limited the type of networks that could form and the problems that were researched. These factors meant that capability for sustained revolutionary innovation was not achieved. Klerkx et al (2012) warn of the propensity for innovation projects to contribute to the delay of revolutionary innovation because they tend to support 'more of the same'. In reflecting upon our case, we suggest that by choosing indicators and impact measures of more ambitious innovation goals, perhaps more could have been achieved.

However, we also note how the project experience encouraged the EIP to work creatively and reflexively, and with greater awareness of the numerous interdependent factors affecting the functioning of their target agri-environmental system.

Finally, we suggest that it would be useful to develop and routinely use indicators and feedback procedures that reveal the types of networks formed, their reach, scope and membership, their bonding, bridging or linking functions, and the kinds of research problems articulated by network members. Social network analysis (SNA) offers a range of tools and analytic methods that could assist in this task (Bodin et al, 2006; Bodin and Crona, 2009). Beilin et al (2013), for instance, have shown the usefulness of SNA in developing participants' understanding of transitions in multi-scalar social networks relevant to Landcare land management arrangements in Victoria, Australia.

CHAPTER 2.6 CONCLUSIONS

If a systems approach to innovation is considered desirable by agri-environmental partners, then the design features identified in our case study are worth considering. The space and time to be creative at the level of problem definition and in managing network developments also seem important and may require new organizational arrangements. In terms of an IB's skill set, it is the ability to theorize about social learning, then apply this understanding in practical PAR processes, that stands out. It is this skill that enables cross-scale, cross sector knowledge development and connectivity. We suggest, in addition, that by building in indicators that map changes in problem definition and network arrangements and that consider all levels of the system of interest, a short-term initiative may be able to overcome barriers to revolutionary change. Finally, we consider the novel deployment of agri-environmental incentives to assist knowledge developers to purchase self-directed information needs and knowledge development capability, to be of considerable interest. However, we suggest that its impact would be strengthened if the financial offer required attention to novel solutions that assisted in the transition from 'business as usual'. The European Union's EIP-Agri 2013 offers the opportunity to test these propositions further.

CHAPTER 2.7 REFERENCES

Beilin, R., Reichelt, N.T., King, B.J., Long, A., and Cam, S. (2013), 'Transition landscapes and social networks: examining on ground community resilience and its implications for policy settings in multi-scalar systems', Ecology and Society, Vol 18, doi: 10.5751/es-05360-180230.

Birner, R., Davis, K., Pender, J., Nkonya, E., Anandajayasekeram, P., Ekboir, J., Mbabu, A., Spielman, D., Horna, D., Benin, S., and Kisamba-Mugerwa, W. (2006), From "Best Practice" to "Best Fit": A Framework for Designing and Analysing Pluralistic Agricultural Advisory Services, International Food Policy Research Institute, Washington, DC.

Bodin, Ö., and Crona, B. (2009), 'The role of social networks in natural resource governance: what relational patterns make a difference?' Global Environmental Change, Vol 19, No 3, pp 366–374.

Bodin, Ö., Crona, B., and Ernston, H. (2006), 'Social networks in natural resource management: what is there to learn from structural perspective?' Ecology and Society, Vol 11, pp 1–8.

Brunori, G., Barjolle, D., Dockes, A.-C., Helmle, S., Ingram, J., Klerkx, L., Moschitz, H., Nemes, G., and Tisenkopfs, T. (2013), 'CAP reform and innovation: the role of learning and innovation networks', EuroChoices, Vol 12, No 2, pp 27–33.

Callan, V., Christensen, I., and Harris, G. (2004), Knowledge Management in Cotton and Grain Irrigation, Cotton Catchment Communities Cooperative Research Centre, Narrabri, NSW.

Campbell, A. (2006), Australian Natural Resource Management Knowledge System, Land and Water Australia, Canberra.

CCCCRC (2007), Delivering Increased Adoption of Best Management Practices in Water Use Efficiency to the Cotton Industry in the Catchment, Cotton Catchment Communities Cooperative Research Centre, Narrabri, NSW.

Coutts, J. (2008a), E-mail, 15 April.

Coutts, J. (2008b), Sustainable Industries Initiative: Natural Resource Management Delivery in the Australian Cotton Industry: External Evaluation, Coutts J&R, Toowoomba.

Coutts, J., and Samson, A. (2008), Review and Evaluation of the Implementation of the Use of On-Ground Incentives to Achieve Sustainable Agriculture and Grazing Outcomes for the Burdekin Dry Tropics NRM Region, Burdekin Dry Tropics NRM, Townsville, Queensland.

Dick, B. (1993), 'You want to do an Action Research Thesis? How to conduct and report action research', Interchange, website: http://www.aral.com.au/resources/arthesis.html.

EU (2013), 'Opportunities provided by the European Innovation Partnership "Agricultural Productivity and Sustainability" and its Operational Groups', European Union, website: http://ec.europa.eu/agriculture/eip/documents/eip-opportunities_en.htm (accessed 12 October 2013).

Hermans, F., Klerkx, L., and Roep, D. (2011), Review of Relevant EU Policy Documents on Innovation, Wageningen University and Research Centre, Wageningen.

Hood, O. (2008), CA07020 Final Report, Sustainable Irrigation Systems, Toowoomba.

Hounkonnou, D., Kossou, D., Kuyper, T.W., Leeuwis, C., Nederlof, E.S., Röling, N., Sakyi-Dawson, O., Traoré, M., and van Huis, A. (2012), 'An innovation systems approach to institutional change: smallholder development in West Africa', Agricultural Systems, Vol 108, pp 74–83.

IFSA (2013), 2014 IFSA Europe Group Symposium Workshop 1.2, The Plone Foundation, website: http://project2.zalf.de/IFSA_2014/calls/call-for-abstracts/theme-1/workshop-1.2.

Ison, R. (2010), Systems Practice: How to Act in a Climate-Change World, Springer, London.

Ison, R., Röling, N., and Watson, D. (2007), 'Challenges to science and society in the sustainable management and use of water: investigating the role of social learning', Environmental Science & Policy, Vol 10, pp 499–511.

King, C.A. (2000), Systemic Processes for Facilitating Social Learning, Department of Rural Development Studies, Swedish University of Agricultural Sciences, Uppsala.

Klerkx, L., Schut, M., Leeuwis, C., and Kilelu, C. (2012), 'Advances in knowledge brokering in the agricultural sector: towards innovation system facilitation', IDS Bulletin, Vol 43, No 5, pp 53–60.

Koutsouris, A. (2012), Exploring the Emerging Facilitation and Brokerage Roles for Agricultural Extension Education, AUA Working Paper Series, Agriculture University of Athens, Greece, pp 1–34.

Pretty, J. (2003), 'Social capital and the collective management of resources', Science, Vol 302, pp 1912–1914.

QG (2009), Cotton Tales, Queensland Government Department of Primary Industries and Fisheries, 9, Brisbane, Queensland.

Robson, C. (2002), Real World Research: A Resource for Social Scientists and Practitioner-Researchers, Blackwell Publishers, Oxford.

Spanswick, S., and Jones, P. (2008), 'Working with regional natural resource management bodies to improve water management', paper presented at Proceedings of 14th Australian Cotton Conference, Broadbeach, Queensland.

Stake, R.E. (1995), *The Art of Case Study Research*, Sage, Thousand Oaks, CA.

Steyaert, P., and Jiggins, J. (2007), 'Governance of complex environmental situations through social learning: a synthesis of SLIM's lessons for research, policy and practice', Environmental Science & Policy, Vol 10, No 6, pp 575–586.

Yin, R. (2009), *Case Study Research, Design and Methods*, Sage Publications, Newbury Park, CA

CHAPTER 3 NETWORK ANALYSIS OF CROSS SCALE INTEGRATION INSTITUTIONS WITHIN A CASE STUDY OF A COMPLEX ADAPTIVE WATER GOVERNANCE SYSTEM[6],[7]

CHAPTER 3.1 ABSTRACT

This instrumental case study research combines Complex Adaptive Systems and Social-Ecological Systems frameworks in its focus on environmental governance and institutional resilience.  The patterns of cross scale and level relations (i.e. integration institutions) that emerge from the system under examination during a set of release and reorganisation phases, when the potential for institutional revolution was high, was able to be exposed through a researcher embedded Network Analysis.  The analysis shows that several attempts at reorganisation of integration institutions within the context of the examined case have produced a system which supports the recognition and use of multiple scales, including biophysical scales, and some levels within them.  However, it also shows that the system is yet to produce patterns of connectivity that support cross-level relations.  Moreover, whilst the system produces insular within level patterns for the State level of the governance scale it does not for any of the other levels on other scales.  These results allow for the tentative assertion that the latest release and reorganisation phases within the system may not be able to achieve the renovation implied in the integrated Localism rhetoric of its participants.  This assertion could be tested with similar analyses conducted at a later date.  This research has demonstrated the applicability of Network Analysis as a diagnostic tool within a complexity informed approach to the practical problem of institutional intervention within contemporary complex adaptive water governance systems which tend to produce resilient institutional arrangements.

CHAPTER 3.2 ENTRY VIGNETTE

In 2010, researchers from Australia's Commonwealth Scientific and Industrial Research Organisation and a team commissioned by the chairs of Australia's 56

---

[6] Submitted to the journal titled 'Ecology and Society' and is under review.

[7] I acknowledge that Dr Ryan McAllister. CSIRO Ecosystem Sciences, Eco science Precinct, Brisbane Queensland, Australia managed the computational and statistical analysis of the network data that I collected in this study.  However I am fully responsible for how these results were generated, used and interpreted.

Natural Resource Management (NRM) organisations argued that Australia's Murray Darling Basin (MDB) water governance system had entered its fourth set of *release* and *reorganisation* phases since 1890 (Ryan 2010:382, Ryan et al. 2010:17) (Table 3.2.1). *Release* phases are described by Social-Ecological System (SES) theorists as chaotic yet comparatively brief periods of heightened uncertainty which may lead to either renovation or maintenance in the subsequent *reorganisation* phase (Walker and Salt 2006). Importantly, release phases set the starting conditions for the following phases and therefore are an important step in whether a system maintains or revolutionises its properties

By 2011, members of Australia's MDB water governance system were using the term '*Localism*' (MDBA 2012) to signal their emergent agreement of the significance of both the catchment and the basin wide levels in the governing of this water system; and the need for greater connectivity between these scales and levels. *Localism* can therefore be viewed as an emergent discourse within a theorised release phase of this system. It signals that the participants of this system were attempting to, preceded by three other attempts since 1890, institute greater recognition of the hydrology of the basin and greater connectivity amongst the participants of the system located across various *levels* within existent governance and emergent hydrological *scales*. I define *scales* as analytical and practical boundaries with internal *levels* (Cash et al. 2006, Berkes 2008, Gibson et al. 2000) that are assigned by those involved in the governing and/or researching of a governance context as they draw lines from different viewpoints, such as hydrological or social management viewpoints, between spheres of interaction that they discern to be significant by their recognition of certain relationships, distances and sizes.

The prospect of Localism leading to renovation of MDB *integration institutions* in the subsequent fourth reorganisation phase is worthy of investigation. *Integration institutions* are the regular ways that actors identify, use and connect across scales and between levels that are discernible in governance contexts (Woodhill 2010, Hodgson 2006, Lammers and Barbour 2006). Therefore I considered the case of the Condamine catchment, Australia's MDB headwater catchment, at this time to be a rich case in which to investigate institutionalisation of integration objectives from a Complex Adaptive System (CAS) perspective of water governance.

Table 3.2.1: Adaptive cycles and the Murray Darling Basin

| Phase in adaptive cycle | Characteristics | Events | | |
|---|---|---|---|---|
| | | 1st cycle 1890s to 1914 | 2nd cycle 1914–1985 | 3rd cycle 1985–2006 |
| Rapid growth | Innovative exploitation of new opportunities | First irrigation settlements under state auspices | Major dam and weir construction, irrigation expansion | Major new environmental policies developed |
| Conservation | Efficiency increases, capital grows, inter-connections strengthen, system becomes rigid, resilience declines | New Australian constitution (1901) locks in strong independent state powers over water | Technological innovation in irrigation drives diversions to very high levels, irrigators develop strong political influence | Early success with salinity strategy, and introduction of Cap (1995) but then slow decision-making leads to lags in environmental flows policy and dealing with future risks |
| Release | Disturbance breaks the connections, regulatory controls weaken, capital is released | Pressure for reform built from inability to plan for the use of shared water under the constitution | Long trend of increasing salinity finally resulting in damage to irrigated crops | 2002–2007 drought, lowest inflows on record. Prime Minister announces plan for new Basin governance |
| Reorganization | Starting conditions set for next cycle | 1914 River Murray Waters Agreement signed | 1985 Murray-Darling Basin Agreement signed | 2008 New Murray-Darling Basin Authority established |

I here present the results of my case study of the Condamine catchment during this period using Stake's (Stake 1995, Cresswell 2013) structure for reporting case study research. That is, following this entry vignette the theoretical issues that I examined in this research, along with my methodological choices are reported. Subsequently a contextual description of the relevant aspects of the case at the time of this research is provided. Next the results that emerged from my case research are discussed and analysed. Finally, I make provisional assertions based on this research. Firstly, what theoretical matters were considered in this research?

CHAPTER 3.3 THEORETICAL MATTERS

Increasingly researchers are considering the complexity of contemporary governance arrangements, including those relevant to the environment. Examples include the interactive governance (Torfing et al. 2012, Kooiman et al. 2007), network governance (Torfing and Sørensen 2014), concerted governance (Steyaert and Jiggins 2007), and the new water governance theorists (Teisman et al. 2013). In fact, various authors (Lubell et al. 2014, Connick and Innes 2003, Bovaird 2008, Berkes 2006) demonstrate the value of construing environmental or water governance regimes as CASs (See Levin 1998 for a succint definition of CAS).

I define a CAS as 'a dynamic network of many agents (which may represent cells, species, individuals, firms, nations) acting in parallel, constantly acting and reacting to what the other agents are doing' (Waldrop 1992, as cited in Woodhill 2010:53). Which and what types of agents that are considered to be part of a CAS is a boundary judgement made and re-made by those acting within and/or in relation to systems in question (Wuisman 2005, Verweij 2012). SESs are generally seen as including both social and ecological agents (Berkes 2006, Olsson et al. 2004). Although others have included bio-physical agents (Blackmore et al. 2007, Callon 1986) or institutions and issues as agents (Lubell et al. 2014), generally in theory and practice agents tend to retain an anthropocentric bias and bound their view of governance system to sets of interacting human agents. In the case research reported here the MDB governance system is viewed as a CAS whose boundaries are produced by interacting human agents. Therefore who and what is included is an empirical question that cannot be predetermined but is rather to be discovered as the research unfolds.

CAS governance researchers theorise that governance systems tend to produce outcomes that exhibit periods of seemingly intractable stability that can be punctuated by surprising and unpredictable behaviour because of their co-evolving, non-linear and self-organising natures (Teisman et al. 2009). These researchers investigate the co-evolving interactions between self-organising agents over-time within contexts that have certain histories because these processes and particulars are thought to be the genesis of the system's usually stable but sometimes unpredictable outcomes. In SES research, *resilience* has been used to capture the complex production of stability in ecological systems and loss of resilience has been used to describe periods when the stability is threatened (Gunderson and Holling 2002, Walker et al. 2004, Holling 1973, Folke 2006).

For CAS governance researchers the relationships between systems and outcomes, between internal dynamics and observations of stability, represent a key theoretical interest which is underpinned by the concept of *emergence* (Elder-Vass 2005). *Emergence* is used to describe and investigate the interactive accomplishment of broad patterns at the level of a system, whether the broad patterns are observed to be highly stable or surprising. Together a CAS framework of governance and the concept of resilience and emergence allow for theoretical explorations of how and why complex governing systems are observed reproducing remarkably consistent outcomes despite their complex internal dynamics and despite governmental intervention programs (Edelenbos 2005). Therefore in the case research reported here it was theorised that the MDB governance systems, viewed as a CAS, was emerging from a release phase offering the opportunity for examination of the system as it produced either stability or instability in its emergent properties.

Within governance contexts, institutional outcomes are invariably the object of most research and practice (Young et al. 2008). Often when we are talking about wanting certain aspects or outcomes of a governance system to change what we are really wanting are certain institutions to change (Woodhill 2010). Institutions have also been observed to be highly stable, or resilient, causing them to be variously described as having the properties of stickiness (Young et al. 2008); of being locked-in (Allison and Hobbs 2004) and of being pathologically trapped (Gunderson and Light 2006).

Some institutional theorists have used CAS compatible frameworks to draw attention to the interactional accomplishment of the regularities of institutional arrangements

(Edelenbos 2005, Woodhill 2010, Hodgson 2006, Lammers and Barbour 2006). I adopt their perspective and see institutions as emergent patterns of relations that are produced through co-evolving, self-organising actor interactions within a particular context over time. Such a viewpoint acknowledges the propensity for resilience of emergent institutional arrangements and the interactional basis of this resilience.

In the case under examination in this research the institutions of interest are those which are known as integration institutions (Lane and Robinson 2009, Morrison and Lane 2005, Morrison et al. 2004). Some water governance and public administration theorists (Edelenbos et al. 2013b) as well as the soft systems theorists before them (Steyaert and Jiggins 2007) have been developing a literature on the topic of integration with a CAS consistent viewpoint. The concept of concerted governance (Steyaert and Jiggins 2007, Riley 2001, Collins et al. 2007), the process of synchronisation (Edelenbos et al. 2013a, Verweij 2012) and the development of connective capacity (Edelenbos et al. 2013b) are their research pursuits.

What these groups of researchers have in common is the assertion that better socio-environmental outcomes can be generated from governance systems when participants connect with relevant levels in multiple ecological and social scales at appropriate times. Integration is therefore never solved but is achieved adaptively over time. This polycentric, responsive and labile view of integration institutions within water governance contexts complies with the Adaptive Governance model developed by SES researchers (Huitema et al. 2009).

Recently Network Analysis has been used within CAS aligned governance research to produce and empirically evaluate visual illustrations of a representative sub-set of the connections being made amongst agents within governing contexts at certain points in time (Lubell et al 2014). It can therefore be used to identify the emergent institutional arrangements associated with integration (Lubell et al. 2014, Robins et al. 2011, Robins et al. 2012, McAllister et al. 2014, Guerrero et al. 2014, Bodin and Tengo 2012).

Therefore in this case study I experiment with the use of Network Analysis as a tool for describing and diagnosing integration institutions (Young 2008, 2011) being produced by interactive agents within a complex adaptive water governance system during a theorised release phase. I also relate the emergent relations being produced

to the context and its history in order to make tentative assertions about whether the system is likely to maintain or renovate its integration institutions in the subsequent reorganisation phase.  In doing so, I also examine the practicality of Network Analysis as a diagnostic tool for improving action aimed at influencing such arrangements.

CHAPTER 3.4 METHODOLOGICAL CHOICES

When applying a CAS research perspectives context and history matter, the data is located within the interactions between agents and the researcher is just one of many agents (Verweij 2012, Buijs et al 2009).  Appropriate methodologies locate the researcher within the context of interest and allow them to observe the interactions between themselves and/or other members of the system as they happen over extended periods of time (Buijs et al. 2009).  As such, I undertook instrumental case study research in the study being reported on here (Yin and Davis 2007, Yin 2009, Stake 1995, Cresswell 2013).  Case study has been used by others applying complexity theory in public administration contexts (Buijs et al. 2009). Further, the proponents of instrumental case study methodology have acknowledged its applicability when the researcher is seeking to investigate issues from within complex social phenomena (Stake 1995, Yin 2009).

I used Network Analysis techniques in order to undertake an embedded analysis (Yin 2009, Cresswell 2013) of the integration institutions in operation within the case at the time of the research.  The methods of data collection and analysis that I used emerged from the interactions between me and others within the system. This emergent iterative mixed method data collection proceeded as follows.  Firstly, I began by listing all known Condamine catchment relevant collaborative water forums and their participants. To assist, in data management efficiency and subsequent data analysis I then developed a provisional coding scheme by differentiating the participants and the collaborative forums by the scales and levels they were being identified as by the participants of this context.  For example, a representative from the State government was identified as a level 2 governance scale actor; and the Murray Darling Basin Authority was considered to be a level 3 hydrological scale forum.  Then I used mixed methods over time whilst observing a subset of the known forums to correct the original lists, generate new data and allow coding to be adaptively improved.  The mixed methods I employed included desk top

analyses of publically available data from organisational, governmental and community websites, participant observation of several forums and document analyses of minutes and communiqués not publically available that were obtained with permission from the organisations involved. Consistent with a snowballing approach (Robson 2002:265) the data collection process continued until no new data was being generated.

The data set produced included all observed un-weighted relations between two types of nodes: multi-scaled and levelled actors and the multi-scaled and levelled forums they were using to connect themselves across scales and levels within their water governance system. Un-weighted relations mean that the ties either exist or not and therefore are not differentiated by direction or strength (Carlsson and Sandstrom 2008:44). In Network Analysis, networks that contain two types of nodes are called bipartite. Recent bipartite network analysis within commensurate contexts such as large scale conservation networks (Guerrero et al. 2014), large scale river basin governance (Lubell et al. 2014) and climate change policy networks (McAllister et al. 2014) have started to define and relate the configurations of the nodes and ties to interactional pattern descriptions. Subsequently the data collected was developed into a bipartite network of the observed un-weighted connections that were being made between scales and levels via actors participating in multiple collaborative forums.

Exponential Random Graph Modelling (EGRM) (Robins et al. 2007, Robins and Morris 2007) was then used to identify the emergent patterns in the observed bipartite network of un-weighted relations between multi-scaled and levelled actors and the collaborative forums they were participating in. Following others (Guerrero et al. 2014, Lubell et al. 2014, McAllister et al. 2014) the application of EGRM uncovered the patterns by comparing the observed frequencies of certain types of relational patterns known as network motifs (Figure 3.5.1) to the frequencies of the same configurations in a large (i.e. 2000) sample of randomly generated networks that share certain properties with the observed network. Importantly, as these same researchers do, the emergent patterns of non-random relations that can be identified through this method of Network Analysis were then compared in relation to each other not just in isolation.
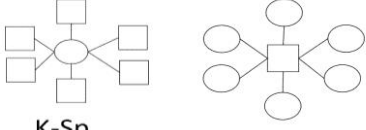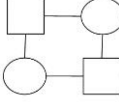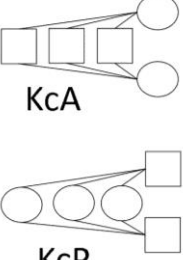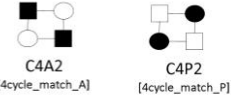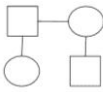
| Interaction Descriptors | Network Motifs | Interaction Description |
|---|---|---|
| Clustering, Centralising, Coordinating | K-Sp  K-Sa | Actors (K-Sa) or collaborative forums (forums) (K-Sp) are involved in clustering relations |
| | TsoA2 [2path_match_A]  TsoP2, [2path_match_P] | Within the clustered interactions of the network actors of a certain level are more likely to participate in the same forums (TsOP2) or forums of a certain level are more likely to be connected through actors (TsOA2) |
| Closing, bonding | C4 | Some actors and forums are involved in relationships that are closed off to other actors and forums |
| | KcA  KcP | Within the closed relations, actors (KcA) or forums (KcP) are the mainly involved |
| | C4A2 [4cycle_match_A]  C4P2 [4cycle_match_P] | Actors (C4A2) or forums (C4P2) of certain levels are more likely to be connected in the closed sections of the network. |
| Loose Threads | L3 | When this configuration is observed with closing configurations then the tendency to use centralising closing relations in this network is further validated. |
| Legend | Actors  Forums | |

Figure 3.5.1: Network configurations/motifs and their definitions (note in this case A=actors; P=forums).

CHAPTER 3.5 CONTEXT OF THE CASE

Complexity theorists use the term Co-evolution to theorise about and investigate the observation that system states at any point in time have a contingency with their

previous states that is at once contextual or situated environmentally and socially and at once historical in that context has influence over time (Gerrits et al. 2009, Gerrits 2008). This means that when studying cases through a CAS framework context and history matter.

Connell (2007) provides a detailed account of water politics in the MDB since federation. This account draws attention to on-going attempts to de-institute the influence of State government borders through Integrated Catchment based Management (ICM) in the MDB relevant components of Australia's three tiered public administration system (i.e. Local, State and Federal governments). ICM programs within the MDB have attempted to institute basin wide management through an overarching coordinating organisation, known since 2007 as the Murray Darling Basin Authority (MDBA) and 18 local or sub-basin adaptive water management plans (Wentworth Group 2010).

Similar trends can be observed in Australia's broad governance (Summers and Lowe 2014) where the Federal government has increasingly expanded its influence within traditional State government jurisdictions through fiscal agreements between State and Federal government that are tied to an increase in direct interaction between these levels of public administration and local levels such as regions, communities and catchments. Within the domain of environmental governance, constitutionally a State government jurisdiction, there have been multi-million dollar partnerships between Federal and State governments that have been focused on increasing local participation in environmental management. Such programs have included the national Landcare program (Curtis and De Lacy 1996, Wilson 2004) and the significant regional Natural Resource Management experiment (Lane et al. 2009). Landcare saw the development of thousands of local farmer organised groups around Australia that were focused on localised problems such as salinity and riparian zones (Wilson 2004:264). The NRM program saw the development of 56 regional NRM bodies covering the land mass of Australia (Robins and Dovers 2007).

The case examined in this research is a catchment, at the headwaters of the MDB located within the State of Queensland within Australia (Figure 3.5.2) (Condamine Alliance 2012:2). Queensland is one of four basin States and the processes previously discussed at the national and basin levels have some particular local nuances when compared to other States. For example, the Queensland government is

considered one of Australia's laggard States when it comes to its approaches to environmental and water management (Grant and Papadakis 2004, Tan et al. 2012).
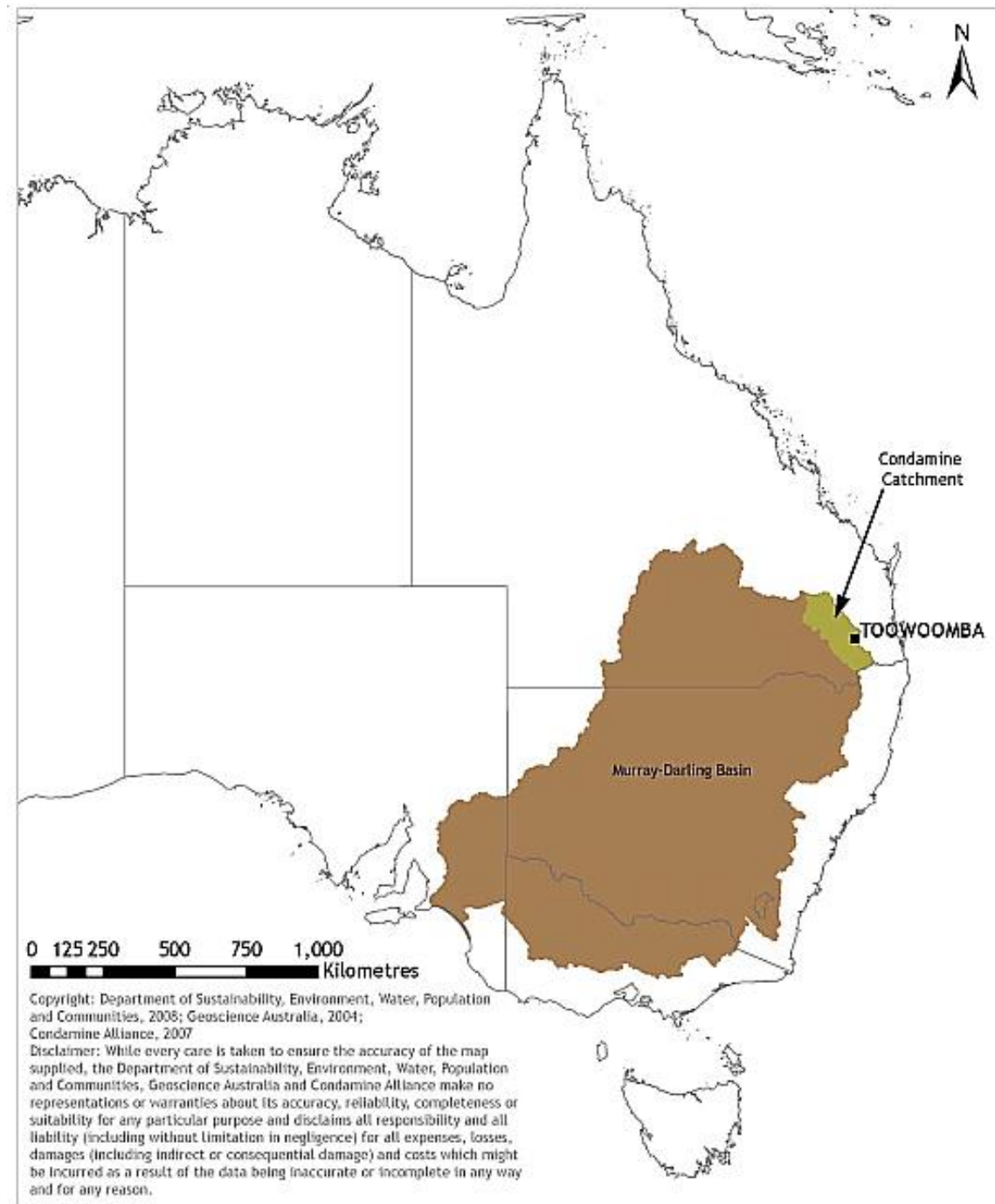


Figure 3.5.2: Condamine catchment at the headwaters of Australia's Murray Darling Basin (Condamine Alliance 2012, p.2)

Its initial involvement in the MDB process was delayed and since then Queensland has often been tardy in meeting its agreed objectives within the process (Connell 2007). The separation of the regional NRM program from the catchment water

managing processes has been particularly noteworthy in Queensland. In addition the problem of state borders being unaligned with hydrological borders has been a particular issue at the border between Queensland and New South Wales (Bellamy et al. 2002). It is in within this context that this case study was undertaken in 2010.

CHAPTER 3.6 EMERGENT RESULTS

The MDB water governance system relevant to the Condamine catchment at the time of investigation was being sustained by the interaction of 653 multi-scaled and levelled participants. Connections between participants were being made via their enactment and use of 78 multi-scaled and levelled forums. Governance and hydrological scales were being used by the participants in their management of the system (Table 3.6.1 and 3.6.2). Within the governance scale four levels were supported by the participants: Local, State, Federal and International. Within the hydrological scale catchment and basin wide levels were able to be identified. At the time of my investigation only one forum separating the northern and southern parts of the MDB basin was able to be identified.

Table 3.6.1: The number of forums identified as being located on each level of each scale being used by the participants of this system (as a tally and as a percentage of the total count).

| Total | Governance Scale | | Hydrological Scale | |
|---|---|---|---|---|
| 32 (42%) | Local | 5 (7%) | Catchment | 27 (35%) |
| 23 (29%) | State | 22 (28%) | Northern Basin | 1 (1%) |
| 23 (29%) | Federal | 16 (20%) | Basin | 7 (9%) |
| 78 (100%) | Total | 43 (55%) | Total | 35 (45%) |

Table 3.6.2: The number of actors identifying themselves and being identified by others as being located on each level of each scale being used by the participants of this system (as a tally and as a percentage of the total count).

| Total | Governance Scale | | Hydrological Scale | |
|---|---|---|---|---|
| 301 (46%) | Local | 128 (20%) | Catchment | 173 (26%) |
| 208 (32%) | State | 208 (32%) | Northern Basin | 0 |
| 108 (17%) | Federal | 102 (16%) | Basin | 6 (1%) |
| 36 (5%) | International | 36 (5%) | | |
| 653 (100%) | Total | 474 (73%) | Total | 179 (27%) |

Together, in this case, the multi-scaled and levelled forums that were being used by the multi-scaled and levelled actors were observed to be producing a network of relations (Figure 3.6.1) in which patterns consistent with those that relate to types of network motifs are observed (Figure 3.6.2).

Figure 3.6.1: Observed Network.
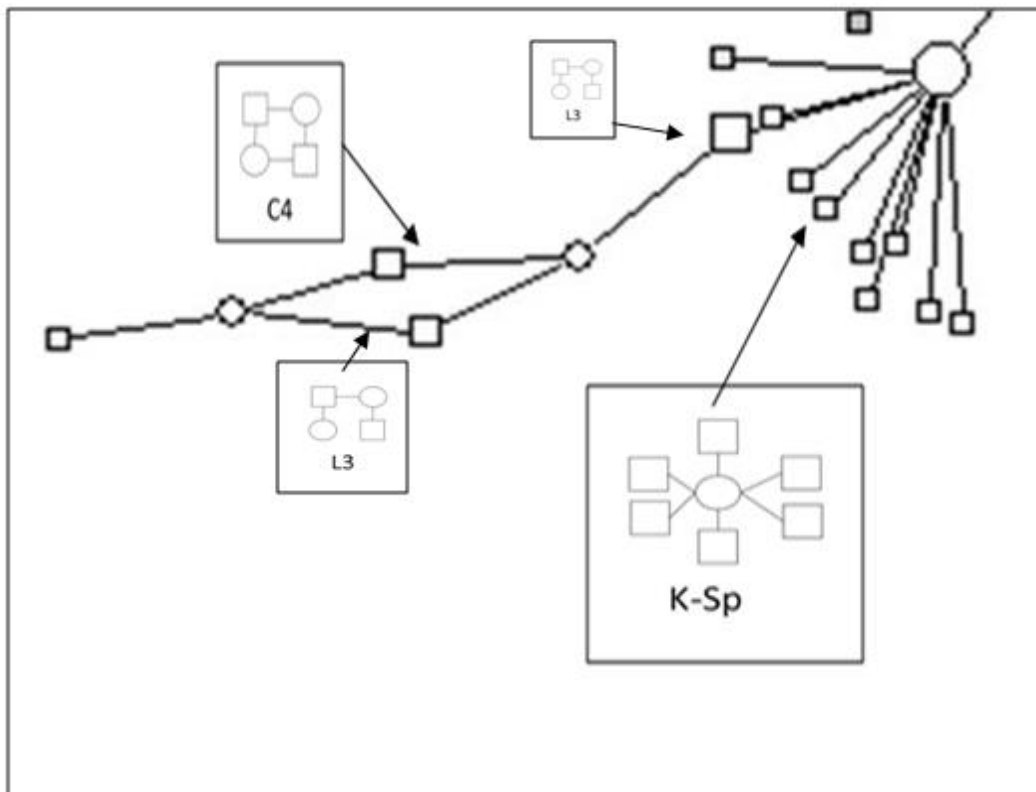
Figure 3.6.2: Enlarged inset of the observed network showing identifiable relational types (motifs).

The significance, or the strength, of each observable pattern is able to be determined by comparing its actual incidence to that which occurs in 2000 randomly produced networks that comply with several attributes of the observed network. This was a two-step process. Firstly, key attributes of the observed network were selected and then used to set the attributes that would be used to generate 2000 random graphs. In this case the attributes that were used to parameterise 2000 random networks included number of ties (L) and number of ties branching from female actors (i.e. _rA(actor, female=1). Then the incidence of the non-set attributes within the observed network was compared to the incidence of those same attributes in 2000 simulated random network graphs that shared key attributes with the observed network (3.6.3)
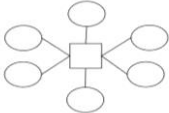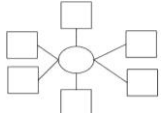
| Motif | Count of motif in observed network | Average count of motif in 2000 graphs (s.e.) | t-statistics |
|---|---|---|---|
| L<br>Any actor to forum ties<br><br>L | 786 | 769.85 (31.35) | 0.52 |
| KsA<br>Actor centred custers<br><br>K-Sa | 258.5625 | 243.07 (27.96) | 0.55 |
| KsP<br>Forum centred clusters<br><br>K-Sp | 1325.088 | 1310.38 (47.47) | 0.31 |
| _rA (actor, female=1)<br>Female actor ties to other actors or forum | 108 | 106.37 (7.18) | 0.23 |
| _rA (actor, inside=1)<br>Inside actor ties to other actors or forums | 214 | 210.95 (10.84) | 0.28 |
| _rA(actor, State scaled =1) State scaled actor ties to other actors or forums | 605 | 591.34 (25.15) | 0.54 |
| _rA(institution, State scaled =1) State scaled forum ties to other actors or forums | 252 | 246.29 (11.82) | 0.48 |
| rAP (State scaled =1) State scaled actors to State scaled forums | 108 | 110.03 (8.66) | -0.23 |

Figure 3.6.3: Null model


Secondly, general patterns of interactions were tested (Figure 3.6.4). Here it was found that there was statistically significant patterns of closure (i.e. significance of C4 configurations) being produced by the network of relations being sustained within the case at the time of my observation. It was found that the participants of this network were producing this closure through the use of forums and not actors (i.e. KcP is significant and KcA is not). Moreover the closure patterns being produced in the Condamine catchment water governance network at the time of observation is

statistically differentiable from large parts of the network which is largely producing not closed (i.e. both C4 and L3 are significant) patterns of interaction.
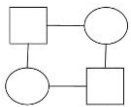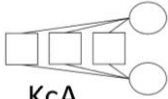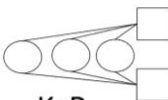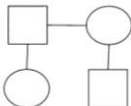
| Configurations with no attributes | Actual | Average Count of Configuration in 2000 graphs (s.e.) | t-statistics |
|---|---|---|---|
| C4 | 400 | 21.47 (5.57) | 67.98 *** |
| KcA | 219.0497 | 245.74 (29.83) | -0.89 |
| KcP | 6042.5 | 5269.17 (295.74) | 2.61*** |
| L3 | 10318 | 7040.54 (684.51) | 4.79*** |

Figure 3.6.4: Results of the general interaction patterns (i.e. institutions).

Testing of actor attributes within these statistically significant patterns of multi-scalar and level interactions within the Condamine catchment water governance network showed that State level (i.e. second level on governance scale) actors are more likely to be particpating in the same forums whether they are supporting closed or clustered relational patterns (i.e. Tso_A2, C4A2) (Figure 3.6.5). In fact, any levelled actor is more likely to connect with actors of the same level within the same forums whether they are enacting closed or clustered interaction patterns (i.e. 2path_match_A, 4cycle_match_A) (Figure 3.6.5).

The data also revealed that actors within this network are producing patterns of connectivity that link State levelled collaborative forums to the same actors whether these State level forums and actors are also producing closed or clustered interactional patterns (i.e. Tso_P2, C4P2) (Figure 3.6.6).  Moreover these connection patterns link forums of a praticular level through actors to other forums of the same level whether they are also involved in producing closed or clustered relational patterns (i.e. 2path_match_A; 4cycle_match_A) (Figure 3.6.6).  Lastly, actors use forums to create connection patterns which are more likely to link actor and forums of the same level to actors and forums of the same level (i.e. RAPC) (Figure 3.6.6).
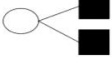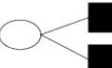
| Motif with binary actor attributes | Count of motif in observed network | Average count of motif in 2000 graphs (s.e.) | t-statistics |
|---|---|---|---|
| Tso_A2 (actor, state scale=1) <br><br> TsoA2 [2path_match_A] | 1097 | 591.50 (61.90) | 8.17 *** |
| C4A2 (actor, state scale=1) <br><br> C4A2 [4cycle_match_A] | 133 | 3.27 (2.05) | 63.39 *** |
| Motif with categorical actor attributes | | | |
| TsoA2 [2path_match_A] <br> 2path_match_A (actor, scale) | 3403 | 1811.83 (109.03) | 14.59 *** |
| C4A2 [4cycle_match_A] <br> 4cycle_match_A (actor, scale) | 212 | 7.98 (2.80) | 72.76 *** |

Figure 3.6.5: Results for the coordinating patterns of specific types of actors differentiated by scale.
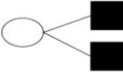
| Motif with binary forum attributes | Count of motif in observed network | Average count of motif in 2000 graphs (s.e.) | t-statistics |
|---|---|---|---|
| Tso_P2 (forum, state scale=1)<br><br>TsoP2,<br>[2path_match_P] | 84 | 30.00 (6.25) | 8.64<br>*** |
| C4P2 (forum, state scale=1)<br><br>C4P2<br>[4cycle_match_P] | 181 | 4.03 (2.47) | 71.58 *** |
| Motif with categorical forum attributes | Count of motif in observed network | Average count of motif in 2000 graphs (s.e.) | t-statistics |
| TsoA2<br>[2path_match_A]<br>2path_match_A (forum, scale) | 219 | 87.18 (12.81) | 10.29 *** |
| 4cycle_match_A (forum, scale)<br><br>C4A2<br>[4cycle_match_A] | 333 | 7.57 (2.82) | 115.24 *** |
| RAPC (scale)<br><br>rAP<br>[rAPC] | 2931 | 2801.49 (116.66) | 1.11*** |

Figure 3.6.6: Results for the coordinating patterns of specific types of collaborative forums differentiated by scale.


CHAPTER 3.7 INTERPRETATIONS AND ASSERTIONS

The application of CAS theory exposes the complexity and dynamics of the governance of the Condamine catchment within the MDB. A complexity which at the time of my investigation was being produced from the interaction of 653 multi-scaled and levelled actors whom utilise 78 multi-scaled and levelled forums to

maintain connectivity across hydrological and governance scales and between levels within these scales.

Observations of the interactions between members through forums at this point in time allowed several patterns to emerge at the system level. Firstly, at the time of my investigation participants of the system of interest were producing both governance and hydrological scales, both with multiple levels in their governance interactions. The production of the Local and Federal government levels of the governance scale and the catchment and basin level of the hydrological scale are considered to be indicators of the recent yet intensive approaches to instituting regional, catchment and local participation within the governance system of the MDB and the broader Australian NRM governance system. However, the virtual absence of the second level of the hydrological scale is notable and will be revisited later in this discussion.

Next, despite these indicators of recent influence on institutions, the stability of the integration patterns emerging from the interactions of the agents within this case was also exposed. This exposure is identifiable in the interaction patterns that the actors involved produced when it comes to connecting across multiple levels and scales. These interaction patterns are variously interrelated.

First, there is an absence of institutions that connect the first and third scales either to each other or to the second level (i.e. State government) of the governance scale. This is demonstrated by the emergent pattern that actors of the same level tend to use forums of the same level to connect with other actors and forums of the same level. This suggests that the system, despite the presence of many actors and forums, levels and scales can be considered to be producing administratively organised patterns rather than patterns which may emerge if the system was organised along other viewpoints (e.g. hydrologically, ecologically etc.). This is further supported by the absence of patterns that demonstrate and acknowledgement of a second level in the hydrological scale.

Secondly, the absence of patterns that connect across levels and scales is interrelated with an absence of patterns that connect within scales for the first and third level of both the governance and hydrological scales. This suggests that the actors within this system, despite their increased enactment and inclusion of Local and Federal

levels on the governance scale and the catchment and basin levels on the hydrological scale have not yet generated institutions that support these included agents and forums to interact and connect amongst themselves. In sum, the system is yet to support substantiative connective capacity at the local level despite the proliferation of localised forums (e.g. 32 mainly catchment forums out of 78 total forums) and actors (e.g. 301 Local or Catchment actors out of a total of 653 actors). Will the newest wave of reform under the auspices of Localism be able to address this issue?

Lastly, the absence of the production of patterns connecting across levels and within the first and third levels of this system that is being institutionally organised within administrative tiers, is interrelated with the presence of patterns supporting insular connectivity at the second level of the governance scale. As there is virtually an absence of institutional support for the recognition of a second level of the hydrological scale this suggest that the participants of this system are failing at this point in time to achieve their rhetorical goal to de-institute the centricity of the second level of public administration (i.e. the State government) in the governance of the Condamine catchment within the MDB governance system. This is akin to what Keil and Debbane (2005:264) have described as a scalar fix. In their case, they were referring to the retention of the centrality of State level of public administration within African water governance systems despite a widespread rhetoric of localised governance. This finding for the Condamine catchment suggests remarkable resilience of these institutions given the magnitude, rhetorically and fiscally, of attempts to institutionally renovate state centricity since federation (Connell 2007).

Finally, as these emergent patterns have been observed within a system that other authors have theorised to be in a set of release and reorganisation phases, it can be asserted that these patterns are potentially instructive of the process of institutional resilience. Berardo and Scholz's (2010) risk hypothesis, as explained by Lubell et al. (2014) asserts that when political contexts are experiencing high levels of uncertainty than those whom are at most risk, that is those to whom potential changes to the status quo present the greatest risk, tend to institute connective patterns that are remarkably closed and clustered so that resource exchange and within group compliance and sanctioning is more efficient.

This is what is observed in the integration institutions that emerged in the social network analysis of the governance of the Condamine catchment at the time of my investigation. Attempts to de-institute the State during a theorised fourth set of release and reorganisation phases in the MDB governance system's history in the late 2000's appears to have led to connection patterns that are characterised by visually greater connectedness and closure between second level (i.e. State) actors and forums. Therefore it can be tentatively asserted that despite the rhetoric of Localism the fourth set of release and reorganisation phases within the MDB system of governance is unlikely to lead to greater recognition of hydrological levels and greater connectivity between local levels and the other levels of the system of governance. This assertion could be tested by repeating this analysis at a future time.

This research has successfully used a CAS system framework and network analysis to diagnose institutional arrangements (Young 2008, 2011) construed as co-evolving emergent properties of a system of interacting actors at a particular point in time in a certain context with a certain history. It has also allowed some assertions to be able to be made about these emergent properties and what they mean for the system in the near future and therefore the prospects of further renovation of institutional arrangements. Therefore it is asserted that the diagnostic analysis of integration institutions through Network Analysis has both theoretical and practical applicability in contemporary water governance systems.

CHAPTER 3.8 CONCLUSION

Godden and Ison (2010) concluded that Australian water governance is likely to continue to produce disappointing outcomes if a systemic appreciation of how such outcomes are produced remains outstanding. They are not alone in the call for a greater use of systemic thinking when it comes to theorising about both the process and practice of contemporary water governance (Teisman et al. 2013).

In this paper I have reported on research that has built upon the work being conducted by others where governance systems are viewed as CASs and institutions are seen as the resilient emergent properties of governance systems. The specific developments that were made in this research relate to the applicability of a systemically aligned Network Analysis to the diagnosis of integration institutional arrangements within a water governance system at particular point in time in its

history when the opportunity for institutional change was thought to be high. As such the practical merit of applying Network Analysis within a diagnostic approach to institutional intervention was also investigated.

It was found that the participants of the system produced and used governance and hydrological scales in their management of the situation. However, they did not produce and use a middle level of the hydrological scale despite the bio-physical differences between the northern and southern parts of the basin. At the time of this research any such differences were not institutionally acknowledged within this system.

It was also found that after multi-decadal attempts to institute multi-level governance within this system of governance the participants maintained patterns of connectivity that demonstrated a propensity to connect within level as opposed to across levels. In addition whilst participants of the State level of the governance scale were observed to sustain insular within level connection patterns, the other levels of both scales did not.

At the time of the investigation the system was thought to be transitioning between release and reorganisation phases. Therefore it was able to be tentatively asserted that the propensity to produce a scalar fix (Keil and Debbane 2005) at the second level of the governance scale was instructive of the process of systemic renewal of antecedent integration institutions during a release phase. That is, it is cautiously proposed that the system of governance under examination in this research is unlikely to achieve the institutional change that it was rhetorically seeking under the auspices of Localism. This would require further assessment and testing at a later date. Regardless, the theoretical and practical merit of applying Network Analysis to the understanding of the production of institutional arrangements within complex water governance systems has been demonstrated.

## CHAPTER 3.9 LITERATURE CITED

**Allison, H. E., and R. J. Hobbs.** 2004. Resilience, adaptive capacity, and the "lock-in trap" of the Western Australian agricultural region. *Ecology and Society* **9**(1):3. [online] URL: http://www.ecologyandsociety.org/vol9/iss1/art3/.

**Bellamy, J., H. Ross, S. Ewing, and T. Meppem.** 2002. *Integrated Catchment Management: Learning from the Australian experience for the Murray-Darling Basin*. CSIRO Sustainable Ecosystems, Brisbane, Australia. [online] URL:

http://www.mdba.gov.au/sites/default/files/archived/mdbc-NRM-reports/2234_ICM_Learning_from_the_Aust_exp_MDB.pdf.

**Berardo, R., and J. T. Scholz**. 2010. Self-organizing policy networks: Risk, partner selection, and cooperation in estuaries. *American Journal of Political Science* **54**(3):632-49.

**Berkes, F.** 2006. From community-based resource management to complex systems: The scale issue and marine commons. *Ecology and Society* **11**(1):45. [online] URL: http://www.ecologyandsociety.org/vol11/iss1/art45/.

**Berkes, F.** 2008. Commons in a multi-level world. *International Journal of the Commons* **2**(1):1-6.

**Blackmore, C., R. Ison, and J. Jiggins**. 2007. Social learning: An alternative policy instrument for managing in the context of Europe's water. *Environmental Science & Policy* **10**:493-8.

**Bodin, Ã. r., and M. Tengo**. 2012. Disentangling intangible Social-Ecological Systems. *Global Environmental Change* **22**(2):430-9.

**Bovaird, T.** 2008. Emergent strategic management and planning mechanisms in Complex Adaptive Systems. *Public Management Review* **10**(3):319-40.

**Buijs, M., J. Eshius, and D. S. Byrne.** 2009. Approaches to researching complexity in public management. Pages 37-55 *in* Teisman G. R., A. van Burren, and L. Gerrits editors *Managing complex governance systems: Dynamics, self-organization and coevolution in public investments*. Routledge, New York.

**Callon, M.** 1986. Some elements of a sociology of translation: Domestication of the scallops and the fisherman of St Brieuc Bay. 196 - 233 *in* Law J. editor, *Power, action and belief: A new Sociology of knowledge?* Routledge & Kegan Paul, London.

**Carlsson, L., and A. Sandstrom**. 2008. Network governance of the commons. *International Journal of the Commons* **2**(1):33-54.

**Cash, D. W., W. Adger, F. Berkes, P. Garden, L. Lebel, P. Olsson, L. Pritchard, and O. R. Young.** 2006. Scale and cross-scale dynamics: Governance and information in a multi-level world. *Ecology and Society* **11**(2):8. [online] URL: http://www.ecologyandsociety.org/vol11/iss2/art8/.

**Collins, K., C. Blackmore, D. Morris, and D. Watson**. 2007. A systemic approach to managing multiple perspectives and stakeholding in water catchments: Some findings from three UK case studies. *Environmental Science & Policy* **10**(6):564 - 74.

**Condamine Alliance.** 2012. *Draft surface water environmental values for the Condamine catchment, Queensland*. Condamine Alliance, Toowomba, Queensland URL: http://www.nrmlibrary.com.au/record/811/draft_surface_water_environmental_values_for_the_condamine__.

**Connell, D.** 2007. *Water politics in the Murray-Darling Basin*. The Federation Press, Sydney.

**Connick, S., and J. E. Innes**. 2003. Outcomes of collaborative water policy making: Applying complexity thinking to evaluation. *Journal of Environmental Planning and Management* **46**(2):177-97.

**Cresswell, J.** 2013. *Qualitative inquiry and research design: Choosing among five approaches*. 3rd edn, SAGE Publications Inc, Thousand Oaks, CA.

**Curtis, A., and T. De Lacy**. 1996. Landcare in Australia: Does it make a difference? *Journal of Environmental Management* **46**(2):119-37.

**Edelenbos, J.** 2005. Institutional implications of interactive governance: Insights from Dutch practice. *Governance* **18**(1):111 -34.

**Edelenbos, J., N. Bressers, and P. Scholten.** 2013a. Conclusions: Towards a synchronisation perspective of connective capacity in water governance. Pages 333-51 *in* Edelenbos J., N. Bressers, and P. Scholten editors *Water governance as connective capacity*. Ashgate, Surrey.

**Edelenbos, J., N. Bressers, and P. Scholten, editors.** 2013b. *Water governance as connective capacity*. Ashgate, Surrey.

**Elder-Vass, D.** 2005. Emergence and the realist account of cause. *Journal of Critical Realism* **4**(2):315-38.

**Folke, C.** 2006. Resilience: The emergence of a perspective for Social–Ecological Systems analyses. *Global Environmental Change* **16**(3):253-67.

**Gerrits, L.** 2008. *The gentle art of coevolution: A complexity theory perspective on decision making over estuaries in Germany, Belgium and the Netherlands*. PhD, Erasmus University, Rotterdam.

**Gerrits, L., P. Marks, and A. van Burren.** 2009. Coevolution. *in* Teisman G. R., A. van Burren, and L. Gerrits editors *Managing complex governance systems: Dynamics, self-organization and coevolution in public investments*. Routledge, New York.

**Gibson, C. C., E. Ostrom, and T. K. Ahn**. 2000. The concept of scale and the human dimensions of global change: A survey. *Ecological Economics* **32**(2):217-39.

**Godden, L., and R. Ison.** 2010. From water supply to water governance. 177-84 *in* David M., and M. Lyons editors. *More Than Luck. Ideas Australia Needs Now.* Centre for Policy Development, Sydney. [online] URL: http://morethanluck.cpd.org.au/more-than-luck-ebook/from-water-supply-to-water-governance/.

**Grant, R., and E. Papadakis**. 2004. Transforming environmental governance in a "laggard" state. *Environmental and Planning Law Journal* **21**(2):144.

**Guerrero, A. M., R. R. J. McAllister, and K. A. Wilson**. 2014. Achieving cross-scale collaboration for large scale conservation initiatives. *Conservation Letters* **8**(2):107-17.

**Gunderson, L., and S. S. Light**. 2006. Adaptive management and adaptive governance in the Everglades ecosystem. *Policy Sciences* **39**(4):323-34.

**Gunderson, L., and C. S. Holling, editors.** 2002. *Panarchy: Understanding transformations in human and natural systems*. Isalnd Press, Washington, D.C., USA.

**Hodgson, G., M.** 2006. What Are Institutions? *Journal of Economic Issues* **40**(1).

**Holling, C. S.** 1973. Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics* **4**:1-23.

**Huitema, D., E. Mostart, W. Egas, S. Mollenkamp, C. Pahl-Wostl, and C. Yalcin.** 2009. Adaptive water governance: Assessing the institutional prescriptions of adaptive (co-)management from a governance perspective and defining a research agenda. *Ecology and Society* **14**(1):26. [online] URL: http://www.ecologyandsociety.org/vol14/iss1/art26/.

**Keil, R., and A. Debbane**. 2005. Scaling discourse analysis: Experiences from Hermanus, South Africa and Walvis Bay, Namibia. *Journal of Environmental Policy & Planning* **7**(3):257 - 76.

**Kooiman, J., S. Jentoft, and R. Pullin.** 2007. *Fish for life: Interactive governance for fisheries*. Amsterdam University Press, Amsterdam.

**Lammers, J. C., and Barbour, J. B.** 2006. An instiutional theory of organisational communication. *Communication Theory* **16**(3): 356-377.

**Lane, M., and C. Robinson**. 2009. Institutional complexity and environmental management: The challenge of integration and the promise of large-scale collaboration. *Australasian Journal of Environmental Management* **16**(1):16-24.

**Lane, M., C. Robinson, and B. Taylor, editors.** 2009. *Contested country : Local and regional Natural Resources Management in Australia*. CSIRO Publishing, Collingwood, Vic.

**Levin, S. A.** 1998. Ecosystems and the biosphere as Complex Adaptive Systems. *Ecosystems* **1**(5):431-6.

**Lubell, M. N., G. Robins, and P. Wang.** 2014. Network structure and institutional complexity in an ecology of water management games. *Ecology and Society* **19**(4):23. [online] URL: http://www.ecologyandsociety.org/vol19/iss4/art23/.

**McAllister, R. J., R. McCrea, and M. Lubell**. 2014. Policy networks, stakeholder interactions and climate adaptation in the region of South East Queensland, Australia. *Regional Environmental Change* **14**(2):527-39.

**MDBA.** 2012. *MDBA paper on Localism*. MDBA, viewed June 24, 2012, [online] URL: http://www.mdba.gov.au/sites/default/files/MDBA-paper-on-localism.pdf.

**Morrison, T., and M. Lane**. 2005. What 'whole-of-government' means for environmental policy and management: An analysis of the connecting government initiative. *Australasian Journal of Environmental Management* **12**(1):47-54.

**Morrison, T. H., G. T. McDonald, and M. B. Lane**. 2004. Integrating natural resource management for better environmental outcomes. *Australian Geographer* **35**(3):243-58.

**Olsson, P., C. Folke, and F. Berkes**. 2004. Adaptive comanagement for building resilience in Social-Ecological Systems. *Environmental Management* **34**(1):75-90.

**Riley, J.** 2001. Preface: The indicator explosion: Local needs and international challenges. *Agriculture, Ecosystems and Environment* **87**(2):119-20.

**Robins, G., and M. Morris**. 2007. Advances in Exponential Random Graph (p*) Models. *Social Networks* **29**:169-72.

**Robins, G., L. Bates, and P. Pattison**. 2011. Network governance and environmental management: Conflict and cooperation. *Public Administration* **89**(4):1293-313.

**Robins, G., J. M. Lewis, and P. Wang**. 2012. Statistical network analysis for analyzing policy networks. *Policy Studies Journal* **40**(3):375-401.

**Robins, G., P. Pattison, Y. Kalish, and D. Lusher**. 2007. An introduction to Exponential Random Graph (p*) Models for social networks. *Social Networks* **29**(2):173-91.

**Robins, L., and S. Dovers**. 2007. NRM regions in Australia: The 'Haves' and the 'Have Nots'. *Geographical Research* **45**(3):273-90.

**Robson, C.** 2002. *Real world research: A resource for social scientists and practitioner - researchers*. 2nd edn, Blackwell Publishers Inc, Oxford, UK.

**Ryan, S.** 2010. Murray-Darling Basin – integrated management in a large, dry and thirsty basin. Pages 303-22 *in* Ferrier R., and A. C. Jenkins editors *Handbook of catchment management*. Wiley-Blackwell, Sussex UK.

**Ryan, S., K. Broderick, Y. Sneddon, and K. Andrews.** 2010. *Australia's NRM governance system. Foundations and principles for meeting future challenges.* Australian Regional NRM Chairs, Canberra. .

**Stake, R. E.** 1995. *The art of case study research*. Thousands Oaks, California.

**Steyaert, P., and J. Jiggins**. 2007. Governance of complex environmental situations through social learning: A synthesis of SLIM's lessons for research, policy and practice. *Environmental Science & Policy* **10**(6):575-86.

**Summers, J., and J. Lowe.** 2014. The Federal system. *in* Fenna A., J. Robbins, and J. Summers editors *Government and politics in Australia*. Pearson Australia, Frenchs Forest, NSW.

**Tan, P., C. Baldwin, I. White, and K. Burry**. 2012. Water planning in the Condamine Alluvium, Queensland: Sharing information and eliciting views in a context of overallocation. *Journal of Hydrology* **474**:38-46.

**Teisman, G. R., A. van Burren, J. Edelenbos, and J. Warner**. 2013. Water governance: Facing the limits of managerialism, determinism, water-centricity, and technocratic problem-solving. *International Journal of Water Governance* **1**(1):1-11.

**Teisman, G. R., A. van Burren, and L. Gerrits, editors.** 2009. *Managing complex governance systems: Dynamics, self organisation and co-evolution of public investments*. Routledge, New York.

**Torfing, J., and E. Sørensen**. 2014. The European debate on governance networks: Towards a new and viable paradigm? *Policy and Society* **33**(4):329-44.

**Torfing, J., G. Peters, J. Pierre, and E. Sorensen, editors.** 2012. *Interactive governace: Advancing the paradigm*. Oxford, NY, Oxford University Pree.

**Verweij, S.** 2012. Management as system synchronization: The case of the Dutch A2 Passageway Maastricht project. *Emergence: Complexity & Organization* **14**(4):17-37.

**Walker, B., and D. Salt.** 2006. *Resilience thinking: Sustaining ecosystems in a changing world*. Island Press, Wahington DC.

**Walker, B., C. S. Holling, S. R. Carpenter, and A. Kinzig.** 2004. Resilience, adaptability and transformability in Social–Ecological Systems. *Ecology and Society* **9**(2):5. [online] URL: http://www.ecologyandsociety.org/vol9/iss2/art5/.

**Wentworth Group.** 2010. *Sustainable diversions in the Murray Darling Basin: An analysis of the options for achieving a sustainable diversion limit for the Murray-Darling Basin*. [online] URL: http://wentworthgroup.org/wp-content/uploads/2013/10/Sustainable-Diversions-in-the-Basin.pdf.

**Wilson, G. A.** 2004. The Australian Landcare movement: Towards 'post-productivist' rural governance? *Journal of Rural Studies* **20**(4):461-84.

**Woodhill, J.** 2010. Capacities for institutional innovation: A complexity perspective. *IDS Bulletin* **41**(3):47-59.

**Wuisman, J. J. J. M.** 2005. The logic of scientific discovery in critical realist social scientific research. *Journal of Critical Realism* **4**(2):366-94.

**Yin, R.** 2009. *Case study research, design and methods*. 4th edn, Sage Publications, Thousand Oaks, CA.

**Yin, R. K., and D. Davis**. 2007. Adding new dimensions to case study evaluations: The case of evaluating comprehensive reforms. *New Directions for Evaluation* **2007**(113):75-93.

**Young, O.** 2008. Building regimes for Socioecological Systems: Institutional diagnostics. Pages 115-44 *in* Young O., L. King, and H. Schroeder editors *Instiutions and environmental change: Principal frindings, applications and research froniters*. The MIT Press, Cambridge.

**Young, O.** 2011. Land use, environmental change, and sustainable development: The role of institutional diagnostics.  **5**(1):66-85. [online] URL: http://www.thecommonsjournal.org/index.php/ijc/article/view/244.


**Young, O., L. King, and H. Schroeder.** 2008. *Instituions and environmental change: Principle findings, applications and research frontiers*. The MIT Press, Cambridge.

CHAPTER 4 APPLICATION OF THE SYNCHRONISATION FRAMEWORK WITHIN AN AUSTRALIAN ENVIRONMENTAL INTEGRATION INITIATIVE[8]

## CHAPTER 4.1 ABSTRACT

Synchronisation theorists have proposed an alternative view of integration and how it can be researched. For them, integration institutions within environmental governance contexts emerge from the interactions between self-organising actors whom connect/disconnect from each other as they work on certain governmental issues in specific situations over time. Tools for practitioners to use within governance contexts to understand and work purposefully on integration institutions are the preferred research product. In this paper I test synchronisation theory as a diagnostic tool by applying it within a reflexive instrumental case study. Ethnographic data was collected during the first six months of a significant integration initiative within an Australian environmental governance context where water was considered to be the preeminent environmental issue. Insights gained from a retrospective Foucauldian discourse analysis of ethnographically collected data demonstrate the value of applying synchronisation as a diagnostic tool. The analysis shows that the significant resources deployed by participants within this initiative were at risk of sustaining antecedent integration levels. Further applications within such contexts is required to develop improved understanding of the synchronisation framework as a diagnostic tool and how its use may improve outcomes from environmental governance initiatives that are focused on integration.

## CHAPTER 4.2 INTRODUCTION

Scholars have observed the problematic effects of fragmentation within environmental governance contexts (Garcia, Rice, & Charles, 2014; Rahaman & Varis, 2005; Schneider, Scholz, Lubell, Mindruta, & Edwardsen, 2003; Tropp, 2007). Inclusion of the term integration in the integrated water resources management scholarship is evident of the centrality of integration theory within water governance research (Biswas, 2004). In Australia, fragmentation of various governance components has continued to compromise initiatives aimed at building integrated environmental governance (Morrison, McDonald, & Lane, 2004). Thus

---

[8] Submitted to the 'International Journal of Water Governance' and is under review.

experiments have continued in Australia (Lane, Robinson, & Taylor, 2009) and elsewhere (See a list in Margerum, 1999: 151-152) by those seeking to improve environmental governance outcomes through integration. However, improvements in the state of the global commons have yet to be observed (Steffen, Crutzen, & McNeill, 2007) despite multi-decadal widespread deployment of integration initiatives.

Recently, synchronisation theorists have proposed a revision of how integration is viewed and theorised (Edelenbos, Bressers, & Scholten, 2013; Meerkerk, Buuren, & Edelenbos, 2013; Teisman & Edelenbos, 2011). Proponents of the synchronisation framework of integration assert that the natural propensity for fragmentation within environmental governance systems can be improved by purposefully understanding and working on the integration institutions which actors are producing and maintaining within specific contexts. Following connective capacity theorists (Edelenbos et al. 2013) integration institutions are here defined as the connecting patterns being sustained by interacting individuals located across various social sectors and various levels of social organisation within governance systems. Synchronisation theorists are interested in developing theories and tools to be used in practice by those whom are embedded within governance systems and who are seeking to influence institutional arrangements. Yet apart from Verweij's (2012) application the synchronisation framework of integration has been overlooked by complex systems perspectives of environmental governance regimes.

In the research reported here I test Young's (2008, 2011) call for diagnostic tools through my application of the synchronisation framework to the first 6 months of a two year Aus$1.54 million dollar Australian integration initiative when diagnosis would be considered critical to subsequent action.

CHAPTER 4.3 CONTEXT OF THE CASE

The case of interest here is located within Australia's national "experimentation" with integrated regional environmental governance (Lane, Taylor, & Robinson, 2009: 5) that saw the establishment of 56 regional environmental organisations across the continent between the years 1995 to 2000 (Robins & Dovers, 2007), hence forth referred to as Natural Resource Management Groups (NRMGs).

The case of interest was a sub-national State-wide initiative aimed at improved integration between a particular industry and the NRMGs that were located within that particular State. To protect the privacy of participants, neither the initiative, the state it was conducted in, the industry involved nor specific individuals and organisations will be named in this manuscript. NRMGs, relevant State and Federal governments and several state and national industry organisations partnered to propose and implement the initiative. Their objective was to improve environmental and program outcomes at the regional, state and industry levels through improved integration between sectors and across levels of government. Within this case water quality and distribution between productive and environmental uses is the predominant issue. At the time, across Australia there was extensive experimentation with use of Environmental Management Systems (EMSs) by small to medium enterprises within several industries, including the industry that was a partner of the integration initiative examined in this research. For this industry, EMSs were being used as a form of environmental "co-regulation" (Gunningham, 2009) expected to be achieved by industry led environmental business management. These EMSs were, and still are, at various stages of development between sectors within the industry of relevance to this research and therefore at various levels of co-regulatory status.

At the same time, Australia's 56 NRMGs throughout Australia were charged with developing community endorsed plans for integrated environmental management (Lane, Taylor, et al., 2009; Wallington, Lawrence, & Loechel, 2008). These plans included industry specific targets such as a percentage change in the number of enterprises within a particular sector that were compliant with an industry EMS. Each year, priority areas were selected and co-investments were made available to the relevant industries and community members to support the changes required to meet the targets. The EMS case under investigation here was funded to assist it with faster development of the environmental components of the EMSs being developed by each sector within a particular industry and to support the experimentation of various co-implementation and/or co-regulatory scenarios between industry groups, NRMGs and various levels of government. To this end the project comprised nine sub-projects involving various industry bodies partnering with various NRMGs to achieve these espoused goals.

I was appointed as the state-wide manager of the initiative in July 2007. I was a full participant of this initiative, and more a participant than researcher. However, my records from this time present a detailed account of how the project unfolded from multiple perspectives captured in field notes collected during informal discussions, whilst I was reviewing relevant documents and whilst I participated in meetings and functions. Periodically during my tenure I would reflect upon what was happening, mainly for reporting purposes but also because of my desire to continuously improve my practice and the outcomes of the initiative I was managing. Therefore, although I was mostly positioned as insider, I was at regular intervals positioning myself outside of the process seeking to reflect upon what was happening (Paechter, 2013). Like Elyacher (2013) I will assert in the methodology section later in this document that I was doing ethnography before I had a vocabulary for it. Like others before me (Brodsky, 1993; Elyacher, 2013; Greed, 1990; Norell, 2007; Paechter, 2013), the ethnographic archive I produced at this time provided an opportunity for rich reflexive case research. In the next section I elaborate the synchronisation framework that was tested as a diagnostic tool in the research reported here.

CHAPTER 4.4 THEORETICAL FRAMEWORK

Fragmentation within environmental governance contexts has been found to reduce the performance of governance in multiple ways. Fenger & Bekkers (2012a: 6-8) discuss how fragmentation caused by increasing specialisation in public management domains has contributed to less effective governmental problem solving and public service delivery. Morrison et al. (2004: 244-246) discuss how fragmentation between and within levels of government, along with between economic, social and environmental governmental departments has not allowed the espoused principles of ecologically sustainable development to be actualised within Australian environmental governance systems.

In response there has been widespread implementation of integration initiatives within environmental governance contexts since 1992 (Lane, Haygreen, Morrison, & Woodlands, 2009; Morrison et al., 2004). Approaches such as "whole of government", "joined up government" (Morrison & Lane, 2005) and "integrated water resources management" (Biswas, 2004) have been involved in these efforts. All integration initiatives have the common objective to improve governance actors'

capacity to connect (Fenger & Bekkers, 2012b) across boundaries and recognise interdependencies for improved outcomes from environmental governance systems.

Yet the multi-decadal global effort to improve connectivity capacity has not reduced the propensity for fragmentation within environmental governance systems. It seems that the way that integration is theorised is in need of revision (Lane, Haygreen, et al., 2009: 70). The tendency to develop and apply integration panaceas needs to be replaced by a contextual diagnostic approach that sees and works on integration as the product of the interactions between those actors involved in a context of interest (Boulton, 2010; Dewulf, Mancero, Cárdenas, & Sucozhañay, 2011; Grindle, 2010; Lubell & Lippert, 2011). Such assertions are similar to Young's (2008) call for diagnostic approaches for institutional intervention within environmental governance contexts following ten years of research focused on the "Institutional Dimensions of Global Environmental Change". A diagnostic approach is one that sees researchers and practitioners working together to develop antecedent as well as periodic understandings of integration institutions within specific contexts for the purpose of working on these institutions provisionally and adaptively over time.

Synchronisation theorists, operating from a complexity framework of governance, have proposed a viewpoint of integration and how it should be researched (Teisman & Edelenbos, 2011) that could be applied as a diagnostic tool. Synchronisation theorists see integration as the connecting patterns that emerge from the interactions between complexly and dynamically engaged actors whom are all partially in charge (Teisman & Edelenbos, 2011; Teisman, Gerrits, & van Burren, 2009; Verweij, 2012). For them, the institutional patterns or rules of interests include which interdependencies are recognised and acted upon and which interrelated boundaries are used and acted within.

A review of publications (Moore, 2013; Pel, Edelenbos, & van Burren, 2012; Teisman, van Burren, Edelenbos, & Warner, 2013 citing Teisman & Edelenbos, 2011) reveals that only Verweij (2012) has tested synchronisation as a tool for application. For Verweij (2012, p. 20), whilst taking up Checkland's (1981) directive to "follow the managers" through their daily decision making and acting, the synchronisation framework was able to generate insights into how integration outcomes were being produced within the planning and implementation phases of a significant road infrastructure project in the Netherlands. He used a grounded

theoretical methodology to expose that both public and private actors agreed on certain interdependencies in relation to certain goals (i.e. budget, time, quality and integrality) yet did not share in the motivations behind these goals. He was then able to relate the disjunct between goals and motivations to the boundaries that managers shared in terms of joint and separate activities between the construction and planning phases and between management and process activities.

Verweij's (2012) approach reveals what is involved in the application of the synchronisation framework as a diagnostic tool. Firstly, because synchronisation theory operates from a self-organising viewpoint of governing arrangements, who is involved becomes an empirical question, the answer to which exposes interdependencies and boundaries in use. Verweij's (2012) analysis showed that actors from both the public and private sector and from various levels of social organisation were actively involved in the governance context. Therefore, when applying synchronisation as a diagnostic tool for integration institutions the analytical lens must be focused on identifying whom the actors involved interact or do not interact within their daily activities.

Next, synchronisation theorists assert that integration institutions can be diagnosed by patterns of interdependencies and associated boundaries that those involved and mutually adjusting actors recognise within certain contexts (Teisman & Edelenbos, 2011). This particular point of view means that for those wishing to understand why integration outcomes are being produced in governance contexts their analytical lens must be focused in on the types of interdependencies and associated boundaries that actors are selecting and using to rationalise and act within such contexts over time. For Verweij (2012) the boundaries created between the shared and unshared interdependencies across planning and construction phases resulted in continued fragmentation at the juncture between planning and implementation and across the public and private divide.

Lastly, for synchronisation theorists institutional arrangements are context dependent. As such, appropriate data collection approaches are those which allow the researcher to be involved in the on-going interactions between multiple actors within specific contexts over time (Buijs, Eshius, & Byrne, 2009). For Verweij (2012) this meant following the actors over time and using grounded theoretical

methodology to identify the interdependencies and boundaries that the actors were recognising, using and enforcing.

This study builds on Verweij's (2012) application of the synchronisation framework by incorporating insights from Foucault's work on governmentality. Through his work on governmentality Foucault (1979) uncovered the regular and somewhat rigid ways that governmental actors discursively reproduced certain relevant interdependencies and boundaries such as whom can/cannot be involved in the governmental issue, how can they be involved and therefore the ways in which they can't be involved, and lastly to which and therefore not other ends is the governmental action geared towards (Cheshire 2006:26, Agrawal 2005:217, Rose O'Malley, & Valverde, 2006:84-85). Contemporary governmentality researchers have examined current governmental texts (Bacchi, 2009; Brady 2011; Li, 2007; Lockwood & Davidson, 2010) and have expanded the data collection process through ethnographies to include both talk and text. Therefore a Fouculadian governmentality discourse analysis focused on locating regularities in the boundaries and interdependencies that are being discursively reproduced in talk and text within a contemporary governance context offers a methodological tool for implementing the synchronisation framework. This will be elaborated on further in the methodology section.

In sum, while a synchronisation integration framework focuses on the rules that self-organising actors generate and use in relation to the (non)recognition of interdependencies and the interrelated maintenance of certain boundaries. To apply this in context, our understanding needs to be refined  f the synchronisation framework is to provide further tractability as a diagnostic tool in practice. This paper seeks to contribute to this ambition by reporting on an instrumental case study of an integration experiment in an Australian environmental governance context where water was the preeminent environmental concern. In the next section I will detail the methods I used to collect and analyse data in the research reported here.

CHAPTER 4.5 METHODOLOGY

This study was designed to explore the use of the synchronisation framework as a diagnostic tool from within an integration initiative located within a complex governance context. I therefore employed an instrumental case study (Cresswell,

2013; Stake, 1995; Yin, 2009; Yin & Davis, 2007) of the ethnographic record that I had compiled as the manager of a particular integration initiative. This choice is appropriate for several reasons. First, those whom also employ a complexity perspective of governance, institutions and integration have approved case study as a method for such research (Buijs et al., 2009; Wagenaar & Cook, 2003). Second, case study was the method employed by Verweij (2012). Lastly, given the exploratory nature of this research an instrumental case study is deemed applicable by authors of case study methodological texts (Cresswell, 2013; Yin, 2009).

However, the circumstances of an eight year time lag between data collection and analysis in the research reported here led to a retrospective application of the instrumental case study methodology to an ethnographic archive. Others have done the same either because the time lag offered another layer to the ethical management of political and personal sensitivities within the context of interest and/or because new frontiers in research presented an opportunity to revisit data collected previously (Brodsky, 1993; Elyacher, 2013; Greed, 1990; Norell, 2007; Paechter, 2013). In this case, Like Rhodes et al (2007) the time lag allowed me to further insulate myself and my peers against potential political and personal consequences of examining an active political program. Moreover for me, a move into academia from practice presented an opportunity to reflect upon practical experiences through theoretical lens.

The contents of the record I amassed over the first six months of my tenure as the manager of the project is studied in this case. This record includes eight hardcover notebooks, totalling 1200 foolscap sized pages, three diaries and wall calendars and an extensive digital archive including reports and emails. The first six months was chosen for the reason that at that time I was allocated six months to generate a plan for next two years of the project. Therefore this allows me to test the application of the synchronisation framework as a diagnostic tool within a context where such a diagnosis could have contributed to subsequent action within a practical situation; and if successful could have been re-used at a later date to examine how successful the subsequent action was.

Like Elyacher (2013) whom undertook a retrospective ethnography on data she collected 31 years prior without a specific research mandate or social science training at the time of the data collection, whilst she was employed as an economic analyst

within the American Federal Reserve Bank, the archive I developed as project manager satisfies the criteria for ethnography. The data was collected using the four methods generally used by ethnographers (Angrosino, 2007). Firstly, over the first six months 14% of the record was generated through full participant observations. Secondly, almost two thirds of this six month record was generated from conversations or informal interviews. Next about 10% of the record was in the form of documents such as proposals and reports. Lastly, sometimes as a separate document but also within a subset of each of the preceding data sources the record was punctuated by several reflexive pieces such as informal jottings in my notebook or reflections that can be observed in the project reports and updates being generated by project participants and myself.

Like Paechter (2013) the ethnographic record represented the object of my research. Therefore my ethnographic record delineated the boundaries of my case research. First, I read or listened to the data which I had chronologically ordered and I extracted relevant pieces. The Foucauldian governmentality questions framed the process of data analysis. Subsequently, any data that contained text, or talk transferred to text, that included answers to the governmentality questions of whom has the governmental problem, how can it be solved, by whom and to what ends were extracted and placed in chronological order in another file. Using the methods of selecting key concepts and categories as well as the identification of binaries as outlined within Bacchi's (2009) approach to a Foucauldian discourse analysis I extracted from these data sets phrases and organised them under the governmentality questions.

For example in relation to the governmental question of how can the problem be solved the term "roll out" of programs and products appeared several times in the data. For example, in a proposal produced by government in July 2007 the phrase "prepare and roll out" appeared. At another time in a discussion between myself and an industry organisation in November 2007 a "state-wide roll out" of tools was proposed. I placed these phrases within the category of how can the governmental problem be solved.

I then grouped phrases together with other phrases that expose a similar answer to the question of how the problem can be solved. For example "roll out" was then grouped with phrases that contained the terms "delivery to" and "up take of". Then

key phrases were linked together into groups of statements that effectively answer the governmentality question of interest.

Finally, the patterns of interdependencies and boundaries were able to be generated. Boundaries can exist in terms of whom is involved in the solution (i.e. industry, NRMGS and scientists) and how can they be involved (i.e. in the roll out of standardised programs to individual business owners). Therefore other groups are excluded by the boundary of who has the problem and other ways of achieving outcomes are excluded by the boundaries in how the problem can be solved (i.e. rolled out versus developed from). Moreover, interdependencies are truncated at and within these boundaries. For example the interdependencies between separate business owners are ignored in a solution that involves the uptake of standardised programs by individual business owners. In the next section the results of the data analysis are presented in Stake's (1995) approach to representing case study research. That is, the results of the Foucauldian governmentality framed discourse analysis are book-ended by opening and ending vignettes.

## CHAPTER 4.6 MAIN FINDINGS

## CHAPTER 4.6.1 ENTRY VIGNETTE

During the first month in the position of manager I travelled the state and visited with representatives from the 22 organisations that were included in the project documents I had inherited from the previous manager. Following "my month of talking" I said to my supervisor that I felt like "I had 22 bosses" (August 15th 2007). Some two years later, after I tendered my resignation, a consultant whom had been contracted to take on the coordination of one remaining cross state-industry partnership said in correspondence dated 27th April 2009 that after a month she felt "like a roman chariot getting pulled in various directions by different horses". My discourse analysis of the ethnographically collected data during the first 6 months of the case under investigation in the research reported here reveals that her description of integration is instructive.

## CHAPTER 4.6.2 EMERGENT GOVERNMENTALITY RESULTS

When participants of the case referred to themselves and each other, government, industry and NRMG labels were used over ninety percent of the time. For the remainder of this document it should be recognised that when I refer to the

participants of this initiative I am including myself. Approximately seventy five percent of these referrals identified industry, NRMRGs and the State level of government alone. The majority of the remaining ten percent of conversations and texts named scientists, universities or technical experts as well. For example in October 2007 the signatories of a joint document wrote, "A coordinating group comprising 2 industry representatives, 2 NRMG representatives and technical expertise as required will oversight the program and provide advice to the Federal government on the development and delivery of the program". In sum, environmental management of this industry was being seen as a problem to be addressed by industry, government and NRMGs with the assistance of scientific-technical experts; and not for example conservationists, first people or school children whom together were only ever referred to at a rate of less than three percent of the time.

However, motivations behind this sharing of responsibility of the management of the problem were to enhance each other's ability to secure funds within a funding regime that supported projects that were to be implemented through partnerships. Although some participants observed that their collaborative objectives needed to move from "money pots to outcomes" (2nd August 2007), integration was generally constructed as working out "how we can work together to access these funds for mutual benefit".

Despite the inclusion of the broad sectors of government, industry and NRMGs in the way that management of the environmental impacts of this industry was being constructed, it was also being constructed by the participants of this initiative that the individuals whom had the problem were separate business owners within the industry of concern. As Bacchi's (2009) analysis of governmental texts demonstrated the people whom are required to change something are those whom are being constructed as the target of the intervention. Individual business owners, despite their general exclusion physically and discursively from face to face discussions and co-produced texts, were repeatedly identified as the cohort whom were required to manage the environmental impacts of this industry through their management of their individual businesses.

The strategy for this industry to improve their environmental management was being described by the members of this integration initiative as rational and linear. The terms "planning", "prioritising" and "rolling out" of "best practice" were repeatedly

used to describe how the sectors could work together to achieve results through their modification of individual business management. Another key set of terms that are best captured by the word "alignment" were used to indicate that the participants clearly expected this linear delivery to occur through the alignment or the lining up of their individual activities indicating that the lines between them were not to be blurred.

For example, by 11th November 2007 I had prepared a draft delivery plan for the project. I titled the new plan "from projects to partnerships" and in it I had replaced the term "alignment" with phrases such as "enhanced relationships between" and "better understandings of each other's goals". The document was returned to me with revisions provided by a NRMG Chief Executive Officer. The revisions removed these phrases and reinserted the word alignment. The reason was justified as follows. "Disagree. Means to end. Intent to better align EMS, so they can deliver on NRMG plans for joint outcomes. Better relationships could have been a necessary action and possible benefit". Integration in practice was being constructed as undertaking business as usual but just alongside each other.

This exchange was indicative of a disjunct between the design and delivery phases of this initiative. As Verweij (2012) also found interdependencies that brought sectors together in the problem definition and planning phases did not transfer into the implementation ideas shared by the participants of this initiative. For example, despite evidence of a lengthy proposal phase where industry government and NRMGs worked together to design the initiatives milestones and their delivery frameworks several discussions in relation to the delivery of one project (Discussions on: 13/7/2007; 14/8/2007; 27/11/2007) exposed that the organisations involved had completed all of the milestones independently of each other and that I was facilitating the necessary dialogue between them in order for each other to generate some understandings about how their activities contributed to each other's goals. This occurred regularly in other projects (Discussions on: 17/7/2007; 12/8/2007; 22/8/2007; 6/12/2007; 13/12/2007).

In sum the participants of this case were co-producing boundaries and interdependencies that had implications for which people could and could not be

involved and the ways they could and could not be involved that had implications for whom connects with whom and for what purposes (Table 4.6.2.1).

Table 4.6.2.1: Summary of the boundaries and interdependencies implicit in the emergent governmentalities

|  | Boundaries | Interdependencies |
|---|---|---|
| Who has the problem | Individual business owners | By separating business managers as the owners of the problem from those whom can solve the problem ignores interdependent production of the problem. |
| Who can solve the problem? | Government, NRMGs and Industry Organisations | As above.<br><br>Also as government, NRMGs and Industry Organisations do not have the problem they are not required to change and therefore can operate as business as usual. |
| How can the problem be solved | Alignment of activities in a program that is rolled out towards individual business owners | Alignment means no overlap, rolled out is linear and not cyclic, individual owners take up practices in isolation from peers without resistance or modification or non-adoption. |

CHAPTER 4.6.3 MAINTENANCE OF INTEGRATION ISSUES

Throughout the 6 month data record participants expressed a continual dissatisfaction with integration. NRMGs stated that "our partnerships are so weak" (29th July 2007). Industry group representatives stated that the "there is a lot of discussion but not much action". State government agreed, saying that there are "few outcomes" from numerous attempts to integrate. Duplication of effort, the resource limited context and confusion for the targeted cohort of individual business owners were repeatedly identified as shared integration problems (My reflections 4 Dec 2007). For example an industry organisation said that collaboration continued to be necessary "to make better use of scare resources" (8th August 2007).

Two key indicators of the maintenance of integration issues can be found in the continual dialogue that was produced in relation to partner diversity and the inability

of those involved to demonstrate the aggregate environmental benefits of the changes being made by individual business owners. Firstly, when it came to our partners we challenged their internal diversity saying that "NRMGs are all so different" or the various industry organisations need to be "more consistent". Interestingly, though, each sector at the same time continued to defend their internal diversity asserting that differences in social and biophysical factors drove regional differences for NRMGs and Industry. Secondly, we continued to discuss the difficulties in "linking" changes at the individual business owner level to "landscape outcomes" (13th August 2008).

## CHAPTER 4.6.4 MORE INTEGRATION RESOURCES REQUIRED

The need for more integration resources was equally discussed by NRMGs, State Government and industry organisations. One industry commented "It costs us a thousand dollars each time to get up there and we just do not have the time". State government discussed this issue as much as industry with one person suggesting "If I was in charge I would resource it [integration] and pay someone to connect it all". NRMGs discussed this issue less but had similar concerns saying that "even more people are doing stuff but no one will fund the coordination" further stating that "policy integration is necessary but there is no agency or support for it".

In sum, whilst working on improving the situation we were participating in a continual dialogue that identified issues with our approach to integration whilst at the same sought further similar types of assistance to improve the situation. We were generally in support of providing the resources necessary to retain position(s) like mine in order to overcome these issues.

## CHAPTER 4.6.5 CLOSING VIGNETTE

I was appointed as the manager of the integration initiative that is the subject of the case reported here on the 2nd July 2007 and I held the position until the 15th May 2009. At the end of a teleconference recorded in May 2009 involving representatives from several industry groups and NRMGs discussion turns to my impending departure and a brief reflexive conversation ensues. In this exchange I apply the word "co-opetition", which some of us had at the time begun to use to convey how we had experienced our cooperating yet competing relations during our two years of attempting to integrate our environmental planning policies and activities. Co-opetition emerges as another way that the participants could convey that integration

in this instance feels like a roman chariot that tethers them together on some levels (e.g. competitive funding programs that reward highly collaborative project proposals) whilst also allowing for independent, side by side, joined up, aligned action.

CHAPTER 4.7 DISCUSSION

When seeking to support institutional change, such as attempting to change socially constructed rules that bound interdependent action (Edelenbos, 2005), it has been asserted that what is missing is a diagnostic approach (Young, 2008, 2011).  A diagnostic approach would seek to understand rules in use and why they are being produced both prior to and after intervention.  Synchronisation theorists have provided a framework for viewing integration, a process for identifying those rules in use which are considered important to the production of integration outcomes, and lastly a strategy for hypothesising how these rules are being reproduced (Teisman & Edelenbos, 2011).

This research investigated whether the synchronisation framework can act as a diagnostic tool for those seeking to influence integration within complex environmental governance systems.  In response this discussion is organised as follows.  Firstly, how this research contributes to synchronisation framework is examined.  This discussion is focused on the three components of as the framework: self-organisation, interdependence and boundary making.  Secondly, the application of synchronisation framework as a diagnostic tool for those embedded in complex environmental governance contexts and who are charged with working on integration is explored.  Lastly, the utility of the methodology used to apply the synchronisation framework within this research is examined.

CHAPTER 4.7.1 APPLICABILITY OF THE SYNCHRONISATION FRAMEWORK

Scholars contributing to Fenger & Bekkers (2012b) volume deploy in their research the opinion that integration within governance contexts involves actors and groups of actors whom continuously experience both connecting and consensual (i.e. cooperating) and fragmenting defences of autonomy (i.e. competing) forces and reactions.  Likewise for Teisman & Edelenbos (2011) integration is seen as the product of self-organising actors whom mutually adjust between themselves and

each other in effort to remain independent in their pursuit of certain interdependent outcomes.

The use of the term co-opetition and the analogy of the roman chariot used by a colleague in a similar role to mine within the same context demonstrates the relevance of the research to these understandings of integration institutions. Moreover, the multi-sectoral reproduction of the boundaries between who is inside the problem and who is outside it, as well as between each other in our implementation of solutions supports the viewpoint that integration emerges from a "multi-sided interaction process of self-organisation of several actors partly in charge" (Teisman & Edelenbos, 2011, p.5).

Next, for synchronisation theorists, the rules that self-organising actors use when they recognise certain interdependencies (and not others) and maintain certain boundaries (and not others) provide the focal point for understanding integration outcomes and how they are reproduced. As has been shown previously in contexts where interactive self-organising viewpoints are applicable, such as neurology, the flying formations of ducks, and people's movements in urban settlements, outcomes are produced by self-organising entities that share an appreciation of a few simple rules (Heylighen, 2002). Verweij (2012) found this to be the case when he produced a grounded theoretical application of the synchronisation framework and in doing so exposed why the actors involved co-produced integration outcomes through the sharing of goals but not motivations. In a similar vein I found that the application of the synchronisation framework allowed me to identify the co-production of rules and associated integration outcomes.

For example in the case research reported here participants were constructing certain sectors as relevant to the integration solution, and in doing so erected boundaries in subsequent joint action that limited the inclusion of other sectors. When we constructed one cohort as being responsible for change, we set up boundaries that maintained business as usual in all other sectors in the implementation of joint responses. By constructing the problem as amenable to joint action sector by sector then boundaries between organisations in implementation were adhered to. Therefore this research supports the synchronisation framework's attention to the rules that actors use in relation to the recognition of interdependencies and the

maintenance of boundaries when assessing the systemic sources of regularities in institutional arrangements relevant to integration.

Lastly, the findings of this research tend to support Tesiman and Edelenbos' (2011) assertion that where there is a failure to take a systemic view of governance and its outcomes, the resources (e.g. time, effort and money) that are deployed to support integration will most likely sustain the reproduction of antecedent levels of fragmentation. In the environmental governance context that was investigated in this research the extensive resources deployed by participants reproduced an ongoing dissatisfaction with the levels of integration being produced, an espoused desire to improve this situation, and a continued call for more of the same types of resources and actions in order to improve integration.

CHAPTER 4.7.2 CAN SYNCHRONISATION IMPROVE STRATEGIES AIMED AT IMPROVING THE SITUATION

The findings show the salience of certain shared viewpoints and approaches and how these shared theories and practices are relatable to integration outcomes. The participants within this environmental governance context maintain certain governmental rationalities (i.e. governmentalities) from design to implementation of a project that have implications for what can be achieved in terms of improved integration. In this way the synchronisation framework has merit in terms of producing better outcomes from integration programs if used to expose the antecedent rules in use for their subsequent purposeful consideration. This seemed to be the case here.

In addition, the findings of this research "problematise' (Bacchi 2009) the role of a partnerships manager and the logic of funding programs that seek to improve integration through the purchasing of partnerships. Whether within the program under investigation in this study or in observations of actors in positions like mine in concomitant integration activities the externalisation of inter-connecting activities was actively maintained. Coordinating positions seem to be at risk of supporting counter-intuitive outcomes if they are incorporated into a systemic externalisation of the connecting activities necessary for interdependent recognition and action.

In reflection these are the types of insights that I could have more purposefully addressed in the role. Although there were attempts to move the experiments

towards partnerships and away from separate projects the salient boundaries of the integration project were reinforced. Therefore synchronisation has merit as a diagnostic tool but will be impeded by project designs that fail to take a systemic understanding of the production of integration outcomes. This leads to the next point of discussion. What are practical and theoretical insights of the methodologies applied in this research?

## CHAPTER 4.7.3 REFLECTIONS ON METHOD

I argue that this way of doing research on integration institutions within environmental governance contexts departs from traditional views of research within this domain. It engages with the on-going, dynamic and co-produced process through which government is enacted within such systems. Synchronisation, with its focus on the interactions that produce integration outcomes, here investigated within an instrumental case study proved a useful tool that was commensurate with the time frame allocated for preparing a project implementation plan. However, it also shows that the application of synchronisation framework needs to be further investigated within the dynamics of mutual adjustment as it is occurring where interim findings could inform discussion, decisions and action such as revisions that a partnerships manager ideally with the participants may experiment with following reflection upon these observations. A case study of pre-planned embedded analyses within reflexive managerial praxis is worthy of further attention.

## CHAPTER 4.8 CONCLUSION

Fragmentation is a perennial problem in contemporary environmental governance. Integration thus will remain a key concern for actors attempting to achieve environmental and social outcomes through interdependent action. Integration programs such as 'joined up government' or 'integrated water resources management' have been used for some time to address the effects of fragmentation. This paper examines a commensurate integration initiative within an environmental governance context in Australia and provides supportive evidence that the strategies currently employed have not alleviated the effects of fragmentation or eased the need for improved integration.

Synchronisation theorists propose a different way of viewing the problem, and offer a framework that can be used by interested actors to understand and act within the

dynamic of more or less interdependent mutual adjustment that both reproduces fragmentation and influences the effectiveness of integration experiments. From their perspective, it is proposed that tools are required that recognise the concomitant on-going presence of opposing tendencies to fragment and integrate, as indicated by our use of the word co-opetition, within these environmental governance contexts and therefore discovers and works on the boundaries and interrelated interdependencies that actors within specific contexts are using to bound what can be integrated, when and how and by whom.

The application of the synchronisation framework in the case analysed in this paper gives rise to several conclusions. Firstly synchronisation is found to be a useful framework because the interactions sustained by the actors involved revealed the three interrelated processes theorised to produce fragmentation in such contexts: self-organisation; recognised interdependencies; boundary reproduction. Secondly, the framework as applied revealed that the root of integration outcomes in this context is constituted in the limited recognition of interdependent relationships post planning and design and in the reproduction of interrelated boundaries in implementation. Ultimately fragmentation was sustained, and there was an ongoing call for more of the same resources and roles to assist in evolving integration levels that are maintained by the participants themselves, despite their espoused commitment to more effective integration.

As a result of these findings three areas of future research are proposed. Firstly, the utility of the synchronisation framework depends upon further applications in commensurate contexts with similar methods, applied during experiential reality. Next, the data suggests that the utilisation of the framework as a diagnostic tool may contribute to better outcomes from such experiments if embedded within projects that apply a systemic viewpoint of the process. Finally, integration programs aimed at better environmental outcomes by requiring cross sector and cross level partnerships and their support through liaison personnel may produce counter-intuitive responses and this merits further theoretical attention.

CHAPTER 4.9 REFERENCES

Agrawal, A. (2005). Environmentality technologies of government and the making of subjects. Durham and London:  Duke University Press.

Bacchi, C. (2009). Analysing Policy: What's the problem represented to be? Frenchs Forest, NSW: Pearson Australia.

Biswas, A. K. (2004). Integrated water resources management: A reassessment. Water International, 29, 248-256. doi: 10.1080/02508060408691775.

Boulton, J. (2010). Complexity theory and implications for policy development. Emergence: Complexity & Organization, 12(2), 31-40.

Brady, M. (2011). Researching governmentalities through ethnography: the case of Australian welfare reforms and programs for single parents. Critical Policy Studies, 5, 264-282. doi: 10.1080/19460171.2011.606300.

Brodsky, J. I. (1993). The mineshaft: A retrospective ethnography. Journal of Homosexuality, 24(3-4), 233-252. doi: 10.1300/J082v24n03_16.

Buijs, M., Eshius, J., & Byrne, D. S. (2009). Approaches to researching complexity in public management. In G. R. Teisman, A. van Burren, & L. Gerrits (Eds.). Managing complex governance systems: dynamics, self-organization and co-evolution in public investments. (pp. Pages 37-55). New York: Routledge.

Checkland, P. (1981). Systems thinking, systems practice.

Cheshire, L. (2006). Governing rural development discourses and practices of self-help in Australian rural policy. Hampshire, England: Ashgate Publishing Limited.

Cresswell, J. (2013). Qualitative inquiry and research design: Choosing among five approaches (3rd ed.). Thousand Oaks, CA.: SAGE Publications Inc.

Dewulf, A., Mancero, M., Cárdenas, G., & Sucozhañay, D. (2011). Fragmentation and connection of frames in collaborative water governance: a case study of river catchment management in Southern Ecuador. International Review of Administrative Sciences, 77(1), 50-75. doi: 10.1177/0020852310390108.

Edelenbos, J., Bressers, N., & Scholten, P. (2013). Conclusions: Towards a synchronisation perspective of connective capacity in water governance. In J. Edelenbos, N. Bressers, & P. Scholten (Eds.). Water governance as connective capacity. (pp. Pages 333-351). Surrey: Ashgate.

Elyacher, J. (2013). Regulating crisis: A retrospective ethnography of the 1982 Latin American debt crisis at the New York federal reserve bank. Valuation Studies, 1(2), 147-160.

Fenger, M., & Bekkers, V. (2012a). Creating connective capacities in public governance: Challenges and contributions. In M. Fenger & V. Bekkers (Eds.). Beyond fragmentation in public governance: The search for connective capacity. (pp. 3-16). Amsterdam: IOS Press.

Fenger, M., & Bekkers, V. (Eds.). (2012b). Beyond fragmentation and interconnectivity: Public governance and the search for connective capacity. Amsterdam: IOS Press.

Foucault, M. (1979). Governmentality. Ideology and Consciousness, 6, 5-21.

Foucault, M. (1998). The history of sexuality Vol 1: The Will to Knowledge. Harmonsworth: Penguin.

Garcia, S. M., Rice, J., & Charles, A. (2014). Governance of marine fisheries and biodiversity: The integration challenge. In S. M. Garcia, J. Rice, & A. Charles (Eds.). Governance of marine fisheries and biodiversity: Interaction and coevolution. (pp. 37 - 52). UK: John Wiley & Sons Ltd.

Greed, C. (1990). The professional and the personal: A study of women quantity surveyors. In L. Stanley (Ed.), Feminist praxis: Research, theory and epistemology in feminist sociology. (pp. 145-155). London and New York: Routledge Taylor and Francis Group.

Grindle, M. S. (2010). Governance reform: The new analytics of next steps. Governance: An International Journey of Policy, Administration and Institutions, 24, 415-418.

Gunningham, N. (2009). The new collaborative environmental governance: The localization of regulation. Journal of Law and Society, 36(1), 145-166. doi: 10.1111/j.1467-6478.2009.00461.x.

Heylighen, F. (2002). The science of self organisation and adaptivity. The encyclopaedia of life support systems. UNESCO Publishing-Eolss Publishers.

Lane, M., Haygreen, A., Morrison, T. H., & Woodlands, J. (2009). Will regionalisation achieve integrated natural resource management? Insights from

recent South Australian experience. In M. Lane, C. Robinson, & B. Taylor (Eds.). Contested country. Local and regional natural resources management in Australia. (pp. 59-74). Victoria: CSIRO Publishing.

Lane, M., & Robinson, C. (2009). Institutional complexity and environmental management: the challenge of integration and the promise of large-scale collaboration. Australasian Journal of Environmental Management, 16(1), 16-24.

Lane, M., Robinson, C., & Taylor, B. (Eds.). (2009). Contested country : local and regional Natural Resources Management in Australia. Collingwood, Vic: CSIRO Publishing.

Lane, M., Taylor, B., & Robinson, C. (2009). Introduction: contested country - regional natural resources management in Australia. In M. Lane, C. Robinson, & B. Taylor (Eds.). Contested country. Local and regional natural resources management in Australia. (pp. 1-11). Victoria: CSIRO Publishing.

Li, T. M. (2007). Governmentality. Anthropologica, 49, 275-281.

Lockwood, M., & Davidson, J. (2010). Environmental governance and the hybrid regime of Australian Natural Resource Management. Geoforum, 41, 388-398.

Lubell, M., & Lippert, L. (2011). Integrated regional water management: a study of collaboration or water politics-as-usual in California, USA. International Review of Administrative Sciences, 77(1), 76-100. doi: 10.1177/0020852310388367.

Margerum, R. D. (1999). Integrated environmental management: The foundations for successful practice. Environmental Management, 24(2), 151 - 166.

Meerkerk, I., Buuren, A., & Edelenbos, J. (2013). Water managers' boundary judgments and adaptive water governance. An analysis of the Dutch Haringvliet Sluices case. Water Resources Management, 27(7), 2179-2194. doi: 10.1007/s11269-013-0282-7.

Moore, M.-L. (2013). Perspectives of complexity in water governance: Local experiences of global trends. Water Alternatives, 6.

Morrison, T., & Lane, M. (2005). What 'whole-of-government' means for environmental policy and management: an analysis of the connecting government initiative. Australasian Journal of Environmental Management, 12(1), 47-54.

Morrison, T. H., McDonald, G. T., & Lane, M. B. (2004). Integrating natural resource management for better environmental outcomes. Australian Geographer, 35(3), 243-258.

Norell, K. (2007). Governing Karlstad: An insider's story. In R. A. W. Rhodes, P. t'Hart, & M. Noordegraf (Eds.). Observing government elites up close and personal. (pp. 103-128). New York: Palgrave Macmillan.

Paechter, C. (2013). Researching sensitive issues online: Implications of a hybrid insider/outsider position in a retrospective ethnographic study. Qualitative Research, 13(1), 71-86. doi: 10.1177/1468794112446107.

Pel, B., Edelenbos, J., & van Burren, A. (2012, Pel, B, Edelenbos, J, & van Buuren, M.W. (2012). The design of design: A systems approach to Integral Planning and spatial Design in the Dutch Southwest Delta. Retrieved from http://hdl.handle.net/1765/34812). The design of design: A systems approach to integral planning and spatial design in the Dutch southwest delta. Retrieved February 18th, 2015 from http://hdl.handle.net/1765/34812

Rahaman, M. M., & Varis, O. (2005). Integrated water resources management: Evolution, prospects and future challenges. Sustainability : Science, Practice, & Policy, 1, 15.

Robins, L., & Dovers, S. (2007). NRM regions in Australia: The 'haves' and the 'have nots'. Geographical Research, 45(3), 273-290.

Rose, N., O'Malley, P., & Valverde, M. (2006). Governmentality. Annual Review of Law and Social Science, 2, 83-104. doi: doi:10.1146/annurev.lawsocsci.2.081805.105900.

Schneider, M., Scholz, J., Lubell, M., Mindruta, D., & Edwardsen, M. (2003). Building consensual institutions: Networks and the national estuary program. American Journal of Political Science, 47, 143-158.

Stake, R. E. (1995). The art of case study research. California: Thousand Oaks.

Steffen, W., Crutzen, P. J., & McNeill, J. R. (2007). The Anthropocene: Are humans now overwhelming the great forces of nature? Ambio, 36, 614-621.

Teisman, G. R., & Edelenbos, J. (2011). Towards a perspective of system synchronization in water governance: A synthesis of empirical lessons and

complexity theories. International Review of Administrative Sciences, 77(1), 101 - 118. doi: 10.1177/0020852310390121.

Teisman, G. R., Gerrits, L., & van Burren, A. (2009). An introduction to understanding and managing complex process systems. In G. R. Teisman, A. van Burren, & L. Gerrits (Eds.). Managing complex governance systems: Dynamics, self organisation and co-evolution of public investments. New York: Routledge.

Teisman, G. R., van Burren, A., Edelenbos, J., & Warner, J. (2013). Water governance: Facing the limits of managerialism, determinism, water-centricity, and technocratic problem-solving. International Journal of Water Governance, 1(1), 1-11.

Tropp, H. (2007). Water governance: Trends and needs for new capacity development. Water Policy, 9, 19-30. doi: 10.2166/wp.2007.137.

Verweij, S. (2012). Management as system synchronization: The case of the Dutch A2 Passageway Maastricht project. Emergence: Complexity & Organization, 14(4), 17-37.

Wagenaar, H., & Cook, S. D. N. (2003). Understanding policy practices: Action, dialectic and deliberation in policy analysis. In M. Hajer & H. Wagenaar (Eds.). Deliberative policy analysis: Understanding governance in the network society.

Wallington, T., Lawrence, G., & Loechel, B. (2008). Reflections on the legitimacy of regional environmental governance: Lessons from Australia's experiment in Natural Resource Management. Journal of Environmental Policy & Planning, 10, 1 - 30.

Yin, R. (2009). Case study research, design and methods (4th ed.). Thousand Oaks, CA: Sage Publications.

Yin, R. K., & Davis, D. (2007). Adding new dimensions to case study evaluations: The case of evaluating comprehensive reforms. New Directions for Evaluation, 2007(113), 75-93. doi: 10.1002/ev.216.

Young, O. (2008). Building regimes for socioecological systems: Institutional diagnostics. In O. Young, L. King, & H. Schroeder (Eds.). Institutions and environmental change: Principal findings, applications and research frontiers. (pp. Pages 115-144). Cambridge: The MIT Press.

Young, O. (2011). Land use, environmental change, and sustainable development: The role of institutional diagnostics. 5(1), 66-85, Retrieved from URL: http://www.thecommonsjournal.org/index.php/ijc/article/view/244.

CHAPTER 5 A FOUCAULDIAN ILLUMINATION OF INSTIUTIONAL RESILIENCE WITHIN AN AUSTRALIAN WATER GOVERNANCE SYSTEM[9]

CHAPTER 5.1 ABSTRACT

In this paper I examine institutional resilience from within an Australian water governance system.  I use Foucault's view of power as three types of interrelated disciplinary practices used by actors in complex governance interactions to secure certain thinking and behaving limits. The results presented in this paper emerged from my embedded and intensive study of the discourse being co-produced by actors within an Australian water governance system between the 1st to the 31st May 2010. The disciplinary practices of dividing, knowledge, and self-actualizing that actors discursively deploy are brought into focus in order to expose how actors together reproduce institutional limits that will not allow them to achieve their espoused goal of Ecologically Sustainable Development.  The study reveals that the lack of the desired integration institutions does not result from the failures of authorities positioned in various sectors and levels of social organization to espouse or legislate for such institutions.  Rather, it is concluded that a pervasive network of on-going disciplinary relations that sustain historically contingent yet equally arbitrary boundaries would need to be de-stabilized if the espoused desire for Ecologically Sustainable Development were to be realized in this Australian water governance context.

CHAPTER 5.2 INTRODUCTION

Since the release of Our Common Future (World Commission on Environment and Development, 1987) and the development of Agenda 21 in 1992 (United Nations Conference on Environment and Development, 1992) sustainable development goals have been pursued globally and in Australia through such initiatives as *Integrated* catchment based Water Resources Management (IWRM) (Biswas, 2004; Dinar et al., 2005; Fischhendler & Heikkler, 2010) or more broadly *Integrated* regional or devolved Natural Resource Management (INRM) (Lane, Robinson, & Taylor, 2009; Margerum, 1999).  In Australia, where both IWRM (Bellamy, Ross, Ewing, & Meppem, 2002) and INRM (Lane et al., 2009) have been implemented the National

---

[9] Written for submission to the 'International Journal of Water Governance'.

Strategy for Ecologically Sustainable Development (ESD) represents the local interpretation and accommodation of the broader global agenda to institute sustainable development (Emmery, 1994). The development of institutions that support integrated approaches to managing environmental issues is considered central to sustainable development, so that environmental policy and action can "integrate and optimize social, economic and environmental outcomes' (Morrison, McDonald, & Lane, 2004: 244).

In sum, the importance of integration institutions to environmental governance, and more specifically water governance, has precipitated much policy experimentation and research globally since the late 1980s. Following Edelenbos (2005) and Hodgson (2006) *Institutions* are here defined as emergent patterns of thinking and behaving in a social context, where the context is seen as groups of embedded self-organizing actors located within co-evolving social and ecological systems that are producing and responding to complex adaptive interactions between themselves. From this perspective, governmentalities are defined as those institutions that emerge in governing contexts. *Integration* therefore is institutionalised governmentalities that emerge in relation to the ways that people connect and also think about connecting with each other when attempting to manage issues in environmental governing contexts (Teisman & Edelenbos, 2011). In this paper the focus is on the integration institutions that might support the espoused social and political goals for increased connection between actors located within economic, social and ecological domains of governance in a water governance context within the state of Queensland in Australia.

Today it is recognized that environmental governance institutions, of which integration institutions are here considered a subset, are difficult to modify. They have been variously labeled as "inert" (Bellamy et al., 2002: 33), "sticky" (Duit & Galaz, 2008: 320; Ekstrom & Young, 2010; Galez, Olsson, Hahn, Folke, & Svedin, 2008: 320; O'Neill et al., 2013; Young, 2010: 379) or "pathologically trapped" (Gunderson & Light, 2006; Holling & Meffe, 1996). This does not mean they cannot change or that they are not subject to potentially destabilizing forces of social and/or ecological origin. To the contrary, complexity theory (Levin, 1998) and Social-Ecological System (SES) theory (Holling, 1973) together demonstrate that the emergent properties of complex systems are the product of interactions among many

dynamically interconnected sets of relations between agents. In order to understand, or change these outcomes the interconnections in any particular context needs to be examined.

This paper explores, by means of a systemic application of Foucauldian (Agrawal, 2005; Foucault, 1994b) constructs of power, how emergent patterns of thinking and behaving are maintained in an environmental governance setting, and why these institutions are highly 'resilient' or resistant to efforts to change them. By doing so, this paper provides an alternative framing to apolitical studies of environmental and water governance (Mollinga, Meinzen-Dick, & Merrey, 2007; Torfing, Peters, Pierre, & Sorensen, 2012) and addresses an acknowledged gap (Teisman, van Burren, Edelenbos, & Warner, 2013) in the relevant scholarship by applying complex systems thinking to a water governance study focused on integration institutions.

CHAPTER 5.3 THEORETICAL FRAMEWORK

Teisman et al. (2013) and Godden & Ison (2010) critique the paucity of systems thinking across the water governance research. Likewise the water governance literature has been found to maintain interconnected normative and technical frameworks of institutions that obfuscate the role of power and politics in several ways (Torfing et al., 2012; Mollinga et al., 2007; Cote & Nightingale, 2012). In this paper I depart from non-systemic and power neutral frameworks of water governance and institutions for the purpose of exploring the insights that a counter approach may generate. In this section I provide the systemic framework of water governance, institutions and power that was used in the research that is being reported here.

Firstly I construe water governance regimes as Complex Adaptive Systems (CASs) that are sustained through the interactions between actors within a given context. CASs are produced and re-produced through the interactions of complexly and dynamically interrelated agents (Levin, 1998). From this viewpoint the boundary of the system of interest cannot be pre-determined but needs to be empirically identified through documenting interactions between the social and bio-physical agents in a given context (Buijs, Eshius, & Byrne, 2009; Gerrits, 2008; Verweij, 2012).

Yet CASs despite their internal dynamics produce remarkably consistent outcomes that are discernable in the patterns they produce at various levels of analysis. Complexity theorists describe the production of these patterns as 'emergence'

(Hodgson, 2006; Wuisman, 2005). Some complexity theorists have argued that institutional arrangements are emergent thinking and behaving properties of social systems, of which water governance systems are a subset (Edelenbos, 2005; Hodgson, 2006).

A similar framework of governance and institutions can be found in the oeuvre of the power theorist Michel Foucault. For Foucault, government could no longer be construed as having a single locus of power, but as "witches brew" (Foucault 1994c: 81-82; Brady, 2011: 260; Li, 2007: 278) of relations amongst actors that together manage the "conduct of conduct" (Foucault, 1994b: 341) by their actions and counter-actions. He can be understood here as describing government as a CAS of actor relations.

Next, Foucault used the term 'govenrnmentality' to describe what he observed to be patterns in the rationalities (i.e. ways of thinking) and the technologies (i.e. ways of doing) of government (Dean, 1999: 36; Rose & Miller, 1992: 172) in governmental texts and discourses (Bacchi, 2009). However, more recently anthropologists and ethnographers (Brady, 2011; Li, 2007) have used data generated by embedding themselves in the discourse as it unfolds to identify such patterns. It is consistent with these approaches to construe governmentalities as institutions of governmental systems.

Next, Foucault's (1994a: 220-221) term 'governmentalisation' can be used to name the systemic alignment of governance, institutions and power. He used governmentalisation to describe the on-going reflective practices that actors within governmental settings discursively undertake in order to continually secure governmentalities that are somewhat contingent but never settled. If institutions are seen as the emergent products of governmentalisation within the actor relations that produce CASs of governance then power can be viewed as the on-going interactional processes that reproduce institutions.

This view of power is elaborated by Foucault (1994b), and others (Agrawal, 2005; Hacking, 1986) who have drawn upon his work. They label and use power to mean the deployment of three interrelated disciplinary mechanisms by actors interacting within systems of "subject making" (Agrawal, 2005: 255). Here 'subject' is used with a plural meaning, involving both the subjectivities that are in use and the

subjects who are using them. If subject making disciplinary processes produce how people act and speak and the subjectivities they deploy when doing so, then a system of subject making can be read as a system for institutionalizing ways of behaving and thinking in a given situation. This discussion is drawn together in Table 5.3.1.

Table 5.3.1: Systemic framework of key relationships among the concepts of Institutions, Governmentalities and Power

|  | Emergent patterns in: |
| --- | --- |
| In social systems *Institutions* are: | Thinking and Behaving |
| In those social settings which are governmental, that is in *governance* systems, *Governmentalities* are | Rationalities and Technologies |
| *Power* or subject making systems produce | Subjectivities and Subjects |

It is theorized that systems of subject making are driven by the three interdependent disciplinary practices (Agrawal, 2005: 315; Foucault, 1994b), known as dividing, self-actualizing and knowing practices, and these have been applied in the study reported in this paper. Dividing practices include categorization and division of things in conversation (i.e. mad/insane, uninformed/informed, local/national); in diagrams (i.e. map boundaries, flow charts); or physically (e.g. who attends a meeting and who does not) (Bacchi, 2009). Self-actualizing practices are speech and behavioral choices made by actors that allow them to be identified as members of certain groups that maintain characteristic divisions and expectations. For example, homosexuality existed long before it became a term and a way of dividing through identification of selves by selves and other selves (Foucault, 1998). Knowing practices refer to the knowledge that actors bring to a situation when they are involved in dividing and self-actualizing.

In the research reported here the systemically aligned framework of governance, institutions and power that has been described above was used to examine the role of power in the production of institutional arrangements within a water governance system located within Queensland, Australia during the rapidly expanding phase of the Coal Seam Gas industry. In Queensland, the *Environment Protection Act 1994*

(Qld) and the *Water Act 2000* (Qld) both espouse the aim of achieving Ecologically Sustainable Development.  Therefore of particular interest are institutions that integrate environmental, economic and social rationales of governing.  In the next section the methods used to collect and analyze data for the case of interest are reported

CHAPTER 5.4 METHODOLOGY

Discourse analysis is applied in this study because it allows analysis of what is being said, verbally, non-verbally or in text, so that what is taken as self-evident, as well as the non-self-evident, are exposed (Butteriss, Wolfenden, & Goodridge, 2001: 50; Colombo & Porcu, 2014: 68). The definitions adopted by Butteriss et al (2001: 49-50) who have applied discourse analysis in the "context of adaptive environmental conflict management", have been followed, such that discourse is defined as "a collection of stories, narratives, scripts, myths, legends, and sagas accounting for events, usually developed chronologically and sequentially, to indicate a causal relationship between one event and another". Ethnographic methods were used to collect the discourse (Angrosino, 2007), whilst I was employed as an embedded participant in the context of interest. Participant observation enabled the collection and assembly into chronological order media releases and stories, meeting minutes, government reports and scoping documents, parliamentary records, Laws, explanatory notes, videos, emails and blogs over a one month period from the 1st of May 2010 to the 31st May 2010 (Table 5.4.1).

These data are connected to each other in the documented discourse.  For example, the Chief Executive of the Queensland Resources Council stated on the 20th May (Roche, 2010: 1):

> "As Minister Robertson told Parliament, the amendments to the existing land access framework are about providing certainty to all stakeholders.  This is not, as some have claimed, a knee-jerk reaction to a once-over-lightly TV report last Sunday night, but rather the product of extensive consultations between the state government, the QRC, APPEA and the peak rural representative bodies, Agforce and the Queensland Farmers' Federation dating back to 2008".

Table 5.4.1: Data collected

| Source and type of Data | | National | State | Local |
|---|---|---|---|---|
| Media | Television | 5 | | |
| | Social | | | 2 |
| | Print | | 3 | |
| | Radio | 2 | | |
| Government | Hansard - transcript | 2 | 6 | |
| | Document, Law | | 11 | |
| | Press Release | | 3 | |
| | Participant Observation | | 2 | |
| | Meeting Minutes | 1 | | |
| | Interview | | 1 | |
| Darling Downs Groups | Press Release | | | 1 |
| | Participant Observation | | | 2 |
| | Document | | | 2 |
| Environmental Representatives & Organizations | Speech | 1 | | |
| | Social | 1 | | |
| Mining Representative Organizations | Speech | 1 | 1 | |
| | Press Release | 1 | | |
| | Interview | | 1 | |
| Mining Companies | Meeting Minutes | | | 3 |
| Agricultural Representative Organizations | Documents | 1 | | |
| Total | 53 | 15 | 28 | 10 |

Here the Chief Executive is connecting several pieces of data together, such as parliament, laws, a TV show, and an extensive consultative process dating back to 2008. In this statement he is also connecting data that is being produced across the three levels of public administration in Australia: Local, State and Federal. He represents a State level mining industry organization and he includes in his statement reference to the State parliament and laws, agricultural representative bodies operating at the Queensland level and a mining industry organization operating at the

Federal level, as well as with local representatives such as a Mayor, farmers and community members who were part of the TV show he refers to.

Participants in discussions, such as the 2 year long consultative process referred to above, on occasion referred to documents, events and conversations that occurred prior to the month of observation. Therefore the data also includes discourse produced prior to the observation period but used within the observation period. In addition, some discussions and documents that occurred after the observation period are included, such as annual reports. Together the data (Table 5.4.1) represent a connected one month long political discourse that traverses levels of social organization and is produced by multiple actors located in a diversity of socially and geographically orientated positions, in reference to the issue of the development of a CSG industry in Queensland as a whole and in particular on the Darling Downs.

The discourse analysis procedures developed in Attar and Genus (2014: 245) has been adopted for the manual examination and coding of texts presented in Table 2 to identify themes, and emergent patterns. One key emergent theme, denoted in this article as "Best versus the Rest", was identified in the pronouncement that CSG explorers are "developing gas fields on some of the State's prime farmland" and in discussions of the economic hierarchy of agricultural landscapes across the state of Queensland, expressed in various phrases such as "strategic cropping land", "top quality land" and "valuable farm land".

Instances in which the identified themes were actively maintained by the participants in the study were also noted and categorized. In the case of the 'Best versus the Rest" theme, for instance, there were episodes in which mining industry actors began to separate the Darling Downs from the other areas that the industry was operating in, constituting a dividing practice that was deployed further by these actors and justified as consistent with their own view of economic development. There were also instances when landholders argued against and for mining intrusion based on the economics of compensation. For landholders on the very best cropping land it is economically unviable for mining companies to compensate the impacts of mining development on their lucrative irrigated cropping businesses. Graziers for their part were heard welcoming the assured base cash flow that mining compensation provided to their less economically stable businesses. Here knowing practices are deployed as economic knowledge as opposed to other knowledge that is used to

maintain a boundary between economically superior farming land and the rest. These dividing and knowing practices within the "Best versus the Rest" theme interrelate with self-actualizing practices for those farmers who subscribed or belonged to a population that argues the merits of development and where it should be allowed to occur in the landscape in terms of economics rather than other valuing systems.

Eventually four themes were uncovered in the discourse: "Best versus the Rest", "Environmental impact = Economic impact", "Climate's right for growth" and "CSG Water is not Water". These themes and the disciplinary practices that actors used to secure and re-produce their on-going expression within the context of interest to this research exposed the interrelated boundaries to how environmental governance is thought about and acted upon over time (i.e. governmentalities). In the next section the data are re-presented as a rich descriptive narrative that unfolds over the period of investigation within the boundaries of the four themes.

CHAPTER 5.5 ANALYSIS

CHAPTER 5.5.1 CONTEXT

According to an environmental website (Six Degrees, 2010) and the organisers' press release (Save Our Darling Downs, 2010) the Save our Darling Downs (SODD) action group was launched at a protest rally *against* CSG mining held at the property "Waverly" located on Queensland's Darling Downs. On that day SODD joined the Basin Sustainability Alliance (BSA), also headquartered on the Darling Downs at Dalby, which had been launched on the 22nd April 2010 (Observation, 24th May). The first fact sheet about BSA's formation dated July 2010 (Basin Sustainability Alliance, 2010) states that BSA is "an organization representing the concerns of landholders and communities across the Great Artesian Basin (GAB)". The protest against CSG mining brought together these local groups with others such as the Northern Landowners Group that had existed for some time prior and represented areas further west where the main operations of the CSG industry had been located for approximately 10 years prior according to a CSG company executive (*Pipe Dreams*, 2010), a mining industry representative (Roche, 2010) and a State Government minister (Queensland Government, 2010b).

Up to this point the CSG industry had been operating in an exploration phase with limited domestic gas production (*Pipe Dreams*, 2010). However, the industry was now constructed as moving towards a greater production phase and was variously said to be "booming" (Various, 2nd, 9th, 20th and 29th May), "in a gold rush phase" (Various, 2nd, 16th and 20th May), and as "creating a bonanza" (Various, 3rd and 9th May). It was "full steam ahead" (*Pipe Dreams*, 2010), for Queensland's "fastest growing industry" (Queensland Government, 2010b), "ramping up" its activity for a CSG to Liquefied Natural Gas (LNG) export industry (*Pipe Dreams*, 2010). The then Queensland Premier declares that Queensland's gas reserves would rival those of Australia's other energy provinces such as Western Australia for example (*Pipe Dreams*, 2010), an irrigation farmer asserts that it will be world class energy province (*Pipe Dreams*, 2010) and a local Mayor marvels at the potential wealth beneath his feet (*Undermined*, 2010). CSG explorers had started to prove and publicly discuss international markets for LNG. It is announced that the Queensland Gas Company had in March 2010 signed a major contract in Beijing (*Risk Management*, 2010) with the China National Offshore Oil Corporation, in the presence of the Australian Federal Minister for Mines and the British Duke of York (March, 2014: Appendix A).

The proponents of four LNG export projects at that time were seeking environmental impact management approval from the Queensland and Australian Governments to extract CSG, transport it to Gladstone, a coastal town, and then, in what is said by some to be a world first (Grant-Taylor & McCarthy, 2010; *Risk Management*, 2010), liquefy it there for shipping to other countries. On the 28th May, the first project, known as the Gladstone LNG (GLNG) project, proposed by the Australian company Santos and its joint venture partner PETRONAS, were given the necessary Queensland government approvals (Coordinator General, 2010) to handle its expected environmental impacts in the ways that had been proposed in their Environmental Impact Statement. In announcing that GLNG had received the necessary environmental approvals, the Queensland Premier states (Queensland Government, 2010d):

> "given Queensland could host the first coal seam gas (CSG) to
> liquefied natural gas (LNG) industry in the world the Coordinator-
> General has imposed strict conditions on this project to ensure its

social and environmental impacts are reduced and sustainably managed. For example the Coordinator-General will require Santos to contribute directly in substantial community infrastructure, such as accommodation and transport".

The announcement of environmental approvals, in which the Coordinator General has chosen to highlight how proponents will mitigate social impacts rather than environmental impacts, marked the end of a process of engagement initiated by the GLNG proponents with the Queensland Government on the 10th of July 2007 (Coordinator General, 2010). During May 2010, GLNG proponents did not have mining leases on the Darling Downs but other CSG proponents did and were in the process of proving their reserves there in early May, prompting a protest rally. The SODD media release begins (Save Our Darling Downs, 2010):

"A 500 strong crowd of farmers, environmentalists and concerned citizens met at 'Waverley' on Wednesday 19th May to take part in a peaceful rally against the expansion of the Coal Seam Gas Mining Industry. 'Waverley' is the first intensive cropping property on the black soil plains that has been approached by a mining company looking to prove their methane reserves in the area."

'Waverley' is situated on the Darling Downs and identified as the first case of a particular type of farming operation in a "special" farming area to be impacted by CSG mining. This expansion of mining onto the Darling Downs draws together existing and emergent groups to argue against the booming and expanding CSG industry and for stronger governmental oversight. When a shadow State Government Minister returns to parliament on the evening of the protest he states (Queensland Parliament, 2010a: 1694), "I was … where the rally was held today ... This place was the most beautiful black soil country you would ever see". He goes on to say it is "an absolute disgrace!" that "the government is allowing drilling in prime agricultural irrigation land" (Ibid, 2010a: 1694).

The four interrelated themes that are treated in this article began to surface in the political discourse that surrounds and includes the protest rally held at Waverley. These are elaborated on in turn below together with their constituent dividing, self-actualizing and knowledge practices.

CHAPTER 5.5.2 BEST VERSUS THE REST

A division between the best and the rest of Queensland's agricultural landscapes, rated on economic terms, is maintained in the discourse. The division is made along several lines using economic knowledge (Table 5.5.2.1).

The protesting farmers from both sides of the Darling Downs dividing line, environmentalists, mining companies, mining and agricultural industry representatives and the government and its opposition were observed to be actively participating in economically differentiating the Darling Downs from all other areas of mining activity across the state during the period of examination. Therefore, as participants together divide the landscape and themselves in terms of economic productivity and with associated knowledge they also together identify themselves as individuals who think about impacts of development in economic terms.

These interrelated dividing, knowing and self-actualizing discourses are also interrelated with other boundary-making discourses. For example, a Darling Downs farmer speaks as an eyewitness when he states on a TV program (*Unlikely allies in fight over mining expansion*, 2010),

> "Well, I've seen the impact west of here. You can't translocate back that anywhere west, east, north or south and not have a major environmental conflict".

This shows environmental conflict being thought about in terms of economic conflict.

CHAPTER 5.5.3 ENVIRONMENTAL IMPACTS=ECONOMIC IMPACTS

The discourse that sets apart the best agricultural areas, defined in both production and in economic terms; also positions environmental issues in terms of a minimization of the economic risks a booming CSG industry represents to co-located agricultural industries, especially those located on the best of the best agricultural land (Table 5.5.3.1).

Table 5.5.2.1: Disciplinary practices involved in the separation of the best agricultural land from the rest

| Dividing Patterns | Examples – Direct Quotes or Actions | Speaker, date |
|---|---|---|
| Where CSG has been operating and where it is starting to operate | "first intensive cropping property on the black soil plains that has been approached by a mining company" | SODD Press Release, 19th May (Save Our Darling Downs, 2010). |
| | Until now, there has been no Coal Seam Gas or CSG mining, as it's called, on these plains | TV Reporter, 24th May (*Unlikely allies in fight over mining expansion*, 2010). |
| | growth of this industry in areas not previously touched by the mining industry presents new challenges | Government Minister, Press Release, 17th May (Queensland Government, 2010b). |
| Darling Downs from the rest | "at the present time [there] is unease in some quarters over the industry's growth in the Surat Basin, and particularly the Darling Downs". | Mining Industry Representative, Conference Speech, 19th May (Roche, 2010). |
| | "what the State Government and mining companies are planning for the Darling Downs, is the very opposite of sustainability" | Environmentalist, protest speech, 19th May (Six Degrees, 2010). |
| | The mining company whose activities at 'Waverley' sparked the protest will take up the division by developing two community consultative committees, one for the Darling Downs and one for the rest of their mining lease area. | Mining Company, website (Arrow Energy, 2016) |
| Where industry growth can and can't be challenged | "over my dead body" | Prime agricultural Land farmer, 2nd May, TV program (*Pipe Dreams*, 2010) |
| | "can't fight the gas" | Reporter about a grazier, 2nd May TV program (*Pipe Dreams*, 2010) |
| Reparation satisfactory or un-satisfactory strategy based on economics | "[compensation is] not dependent on cattle prices" and "not dependent on will we get the rain from above. So yeah, it is a welcome addition to our budget" | Roma Grazier, TV Program, 9th May (*Risk Management*, 2010) |
| | "[gas ] creates a major management problem for the irrigator or farmer, who has probably spent hundreds of thousands of dollars in laser levelling the land...The compensation that goes with those wells [on grazing block] is very marginal in comparison to their overall impact on that highly developed agricultural block." | Opposition Minister, Queensland Parliament, 19th May (Queensland Parliament, 2010a: 1661) |

The impacts on underground water supplies are consistently, with minimal deviation, discussed in terms of how CSG extraction would affect the water bores of landholders or the "farmers' water" (*Undermined*, 2010). The maintenance of groundwater springs are mentioned along with water bores sometimes (Brian, 2010; Queensland Government, 2010c; Roche, 2010).

Table 5.5.3.1: Discursive limits to thinking about management of impacts of CSG

| Direct Quotes | Speaker, date, location |
|---|---|
| "The potential for conflict arises because farmers and gas companies are trying to do business on the same dirt". | Reporter, 2nd May, TV Program (*Pipe Dreams*, 2010) |
| "They've got a business, we've got a business, it's unfair if their business impacts ours and so they have to pay correctly just the same as any other commercial arrangement" | Grazier, 9th May, TV Program (*Risk Management*, 2010) |
| "it's really important that it is a strong and a trusting relationship [between companies and landholders] because if it's not, it's going to be difficult for either of us to do business" | Gas company executive, 9th May, TV Program (*Risk Management*, 2010) |
| Told the gas companies at the annual Australian Petroleum Production and Exploration Association conference held in the Queensland's capital of Brisbane, that they "have to go out there and prove their case to landholders that what they are engaging in will not have a detrimental impact on landholders operations". | State Government Minister, Radio Interview, 20th May (Paterson, 2010a) |

Twice the cultural and ecological values of groundwater springs are mentioned. Firstly, in the Queensland Government's Blueprint for Queensland's LNG Industry (Queensland Government, 2009). Next, in the You-Tube clip of an environmentalist's protest speech that is posted on a climate change activists' website (Six Degrees, 2010). For most of this video an irrigator stands behind the environmentalist as he speaks. As soon as the environmentalist mentions the significance of groundwater within the Great Artesian Basin (GAB) to the first peoples of Australia, and the internationally and culturally significant ecologies of the GAB springs, the irrigator leaves the stage. He returns once the speech reverts to what was going on in parliament that day.

The environmentalist goes on to argue that the CSG issue that had brought them all together that day is an opportunity to progress a world heritage listing of the GAB. This opportunity is not much mentioned subsequently, probably because a heritage listing might limit the

activities of all industry, farming included.  As the environmentalist says in relation to the Great Barrier Reef (Six Degrees, 2010) "its a world heritage area and you have to be really careful what you, what activities take place in that area".  Heritage listing of the GAB is inconsistent with the economic rationalities of environmental governance also being expressed by the participants at this time.

CHAPTER 5.5.4 CLIMATE'S RIGHT FOR GROWTH



Figure 5.5.4.1: Queensland Government advertisement photographed at Brisbane Airport 29th Dec 2010 at 10:13am © Murray Griffiths

According to Spearritt (2008: 19) if you flew into Brisbane in 2006 you would have seen an ad that was part of a national campaign to welcome people to Queensland because the "climate's great for growth".

He goes on to say these words were set against a background "of vast humanoid cranes walking across a brown landscape" that he thought would remind "punters of Queensland's booming open cut coal mines" (ibid.: 19).  On a trip out of Brisbane my travelling companion was able to capture the same image at the same airport on December 29th 2010 (Figure 5.5.4.1).

That is, the proven CSG reserves in Queensland, if developed into a CSG to LNG industry, represents "big jobs and big dollars" (Local Mayor, *Risk Management*, 2010), "new jobs" and "brighter prospects" (CSG Company Ad, *Pipe Dreams*,

2010), with the "potential to boost job numbers and investment in Queensland (Queensland Government Minister, Queensland Government, 2010b).

However, these same economic outcomes are also used to argue for the quarantining of the best possible land from mining. For example, in the Strategic Cropping Land discussion paper (Queensland Government, 2010e: 2) it is stated that Agriculture is worth Aus$22.7 billion to the state's economy and 272 471 jobs. Although it was released in February 2010 it was discussed by a Government Minister (Queensland Government, 2010c) and a Mining Industry Representative (Roche, 2010) during the period of observation. The latter of which describes the policy as "useful" but is in need of being a part of genuine consultation process or "untold damage" will be done to "relationships" between key stakeholders and "investment certainty". A reporter claims in her report from the rally site (*Unlikely allies in fight over mining expansion*, 2010) that "this area above the Great Artesian Basin, sustains between three and five billion dollars of agricultural production every year". In parliament on the 18th May an opposition minister tables a counter strategic cropping land policy which also argues the quarantining of the best agricultural land in economic terms, with the intent for developing a world class agricultural industry that is cognisant of global food market trends (Queensland Parliament, 2010b: 1538).

The assured benefits in terms of economic and employment outcomes are matched by claims that the CSG industry is able to manage the environmental externalities of CSG mining and that there is no potential of there being ecologically catastrophic consequences. CSG development is also being positioned by some cohorts at this time to be part of responsible climate change mitigation management because gas is cleaner than coal and will help transition developing international economies to fuel with a lower greenhouse gas footprint (Queensland Parliament, 2010b). However there are claims citing uncertainty about what the potential environmental harms might be and their scale of impact. For example, when the government's Coordinator General approves the GLNG project on the 28th May a newspaper article on the same day reads (Grant-Taylor & McCarthy, 2010):

> "Queensland Co-ordinator General Colin Jensen said he needed more
> information on the project's impacts, particularly of the 55,000 tonnes
> of salt and additional water that will be produced to allow the CSG
> for the project to flow. But the Government didn't seem much worried

by that. Premier Anna Bligh said the approval was great news for

Queensland. "This is an exciting day for the Gladstone and Roma

regions in particular which will benefit directly from over 4800

construction jobs, 1200 permanent jobs," she said."

The reporter's observations expose what the key, yet tame, environmental management issues were for the participants at this time and how they were in the name of economic development being differentiated and triaged. The management of the salty, poor quality water that is produced in large volumes during CSG mining is differentiated and prioritized from all other water management issues, such as impacts of the extracting large quantities of water on underground water systems and the internationally significant groundwater spring ecologies they sustain.

CHAPTER 5.5.5 CSG WATER IS NOT WATER

The issue of CSG water and all other water management issues are discussed separately. The CSG industry is positioned as a water producer and not a water user. This positioning means that CSG water management cannot be accommodated within existing water management systems because they have developed over time to manage the allocation of water to water users, not to manage the industrial production of water. There are several simple ways that CSG water issues are maintained as separate from other water issues (Table 5.4.5.1).

Discourse about CSG water impact management distinguishes two broad areas *viz.* managing the generally poor quality water that is produced during the CSG extraction process, and managing the potential for impacts of CSG extraction on the aquifers that are "very close to" (Hydrologist, *Undermined*, 2010) or "adjacent to" (State Government Minister, Ibid., 2010) but not connected to the coal seams. They are usually discussed in that order, with the latter issue given much less consideration because for some time now it has been generally understood that "coal seam gas water was separate from GAB water" (Opposition Minister, Queensland Parliament, 2010a: 1658) and therefore there is little if any interaction between them and therefore minimal risks.

In relation to the first issue of the large amounts of poor quality water that is expected to be produced during the CSG extraction process the focus of environmental management discussions is on how to manage this waste product to

the most economical ends.  At this point it is worthwhile to put the predicted
volumes of water that people were predicting would be "produced" by the CSG
industry in perspective.

Table 5.4.5.1: Simple divisions between the CSG water and all other water

| Division Pattern | Example | Speaker, date |
|---|---|---|
| CSG wells and water bores | "There are about 1,200 operational gas wells scattered across private land in south-west Queensland" | Reporter, 2nd May, TV Program (*Pipe Dreams*, 2010) |
| | the aquifers that feed the 1,500 bores in the Great Artesian Basin | Reporter, 9th May, TV Program (*Risk Management*, 2010) |
| Coal seams and aquifers | On the environmental impact question of the impacts that CSG, coal seam gas extraction will have on the country and underground aquifers can you point as an industry to any science that proves CSG extraction won't affect underground water reserves | Reporter, Radio Interview, 20th May (Paterson, 2010b) |
| CSG interacts with the Surat Basin and other industries interact with the Great Artesian Basin/Murray Darling Basin | "[GLNG] project will extract gas from the Bowen and Surat Basins" | Courier Mail, 28th May (Grant-Taylor & McCarthy, 2010) |
| | representing the concerns of landholders and communities across the Great Artesian Basin | BSA Fact Sheet July 2010 (Basin Sustainability Alliance, 2010) |

The predicted volume of water that the gas industry was expected to produce from
coal seams at the time is between 126 – 281 Gigalitres per annum.  At the time of the
expansion of the CSG industry the MDBA was expected to cut allocations within the
Condamine catchment in order to return 47 Gigalitres per annum to the environment.
In addition, Queensland GAB bore water users had up to 2011 co-invested with
Australian and Queensland governments in the capping and piping of artesian water
bores in order to save 170 Gigalitres per annum of GAB water from evaporation and
therefore improve hydrostatic pressure in the GAB to sustainable levels (Department
of Environment and Resource Management, 2011).

The draft laws before the Queensland parliament in April and May 2010 construct
the management of this produced water as a waste regulation issue (Queensland
Government, 2010a: 1), where opportunities to make "Beneficial Use" of the waste
water is the priority, for instance by ameliorating it to certain water qualities so that it

may be used to irrigate tree crops, or to irrigate crops that could 'drought proof' western Queensland properties or to re-inject it into water aquifers. The term beneficial use is common within Queensland's waste regulation regimes.

The risk of the extraction of this water during CSG gas production on the aquifers that are "adjacent to" or "very close" to where other industries are pumping water from is considered a separate and minimal issue (Australian Petroleum Production and Exploration Association, 2010; Queensland Parliament, 2010a). This separation is important because the GAB water resource has an established Resource Operation Plans (ROP). ROPs are used in Queensland to set ecological limits on the amount of water that can be extracted from water resource systems. If CSG water is GAB water there could be ecological limits to the continued expansion and development of this industry. As an opposition minister says in Parliament (Queensland Parliament, 2010a: 1661), "under the ROP for the artesian basin, which has been in place since 2006, there is a strict limitation on access to those reserves of water and an inability to take any more water from those artesian reserves".

But the management of the GAB is not the only existing water system at stake. The Condamine Alluvium, the alluvial aquifers that support irrigation on the Darling Downs, is part of Australia's Murray Darling Basin (MDB) are also important here. The minutes of the Murray Darling Basin Authority's (MDBA) Basin Community Committee (BCC) held on the 4th and 5th of May, note that the governance of the MDB is currently in a state of flux (Murray Darling Basin Authority, 2010). These minutes indicate that the BCC expected a new draft plan for water resource allocation across the basin to be released in the middle of 2010. The expectation is that the cuts required to reduce extraction to ecologically sustainable levels, known as Sustainable Diversion Limits (SDLs) in the broader MDB governance system, will be severe. As discussed previously, SDLs for the MDB and the GAB are accommodated in Queensland through their respective ROPs and they essentially mean that water extraction from the sub-systems of each main system is capped at a level that ensures the sustainability of the resource and that water is traded amongst users within the cap limits.

The minutes of the BCC show that CSG is not mentioned as a specific issue, but after listening to the effect on communities of reduced allocation to irrigators in areas of intensive farming, it is suggested that the process of determining new SDLs was

creating a problem by pitting co-located industries such as agriculture, mining and grazing against each other. Ecological limits are here indicated to be problematic if they cause industries to displace other industries and therefore place limits on economic activities.

Finally, the separation of CSG water from all other water issues is most evident in discussions related to the Healthy Headwaters CSG Water Use Feasibility study. The study's purpose is described as using the water being produced during CSG extraction to support "irrigation communities of the MDB to transition to lower water allocations" (Australian Government & Queensland Government, 2010). For CSG water to be conceived of a solution to the economic impact of reduced water allocations in the headwaters catchment of the MDB it cannot be conceived that the water extraction that occurs during CSG production is having an impact on the over-allocated underground resources that it can then be used to augment in a transition phase to reduced allocation.

In total, this analysis reveals a set of four interrelated boundary constructions constituted in dividing, knowing and self-actualizing practices. In the next section these results are discussed.

CHAPTER 5.6 DISCUSSION

The Australian National Strategy for ESD (Emmery, 1994) was considered to be 'dead' by 1997 and by 2006 it was predicted that it would be highly unlikely that the necessary institutions would ever be able to be developed in Australia (Mercer & Marden, 2006: 198). The observed institutional resilience was explained as the product of Australia's long history of economic dependence upon the exploitation of its natural resources driven by global demands since colonization. Australia is described as a "rocks and crops" export economy reliant on shipping natural resources or their primary products to the rest of the world (Mercer & Marden, 2006: 189). Similar trends are observed in the case of the Condamine catchment during May 2010. Here with limited accounting for ecological limits mining companies were being approved to develop a fledgling domestic enterprise into an international export CSG industry. The latest export industry from an area which had been involved in global export markets since it began exporting wool to the lucrative Scottish markets in the 1800s, equally with limited consideration of potential

ecological impacts of the introduction of sheep into these landscapes for example. Both then and now it seems a certain approach to economic development has been maintained despite the global, national and local espoused commitment to ecologically sustainable development since the early 1990s.

The research reported here sheds some insights into this observed maintenance of status quo within Australian approaches to economic development. Unsurprisingly patterns of thinking and behaving necessary to support actors' espoused desire for ESD do not appear to exist. First, the analysis shows that nature is thought about and acted upon by actors within the governance system analysed in this study as sets of separate natural resource bundles such as land, water, coal seam gas water and coal seams. These bundles are further dissected into units differentiable only in terms of their economic productivity potential as the annexure of the Darling Downs from all other areas of Queensland demonstrated. Similarly, the management of externalities is thought about and acted upon by actors within the system of governance analysed in this study in terms of managing the economic costs incurred by diminishing the natural resource assets of other co-located industries. In doing so, all other impacts that are difficult to cost such as social, cultural, ecological, emotional or regenerative values are ignored. Others have demonstrated previously that Australia at the aggregate level maintains an economic bias that treats the natural environment as commodities and ignores the other services that it provides such as "social goods" (Alston & Mason, 2008). Ultimately the "reproductive" as opposed to "productive" capacities of resources and landscapes (Jochimsen & Knobloch, 1997) are ignored. This results in systems for managing natural resources as if they exist for human exploitation alone and that the impacts that emerge in the process of their development will be tame (i.e. not catastrophic) and the necessary by-products of rational economic development (Colombo & Porcu, 2014).

These patterns in thinking and behaving are expected also in so far as Australia's environmental management systems are often described as being enacted on advanced neo-liberal rationalities, albeit with various contextually driven contradictions and nuances (Hussey & Dovers, 2006; Lockie & Higgins, 2007; Mercer & Marden, 2006). Yet where these studies have observed these rationalities within governmental programs and documents, the present study through an application of Foucauldian concepts of power and a systems thinking lens exposes

that these are in fact emergent patterns of thinking and behaving that are maintained through interrelated disciplinary practices deployed by interacting actors located across all social sectors and across all levels of social organization. The Duke of York, the compensated farmer, the dissenting farmer, international business companies, environmentalists, local, state and federal ministers, multi-level industry representative bodies, community members and social media contributors together deploy disciplinary practices within networks to achieve stability in emergent governmentalities that are the antithesis of those that would be required if ESD were to be realized. As Foucault (1994b: 345) observes "power relations are rooted in the whole network of the social".

This result can be best elaborated upon by locating the protest, the first against CSG mining in Queensland's history, that occurred during the observation period as being embedded in a context and located in the middle of the month long political discourse. Here it is useful to diagrammatically elaborate on this finding (Figure 5.6.1) using the data analyses presented in the previous section. The protest was described by members of the system in focus as being sparked by proposed drilling on the State's best of the best agricultural land. In the diagram, it is shown that this was an event in a series of conducts and counter-conducts between various sectors located across various levels of social organization that demonstrate a process of mutual recognition of the viability of a subset of subjects.

For example, the dividing line between the Darling Downs and all other agricultural areas across Queensland was secured by those that did not farm there just as much as those that did and also by environmentalists, reporters and politicians. This dividing line, maintained using economic knowledge that differentiated landscapes in terms of their ability to generate income and jobs and therefore to be able to be compensated or not meant that all sectors secured together a one-dimensional view of natural resources and economic development that quarantines the most highly developed and intensively farmed landscapes from mining activity and ensures those areas that are less developed and less intensively farmed are open for industrial development. This quarantine was not secured by those whom farmed on the Darling Downs alone. It was secured by all sectors, even those that would not benefit from such perspectives

From this vantage point the protest cannot be viewed as resistance to CSG development or even a potential site for eruption of rationalities. Rather the protest discourse does not depart from the antecedent perceived limits to thinking about and
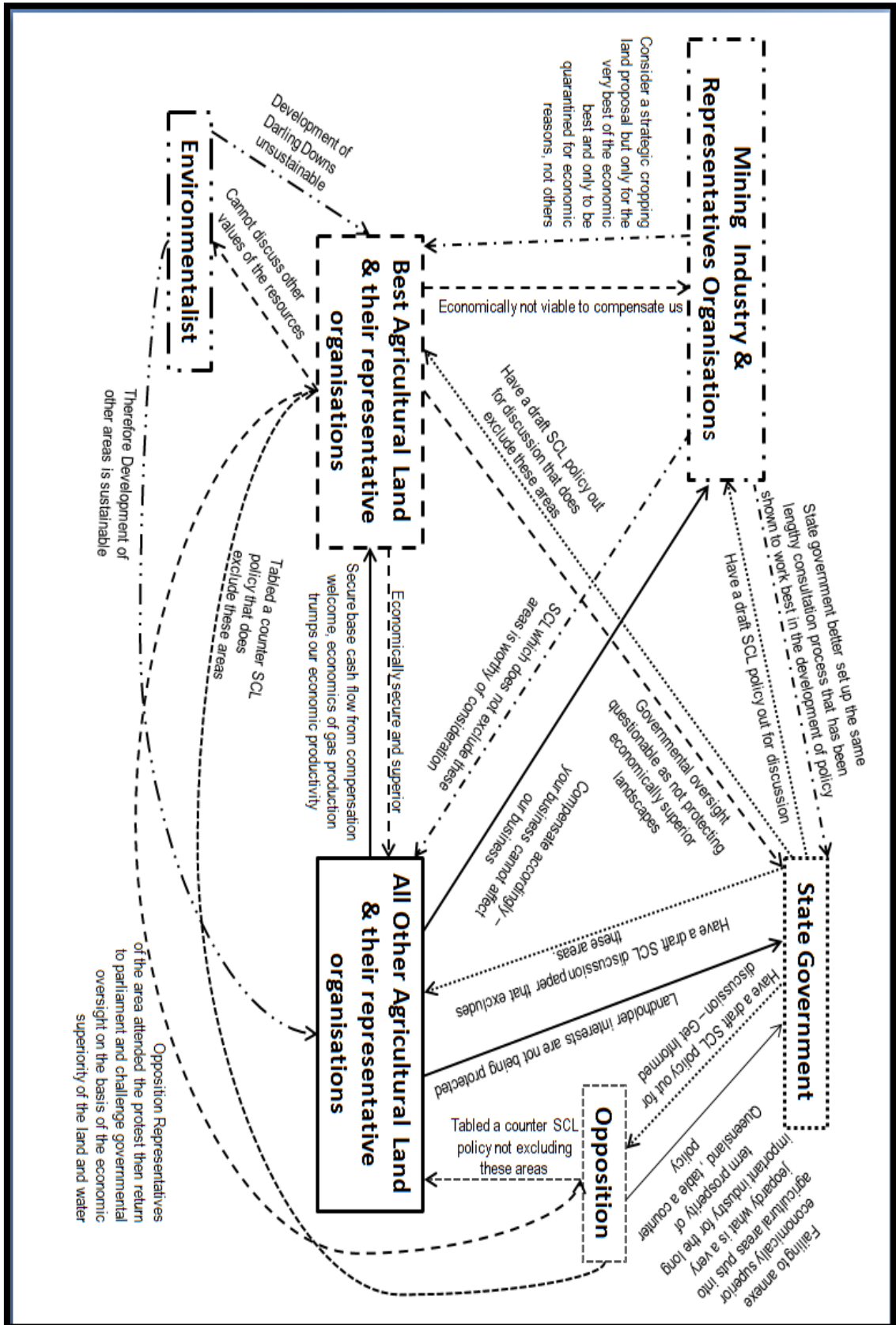
Figure 5.6.1: Network of disciplinary practices involved in securing certain rationalities during the observation period.

relating to the environment and in fact is a point of heightened concern for protection of environmental subjects and their subjectivities. As such it is a disciplinary event in a network of disciplinary events that contribute to the security of certain subjects and subjectivities within and between social sectors and levels of social organization that is calling into question the governmental oversight of the industry on agreed economic terms.

In this way, theories of government which centralize governmental power become problematic. Rather governments are held in place in a series of interconnected disciplinary relations that limit what is possible for governments just as much as it limits what is possible for others. This has implications for how strategies to achieve institutional change for example in relation to ESD might be conceived. In the case examined in this research, the national strategy for ESD and the relevant state government environmental and water acts espouse ESD principles, yet the maintenance of a strongly economic rationality of environmental government prevails in the case studied. This observation calls into question efforts to reconfigure institutions that are reliant on non-systemic views of governance and on simple conceptions of power. The redistribution of power that would be required to achieve a desired balance between social, economic and ecological outcomes through integrated environmental management in Australia would require extensive and on-going intervention within a multiplicity of relations involved in the security of the status quo.

CHAPTER 5.7 CONCLUSION

A global agenda for ESD that emerged in the 1990s has been sustained since this time by researchers and practitioners of integrated environmental governance. Despite these espoused goals and widespread experimentation with various types of integrated governance, integrated environmental governance has been difficult to achieve in practice. Environmental institutions of which integration institutions are a subset have been observed to be highly resilient and therefore resistant to change. In this paper I have reported upon research that aimed to shed light on institutional resilience by examining institutional arrangements through a CAS aligned view of governance, institutions and power. This approach departs from the scholarship which has been criticized for its lack of systems thinking and its apolitical view of environmental governance.

A novel systemic application of Foucault's viewpoint of government, governmentality, governmentalisation and power reveals the dense and expansive disciplinary practices that are at work in the interactions between actors located across various sectors and levels of social organization within CASs of governance whom together reproduce institutional limits. The results offer a rich description of the interrelated ways that such practices are deployed to achieve a systematic exclusion of multiple rationalities in environmental governing in an Australian context.

From this perspective the mechanisms through which the resilience of institutions, and in particular those that are not conducive to the ESD, are exposed. This in turn has implications for how we approach institutional change. This research shows that a multiplicity of interactive processes that span sectors and levels of organization would need to be purposefully worked upon if institutional limits are to lose their resilience. It is not enough to simply enact institutional change as these interactive processes will work on stabilising antecedent perspectives and practices to ensure that the status quo is maintained.

## CHAPTER 5.8 REFERENCES

Agrawal, A. (2005). *Environmentality technologies of government and the making of subjects*. Durham and London: Duke University Press.

Alston, M., & Mason, R. (2008). Who turns the taps off?: introducing social flow to the Australian water debate. *Rural Society, 18*, 131-139.

Angrosino, M. (2007). *Doing Ethnographical and Observational Research*. London: SAGE Publications.

Arrow Energy. (2016). *Intensively Farmed Land Committee*. Retrieved January 9, 2016 from https://www.arrowenergy.com.au/community/community-committees/intensively-farmed-land-committee

Attar, A., & Genus, A. (2014). Framing public engagement: A critical discourse analysis of GM Nation? *Technological Forecasting and Social Change, 88*, 241-250. doi: http://dx.doi.org/10.1016/j.techfore.2014.07.005.

Australian Government, & Queensland Government. (2010). $3.88 Million for completion of Coal Seam Gas water feasiability study [Press release]

Australian Petroleum Production and Exploration Association. (2010). Queensland gas industry committed to meeting the highest environmental, safety and land access standards [Press release]

Bacchi, C. (2009). *Analysing Policy: What's the problem represented to be?* Frenchs Forest, NSW: Pearson Australia.

Basin Sustainability Alliance. (2010). *Basin Sustainability Alliance: Getting the balance right july 2010 fact sheet. Basin Sustainability Alliance*. Dalby, Australia. Retrieved rom URL

Bellamy, J., Ross, H., Ewing, S., & Meppem, T. (2002), *Integrated Catchment Management: Learning from the Australian Experience for the Murray-Darling Basin*, CSIRO Sustainable Ecosystems. Brisbane, Australia. Retrieved from [online] URL: http://www.mdba.gov.au/sites/default/files/archived/mdbc-NRM-reports/2234_ICM_Learning_from_the_Aust_exp_MDB.pdf.

Biswas, A. K. (2004). Integrated water resources management: A reassessment. *Water International, 29*, 248-256. doi: 10.1080/02508060408691775.

Brady, M. (2011). Researching governmentalities through ethnography: the case of Australian welfare reforms and programs for single parents. *Critical Policy Studies, 5*, 264-282. doi: 10.1080/19460171.2011.606300.

Brian. (2010). *Coal seam gas prospects:economic bonanaza or future industrial wasteland*. Retrieved December 9 2015,

Buijs, M., Eshius, J., & Byrne, D. S. (2009). Approaches to researching complexity in public management. In G. R. Teisman, A. van Burren, & L. Gerrits (Eds.). *Managing complex governance systems: dynamics, self-organization and coevolution in public investments.* (pp. Pages 37-55). New York: Routledge.

Butteriss, C., Wolfenden, J. A. J., & Goodridge, A. P. (2001). Discourse analysis: a technique to assist conflict management in environmental policy development. *Australian Journal of Environmental Management, 8*, 48-58.

Colombo, D., & Porcu, M. (2014). Environment and neoliberalism: a critical discourse analysis of three Italian cases. *Journal for Communication Studies, 7*(1), 63-82.

Coordinator General. (2010). *Coordinator-General's evaluation report for an environmental impact statement; Gladstone Liquified Natural Gas - GLNG project*. Brisbane, Australia: Department of Infrastructure and Planning

Cote, M., & Nightingale, A. J. (2012). Resilience thinking meets social theory: Situating social change in socio-ecological systems (SES) research. *Progress in Human Geography, 36*(4), 475-489.

Dean, M. (1999). *Governmentality Power and Rule in Modern Society*. London: SAGE Publications Ltd.

Dinar, A., Kemper, K., Blomquist, W., Diez, M., Sine, G., & Fru, W. (2005), *Decentralization of River Basin Management: A Global Analysis*, World Bank. Retrieved from WPS3637

Duit, A., & Galaz, V. (2008). Governance and Complexity—Emerging Issues for Governance Theory. *Governance, 21*(3), 311-335. doi: 10.1111/j.1468-0491.2008.00402.x.

Edelenbos, J. (2005). Institutional implications of interactive governance: Insights from Dutch practice. *Governance, 18*(1), 111 -134. doi: 10.1111/j.1468-0491.2004.00268.x.

Ekstrom, J. A., & Young, O. R. (2010). Evaluating Functional Fit between a Set of Institutions and an Ecosystem. *Ecology and Society, 14*.

Elder-Vass, D. (2005). Emergence and the realist account of cause. *Journal of Critical Realism, 4*(2), 315-338. doi: 10.1163/157251305774356667.

Emmery, M. (1994). *An overview of Ecologically Sustainable Development Processes in Australia 1990-1992*. Canberra: Commonwealth of Australia

Fischhendler, I., & Heikkler, T. (2010). Does Integrated Water Resources Management Support Institutional Change? The Case of Water Policy Reform in Israel. *Ecology and Society, 15*, 4.

Fletcher, R. (2010). Neoliberal Environmentality:Towards a Poststructuralist Polictial Ecology of the Conservation Debate. *Conservation and Society, 8*, 171-181.

Foucault, M. (1994a). Governmentality. In J. D. Faubion (Ed.), *Michel Foucault Power.* (pp. 201-222). New York: THe New Press.

Foucault, M. (1994b). The Subject and Power. In J. D. Faubion (Ed.), *Michel Foucault Power.* New York:  The New Press.

Foucault, M. (1994c). Questions of Method. In J. D. Faubion (Ed.), *Michel Foucault Power.* (pp. 223-258). New York:  The New Press.

Foucault, M. (1998). *The history of sexuality Vol 1: The Will to Knowledge*. Harmonsworth:  Penguin.

Galez, V., Olsson, P., Hahn, T., Folke, C., & Svedin, U. (2008). The Problem of Fit among Biophysical Systems, Environmental and Resource Regimes, and Broader Governance Systmes: Insights and Emerging Challenges. In O. R. Young, L. A. King, & H. Schroeder (Eds.). *Institutions and Environmental Change Principle Findings, Applications and Research Frontiers.* Cambridge, Massachusetts:  The MIT Press.

Gerrits, L. (2008). *The gentle art of coevolution: A complexity theory perspective on decision making over estuaries in Germany, Belgium and the Netherlands.* (PhD), Erasmus University, Rotterdam.

Godden, L., & Ison, R. (2010). From Water Supply to Water Governance. In M. David & M. Lyons (Eds.), More Than Luck. Ideas Australia Needs Now. (Vol. 2010, pp. 177-184). Sydney: Centre for Policy Development. Retrieved from URL: http://morethanluck.cpd.org.au/more-than-luck-ebook/from-water-supply-to-water-governance/

Grant-Taylor, T., & McCarthy, J. (2010). Tick for Santos coal project. *The Courier Mail*.

Gunderson, L., & Light, S. S. (2006). Adaptive management and adaptive governance in the everglades ecosystem. *Policy Sciences, 39*(4), 323-334.

Hacking, I. (1986). Making up people. . In T. C. Heller, M. Sosna, & D. E. Welber (Eds.), Reconstructing Individualism: Autonomy, Individuality, and the Self in Western Thought (pp. 222-236). Stanford: Stanford University Press.

Hodgson, G., M. . (2006). What Are Institutions? *Journal of Economic Issues, 40*, 1.

Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics, 4*, 1-23.

Holling, C. S., & Meffe, G. K. (1996). Command and Control and the Pathology of Natural Resource Management

Comando-y-control y la patología del manejo de los recursos naturales. *Conservation Biology, 10*, 328-337. doi: 10.1046/j.1523-1739.1996.10020328.x.

Hussey, K., & Dovers, S. (2006). Trajectories in Australian Water Policy. *Journal of Contemporary Water Research & Education, 135*(1), 36-50. doi: 10.1111/j.1936-704X.2006.mp135001005.x.

Jochimsen, M., & Knobloch, U. (1997). Making the hidden visible: the importance of caring activities and their principles for any economy. *Ecological Economics, 20*, 107-112.

Lane, M., Robinson, C., & Taylor, B. (Eds.). (2009). *Contested country : local and regional Natural Resources Management in Australia*. Collingwood, Vic: CSIRO Publishing.

Levin, S. A. (1998). Ecosystems and the Biosphere as Complex Adaptive Systems. *Ecosystems, 1*(5), 431-436.

Li, T. M. (2007). Governmentality. *Anthropologica, 49*, 275-281.

Lockie, S., & Higgins, V. (2007). Roll-out neoliberalism and hybrid practices of regulation in Australian agri-environmental governance. *Journal of Rural Studies, 23*, 1-11.

Margerum, R. D. (1999). Integrated environmental management: The foundations for successful practice. *Environmental Management, 24*(2), 151 - 166.

Marsh, S. (2014). *Certain aspects of Queensland Government administration submission 39*. Canberra, Australia: Commonwealth Government

Mercer, D., & Marden, P. (2006). Ecologically Sustainable Development in a 'Quarry' Economy: One Step Forward, Two Steps Back. *Geographical Research, 44*, 183-203. doi: 10.1111/j.1745-5871.2006.00376.x.

Mollinga, P. (2008). Water Politics and Development: Framing a Political Sociology fo Water Resources Management. *Water Alternatives, 1*, 7-23.

Mollinga, P. P., Meinzen-Dick, R. S., & Merrey, D. J. (2007). Politics, plurality and problemsheds: A strategic approach for reform of agricultural water resources

management. *Development Policy Review, 25*(6), 699 - 719. doi: 10.1111/j.1467-7679.2007.00393.x.

Morrison, T. H., McDonald, G. T., & Lane, M. B. (2004). Integrating natural resource management for better environmental outcomes. *Australian Geographer, 35*(3), 243-258.

Murray Darling Basin Authority. (2010). *Basin community committee meeting summary*. Canberra, Australia: Murray Darling Basin Authority Retrieved from http://www.mdba.gov.au/sites/default/files/archived/bcc/BCC-8-meeting-summary-pdf.

O'Neill, K., Weinthal, E., Suiseeya, K. M., Bernstein, S., Cohn, A., Stone, M. W., & Cashore, B. (2013). Methods and Global Environmental Governance: Reflection, Relevance and Rigor. *Annual Review of Environment and Resources, 38*(1), null. doi: doi:10.1146/annurev-environ-072811-114530.

Paterson, J. (Dir.). (2010a, May 20). *No moratorium on CSG exploration in Surat Basin.* [Radio Interview]. Brisbane, Australia: ABC Radio

Paterson, J. (Dir.). (2010b, May 20). *Resources council rejects criticism.* [Radio Interview]. ABC Radio

B. Hawke (Prod.) *Pipe Dreams.* (2010, May 2). [Television Program]. Brisbane, Australia: ABC-TV. Retrieved from www.abc,net,au/landline/content/2010/s2888078.htm

Queensland Government. (2009). *Blueprint for Queensland's LNG industry*. Brisbane, Australia: Retrieved from http://www.cabinet.qld.gov.au/documents/2009/aug/lng%20review/Attachments/LNG%20Industry.pdf

Queensland Government. (2010a). *Guideline: Environmental Protection (Waste Management) Regulation 2000 Approavl of coal seam gas water for beneficial use*. Brisbane, Australia: Queensland Government

Queensland Government. (2010b). New environmental protection measures for booming CSG industry [Press release]

Queensland Government. (2010c). New laws to protect landholders' rights as CSG industry grows [Press release]. Retrieved from http://www.statements.qld.gov.qu/Statement/Id/69719

Queensland Government. (2010d). Santos LNG project recieves conditional approval [Press release]

Queensland Government. (2010e). *Strategic Cropping land policy and planning framework discussion paper*.  Brisbane, Australia: Queensland Government Retrieved from http://www.QLD_LAN_StrategicCroppingLand_DiscussionPaper_QGOV_2010.pdf

Queensland Parliament. (2010a). *Record of Proceedings: First Session of the fifty-third Parliament Wednesday, 19th May 2010*.  Brisbane, Australia: Queensland Government

Queensland Parliament. (2010b). *Record of Proceedings: First Session of the fifty-third Parliament, Tuesday, 18 May 2010*.  Brisbane, Australia: Queensland Government

B. Hawke (Prod.) *Risk Management.* (2010, May 9). [Television Program]. Brisbane, Australia: ABC=TV. Retrieved from http://www.abc.net.ay/landline/content/2010/s2894275.htm

Roche, M. (2010). *Opening Speech*. Paper presented at the 3rd Surat Coal and Energy Conference, Brisbane. Retrieved from

Rose, N., & Miller, P. (1992). Political power beyond the State: problematics of government. *The British Journal of Sociology, 61*, 271-303. doi: 10.1111/j.1468-4446.2009.01247.x.

Save Our Darling Downs. (2010). Waverley Rally [Press release]

Six Degrees. (2010). *500 Strong Protest to reject coal on the Darling Downs*. Friends of the Earth, Retrieved December 9, 2015 from www.sixdegreed.org.au/content/500-strong-protest-reject-coal-darling-downs

Spearritt, P. (2008). The water crisis in Southeast Queensland: How desalination turned the region into carbon emission heaven. In P. Troy (Ed.), Troubled waters: Confronting the water crisis in Australia's cities (Canberra, Australia: ANU E Press

Teisman, G. R., & Edelenbos, J. (2011). Towards a perspective of system synchronization in water governance: A synthesis of empirical lessons and complexity theories. *International Review of Administrative Sciences, 77*(1), 101 - 118. doi: 10.1177/0020852310390121.

Teisman, G. R., van Burren, A., Edelenbos, J., & Warner, J. (2013). Water governance: Facing the limits of managerialism, determinism, water-centricity, and technocratic problem-solving. *International Journal of Water Governance, 1*(1), 1-11.

Torfing, J., Peters, G., Pierre, J., & Sorensen, E. (2012). Power and politics in interactive governance. In J. Torfing, G. Peters, J. Pierre, & E. Sorensen (Eds.), Interactive Governance: Advancing the Paradigm (Oxford Scholarship Online: Oxford University Press

S. Rice & J. Townsend (Prods) *Undermined.* (2010, May 9). [Television Program]. Sydney, Australia: ninemsn Pty Ltd. Retrieved from http://www.sixtyminutes.ninesmn.com.au/article.aspx?id=1052462

United Nations Conference on Environment and Development. (1992). *Agenda 21*, New York.

 *Unlikely allies in fight over mining expansion.* (2010, May 24). [Television Program]. ABC  TV

Verweij, S. (2012). Management as system synchronization: The case of the Dutch A2 Passageway Maastricht project. *Emergence: Complexity & Organization, 14*(4), 17-37.

World Commission on Environment and Development. (1987). *Our Common Future*.  Oxford: Oxford University Press

Wuisman, J. J. J. M. (2005). The logic of scientific discovery in critical realist social scientific research. *Journal of Critical Realism, 4*(2), 366-394. doi: 10.1163/157251305774356586.

Young, O. R. (2010). Institutional dynamics: Resilience, vulnerability and adaptation in environmental and resource regimes. *Global Environmental Change, 20*(3), 378-385.

CHAPTER 6 DISCUSSION AND CONCLUSION

Four geographically, temporally and practically related research projects that I conducted over a four year period (2007-2011) are reported above in Chapters 2 (Hood et al., 2014) through to Chapter 5. In this section it will firstly be shown how, when examined together as practical applications of a Complex Adaptive Systems (CAS) theoretical framework of governance, institutions, resilience and power, these studies answer the original research questions. The research outcomes then are summarised in terms of five key findings and the contributions that this research makes to the water governance, governmentality, institutional and power theoretical domains are demonstrated. This discussion is followed by a consideration of the limitations of the study. In closing the opportunities for future research are examined.

## CHAPTER 6.1 ANSWERING RESEARCH QUESTIONS THROUGH INTEGRATION OF FOUR STUDIES

The research reported in Chapters 2 to 5, was conducted from deep within the "witches brew" of governance practice (Brady, 2011; Foucault, 1994b; T. M. Li, 2007). It demonstrates that in the everyday reality of government, devoid of major catastrophic environmental and/or social sources of perturbation, integration institutions are resilient or resistant to change, and why they might be considered "inert" (Bellamy et al., 2002: 33), "sticky" (Duit & Galaz, 2008: 320; Ekstrom & Young, 2010; Galez et al., 2008: 320; O'Neill et al., 2013; Young, 2010: 379) or "pathologically trapped" (Gunderson & Light, 2006; Holling & Meffe, 1996). By theoretically and practically engaging in water governance contexts systemically, the researching processes analysed in this thesis reveal, like other studies (Woodhill, 2010), the implications for how people think about and act in relation to governance, institutions and the sources of their resilience. The implications for theory, program design and implementation are shown to be considerable, and in this research have led to the development, re-orientation or refinement of several theoretical and practical tools.

CHAPTER 6.1.1 RESEARCH QUESTION ONE

Driven by my experiences prior to the present study, and by the experience of working within the water catchment system treated here at the time the study was initiated, the first research question of this thesis was:

**Question 1**: *how can governance, understood as co-evolving, self-organising complex adaptive systems (CASs) that sustain resilient emergent institutions, help those who are involved to better understand persistent integration outcomes?*

The research reported here has produced evidence, through application of ethnographic methods (Angrosino, 2007) applied within the practical everyday reality of the governing of a catchment, that catchment water governance systems are co-evolving self-organising CASs (Levin, 1998) sustained by interactions between "plural" or "hybrid" (i.e. government, quasi-government and non-government) (Morrison, 2006; Teisman et al., 2013) actors who are positioned by themselves with others on multiple levels of several social and ecological scales (Berkes, 2008; Cash et al., 2006; Gibson et al., 2000). Therefore this study provides insights into the fluid hybrid networks that Teisman et al. (2013) discussed to be in need of more in depth understanding in their recent assessment of where water governance research should be headed.

The Condamine catchment in which the research reported here was grounded was socially constructed to be located within three tiers of public administration (i.e. local, state and federal), multiple biophysical scales and a global economy through the export of natural resources and their primary products (e.g. minerals and agricultural goods) (Mercer & Marden, 2006). As a practitioner-researcher with pre-existing knowledge, skills, experience and relationships, who was positioned within the Condamine catchment, I found myself involved in attempting to implement integration initiatives that had various integration goals from within, and that changing roles, issues and circumstances drew me into differing "hybrid networks" of multi-scaled, multi-levelled and multi-sectored actor interactions. The networks involved expanded and contracted vertically and horizontally between the different initiatives due to differing integration goals, drawing in or shedding actors from governmental, quasi-governmental and non-governmental sectors located at various levels of social and ecological organisation.

In the first investigation (Hood et al., 2014) the network of interest was vertically and horizontally arranged in a straightforward way, as a set of relationships between a highly water dependent agricultural industry (i.e. cotton farming) and the water resources of the Condamine catchment area. In the next investigation (Chapter 3) I showed that the network of interest can be understood as an expansion of the previous network that included the integrated arrangements for governing water across the hydrological levels of the Murray Darling Basin as well as the administrative levels of the three tiers of the Australian democracy. Chapter 4 examined the networks of interest from an industry focus, contracting the horizontal linkages and re-shaping vertical linkages to involve those governing the relationships between the industry and the three tiers of a relatively recent national Natural Resource Management program (Lane, Robinson, et al., 2009). The final investigation (Chapter 5) examined the network that linked the individuals and organizations which identified themselves as largely from the local and state levels of social organization, and whom were involved in the competing relationships between two industries and water resources management in the Condamine catchment.

The results of the first study (Hood et al., 2014) indicate that by applying the CAS framework of governance, the complexity of multi-scaled hybrid networks of actor interactions is brought to light. They are shown to sustain a system of governance that in terms of governance theory and practice strongly suggests a need for better understanding of the relationships between networks of actor interactions and the production of governance outcomes.

Woodhill (2010) argued that when we are thinking about water governance, and about the outcomes that water governing arrangements are producing, what we are really thinking about is institutions and that if we want some outcome to change what we really want is institutional arrangements to change. The types of institutions that *integrate* water governance arrangements are considered to be related to the types of water resource outcomes achieved in water governing contexts (Teisman & Edelenbos, 2011). This thesis has explored the relationships between water governance systems, enacted through complex evolving actor networks, and the integration institutions that these systems reproduce over time, revealing the following insights.

The studies demonstrate through different methods and theoretical frames (i.e. innovation systems and innovation brokers (Hood et al., 2014), network analysis (Chapter 3), synchronisation theory (Chapter 4) and Foucauldian theories of disciplinary power (Chapter 5)), that institutions can be usefully thought of as emergent properties of networks of actor interactions that sustain CASs of water governance.  Regardless of the way that each of the networks studied engaged with several levels and sectors of society, patterns of thinking and behaving were revealed that bounded the ways that actors could connect with one another; and that often these patterns and their boundaries were the antithesis of the integration outcomes being fiscally and actively pursued by the actors within these networks.

The support for innovation networks in study 1 (Chapter 2) increased internal linkages within the existing government- industry-research triad but these networks were unable to develop the desired relations beyond these historical-contextual boundaries in knowledge development within that industry (Hood et al., 2014). Multi-scaled and tiered water governing relations across the Murray Darling Basin were unable to be supported to link beyond the second level of governmental administration and were unable to be supported to link within these other levels either, leading to what has been described as a "scalar fix" (Keil & Debbane, 2005) on the second level of the public administration scale, and that the fix had been sustained by governing actors despite their espoused desire for institutional renovation since federation (Ryan, 2010; Ryan et al., 2010) (Chapter 3).  Multi-levelled industry, government and quasi-governmental environmental networks recognised inter-dependencies in activities related to planning and securing funding, but their members maintained distinct independencies in implementation activities despite being involved in initiatives to support these changes (Chapter 4).  Lastly, it is shown that in the context of a rapidly developing mining industry within high value irrigated agricultural landscapes, the hybrid networks involved worked to ensure the perpetuation of antecedent boundaries around how environmental governing can be thought about and acted upon regardless of their espoused desire to institute the integration necessary for achieving ESD (Chapter 5).

These results further indicate that when considered together with contextual and historical factors, emergent resilient institutions and in particular emergent resilient integration institutions are co-evolving (Gerrits, 2008).  It is the very fact that they

are co-evolving inter-dependently that renders them, resilient to change. It is shown, for instance in the first study, how and why the program to reform innovation networks was unable to move beyond traditional boundaries when developing industry knowledge (Hood et al., 2014). The study analysed in Chapter 3 indicated that it would be highly unlikely that the networks concerned would de-institute administrative patterns of organization, having successfully resisted re-arrangement over the four attempts made since 1901 (Chapter 3). The unlikelihood that actors within a policy network (Chapter 5) would be able to support the espoused inclusion of multiple rationalities in Australian environmental governing, was analysed in the context of the Condamine catchment in the final study.

None the less, resistance was not absolute. The studies provide evidence that some intentional changes to institutional arrangements had been achieved. In each case, however, these remained *within* the contextual-historical boundaries for thinking and behaving identified in the studies. For example the innovation partnership project, that focused on a knowledge development network, was shown in the first study to increase network activity and did achieve rapid incremental changes within pre-existing boundaries of thinking and acting (Hood et al., 2014). The network of actor interactions that were the focus of the next investigation did reveal that multi-decadal attempts to institute integrated community or catchment-based governance had instituted the inclusion of local and federal actors in the water governing network (Chapter 3). The final investigation showed how the relevant Australian and State government's water and environmental legislation had espoused the principles of Ecological Sustainable Development, a legacy of Australia's involvement in the global sustainable development agenda (Emmery, 1994), and that this had some intentional effect on institutional arrangements. Overall these findings provide insight into why institutional arrangements persist, despite deliberate effort to achieve greater integration in order to achieve explicit goals of sustainable water governance.

In the course of answering the first research question challenges of boundary judgements and boundary management came into focus. For example, the boundaries identified in the qualitative reflexive case study of participatory action research, that was conducted in the context of an attempt to drive innovation within an agri-environmental knowledge development system, were shown to be generated

by and constituted in the interactions between a highly water dependent agricultural industry and the catchment waters the industry interacts with (Hood et al., 2014). These boundaries were related to the types of connections that actors were sustaining in their knowledge development networks. Social capital theorists differentiate social connection patterns by type, labelled bonding, bridging and linking (Pretty, 2003). These types were used in this study to identify that, during the period of investigation, although the actors involved increased their connections with others they did so within existing relational boundaries that supported bonding relations (Hood et al., 2014). Social network analysts also use social capital descriptors of relational types to develop empirical measures of connection patterns with descriptive accounts. Given the first study's findings, and the increasing application of network analysis within broader environmental governance research, social network analysis is increasingly being considered an appropriate tool for visually and empirically discovering the patterns of connectivity that actors sustain in certain governmental contexts.

Network analysis was applied to gain visual and empirical insight into the connection patterns and therefore associated boundaries that actors were instituting within the most recent attempt to replace administrative scales and levels by hydrological scales levels within the Murray Darling Basin governance system (Chapter 3). This research provided empirical evidence that while changes had been brought about in the connection patterns within this network, to include catchment level and basin wide actors and forums, administrative boundaries proved resistant to purposeful change, in particular the second administrative tier in the governance arrangements.

On the basis of these two studies it was theorised that the connective patterns were the products of the maintenance of certain ways of thinking about who connects, with whom, why and to what ends. These are questions that governmentality theorists have traditionally asked (Bacchi, 2009). The findings of Chapters 4 and 5 indicate that analyses of the types of connective patterns that were being produced in the governing contexts of interest could be augmented productively by qualitative analyses of the interactive production of accompanying governmental rationalities. Together these approaches produced insightful accounts of why certain patterns were being maintained (Chapter 4 and 5). Furthermore, the self-organising and mutual adjusting that secures the persistence of institutional arrangements was exposed and

shown to arise in continually competing forces of connection and fragmentation (Chapter 4 and 5).

If integration institutions are secured by the maintenance of certain ways of thinking and acting in water governing relations then it is perhaps self-evident that relations of power are central to understanding how certain institutional arrangements are maintained. To this end Foucault's system of subject making (Agrawal, 2005; Foucault, 1994c; Hacking, 1986) was applied in order to explore the experiential reality of this assertion within the final study (Chapter 5). The final study responded to the critique that water governance research often fails to consider power whilst seeming to maintain in the end that power stymies institutional innovation. Chapter 5 reports research that reveals that the boundaries to thinking and acting in relation to water governance are the product of interrelated disciplinary practices deployed by actors within networks of interactive relations. The resilience of institutions is produced through these disciplinary interactions, such that actors limit themselves and each other in terms of what is considered possible to think and how it is possible to behave in water governing contexts. This finding challenges constructs of institutions and power that assume institutions can be easily changed by a set of more powerful actors in governing networks. Researchers have criticised such mechanistic frameworks of institutions and the relations between institutions and power within the common property resources domain since 2001, when some authors were then arguing for a "post-institutional" turn in this research (Mehta et al., 2001). To the contrary this study shows that resilience is a distributed characteristic of interactive networks of agents with no single locus of power for those desiring institutional change to work upon or through. Numerous loci of multi-sided power relations would need to be de-stabilised for institutions to lose their resilience and be open to transformative change.

On the basis of these responses to the first research question several tentative assertions might be made about how we can purposefully work on institutions that are contextually-historically co-evolved, that tend to be resilient, and whose resilience is the product of dense and distributed relations of power. These are explored in the next section. Several theorists (Steyaert & Jiggins, 2007; Young, 2008; Young, 2010) call for diagnostic and contextually-historically aware approaches to institutional intervention are relevant here.

CHPATER 6.1.2 RESEARCH QUESTION TWO

The application of complexity theory in water governance and broader governance scholarship is a new research domain. Several observers have asserted that this over-due systemic re-orientation of the relevant scholarship will have uncomfortable implications for how programs are designed (Godden & Ison, 2010; Teisman & Edelenbos, 2011; Teisman et al., 2013). Research question two in this thesis provides a response to policy-makers' need to know how to intervene in water governance contexts and how this intervention might be measured. Therefore the second research question for this thesis was:

**Question 2**: *how can governance, understood as co-evolving self-organising CASs that sustain resilient emergent institutions, help those who are involved to be better able to respond to persistent institutional outcomes?*

Each study reported here (Chapters 2 to 5) has produced evidence that systemic thinking may be critical to understanding how to move governance networks beyond given connection patterns. The results of the innovation network study supports the claim by Klerkx, Schut, Leeuwis, and Kilelu (2012) that non-systemic thinking may delay change and produce more of the same in innovation systems (Hood et al., 2014). The network studied in the third investigation reported in this thesis also supports Teisman and Edelenbos (2011) claim that failure to ground the study of integration institutions in systemic understandings of integration will continue to waste resources (Chapter 4). Godden and Ison's (2010) prediction that non-systemically framed governance programs in Australia will continue to produce disappointing results is also relevant to my analysis of an MDB network, during a fourth phase of 'more of the same' reform measures, that indicated that the reforms were unlikely to be realised (Chapter 3). Australia's espoused desire to work towards achieving Ecologically Sustainable Development is challenged by the results of the final investigation reported in this thesis, which revealed a systemic exclusion within the Condamine catchment water governance system of the rationalities that would be required to achieve such development (Chapter 5).

The results of my studies in response to research question two, in short, support what others have found and suggest that a much more "nuanced" approach to practice is required when thinking about and acting within water governances systems, and on

the institutional arrangements that these systems tend to reproduce (Mehta et al., 2001; Steyaert & Jiggins, 2007; Teisman et al., 2013). My studies show that the dynamic and fluid hybrid networks of actor interactions that are sustaining the water governance systems examined, demand a different understanding and therefore merit experimentation with and development of strategies that could address "the problems in directing complex and compounded water governance system in certain wanted directions due to most of time unforeseen and unpredicted multi-level and scale interactions and interferences in social ecological systems" (Teisman et al., 2013: 6).

This is what Young (2008, 2010), Woodhill (2010), Steyaert and Jiggins (2007), Collins and Ison (2010) and Wallis & Ison (2011) were calling for when asking institutional theorists to develop diagnostic tools for use in programs aiming at institutional change, to determine what institutions are in use and also to map changes as programs or situations unfold. Such tools would also support reflexive, adaptive water governing by increasing the reflexive capacities of the practitioners and researchers involved (Blackmore, 2007; Steyaert & Jiggins, 2007; Wallis & Ison, 2011).

The research reported in this thesis developed several diagnostic tools. For example, the synchronisation framework first proposed by Teisman and Edelenbos (2011) and developed by Verweij (2012), was further developed as a useful tool for diagnosing integration institutions and why they were being produced through actors' reasoning within a given context (Chapter 4). It was shown that it could be feasibly used in the time frame that project managers typically require to develop an implementation plan for institutional reform. It is suggested on the basis of the findings of this third investigation that the tool could be used to re-assess the situation at regular intervals. In the second investigation (Chapter 3) a set of network analysis tools are developed to diagnose the connection patterns in the Murray Darling Basin governance system at the time of the study. The diagnosis revealed that it was unlikely that the espoused reform objectives would be achieved. It is again suggested that this set of tools could be used iteratively to assess institutional arrangements over time.

In addition, 'intellectual tools' were developed and applied. Thinking about power as systems of subject making also could be considered a tool, useful for diagnosing the discursive disciplinary relations needed to move actors and institutions toward Ecologically Sustainable Development (Chapter 5). Foucauldian concepts of power,

as systems of subject making, provided for the development of a tool that could be used by practitioners and researchers to purposefully engage with power relations in action and research within water governing contexts.

In environmental and water governance contexts practitioners have generally experimented with mechanistically grounded theories of management rather than with the application of intellectual frameworks for improved understandings of situations and their products. Intellectual tools such as soft systems theories or theories of social learning have been shown (Blackmore, 2007; Blackmore et al., 2007; Ison et al., 2007; Steyaert & Jiggins, 2007) to be both necessary and useful in practice. The studies in this thesis deliver further evidence that institutional arrangements are interrelated with certain ways of thinking about and acting in water governing contexts and that the resilience of the identified ways of thinking and behaving within these contexts depends upon defending the boundaries of what is considered possible and desirable, who can be involved, how and to what ends. This is akin to Mosse (2006: 940-942) viewing governance as "systems of representations", in which "control over interpretation of events" is continually the focus of concern of those involved. Therefore the studies in this thesis demonstrate the highly political nature of water and environmental governance that renders non-political and power neutral theories of governance difficult to reconcile in both theory and practice.

This finding shows that the insistence by planners and policy-makers on multi-sectoral representation in water governing networks is politically motivated. Rather, if transformational potential is dependent upon the efficacy of multiple viewpoints of what the environmental government problem is, how the problem can be governed, by whom and to what ends then what is required is more than the integration of a *range of stakeholders*. Rather a *range of viewpoints* on what is possible needs to be visible and mutually appreciated in the actions of each party. Indeed, "view-holders" might be a more apt term than "stake-holders" in water governance. However moving beyond politically benign research and practice is dangerous for researchers and practitioners as the full weight of multi-sided disciplinary relations (Chapter 5) are brought to bear on malfeasance in attempts to secure systems of representations (Li, 2008; Mosse, 2006). Therefore for those with the fortitude there is a need for critically purposeful practice by researchers and practitioners if resilient

institutionalised ways of thinking and behaving in water and environmental governing systems are to be worked upon.

My studies also give rise to other recommendations about program design. Chapters 2 and 4 indicate that short term intervention strategies fall short because of the complexity of the contexts that produce any given set of institutional arrangements, and the complexity of the power relations.

In a related way, short term innovation brokers or program managers, appointed to short term initiatives, would need to be supported by systemic, longer term framing of intentional processes of institutional change. Short term appointments may contribute to counter-intuitive outcomes because they allow participants to externalise responsibility to integrate or be joined up in new ways and thereby contribute to the deferral of the development of desired connective capacities (Chapter 4). These findings are both worthy of further attention.

CHAPTER 6.2 KEY FINDINGS

Construing governance as a CAS has been shown to have both theoretical and practical merit. This research provides evidence of the complex and dynamic reality of governance. It also establishes how this experience of complexity has implications for those whom are involved and whom attempt to work from within complexity to achieve outcomes. By construing governance systems as CASs then the theoretical framework is better matched to the reality of the situation in which integration projects are implemented. By extension then a more relevant theoretical framework should mean that research will develop research products that have resonance with those involved.

This perspective places the fluid hybrid networks of the complex interactions that are involved in water governing systems in sharp relief. This research has exposed qualitatively and empirically that complex and dynamic networks of multi-scaled, levelled and sectored actor interactions drive governance outcomes. Therefore it is concluded that in order to understand governance outcomes, such as institutional arrangements, analysis of networks and how they are involved in the production is key.

From this vantage point institutions are found to emerge in networks of interactions that any given social-ecological context produces, embedded in specific histories and

relational patterns that are difficult to de-stabilise and re-work. Institutions are resilient emergent properties of governance systems. Some in the environmental and water governance research communities are moving towards perspectives that see integration outcomes as emergent properties of complex adaptive governance systems. However, the implications of this perspective remain outstanding for most of this community (Hodgson, 2000). The research reported here has made some progress towards these ends by examining how power works in these systems. Power has been shown in this research to work through networks of disciplinary actions deployed by actors within governance contexts whom are seeking to maintain certain ways of thinking and acting (i.e. institutions).

These findings have significant implications for programs aiming at institutional innovation. Simple conceptions of institutional change that are based on ideas that power can be easily re-distributed such as those that decentralised and integrated environmental governing programs are usually based on are found wanting. The study exposes the need for moving beyond politically benign research and practice if change is to be achieved. This research produced results that can be used to bolster the call for more systemic understandings of institutional change and therefore less attention to simplistic, mechanical and linear understandings of how institutions are produced and how they may be changed.

The research presented in this thesis has developed and applied several tools for practitioners and researchers to use in a diagnostic-reflexive approach to institutional interventions. Network analysis was used to visually and empirically discover emergent patterns in the multi-scaled and levelled MDB governance system in 2010. The synchronisation framework was successfully deployed to make assessment of why institutions are being produced at a particular point in time. Foucault's viewpoint of power as subject making systems offers a tool that may allow practitioners to engage purposefully in power relations and how they sustain institutional arrangements.

CHAPTER 6.3 RESEARCH CONTRIBUTIONS

This research contributes first and foremost to the growing body of work that applies complexity theory within the public administration domain (Teisman & Klijn, 2008; Teisman, van Burren, et al., 2009) and more recently water governance domain

(Teisman et al., 2013). It does so by contributing to the research concerns articulated for renewed water governance research. By addressing these emergent research concerns this research makes contributions to several key theoretical areas.

First, this study has responded to a call for a thematic turn in water governance scholarship towards complexity theory. Next, institutions are here construed to be constituted in resilient patterns of thinking and acting in social settings, and this finding has implications for institutional theory and power. Further the study produced a theoretical framework that married, institutional theory, with governmentality theory and a systemic power theory. The application of Foucault's governmentality thesis through ethnographic methods of data collection contributes to recent governmentality ethnographies. Lastly this study exemplifies a certain research approach that breaks boundaries between research and practice, engages with the full scale of complexity within water governing systems and is focused on the development of tools for purposeful change. These will be discussed in turn.

Teisman et al. (2013) note a thematic turn towards thinking systemically about water governance. Thinking systemically challenges water-centric and managerial frames of reference in water governance research. Thinking systemically means focusing on building understanding of the fluid hybrid networks sustaining governance within water governing contexts and how theses contribute to governmental (dis)functioning. Investigations into the production of stable/unstable patterns that these networks of interactions tend to produce at the system level usefully could inform program development. The studies reported in this thesis suggest to practitioners, policy-makers and researchers the importance of understanding hybrid networks, the resilience (i.e. stability) of the institutional arrangements they produce, the relationships between institutional resilience and power and the implications for program development.

In this study institutional theory is built on that of others (Edelenbos, 2005; Hodgson, 2006; Woodhill, 2010) in a particular way. By viewing institutions as emergent patterns in thinking and behaving the traditional debate over structure versus agency was able to be suspended in this study. Context, history, agency and structure are revealed as together co-evolving to produce resilient boundaries to thinking and behaving. It is this resilience that gives the impression of the supremacy of structure.

It is the ongoing mutually adjusting agents (who produce structure over time) that offer the counter perspective on the possibility of intentional change.

Subsequently in this research my application of Foucault's (1994c) viewpoint of power as a system of subject making contributed to the research that pluralises power and seeks to draw out how it works in networks of relations to produce subjects and subjectivities. The findings of this study therefore contributes to the scholarship that is engaging with politics and power when building theories about institutional intervention such as in integrated water resource management for example (Mollinga et al., 2007).

In addition, by taking a system lens to institutional theory, the governmentality concept and Foucauldian power theories, I was able to generate a framework that drew them together (Table 1.3.4.1). This framework crosses traditional boundaries between each area particularly with traditional applications of the governmentality concept. Next by being able to align power theories through a systems framework this research contributes a theoretical framework that could be used by water governance scholars to engage purposefully with power when researching institutions.

Moreover, the research reported here expanded the contribution that recent ethnographic and anthropological applications of Foucault's governmentality concept have made (Brady, 2011; Brady, 2014; T. M. Li, 2007). These recent applications of the governmentality concept have established this innovative departure from traditional methods for governmentality research. In this study it has proved as useful as they have found it to be when researching about governmental institutions from within the witches brew.

Next, the research reported here, developed three tools for institutional diagnosis within the messy process of institutional change. It has built on recent network analysis (Lubell et al. 2014, Robins et al. 2011, Robins et al. 2012, McAllister et al. 2014, Guerrero et al. 2014, Bodin and Tengo 2012) in a certain way. The study has successfully used this method to develop network analysis as a potential diagnostic tool that can be used to assess emergent connective patterns in complex environmental governance systems. In addition the theoretical synchronisation (Teisman & Edelenbos, 2011; Verweij, 2012) and Foucauldian power frameworks

(Foucault, 1994c) were developed from within program implementation into potential institutional diagnostic tools for practice.

Lastly, in this study I have developed a certain research approach that breaks boundaries between theory and practice, purposefully engages with the full scope and scale of socio-technical and bio-physical complexity of the water governing systems and employs tools that can map and explain which institutions emerge there and the sources of their resilience. This research approach emerged as this study unfolded, however it could be beneficial if it became more explicit in design phase of future research. Such an approach would combine the tools of network analysis and Foucauldian informed frameworks of synchronisation and power that I applied in my study to understand differently the interdependent dimensions of institutional arrangements and to identify where as individuals or groups of individuals points of leverage exist and opportunities could be created.

## CHAPTER 6.4 LIMITATIONS OF THE RESEARCH

Firstly, at the outset this research was exploratory in nature. The study at times used instrumental case study research and participatory action research to examine whether theory could help to inform practice and shed light on the experience of being located in CASs of governance, and the fluid hybrid networks that sustain them and the institutional resilience these networks of interactions produce. This amounts to exploratory first steps towards outstanding areas of interest that were located within a recent list of next steps for a more systemically grounded water governance research agenda (Teisman et al., 2013). Further research could continue adaptation and refinement in commensurate contexts which could indeed lead to revision of my findings.

The limitations of exploratory research are related to the second limitation of this study. In this study I have not produced grand theories that have universal applicability and therefore would be rendered amenable to policy and practice that seeks research products for implementation that are as tangible as building a dam for example (Woodhill, 2010). The research products here are frameworks and tools for working on complexity from within complexity. I have employed a modest research endeavour that was focused on informing the research and practical communities about the complex reality of institutional resilience and building frameworks and

tools for engaging with this complex reality. In this study I situated complexity. This means working on institutional change in complex and dynamic situations, which the next three limitations will evidence, requires adaptation to changing circumstances and therefore cannot be approached through universal theories of how it should happen and to what ends.

Thirdly, I had proposed at the outset of this study to implement an over-arching long term Participatory Action Research (PAR) methodology. At the outset, my orientation to knowledge development dictated attention to methodologies that collapse the division between researchers and researched. This, I suggested would generate greater rigor and coherence than member checking alone. The testing and reflecting of frameworks and tools by the participants would have generated insights from another angle. However, academic and contextual constraints, discussed below, rendered more engaged research praxis difficult to implement. Although, I did use member checking it is concluded that further research would benefit from equal engagement of researched participants whom are working on intractable environmental governance issues in contexts of interest.

One of the contextual factors that drove the inability to implement an overall PAR methodology was that I became involved in the projects and situations that formed the context of this research through a developing situation in which I had prior relationships and experience. This leads to a further limitation in that what I became engaged with was not pre-planned. This meant that investigations into which institutions were being produced and how and why they were being produced were, although insightful of the everyday reality of practitioners in facilitator roles like myself, were developed in sequence rather than in tandem. Although the end product produces a compelling insight into all of these factors future research could build on these insights by pre-planning research that works on all of the identified areas in tandem with engaged participants within projects grounded in systemic thinking.

Next a second contextual factor that drove adaptation and modification on my part was certain sensitivities of academic institutions and research funding organisations. This research was funded by a cooperative research centre that my academic institution at the time of research initiation had an on-going working relationship with. Therefore the research organisation, although itself wanted a clear pre-planned linear delivery of a research product, were extra sensitive to alternative research

products, because of their desire to meet their perception of commensurate needs of the funding organisation. A muddling through, emergent project design met with resistance that resulted in several iterations of the confirmation of candidature process. Others have well noted the resistance in academic and funding organisations to finance projects which through their engagement with complexity are less prescriptive about what the research product will be whilst being more prescriptive about process (Mosse, 2006; Shore & Wright, 1997).

In the discussion on situational ethics in Chapter 1 I stated that I made several decisions throughout the research that were required at the time to manage emergent ethical issues. One of those decisions was to present the research as a series of journal articles as opposed to a monograph. Another decision was to allow some time lag between certain projects and the reporting of them due to the political sensitivities surrounding them. This is why contributors to Rhodes, t'Hart, & Noordegraf (2007) volume of political ethnographies generally reported their research many years after it was carried out. Therefore there is considerable time lag between much of the research reported here and when it actually took place. This limitation along with a more pervasive application of PAR point to future research opportunities.

Finally, complexity theorists generally agree that complexity oriented frames are best applied over extended periods of time to gain rich deep and co-evolving accounts of the aspects of the researchers interest (Buijs et al., 2009). The application of complexity perspectives in governance research requires that research methodologies are able to focus on interactions as they occur and over time so that co-evolving contingencies can be accommodated. The researching methods employed in the studies in this thesis were implemented in the context of short term projects, and this might to an extent have limited observation of the co-evolving dynamic. However, the application of ethnographic methods of data collection, as well as the positionality of the researcher within the cases observed, to a considerable extent allowed for depth in time to be retrieved from project documentation and actors' experiences. This particularly applies to the research reported in Chapter 5. During the time of investigation the system was under pressure. This meant that the interactions that were in focus were more frequent and under intense scrutiny

throughout the networks involved allowing for a depth and breadth of data that rapidly produced patterns.

CHAPTER 6.5PERSONAL REFLECTIONS

The study presented in this document was iterative and reflexive and therefore emergent. Each piece of research built upon the last as experience, theory, practice and context interacted. As a result a clear progression can be seen from the research presented in Chapter 2 to the research presented in Chapter 5.

Chapter 2 represents an exploration of a context in which innovation was being sought through improved partnerships in an adoption network. Who was involved, how they were connected and the type of thinking that those involved brought to bear on the issues at hand were found to be important in this study. The questions about connections between actors led to the network analysis in Chapter 3. Here it was shown that connection patterns could be mapped and that these patterns were highly resilient. This prompted questions about resilience which led to the next two papers in which the resilience of integration institutions are examined in terms of the recognition of boundaries and interdependencies (Chapter 4) and the role of power (Chapter 5)

Therefore, although I began this research with the intention to examine barriers to integration in Australian governance systems, the research that was actually carried out involved understanding institutional resilience and emerged through reflexive cycles in real world contexts. This meant that my understanding of integration evolved over time. It also meant that over time my personal biases and antecedent viewpoints were constantly under revision.

My commitment to systems thinking and a deep ecological framework as described on page 33 of this document was strengthened. Much of the literature and much of the practical discourse within environmental governance contexts retains an anthropocentric bias that a middle ground perspective cannot ballast. Each piece of research I have reported here shows that in practice there is a need for more researchers and practitioners to adopt complex systems when thinking about integration. In the same way that critical theorists and queer theorists defend biases towards non-traditional frameworks and experiences I defend the need for complex systems thinking research.

My opinion of integration was challenged through this research. At the beginning given my deep ecological frameworks and systems thinking biases I had a positive view of integration and a negative critical view of fragmentation. This was revised as I began to collect data. With the help of Connective Capacity, Concerted Action and Synchronisation theory I began to treat integration as a context specific phenomenon and to focus on the development of frameworks and tools that allow for purposeful engagement by those involved in these contexts. This is evident when the content of the first two case studies are compared with the final two. In the first two I was interested in mapping the institutions produced. In the final two studies I adopt a more empathetic stand and explore why and how they are being produced.

Lastly my engagement with the power theories of Foucault presented me with the greatest challenges and made the most impact upon me. I began to explore power theory as it began to become increasingly important in terms of institutional resilience. Initially I found thinking about power uncomfortable, until I began to read Foucault. To see power as socially constructed ideas about who and what is considered powerful was liberating. Suddenly I saw myself as powerful and I began to notice how others were also powerful despite not being socially constructed as powerful. I began to notice mine and their contributions to the security of the status quo whether passive or assertive and I was more critical of these contributions. As a result of these insights, this thesis uses several frameworks that are not typical to the study of governance and institutions.

CHAPTER 6.6 FUTURE RESEARCH

This research was exploratory and emergent in nature. Partially as explained above because of context and partially because of my theoretical interests. Therefore the theoretical frameworks I developed and the diagnostic tools I experimented with would benefit from pre-planned research that produces mixed method diagnostic accounts of institutional arrangement through the application of ethnographic methods.

This is especially true for the synchronisation framework, network analysis and Foucault's conceptual framework of power as subject making systems. My application of the synchronisation framework was only the second one after Verweij (2012) since it was discussed in 2011 by Teisman and Edelenbos (2011). I

concluded that it needed to be developed further and a key part of this would be to use it as part of a reflexive adaptive process to institutional change. Likewise, the network analysis developed in the second investigation (Chapter 3) could be explored within projects with the same characteristics because although it was able to diagnose relations at a particular point in time, it would have benefited from further use in the same context over time.

In addition the Foucauldian power framework that draws attention to systems of subject making within governance contexts proved useful in illuminating the power relationships working to reproduce the status quo. Further experimentation with this framework of power within the witch's brew of relations would further develop this framework as a tool for understanding institutional resilience, especially if it was able to be embedded in projects explicitly seeking to engage purposefully in power relations.

The next two recommendations are grounded in the overall recommendation that academics, program developers and implementers would benefit from thinking systemically about institutions how they are produced and how they might be change. To this end there were two recommendations requiring further investigation.

First, the endemic use of short term initiatives to facilitate integration is questionable from a complexity perspective. This requires further attention. It may be that the short term intervention initiatives could be more effective in driving institutional change if it was built on certain frameworks and if indicators were built in that allow for diagnostic assessments of change over time. This needs to be further assessed.

In a similar way there was the assertion that innovation brokers whom are responsible for the facilitation of projects that are not founded on systemic thinking may lead to reproduction of the status quo through supporting the externalisation of other actors building capacity to connect. In short if a project manager has been employed to drive and report on integration it may be that the actors whom are expected to integrate externalise that responsibility to the innovation broker. This is worthy of further attention in future research.

CHAPTER 6.7 CONCLUSION

The world water crisis is well documented. Using the concept of peak water, borrowed from peak oil discourse one study shows how three types of ecological limits are being exceeded in the way that water is extracted and used in catchments throughout the globe (Gleick & Palaniappan, 2010).

The world water crisis has often been referred to as a crisis of governance. This crisis of governance discourse locates the issue in the water governing systems that are being sustained throughout the globe. For example, one comprehensive examination locates the crisis as being produced at the catchment level throughout the globe where most governing systems are observed to be sustaining one of three types of problematic management syndromes.

If institutions are defined as the patterns of thinking and behaving that emerge from governing relations then these management syndromes that contribute to peak water observations can be observed as evidence of the resilience of institutional arrangements in contemporary environmental and more specifically water governance systems. In this thesis institutional resilience has been researched in the following ways.

First the viewpoint that institutions are the emergent properties of complex adaptive systems of relations that are sustained between multi-scaled, levelled and sectored actors applied using multiple frames and methods proved able to deliver several insights. First institutional patterns were able to be discerned at the system level through both qualitative and quantitative methodologies. Next the synchronisation framework augmented with a Foucauldian framework of governmentalities was able to generate insights into why institutional patterns were being produced. Finally Foucault's view of power as a system of subject making proved a useful tool for understanding institutional resilience and how it is produced.

In addition to these insights into institutional resilience this study also generated several tools that others may be able to use to generate similar insights in practice. That is the synchronisation framework, the power framework and network analysis all proved useful practical tools for diagnosing institutional arrangements.

In addition through this study I was able to determine future research opportunities. These research opportunities point to pre-planned commensurate exploration of

frameworks and tools within projects aimed at renovating integration institutions that are founded on systemic thinking. Further the role of project managers needs further investigation. It may that when program managers are contracted to drive integration those whom are required to integrate may externalise this requirement to the manager. Further short term interventions seem problematic when institutionalisation is viewed from a complex systems perspective.

In closing, this study has made a contribution to the practical problem of the global production of water crises by focusing on institutional resilience. In doing so it has made a contribution to the new water governance research agenda that is seeking contributions that take a complex systems viewpoint of these intractable issues.

REFERENCES

Agranoff, R. (2006). Inside collaborative networks: Ten Lessons for public managers. *Public Administration Review, 66*(Supplement s1), 56-65. doi: 10.1111/j.1540-6210.2006.00666.x.

Agrawal, A. (2005). *Environmentality. Technologies of government and the making of subjects*. Durhaam, NC:  Duke University Press.

Angrosino, M. (2007). *Doing ethnographical and observational research*. London: SAGE Publications.

Armitage, D., Berkes, F., & Doubleday, N. (Eds.). (2007). *Adaptive co-management: collaboration, learning and multi-level governance*. Vancouver: UBC Press.

Attar, A., & Genus, A. (2014). Framing public engagement: A critical discourse analysis of GM Nation? *Technological forecasting and social change, 88*, 241-250. doi: http://dx.doi.org/10.1016/j.techfore.2014.07.005.

Bacchi, C. (2009). *Analysing policy: What's the problem represented to be?* French Forest, Australia:  Pearson.

Backlund, A. (2000). The definition of system. *Kybernetes, 29*(4), 444-451. doi: doi:10.1108/03684920010322055.

Beatriz, L., & de Oca Barrera, M. (2016). Epistemic to the (inter) subjectivity window.  The potential of the ethnographic method.  *Forum: Qualitative social research, 17*(1).

Bekkers, V., & Fenger, M. (2012). Beyond fragmentation in public governance: The search for connective capacity. In M. Fenger & V. Bekkers (Eds.). *Beyond fragmentation and interconnectivity: Public governance and the search for connective capacity.* (pp. 167-182). Amsterdam:  IOS Press.

Bellamy, J., Ross, H., Ewing, S., & Meppem, T. (2002), *Integrated catchment management: Learning from the Australian experience for the Murray-*

*Darling Basin*, CSIRO Sustainable Ecosystems. Brisbane, Australia.

Retrieved from [online] URL:

http://www.mdba.gov.au/sites/default/files/archived/mdbc-NRM-

reports/2234_ICM_Learning_from_the_Aust_exp_MDB.pdf.

Berkes, F. (2006). From community-based resource management to complex

systems: The scale issue and marine commons. *Ecology and Society, 11*(1),

45.

Berkes, F. (2008). Commons in a multi-level world. *International Journal of the*

*Commons, 2*(1), 1-6.

Berkes, F. (2010). Devolution of environment and resources governance: Trends and

future. *Environmental Conservation, 37*(4), 489-500. doi:

doi:10.1017/S037689291000072X.

Biswas, A. K. (2004). Integrated water resources management: A reassessment.

*Water International, 29*(2), 248-256. doi: 10.1080/02508060408691775.

Blackmore, C. (2007). What kinds of knowledge, knowing and learning are required

for addressing resource dilemmas?: A theoretical overview. *Environmental*

*Science & Policy, 10*(6), 512-525.

Blackmore, C., Ison, R., & Jiggins, J. (2007). Social learning: an alternative policy

instrument for managing in the context of Europe's water. *Environmental*

*Science & Policy, 10*(6), 493-498.

Bodin, Ã. r., & Tengo, M. (2012). Disentangling intangible social-ecological

systems. *Global Environmental Change, 22*(2), 430-439.

Bodin, Ö., & Crona, B. (2009). The role of social networks in natural resource

governance: What relational patterns make a difference? *Global*

*Environmental Change, 19*(3), 366-374.

Bodin, Ö., Crona, B., & Ernston, H. (2006). Social networks in natural resource

management: What is there to learn from structural perspective? *Ecology and

Society, 11*(2), r2.

Boully, L. (2007). Water resource management: multiple values demand multiple

objectives. *Farm Policy Journal, 4*(13), 55 - 63.

Boulton, J. (2010). Complexity theory and implications for policy development.

*Emergence: Complexity & Organization, 12*(2), 31-40.

Bovaird, T. (2008). Emergent strategic management and planning mechanisms in

complex adaptive systems. *Public Management Review, 10*(3), 319-340. doi:

10.1080/14719030802002741.

Brady, M. (2011). Researching governmentalities through ethnography: the case of

Australian welfare reforms and programs for single parents. *Critical Policy

Studies, 5*(3*)*, 264-282. doi: 10.1080/19460171.2011.606300.

Brady, M. (2014). Ethnographies of Neoliberal Governmentalities: from the

neoliberal apparatus to neoliberalism and governmental assemblages.

*Foucault Studies,* (18), 11-33.

Buijs, M., Eshius, J., & Byrne, D. S. (2009). Approaches to researching complexity

in public management. In G. R. Teisman, A. van Burren, & L. Gerrits (Eds.).

*Managing complex governance systems: dynamics, self-organization and

coevolution in public investments.* (pp. Pages 37-55). New York:  Routledge.

Byrne, D. (2005). Complexity, configurations and cases. *Theory, Culture & Society,

22*(5), 95-111. doi: 10.1177/0263276405057194.

Callon, M. (1986). Some elements of a sociology of translation: domestication of the

scallops and the fisherman of St Brieuc Bay. In J. Law (Ed.), *Power, Action

*and Belief: A New Sociology of Knowledge?* (pp. 196 - 233). London: Routledge & Kegan.

Capra, F. (1996) *The web of life: A new scientific understanding of living systems.* New York: Anchor Books.

Carpenter, S. R., Brock, W. A., & Hanson, P. (1999). Ecological and social dynamics in simple models of ecosystem management. *Conservation Ecology, 3*(2), 4.

Cash, D. W., Adger, W., Berkes, F., Garden, P., Lebel, L., Olsson, P., . . . Young, O. R. (2006). Scale and cross-scale dynamics: Governance and information in a multi-level world. *Ecology and Society, 11*(2), 8.

Checkland, P. (1981). *Systems thinking, systems practice.* Chichester, England: John Wiley & Sons

Checkland, P. (1985). Achieving 'desirable and feasible' change: An application of soft systems methodology. *The Journal of the Operational Research Society, 36*(9), 821-831.

Checkland, P. (1999). *Systems thinking, systems practice: Includes a 30 year retrospective.* Chichester, England:  Wiley.

Cheshire, L. (2006). *Governing rural development discourses and practices of self-help in Australian rural policy.* Hampshire, England:  Ashgate Publishing Limited.

Cilliers, P. (2001). Boundaries, hierarchies and networks in complex systems. *International Journal of Innovation Management, 5*(2), 135-147.

Clarke, J. (2008). Governing the local? A response to Kevin Stenson. *Social work & Society, 6*(1), 15-20.

Clegg, S., R. (1989). *Frameworks of power.* London:  SAGE Publications Ltd.

Collins, K., Blackmore, C., Morris, D., & Watson, D. (2007). A systemic approach to
managing multiple perspectives and stakeholding in water catchments: Some
findings from three UK case studies. *Environmental Science & Policy, 10*(6),
564 - 574. doi: http://dx.doi.org/10.1016/j.envsci.2006.12.005.

Collins, K. B., & Ison, R. L. (2010). Trusting emergence: Some experiences of
learning about integrated catchment science with the environment agency of
England and Wales. *Water Resources Management, 24*(4), 669 - 688. doi:
10.1007/s11269-009-9464-8.

Connell, D. (2007). *Water politics in the Murray-Darling Basin*. Sydney: The
Federation Press.

Connick, S., & Innes, J. E. (2003). Outcomes of collaborative water policy making:
Applying complexity thinking to evaluation. *Journal of Environmental
Planning and Management, 46*(2), 177-197. doi:
10.1080/0964056032000070987.

Coop, P., & Brunckhorst, D. J. (2001). Old practices building new institutions: A
commons approach to the rural crisis. In G. Lawrence, V. Higgins, & S.
Lockie (Eds.). *Environment, society and natural resource management:
Theoretical perspectives from Australasia and the Americas.* Cheltenham,
UK: Edward Elgar.

Corning, P. A. (2002). The re-emergence of "emergence": A venerable concept in
search of a theory. *Complexity, 7*(6), 18-30. doi: 10.1002/cplx.10043.

Cresswell, J. (2013). *Qualitative inquiry and research design: Choosing among five
approaches* (3rd ed.). Thousand Oaks, California: SAGE Publications Inc.

Dean, M. (1999). *Governmentality power and rule in modern society*. London:
SAGE Publications Ltd.

Denzin, N., & Lincoln, Y. (2011). Introduction: The discipline and practice of

qualitative research. In N. Denzin & Y. Lincoln (Eds.). *The SAGE handbook*

*of qualitative research.* (pp. 1-42). Thousand Oaks, California:  SAGE

Publications Inc.

Department of Environment and Resource Management. (2011). *The Great Artesian*

*Basin Sustainability Inititaive.*  Brisbane: Queensland Government

Dinar, A., Kemper, K., Blomquist, W., Diez, M., Sine, G., & Fru, W. (2005),

*Decentralization of river basin management: A global analysis*, World Bank.

Doubleday, N. (2007). Culturing adaptive co-Management.  Finding "keys" to

resiliance in assymetries of power. In D. Armitage, F. Berkes, & N.

Doubleday (Eds.). *Adaptive co-management: collaboration, learning and*

*multi-Level governance.* (pp. 226 - 246). Vancouver:  UBC Press.

Duit, A., & Galaz, V. (2008). Governance and complexity - Emerging issues for

governance theory. *Governance, 21*(3), 311-335. doi: 10.1111/j.1468-

0491.2008.00402.x.

Edelenbos, J. (2005). Institutional implications of interactive governance: Insights

from Dutch practice. *Governance, 18*(1), 111 -134. doi: 10.1111/j.1468-

0491.2004.00268.x.

Edelenbos, J., Bressers, N., & Scholten, P. (2013a). Introduction: Conceptualising

connective capacity in water governance. In J. Edelenbos, N. Bressers, & P.

Scholten (Eds.). *Water governance as connective capacity.* (pp. 1 - 25).

Surrey: Ashgate.

Edelenbos, J., Bressers, N., & Scholten, P. (Eds.). (2013b). *Water governance as*

*connective capacity*. Surrey: Ashgate.

Edelenbos, J., Steijn, B., & Klijn, E.-H. (2010). Does democratic anchorage matter?: An inquiry into the relation between democratic anchorage and outcome of Dutch environmental projects. *The American Review of Public Administration, 40*(1), 46-63. doi: 10.1177/0275074009332064.

Edelenbos, J., & Teisman, G. R. (2011). Symposium on water governance. Prologue: water governance as a government's actions between the reality of fragmentation and the need for integration. *International Review of Administrative Sciences, 77*(1), 5-30. doi: 10.1177/0020852310390090.

Ekstrom, J. A., & Young, O. R. (2010). Evaluating functional fit between a set of institutions and an ecosystem. *Ecology and Society, 14*(2), 16.

Elder-Vass, D. (2005). Emergence and the realist account of cause. *Journal of Critical Realism, 4*(2), 315-338. doi: 10.1163/157251305774356667.

Ellis, C., Bochner, A., Denzin, N., Lincoln, Y., Morse, J., Pelias, R., & Richardson, L. (2008). Talking and thinking about qualitative research. *Qualitative Inquiry, 14*(2), 254-284. doi: 10.1177/1077800407311959.

Emmery, M. (1994). *An overview of ecologically sustainable development processes in Australia 1990-1992.*  Canberra: Commonwealth of Australia

Fabinyi, M., Evans, L., & SFoale, S. J. (2014). Social-ecological systems, social diversity, and power: insights from anthropology and political ecology. *Ecology and Society, 19*(4), 28.

Fenger, M., & Bekkers, V. (2012). Creating connective capacities in public governance: Challenges and contributions. In M. Fenger & V. Bekkers (Eds.). *Beyond fragmentation in public governance: The search for connective capacity.* (pp. 3-16). Amsterdam:  IOS Press.

Fichte, J. (1848). *The Vocation of man.*  London: The Catholic Series.

Fischhendler, I., & Heikkler, T. (2010). Does integrated water resources management support institutional change? The case of water policy reform in Israel. *Ecology and Society, 15*(1), 4.

Foucault, M. (1973). *The birth of the clinic*. London: Routledge.

Foucault, M. (1975). *Discipline & punish. The birth of the prison*. Paris: Editions Gallimard.

Foucault, M. (1991). Govermentality. In C. G. Burchell, P, Miller (Eds.), *The Foucault effect. Studies in governmentalty with two lectures by and an interview with Michel Foucault.* (pp. 87-104). Chicago: Chicago University Press.

Foucault, M. (1994a). Governmentality. In J. D. Faubion (Ed.), *Michel Foucault Power.* (pp. 201-222). New York: The New Press.

Foucault, M. (1994b). Questions of Method. In J. D. Faubion (Ed.), *Michel Foucault Power.* (pp. 223-258). New York: The New Press.

Foucault, M. (1994c). The Subject and Power. In J. D. Faubion (Ed.), *Michel Foucault Power.* New York: The New Press.

Foucault, M. (1998). *The history of sexuality Vol 1: The will to knowledge*. New York, USA: Random House Inc.

Foucault, M., & Gordon, A. (1980). *Power/knowledge: selected interviews and other writings, 1972-1977*. New York, USA: Pantheon Books.

Galez, V., Olsson, P., Hahn, T., Folke, C., & Svedin, U. (2008). The Problem of fit among biophysical systems, environmental and resource regimes, and broader governance systems: Insights and emerging challenges. In O. R. Young, L. A. King, & H. Schroeder (Eds.). *Institutions and environmental*

*change. Principle findings, applications and research frontiers.* Cambridge, Massachusetts:  The MIT Press.

Gerrits, L. (2008). *The gentle art of coevolution: A complexity theory perspective on decision making over estuaries in Germany, Belgium and the Netherlands.* (PhD), Erasmus University, Rotterdam.

Gerrits, L., Marks, P., & van Burren, A. (2009). Coevolution. In G. R. Teisman, A. van Burren, & L. Gerrits (Eds.). *Managing complex governance systems: dynamics, self-organization and coevolution in public investments.* New York:  Routledge.

Gerrits, L., & Verweij, S. (2013). Critical realism as a meta-framework for understanding the relationships between complexity and qualitative comparative analysis. *Journal of Critical Realism, 12*(2), 166-182.

Gibson, C. C., Ostrom, E., & Ahn, T. K. (2000). The concept of scale and the human dimensions of global change: a survey. *Ecological Economics, 32*(2), 217-239. doi: http://dx.doi.org/10.1016/S0921-8009(99)00092-0.

Gleick, P. H., & Palaniappan, M. (2010). Peak water limits to freshwater withdrawal and use. *Proceedings of the National Academy of Sciences, 107*(25), 11155 - 11162. doi: 10.1073/pnas.1004812107.

Godden, L., & Ison, R. (2010). From water supply to water governance. (2010): 177-184.

Goldstein, J. (1999). Emergence as a construct: History and issues. *Emergence, 1*(1), 49-72.

Gordon, C. (Ed.). (1980). *Power/Knowledge: Selected interveiws and other writings 1972-1977 Michel Foucault*. New York, USA: Pantheon Books.

Grindle, M. S. (2010). Governance reform: The new analytics of next steps. *Governance: An International Journal of Policy, Administration and Institutions, 24*(3), 415-418.

Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Education Technology Research and Development, 29*(2), 75 - 91.

Guerrero, A. M., McAllister, R. R. J., Corcoran, J., & Wilson, K. A. (2013). Scale mismatches, conservation planning, and the value of social-network analyses. *Conservation Biology, 27*(1), 35-44. doi: 10.1111/j.1523-1739.2012.01964.x.

Guerrero, A. M., McAllister, R. R. J., & Wilson, K. A. (2014). Achieving cross-scale collaboration for large scale conservation initiatives. *Conservation Letters, 8*(2), 107-117. doi: 10.1111/conl.12112.

Gunderson, L., & Holling, C. S. (Eds.). (2002). *Panarchy: understanding transformations in human and natural systems*. Washington, D.C., USA: Isalnd Press.

Gunderson, L., & Light, S. S. (2006). Adaptive management and adaptive governance in the everglades ecosystem. *Policy Sciences, 39*(4), 323-334.

Hacking, I. (1986). Making up people. In T. C. Heller, M. Sosna, & D. E. Welber (Eds.), Reconstructing individualism: Autonomy, individuality, and the self in western thought (pp. 222-236). Stanford: Stanford University Press.

Hall, P. A., & Taylor, R. C. R. (1996). Political science and the three new institutionalisms. *Political Studies, 44*(5), 936 - 957. doi: 10.1111/j.1467-9248.1996.tb00343.x.

Head, B. W., & Alford, J. (2008). *Wicked Problems: The implications for public management.* In International Research Society for Public Management 12th Annual Conference Brisbane.

Heikkila, T., Schlager, E., & Davis, M. W. (2011). The role of cross-scale institutional linkages in common pool resource management: Assessing interstate river compacts. *Policy Studies Journal, 39*(1), 121-145. doi: 10.1111/j.1541-0072.2010.00399.x.

Hodgson, G., M. . (2006). What are institutions? *Journal of Economic Issues, 40*(1), 1-25.

Hodgson, G. M. (2000). The Concept of Emergence in Social Sciences: Its History and Importance. *Emergence, 2*(4), 65-77.

Holling, C. S., & Meffe, G. K. (1996). Command and control and the pathology of natural resource management. *Conservation Biology, 10*(2), 328-337. doi: 10.1046/j.1523-1739.1996.10020328.

Hood, O., Coutts, J., & Hamilton, G. (2014). Analysis of the role of an innovation broker appointed by a cotton industry environmental innovation partnership in Queensland, Australia. *Outlook on Agriculture, 43*(3), 201-206.

Ison, R. (2010). *Systems practice: How to act in a climate-change world*. London: Springer.

Ison, R., Röling, N., & Watson, D. (2007). Challenges to science and society in the sustainable management and use of water: Investigating the role of social learning. *Environmental Science & Policy, 10*(6), 499 - 511.

Johnson, S. (2001). *Emergence: the connected lives of ants, brains, cities, and software*. New York:  Scribner.

Kallis, G., Kiparsky, M., & Norgaard, R. (2009). Collaborative governance and adaptive management: Lessons from California's CALFED water program. *Environmental Science & Policy, 12*(6), 631-643.

Keil, R., & Debbane, A. (2005). Scaling discourse analysis: Experiences from Hermanus, South Africa and Walvis Bay, Namibia. *Journal of Environmental Policy & Planning, 7*(3), 257 - 276.

Klerkx, L., Schut, M., Leeuwis, C., & Kilelu, C. (2012). Advances in knowledge brokering in the agricultural sector: Towards innovation system facilitation. *IDS Bulletin, 43*(5), 53-60. doi: 10.1111/j.1759-5436.2012.00363.x.

Klijn, E.-H. (2008). Complexity theory and public administration: What's new? *Public Management Review, 10*(3), 299-317. doi: 10.1080/14719030802002675.

Koutsouris, A. (2012). *Exploring the emerging facilitation and brokerage roles for agricultural extension education*. AUA Working Paper Series. Working paper. Department of Agrcultural Economics and rural development. Agriculture University of Athens. Athens, Greece.

Lambin, E. F. (2005). Conditions for sustainability of human-environment systems: Information, motivation, and capacity. *Global Environmental Change, 15*(3), 177-180.

Lammers, J. C., & Barbour, J. B. (2006). An instiutional theory of organisational communication. *Communication Theory, 16*(3), 356-377.

Lane, M., Haygreen, A., Morrison, T. H., & Woodlands, J. (2009). Will regionalisation achieve integrated natural resource management? Insights from recent South Australian experience. In M. Lane, C. Robinson, & B. Taylor (Eds.). *Contested country. Local and regional natural resources management in Australia.* (pp. 59-74). Victoria, Australia: CSIRO Publishing.

Lane, M., Robinson, C., & Taylor, B. (Eds.). (2009). *Contested country : local and regional natural resources management in Australia*. Victoria, Australia: CSIRO Publishing.

LeCompte, M. D. (1987) Bias in the biography: Bias and subjectivity in ethnographic research. *Anthropology & Education Quarterly, 18*(2), 43-52.

Levin, S. A. (1998). Ecosystems and the biosphere as complex adaptive systems. *Ecosystems, 1*(5), 431-436.

Li, T. (2007). Practices of assemblage and community forest management. *Economy and Society, 36*(2), 263-293. doi: 10.1080/03085140701254308.

Li, T. M. (2007). Governmentality. *Anthropologica, 49*(2), 275-281.

Li, T. M. (2008). Social reproduction, situated politics, and the will to improve. *Focaal – European Journal of Anthropology, 52*, 111-118.

Lubell, M. N., Robins, G., & Wang, P. (2014). Network structure and institutional complexity in an ecology of water management games. *Ecology and Society, 19*(4), 23.

Manson, S. M. (2001). Simplifying complexity: a review of complexity theory. *Geoforum, 32*(3), 405-414. doi: http://dx.doi.org/10.1016/S0016-7185(00)00035-X.

Margerum, R. D. (1999). Integrated environmental management: The foundations for successful practice. *Environmental Management, 24*(2), 151-166.

Marshall, G. (2008). Nesting, subsidiarity, and community-based environmental governance beyond the local scale. *International Journal of the Commons, 2*(1), 75-97.

McAllister, R. J., McCrea, R., & Lubell, M. (2014). Policy networks, stakeholder interactions and climate adaptation in the region of South East Queensland,

Australia. *Regional Environmental Change, 14*(2), 527-539. doi: 10.1007/s10113-013-0489-4.

Mehta, L., Leach, M., & Scoones, I. (2001). Editorial: Environmental governance in an uncertain world. *IDS Bulletin, 32*(4), 1-9. doi: 10.1111/j.1759-5436.2001.mp32004001.x.

Mercer, D., & Marden, P. (2006). Ecologically sustainable development in a 'quarry' economy: One step forward, two steps back. *Geographical Research, 44*(2), 183-203. doi: 10.1111/j.1745-5871.2006.00376.x.

Mollinga, P. (2008). Water politics and development: Framing a political sociology for water resources management. *Water Alternatives, 1*(1), 7-23.

Mollinga, P. P., Meinzen-Dick, R. S., & Merrey, D. J. (2007). Politics, plurality and problemsheds: A strategic approach for reform of agricultural water resources management. *Development Policy Review, 25*(6), 699 - 719. doi: 10.1111/j.1467-7679.2007.00393.x.

Morrison, T., & Lane, M. (2006). The convergence of regional governance discourses in rural Australia: enduring challenges and constructive suggestions. *Rural Society, 16*(3), 341-357.

Morrison, T. H. (2006). Pursuing rural sustainability at the regional level: Key lessons from the literature on institutions, integration, and the environment. *Journal of Planning Literature, 21*(2), 143-152. doi: 10.1177/0885412206292261.

Mosse, D. (2006). Anti-social anthropology? Objectivity, objection, and the ethnography of public policy and professional communities. *Journal of the Royal Anthropological Institute, 12*(4), 935-956. doi: 10.1111/j.1467-9655.2006.00371.x.

Newman, L., & Dale, A. (2005). Network structure, diversity, and proactive resilience building: A response to Tompkins and Adger. *Ecology and Society, 10*(1), r2.

O'Neill, K., Weinthal, E., Suiseeya, K. M., Bernstein, S., Cohn, A., Stone, M. W., & Cashore, B. (2013). Methods and global environmental governance: Reflection, relevance and rigor. *Annual Review of Environment and Resources, 38*, 441-471. doi: doi:10.1146/annurev-environ-072811-114530.

Olsson, P., Folke, C., & Berkes, F. (2004). Adaptive co-management for building resilience in social-ecological systems. *Environmental Management, 34*(1), 75-90. doi: 10.1007/s00267-003-0101-7.

Olsson, P., Folke, C., & Hughes, T. P. (2008). Navigating the transition to ecosystem-based management of the Great Barrier Reef, Australia. *Proceedings of the National Academy of Sciences, 105*(28), 9489-9494. doi: 10.1073/pnas.0706905105.

Paechter, C. (2013). Researching sensitive issues online: Implications of a hybrid insider/outsider position in a retrospective ethnographic study. *Qualitative Research, 13*(1), 71-86. doi: 10.1177/1468794112446107.

Pahl-Wostl, C., Lebel, L., Knieper, C., & Nikitina, E. (2012). From applying panaceas to mastering complexity: Toward adaptive water governance in river basins. *Environmental Science & Policy, 23*, 24-34. doi: http://dx.doi.org/10.1016/j.envsci.2012.07.014.

Pel, B., Verkerk, J., van Burren, A., & Edelenbos, J. (2013). *Intersections in delta development; analyzing actors for complexity-sensitive spatial concepts*. Paper presented at the Challenges of making public administration and complexity theory work, California, USA.

Perakyla, A., & Ruusuvuori, J. (2011). Analysing talk and text. In N. Denzin & Y.
Lincoln (Eds.). *The SAGE handbook of qualitative research.* (pp. 869-886).
Thousand Oaks, California: SAGE Publications Inc.

Phelan, S. (1999). A note on the correspondence between complexity and systems
theory. *Systemic Practice and Action Research, 12*(3), 237-246. doi:
10.1023/A:1022495500485.

Pretty, J. (2003). Social capital and the collective management of resources. *Science,
302*(5652), 1912-1914.

Rempel, M. (1996). Systems theory and power/knowledge. A Foucauldin
reconstruction of Niklas Luhmann's systems theory. *International Journal of
Sociology and Social Policy, 16*(4), 58-90.

Rhodes, R. A. W., 't Hart, P., & Noordegraf, M. (Eds.). (2007). *Observing
government elites up close and personal*. New York, USA: Palgrave
Macmillan.

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning.
*Policy Sciences, 4*(2), 155-169.

Robins, G., & Morris, M. (2007). Advances in exponential random graph (p*)
models. *Social Networks, 29*(2), 169-172.

Robins, G., Pattison, P., Kalish, Y., & Lusher, D. (2007). An introduction to
exponential random graph (p*) models for social networks. *Social Networks,
29*(2), 173-191.

Rockstram, J. (2009). A safe operating space for humanity. *Nature, 461*, 472-475.

Rockstram, J., Steffen, W., Noone, K., Persson, F. S., III, C. F. S., Lambin, E. F., . . .
Foley, J. (2009). Planetary Boundaries: exploring the safe operating space for
humanity. *Ecology and Society, 14*(2), 32.

Rogers, P., & Hall, A. W. (2000), *Effective water governance*, Global Water
Partnership. Sweden. Retrieved from
http://www.gwp.org/Global/ToolBox/Publications/Background%20papers/07
%20Effective%20Water%20Governance%20(2003)%20English.pdf

Rose, N., & Miller, P. (1992). Political power beyond the State: Problematics of
government. *The British Journal of Sociology, 43*(2), 171-205. doi:
10.2307/591464.

Rose, N., O'Malley, P., & Valverde, M. (2006). Governmentality. *Annual Review of
Law and Social Science, 2*, 83-104. doi:
doi:10.1146/annurev.lawsocsci.2.081805.105900.

Ryan, S. (2010). Murray-Darling Basin – Integrated management in a large, dry and
thirsty basin. In R. Ferrier & A. C. Jenkins (Eds.). *Handbook of Catchment
Management.* (pp. Pages 303-322). Sussex UK:  Wiley-Blackwell.

Ryan, S., Broderick, K., Sneddon, Y., & Andrews, K. (2010), *Australia's NRM
governance system.  Foundations and principles for meeting future
challenges.*, Australian Regional NRM Chairs. Canberra.

Sawicki, J. (1991). *Disciplining Foucault*. New York, USA:  Routledge.

Scheurick, J. J., & Mckenzie, K. B. (2005). Foucault's methodologies, archeology
and genealogy. In N. Denzin & Y. Lincoln (Eds.). *The SAGE handbook of
Qualitative Research.* Thousand Oaks, California:  Sage Publications.

Schneider, M., Scholz, J., Lubell, M., Mindruta, D., & Edwardsen, M. (2003).
Building consensual institutions: Networks and the national estuary program.
*American Journal of Political Science, 47*(1), 143-158.

Scoones, I., Leach, M., Smith, A., Stagl, S., Stirling, A., & Thompson, J. (2007), *Dynamic systems and the challenge of sustinability, STEPS working paper 1*, STEPS Centre. Brighton.

Shore, C., & Wright, S. (Eds.). (1997). *Anthropology of policy. Critical Perspectives on governance and power*. London: Routledge.

Srinivasan, V., Lambin, E. F., Gorelick, S. M., Thompson, B. H., & Rozelle, S. (2012). The nature and causes of the global water crisis: Syndromes from a meta-analysis of coupled human-water studies. *Water Resources Research, 48*(10), 1 - 16. doi: 10.1029/2011wr011087.

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, California: Sage.

Stark, S., & Torrence, H. (2004). Case study. In B. Somekh & C. Lewin (Eds.), Research methods in the social sciences (pp. 33-40). London: Sage Publications.

Steffen, W., Crutzen, P. J., & McNeill, J. R. (2007). The Anthropocene: Are humans now overwhelming the great forces of nature? *AMBIO: A Journal of the Human Environment, 36*(8), 614-621.

Stenson, K. (2008). Governing the local: Sovereignty, social governance annd community safety. *Social Work and Society, 6*(1), 2-14.

Steyaert, P., & Jiggins, J. (2007). Governance of complex environmental situations through social learning: A synthesis of SLIM's lessons for research, policy and practice. *Environmental Science & Policy, 10*(6), 575-586. doi: http://dx.doi.org/10.1016/j.envsci.2007.01.011.

Teisman, G. R., & Edelenbos, J. (2011). Towards a perspective of system synchronization in water governance: A synthesis of empirical lessons and

complexity theories. *International Review of Administrative Sciences, 77*(1), 101 - 118. doi: 10.1177/0020852310390121.

Teisman, G. R., Gerrits, L., & van Burren, A. (2009). An introduction to understanding and managing complex process systems. In G. R. Teisman, A. van Burren, & L. Gerrits (Eds.). *Managing complex governanec systems: Dynamics, self organisation and co-evolution of public investments.* New York, USA: Routledge.

Teisman, G. R., & Klijn, E.-H. (2008). Complexity theory and public management. *Public Management Review, 10*(3), 287-297. doi: 10.1080/14719030802002451.

Teisman, G. R., van Burren, A., Edelenbos, J., & Warner, J. (2013). Water governance: Facing the limits of managerialism, determinism, water-centricity, and technocratic problem-solving. *International Journal of Water Governance, 1*(1), 1-11.

Teisman, G. R., van Burren, A., & Gerrits, L. (Eds.). (2009). *Managing complex governance systems: Dynamics, self organisation and co-Evolution of public investments*. New York, USA: Routledge.

Torfing, J., Peters, G., Pierre, J., & Sorensen, E. (2012). Power and politics in interactive governance. In J. Torfing, G. Peters, J. Pierre, & E. Sorensen (Eds.), *Interactive governance: Advancing the paradigm.* Oxford Scholarship Online: Oxford University Press.

Tortajada, C. (2010). Water governance: A research agenda. *International Journal of Water Resources Development, 26*(2), 309-316. doi: 10.1080/07900621003683322.

Tracy, S. J. (2010). Qualitative quality: Eight "big-tent" criteria for excellent qualitative research. *Qualitative Inquiry, 16*(10), 837-851. doi: 10.1177/1077800410383121.

Tropp, H. (2007). Water governance: Trends and needs for new capacity development. *Water Policy, 9*(2), 19-30. doi: 10.2166/wp.2007.137.

United Nations Conference on Environment and Development. (1992). *Agenda 21*, New York.

United Nations Educational Scientific and Cultural Orgaanisation (2006), *Water a shared responsibility. The United Nations world water report 2.*, United Nations Educational, Scientific and Cultural Orgaanisation. Paris and New York: U. A. B. Books.

van Gils, M., Gerrits, L., & Teisman, G. R. (2009 ). Non-linear dynamics in port systems. In G. R. Teisman, A. van Burren, & L. Gerrits (Eds.). *Managing Complex Governance Systems*. New York, USA:  Routledge.

Verweij, S. (2012). Management as system synchronization: The case of the Dutch A2 Passageway Maastricht project. *Emergence: Complexity & Organization, 14*(4), 17-37.

Verweij, S., & Gerrits, L. M. (2013). Understanding and researching complexity with Qualitative Comparative Analysis: Evaluating transportation infrastructure projects. *Evaluation, 19*(1), 40-55. doi: 10.1177/1356389012470682.

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social–ecological systems. *Ecology and Society, 9*(2), 5.

Wallis, P., & Ison, R. (2011). Appreciating institutional complexity in water governance dynamics: A case from the Murray-Darling Basin, Australia.

*Water Resources Management, 25*(15), 4081-4097. doi: 10.1007/s11269-011-9885-z.

Woodhill, J. (2010). Capacities for institutional innovation: A complexity perspective. *IDS Bulletin, 41*(3), 47-59. doi: 10.1111/j.1759-5436.2010.00136.x.

Woolley, J. T., & McGinnis, M. V. (1999). The politics of watershed policymaking. *Policy Studies Journal, 27*(3), 578-594.

World Commission on Environment and Development. (1987). *Our common future*. Oxford: Oxford University Press

World Helath Organisation (2005), *Ecosystems and human well-being: Health synthesis*, World Health Organisation. Geneva, Switzerland.

Wulff, H. (2002). Yo-yo fieldwork: mobilty and time in a multi-local study of dance in Ireland. *Anthropolical Journal on European Cultures, 11*, 117-136.

Yin, R. (2009). *Case study research, design and methods* (4th ed.). Thousand Oaks, California:  Sage Publications.

Young, O. (2008). Building regimes for socioecological systems: Institutional diagnostics. In O. Young, L. King, & H. Schroeder (Eds.). *Instiutions and environmental change: Principal frindings, applications and research fronitiers.* (pp. Pages 115-144). Cambridge:  The MIT Press.

Young, O., King, L., & Schroeder, H. (2008). *Instiuions and environmental change: Principle findings, applications and research frontiers*. Cambridge:  The MIT Press.

Young, O. R. (2010). Institutional dynamics: Resilience, vulnerability and adaptation in environmental and resource regimes. *Global Environmental Change, 20*(3), 378-385.