A New Institutional Economics Approach to Water Resource Management

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Statement of originality

This thesis contains no material which has been presented for a degree at this or any other university and, to the best of my knowledge and belief, contains no copy or paraphrase of work published by another person, except where duly acknowledged in the text.

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Abstract

Water policy makers around the world currently face the Sisyphean task of managing water resources that have deteriorated due to overuse and mismanagement. This thesis focuses on water resource management and places emphasis on the water policy reform process, with particular reference to Australia's most important, yet most problematic, water resource – the Murray-Darling Basin. It emphasises the importance of institutions in dealing with effective water management and the water policy reform process. The neo-classical economics approach is limited in its approach to water resource management. There is scope for alternative, multidimensional approaches. The new institutional economics tradition offers one such alternative. It is argued that a new institutional economics approach, combined with recognition of the challenges of governance, can provide an alternative and more holistic approach to water resource management.

Using a levels of institutions approach this thesis identifies aspects of the current approach to management of the Murray-Darling Basin that could be improved. It identifies the potential for transaction cost reduction in water markets and successful policy implementation by emphasising the need to focus, alongside economic and political institutions, on social institutions such as cultural norms and behavioural attitudes towards water resources. A new institutional economics analytical framework is used to re-contextualise the water policy debate by centralising the environment within the policy reform process.

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Acronyms

ABS	Australian Bureau of Statistics
COAG	Council of Australian Governments
DEWHA	Department of the Environment, Water, Heritage and the Arts
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
DWE	Department of Water and Energy
EWGM	Effective Water Governance Model
GVAP	Gross Value of Agricultural Production
GVIAP	Gross Value of Irrigated Agricultural Production
ICWE	International Conference on Water and the Environment
LMP	Living Murray Program
MDBA	Murray-Darling Basin Authority
MDBC	Murray-Darling Basin Commission
MDBMC	Murray-Darling Basin Ministerial Council
NPWS	National Plan for Water Security
NSW	New South Wales
NWC	National Water Commission
NWI	National Water Initiative
QLD	Queensland
RMW	River Murray Waters
SA	South Australia
VIC	Victoria

Map of the Murray-Darling Basin[1]

The Murray-Darling Basin is represented by the area shaded in blue.

[1] Source: http://www.mda.asn.au/images/Map_of_Australia_and_Basin_copy.jpg

Part I – Introduction, Theory and Context

Chapter 1 – Introduction and overview

The economics of the environment has been an important research field for many years. An increasing body of research has recently begun to explore solutions to natural resource management problems in a world where diminishing quality and quantity of resources are fast becoming the norm. In some key areas of this environmental economics field there is a particular sense of urgency due to the perilous health of ecosystems. This thesis focuses on water resource management and places particular emphasis on the water policy reform process. Examples from Australia's Murray-Darling Basin will be drawn upon to inform research and analysis of water resource management at a more broad level.

1.1 An Institutionalist Perspective

A common feature of the research focusing on the key areas is that the vast majority of it originates from the neo-classical school of economics. This is the dominant school and has framed the target of research and shaped policy to deal with environmental problems. In order to analyse water resource management in Australia, however, we must not neglect social, institutional and political elements that have had an impact on water policy reform. This requires going beyond the neo-classical economic approach which does not adequately take into consideration the effect of institutions in shaping such reforms. The effect of the political context in shaping such institutions is also not considered. An analysis of water policy reform in Australia

cannot be considered complete without examining the effect of institutions on the reform process.

An institutionalist economic analysis lends itself particularly well to the topic of water policy reform. There are a myriad of issues associated with water policy reform but some recurring themes in the literature are evident. These themes include:

- A lack of common ground about approaches to water policy reform. For example, there does not seem to be consensus on the extent of damage in the Murray-Darling Basin nor what rates of water extraction would ensure longer-term sustainability of water resources. For example, policy approaches seem to be different across jurisdictional levels leading to different policies across regions within the Murray-Darling Basin.
- Conflict of interest between different parties. For example, the Australian Federal government is attempting to ensure the long-term sustainability of the Murray-Darling river system while it seems that state governments are more interested in making politically expedient decisions that have a much shorter time frame.
- A distinctly 'economic-centred' approach to finding solutions to water resource management problems. This approach comes at the expense of other approaches that encompass a range of other factors in the analysis such as social and political factors.

A core objective of this thesis includes an examination of the three elements listed above. The rules and regulations regarding use of key water resources are other

recurring themes that arise in the literature. The different economic and political status of various levels of government and various key players in the water sector all have a significant bearing on how rules and regulations are developed. The institutional economist Douglas North affirms the importance of analysing various types of rule structures (such as political rules and economic rules) (North, 1990: 47). He notes that 'economic and political diversity of interests' (North, 1990: 47) will have an impact on the complexity of rules and regulations. This point is particularly pertinent to the Australian case. The Australian water resource managerial framework is complex and many commentators have raised concerns over this (according to the commentators – unnecessary) complexity.

Another core objective is to examine which institutions helped establish Australian water policy and the role of institutions in shaping the future direction of water policy reform. The thesis will focus on water resources in a non-urban setting. The evolution of institutions concerned with water will be investigated in order to better understand the key drivers of policy reform and the potential catalysts which initiated reform. For example, a question that will be addressed is the relationship between institutional (for example, establishment of regulatory bodies, regulations etc) evolution/change and water policy reform. Is there evidence to suggest that water policy reform in Australia occurred when there were institutional changes? Is there evidence which suggests that, historically, policy reform agendas developed due to scarcity constraints? Historically, have institutional changes preceded water policy reform agendas or *vice-versa* or does evidence point to a simultaneous change?

One of the main reasons for choosing an institutional economic methodology for analysing the research area is the fact that institutions play such an integral role in the economy. A key objective for the vast majority of nations today is to ensure economic growth. The role of institutions in this process is emphasised in the following passage from North's *Institutions, Institutional Change and Economic Performance* (North, 1990):

> *'That institutions affect the performance of economies is hardly controversial. That the differential performance of economies over time is fundamentally influenced by the way institutions evolve is also not controversial. Yet neither current economic theory nor cliometric history shows many signs of appreciating the role of institutions in economic performance…' (North, 1990: 3).*

While this thesis will focus on institutions and water policy reform, it is important to note that appropriate policy reform is key to ensuring economic progress and having appropriate policies in place requires the establishment of appropriate institutional arrangements. The main institutional economic theoretical grounding of thesis is drawn from the work of seminal figures in the institutional economics field – Oliver Williamson[2], Ronald Coase[3] and Douglas North[4]. An important body of multi-disciplinary work, in which Elinor Ostrom[5] is considered a pioneer, dealing with institutions and the environment specifically, is also drawn upon. In particular, this thesis will use a 'levels of institutions' framework for analysing water policy reform (especially in the Murray-Darling Basin). The levels of institutions approach is drawn

[2] Nobel Prize Laureate in 2009.
[3] Nobel Prize Laureate in 1992.
[4] Nobel Prize Laureate in 1994.
[5] Nobel Prize Laureate in 2009.

from the work of Williamson (2000) and is a representation of the different types of institutional arrangements that can used to shape policy. This approach is also used to identify gaps in the historical approach to water management of the Murray-Darling Basin.

1.2 Overview of the Main Issues

The remainder of this chapter provides an overview of the main issues concerning water resource management. It highlights some of the challenges for policy that this thesis addresses.

There is an increasing awareness of water related issues around the world. Global debate about the problems associated with climate change adds to the heightened level of awareness. Water resource related issues occur at different spatial levels: global, national and regional. On a global scale, water resources are under strain (as a result of mismanagement and climatic factors), creating tension between neighbouring countries. For example, in 2006, competition for water resources resulted in the violent loss of life on the border regions of Kenya and Ethiopia (Pacific Institute, 2009).

An example of a more local water resource problem is the degradation of Australia's Murray-Darling Basin. The degradation is the result of both natural factors (drought) and man-made factors (mismanagement of water resources). Climatic variability is a feature of Australia as Pigram notes that '[a]t any one time it would not be difficult to

find some areas of the continent in the grip of drought' (Pigram, 2007: 28) Australia is the driest inhabited country (Pigram, 2007: 10) on the planet and the recent prolonged drought has highlighted the urgent need for water policy reform. The drought and inadequate water policy responses have many impacts including social, political and economic. There is growing recognition that water resources actually have significant relationships with the state of the Australian economy[6]. Indeed, it would be somewhat surprising if there were any commentators who question that water supply could be a key constraint on economic growth.

Table 1.1 – Water consumption in Australia, 2004-05

Industry	2004-05 (total)	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Agriculture	12191	4133	3281	2916	1020	535	258	47	1
Forestry and fishing(a)	51	11	8	3	1	25	4	1	-
Mining	413	63	32	83	19	183	16	17	-
Manufacturing	589	126	114	158	55	81	49	6	1
Electricity and gas	271	75	99	81	3	13	-	1	-
Water supply(b)(c)	2083	631	793	426	71	128	20	8	5
Other industries	1059	310	262	201	52	168	18	30	17
Household	2108	572	405	493	144	362	69	31	31
Total	**18767**	**5922**	**4993**	**4361**	**1365**	**1495**	**434**	**141**	**56**

- nil or rounded to zero (including null cells).
Units = Megalitres.
(a) Includes Services to agriculture; hunting and trapping.
(b) Includes Sewerage and drainage services.
(c) Includes water losses.
Source: Adapted from ABS (2006b).

Table 1.1 and Table 1.2 show that the agricultural sector is the largest consumer of water. The argument that water is not a significant constraint on economic growth is misleading as the agriculture, forestry and fishing sectors share of GDP was 4.2% in 2001-02 (ABS, 2005). This figure actually dropped to 2.9% in 2002-03 as a result of

[6] Pigram notes that a '…CSIRO report suggests, [that] water remains a fundamental resource for Australia. Whereas some economists reject the view that water is a prime constraint on Australia's economic growth and population (Thomas, 1999), water remains essential for human activities and underpins the nation's economic sustainability' (Pigram, 2007: 10).

the drought (ABS, 2005). Mining's share of GDP was approximately 5% in 2000-01, for the manufacturing industry the share of GDP is 11% and for electricity and gas the figure is 2.5% (ABS, 2005). So in total the five industries listed above constitute approximately 20% of GDP. These statistics show clearly that water management problems will place a constraint on economic progress unless adequate policy responses are developed.

Table 1.2 – Water consumption (expressed as a percentage) in Australia, 2004-05

Industry	2004-05 (total)	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Agriculture	65	70	66	67	75	36	59	33	2
Forestry and fishing	0	0	0	0	0	2	1	1	-
Mining	2	1	1	2	1	12	4	12	-
Manufacturing	3	2	2	4	4	5	11	4	2
Electricity and gas	1	1	2	2	0	1	-	1	-
Water supply	11	11	16	10	5	9	5	6	9
Other industries	6	5	5	5	4	11	4	21	30
Household	11	10	8	11	11	24	16	22	55

Source: figures calculated from statistics in Table 1.1.

As mentioned above, inadequate water policy responses have consequences for social, economic and political factors. The main economic consequence has been discussed above. The impact of inadequate water policy responses on economic factors are linked with the adverse impact on social aspects of an economy as well. The plight of farmers struggling to cope with water shortages has been well documented across Australia recently (see for example, McDonald (2007), O'Connell (2007), Australian Associated Press General News (2007) and The Weekly Times (2007)). Furthermore, water policy reform encompasses a wide variety of issues ranging from the establishment of water trading markets to community awareness problems. Each of these issues has social impacts. For example, Tidsell notes that in order for water reform to be successful the reforms need to have 'community acceptance' (Tidsell, 2003: 1). This point is significant. Several commentators (see for example Engle

(2007), Dovers (2007) and Syme (2007)) have highlighted the fact that successful policy implementation requires a change in societal attitudes towards water. Changes in societal attitudes towards water requires effective communication and community involvement in the decision-making process. This is a particular challenge that needs to be addressed in Australia, but '[u]nfortunately Australia has been unsystematic in incorporating community views and knowledge on issues relating to demand management, source development and water allocation issues' (Syme, 2007: 19).

The impact of the drought and water policy issues on political factors has also been highlighted by various commentators (see, for example, Veness (2007) and Morris (2007)). For example, the recent conflict between the Victorian state government and the Federal government over the future management of the Murray-Darling Basin (Topsfield *et al* (2007)) highlights the rather uncooperative state of relations between different levels of government. This is also noted by Pigram: '[d]ifferent conditions of water availability and use, and contrasting perspectives on resource development have slowed the progress of reform in some states (Pigram, 2007: 65).

1.3 Institutions

This thesis aims to emphasise the importance of institutions in dealing with effective water management and in the water policy reform process. The need to understand the role of institutions in the water reform process is acknowledged by Tidsell as follows:

'Institutional failure, across most jurisdictional constituencies, to manage water as an economic good is now understood to be the primary causal agent of water usage associated problems in Australia…' (Tidsell, 2003: 1).

Not only do institutions[7] participate in the policy reform process but they affect all aspects of water resource supply and demand.

A report by ACIL Tasman (2005) emphasises the need to pay particular attention to the institutions and institutional arrangements concerning water policy. The report provides an overview of the institutional arrangements concerning the Australian water sector. While the report does not provide an assessment of the institutional arrangements, it becomes obvious that there is not a single coherent and compatible approach to water management. The lack exists at all levels. For example, different states have different approaches to water management within their jurisdictions (ACIL Tasman, 2005: 5).

Smith (1998) also notes the importance of institutions and the need for institutional change with regard to water reform policy. Smith notes that, since the mid 1990s, other commentators and policy makers have also begun to realise the need for institutional change, so much so that '…[the] interest in change to institutional

[7] A detailed discussion about institutions is provided in chapter. Chapter 2 presents the definition of institutions that is adopted throughout this thesis.

arrangements has been dramatic and changes have been fast moving' (Smith, 1998: 273).

This thesis argues that institutions and institutional arrangements need to play more of a key role in future water policy reform processes. It is acknowledged that institutions and institutional arrangements are undergoing rapid changes and there is some research about institutions and institutional arrangements. However, there is an increasing focus on the 'economics' of water. Issues such as water pricing and positive rates of return on assets are just some of the issues that seem to have shifted the *main* focus of water policy reform away from institutional arrangements. Taken on its own, this point seems rather innocuous. But the economics of water cannot be isolated from institutional factors. Economic factors are *embedded* within institutions. The shift emphasising economic instruments as the solution to water policy issues seems to have coincided with a shift in the ideological framework through which policy makers and advisors view water reform related issues. This point is noted by Pigram when he says, '[a]dditionally, support is growing for a reduced role for the public sector, and consequently, greater opportunities for private sector involvement in water management' (Pigram, 2006: 63).

The global catalyst for the move towards the reregulation of the water industry was initially the Bruntland Commission in 1983 (Pigram, 2006: 64). In 1992 the 'Industry Commission Report on Water Resources and Waste Water Disposal' highlighted the need for resources to be managed in an efficient and sustainable manner (Pigram, 2006: 64). It is interesting to note that the terminology used includes words such as

'efficient' and 'sustainable' – terms that are commonplace nowadays and are closely associated with economic analysis[8]. The use of these terms seems to have coincided with a shift towards market–based approaches to managing the water industry.

1.4 Neo-classical Economics and Water

The ascendancy of neo-liberal ideology, coupled with the dominance of neo-classical economics, has had a significant impact on water management in Australia. The focus of the water policy reform process has shifted towards prioritising economic efficiency and emphasising economic instruments as the solution to water related problems. As with most attempted solutions to any problem, there are key weaknesses and strengths in this approach. The most significant weakness of relying on (abstract) economic models is that many aspects of the problem are either ignored (under the guise of being irrelevant or insignificant) or are inadequately dealt with. For example, it is difficult to effectively endogenise within an economic model the role of community attitudes towards water and what factors have shaped and continue to shape these attitudes towards water. Community attitudes towards water should not be seen as an insignificant factor in the water policy reform process. While creating a variable within an economic model that represents community attitudes is difficult, the *relegation* of community attitudes is fallacious and can lead to inappropriate policy responses. Solutions derived from quantitative economic models should be regarded as rough rather than precise.

[8] A closer examination of 'sustainability' and orthodox economic analysis reveals a tension between the two concepts. This is explored in more detail in chapter 5.

Changing community attitudes towards water and changing 'water culture' in Australia is a daunting task and quite beyond the scope of any economic model. Because water is embedded within daily lives, reforming water management in Australia will have a significant impact on personal behaviour. Dovers notes that '[c]hanging behaviours is serious business and doubly sensitive and difficult when it gets personal' (Dovers, 2007: 3). Incorporating an analysis of institutions and institutional arrangements will allow for a more in depth examination of the underlying problems concerning water resource management and thus will allow for more appropriate policy recommendations.

The rise of neo-liberal ideology and the prominence of neo-classical economic analysis has seen market related solutions applied to a wide range of sectors within the economy. For example, the trend towards a deregulated economy is apparent with financial market liberalisation in the 1980s, deregulation of the telecommunications industry in the 1990s, the ongoing changes to labour markets and the recent recommendations for privatising energy industries such as the electricity industry in New South Wales (NSW). Water has not escaped unscathed from this trend. As Dovers notes, '[m]arketisation of water services and agencies following the neo-liberal revolution has altered both water management and expectations of relative public and private benefits…' (Dovers, 2007: 2).

Marketisation of water in Australia gained pace in the late 1980s and early 1990s. The Hilmer report (1993) and the resulting National Competition Policy framework relegated water to the status of a mere commodity in the conventional sense. As Sheil

argues,'[n]ot only were Australia's water systems now to become purely commercial functions in their own right, the decisions prepared the way for them to become private commercial functions' (Sheil, 2000: 40).

The consequences of policy shifts regarding the role of the government and the public sector in water management is succinctly stated by Pigram: '[t]he end-result is a lessening in the degree of discretion left to water authorities and an increasing requirement to accommodate economic instruments and market based approaches to water allocation and use. Foremost among these are the rationalisation of water pricing and establishment of water markets and tradeable water entitlements' (Pigram, 2007: 64).

1.5 Institutional Reform

The first wave of substantial institutional reform of water management in Australia began in the 1980s and was formalised in the early and mid 1990s with the establishment of the National Competition Policy framework. Further agendas for reform were initiated in 1994 by the Council of Australian Governments (COAG). The 1994 COAG meeting highlighted some of the key issues to be the subject of reform. These key issues included:

- Pricing reform such as full-cost recovery, cross-subsidies removal
- Achieving positive real rates of return on the written-down replacement costs of any assets
- Asset upgrading and refurbishment
- Clear specification of water property rights
- Formal determination of water allocation or water entitlements
- Environmental requirements to be taken into consideration

- Water allocation for the environment and treating the environment as a legitimate user of water
- Establishing water markets and tradeable water entitlements
- Developing an integrated management approach to natural resource management
- Standard setting, regulatory enforcement and service provision be separated institutionally
- The arrangements in respect of service delivery organisations in metropolitan areas in particular should have a commercial focus, and whether achieved by contracting-out, corporatised entities or privatised bodies this must be a matter for each jurisdiction to determine in the light of its own circumstances.
- that jurisdictions individually and jointly develop public education programs in relation to water use and the need for, and benefits from, reform.

(COAG, Attachment A, 1994)

However, a problem with the objectives listed above was a lack of clarity in defining how such institutional reform was to take place (Challen, 2000: 2). A key problem was the need to develop a clear water property rights framework. All the COAG agreement seemed to do was to further reiterate the tenets of neo-liberal ideology without sufficient explanation of how the *process* of reform was to be undertaken. Challen makes this point evident by asserting that '[t]he underlying intent of the COAG agreement was to remove government…management of water resources, and to increase reliance on market mechanisms for the allocation of increasingly scarce water resources amongst alternative uses and users' (Challen, 2000: 2)

1.6 Recent Policy Initiatives

The most recent reforms also emphasise the importance of economic instruments. However, the need to incorporate institutions and institutional arrangements is also being acknowledged. These current reforms are presented under the title 'National Water Initiative' (NWI). The NWI is an agreement between the Commonwealth, State and Territory governments concerning the management of Australia's water

resources. One of the main aims of the NWI is to create a nationally compatible approach to water management in order to address the incoherent approach across different jurisdictions. COAG developed the NWI in 2003 and it was formally adopted in 2004. It has two major components. First, responsibility for implementation of NWI polices resides with the National Water Commission which was established in December 2004 (Pigram, 2007: 79). Second, the Murray-Darling Basin Water Agreement aims to reduce the level of over-allocation and to achieve better environmental outcomes for Australia's largest inland water system, the Murray-Darling Basin.

Key areas of policy focus for the NWI include the following:

- Water markets and trading.
- Best practice water pricing and institutional arrangements.
- Water resource accounting.
- Water Access entitlements and planning framework.
- Community partnerships and adjustment.

(National Water Commission (2007b))

The main challenge posed by these initiatives is the need for a supporting framework of appropriate institutional arrangements. A supporting framework is required in order to ensure that the initiatives can successfully be implemented. For example, water markets and trading require co-operation between different states and also require the development of regulations to prevent damaging practices such as hoarding for the purposes of gaining through speculative activity.

1.7 Thesis Structure

This thesis is divided in three parts. Part I (consisting of chapters one to three) sets the scene by providing an overview of the main issues and the theoretical foundations used in the analysis. Part II (consisting of chapters four to seven) examines the key orthodox economic solutions to water resource problems and, drawing upon the new institutional economics school of thought, provides alternative policy suggestions. These chapters generate arguments for treating environmental resources (and particularly water resources) in a particular manner and for treating the Murray-Darling Basin as a finite resource. Part III (consisting of chapters eight to eleven) analyses water resource governance in detail. A model for effective water governance is developed and a discussion examining the merits of water resource management within the context of federalism is presented. Chapter eleven presents arguments against simplistic solutions to water resource management and summarises the main findings of this thesis and its potential policy implications.

Chapter two presents a detailed discussion on institutional economics and the benefits of applying such an approach to water resource management not only in the Murray-Darling Basin but in relation to water resources around the world. It discusses a key analytical framework – the levels of institutions approach – which is used to frame analysis throughout the thesis.

Chapter three provides a detailed overview of the Murray-Darling Basin. Its unique geographical and hydrological characteristics are outlined along with the key

problems. A summary of the key institutions that have shaped management of the Murray-Darling Basin is presented.

Chapter four builds upon the new institutional economics theoretical framework presented in chapter two. Specifically, it uses the levels of institutions framework as a foundation for analysis of two key institutions– property rights and markets – that form a crucial part of the water policy reform process in Australia. The levels of institutions framework is then used to analyse the Murray-Darling Basin institutions that were presented in chapter three.

Chapter five traces the rise and influence of the neo-classical economic approach to natural resource management. It argues that the neo-classical economic approach to natural resource management is narrow and based on inappropriate assumptions. The tension between the environment and the economy leads to a discussion about the concepts of economic sustainability and environmental sustainability. Contrary to the neo-classical approach, the chapter argues that sustainability is an important and viable goal. Furthermore, it is argued that sustainability is both a moral obligation to the future and an economic obligation. The concept of sustainability is closely linked to the economic concept of scarcity. Distinguishing two main types of scarcity (absolute or Malthusian and relative or Ricardian) leads to an argument for treating the Murray-Darling Basin as a finite resource (by combining the Malthusian and Ricardian notions of scarcity).

Chapter six illustrates the limitations of the orthodox approach to natural resource management. It draws upon Hardin's (1968) 'tragedy of the commons' approach to natural resource management that is often used in orthodox literature, but argues this has been misinterpreted and does not necessarily eschew a collective approach to natural resource management. The tragedy of the commons approach is modified in order to inform analysis of the Murray-Darling Basin. This leads to a discussion about how natural resources are valued which is a particularly sensitive issue in relation to water resources. Water's unique features give it both public good characteristics and private good characteristics.

Chapter seven reflects on the treatment of water as an human right and as an economic good. It puts emphasis on the case for treating water as an economic good and using markets as the appropriate means of allocating it. It explores the concerns about markets for water and contends that, with appropriate institutional arrangements, markets for water are necessary. Inappropriate institutional arrangements are shown to be the main impediments to efficient markets and participation in markets. Because institutions such as social norms play a crucial role in market participation, there is potential for improved water market performance in the Murray-Darling Basin if these social norms change and the transaction costs of trading water are reduced.

Chapter eight develops this theme further by considering social attitudes towards the environment and water resources. An emphasis is placed on social views and behaviour – what Williamson (2000) refers to as level 1 institutions. Orthodox

economic literature neglects these social norms as a key factor for analysis. Examination of survey data reveals that Australians are growing increasingly concerned about the health of the environment. International evidence from water education programs, aimed at changing social views and behaviours, indicates that changing social views and behaviours is possible and beneficial for achieving improved policy outcomes. The chapter argues that social acceptance of policy reform measures increases the likelihood of the measures being successful.

Chapter nine emphasises the danger of one-dimensional policy approaches to complex environmental problems. Because social and environmental ecosystems are closely intertwined, this chapter warns against simple panaceas. The work of Elinor Ostrom is used to justify the use of more *multi-dimensional* policy approaches. It also explores the notion of governance and how it relates to water resource management. It uses the ideas in Coase (1937 and 1960) to develop an effective water governance model and puts forth a model for assessing different institutional structures that are used in the governance process. The establishment of a dispute resolution mechanism for the Murray-Darling Basin is one of the key recommendations of this chapter.

Chapter ten explores the issue of federalism in Australia and how it affects the management of the Murray-Darling Basin. It is argued that the current federal system is not conducive to a whole-of-system management approach. After considering the arguments in favour of a federal system, a case for a more centralist system is proposed by highlighting that the perceived benefits of a federal system have not been realised in the past. The federal system is actually hindering rather than driving the

reform process that is required for designing and implementing new policies to address the severely degraded state of the Murray-Darling Basin. It is argued in this chapter that, while a centralist system does not necessarily mean a total abandonment of the federal system, it could lead to a more co-operative federal system in future.

Chapter eleven summarises the main findings, potential policy implications and directions for future research into water resource management, specifically in the Murray-Darling Basin.

1.8 A Note on Methodology and Data

The data used in this thesis is sourced primarily from the National Water Commission and the Murray-Darling Basin Authority. Notwithstanding the difficulty of obtaining exact and timely water resources data, the data provided by these agencies are the most comprehensive in terms of breadth and depth. Due to the on-going water reform process in Australia and especially in the Murray-Darling Basin, qualitative and quantitative data up until 2009 are used in this thesis. Usually there is a lag of several months before aggregate data such as that used in this thesis is made available through water audit reports published by the Murray-Darling Basin Authority and biennial assessments of the water policy reform process published by the National Water Commission. So, a finite end point has to be adopted – in this case 2009 – notwithstanding the ongoing processes affecting water resource management. This is adequate for the purposes of identifying broad trends as this thesis intends. More up-

to-date micro-level data is available from various water authorities and water trading exchanges and this is used in the thesis wherever appropriate.

Secondary sources of data are also used, primarily in the form of survey data representing societal attitudes and the attitudes of water consumers, such as irrigators, towards the water policy reform process.

At the time of writing, the latest policy reform initiative, the Basin Plan, was introduced in draft form for broader community consultation in late 2010. Following the consultations, the Basin Plan is currently in the process of being revised before being presented again for wider consultation. Due the ongoing nature of water policy reform and the constraints this places on timely scholarly research, the analysis in this thesis will only briefly examine the Basin Plan.

1.9 Conclusion

A wide range of issues need to be addressed in order to better understand the nature of water problems and to manage Australia's water resources. Australia's water resources, and specifically the Murray-Darling Basin, contribute significantly to its economy. Many years of mismanagement followed by *ad hoc* and misguided polices have contributed to the severe degradation of the Murray-Darling Basin. The tendency to look towards neo-classical economic solutions, despite the complexity of problems associated with water management in Australia, has hindered the development of appropriate water management policy. This thesis seeks to address the shortcomings

of these policies and their theoretical underpinnings and suggests alternatives. These alternative options focus on the development of institutions and institutional arrangements that take into account a range of factors such as polity, economics, social factors and the environment. The following chapter outlines the theoretical approach that attempts to address each of these issues in order to provide a more holistic analysis leading to effective policies.

Chapter 2 – Theoretical Framework

2.1 Introduction

Water resource management encompasses a range of issues such as water allocation, property rights, water markets, regulation, jurisdictional responsibility and social attitudes and behaviours. In order to analyse these issues (and as others as well) holistically, the theoretical approach needs to be broad and analytically flexible. Institutional economics is a school of thought whose broad and dynamic analytical framework is suitable for this purpose. The institutional economics school of thought is comprised of two distinct traditions: old and new. The justification for using new institutional economics as the preferred theoretical approach is provided in this chapter.

2.2 Institutions and Organisations

There is a range of literature that attempts to define institutions (see for example, Searle (2005), Hodgson (2006) and North (1991)). Different scholars have derived different definitions and therefore slightly different results when analysing similar problems. This creates problems when trying to compare results that claim to have been achieved using what appears to be the same methodological and analytical framework. Ostrom (1986: 4) notes that '[n]o scientific field can advance far if the participants do not share a common understanding of key terms in their field'. While consensus cannot be found, North's (1991) definition seems to be the basis of definitions discussed by other commentators– '[i]nstitutions are humanly devised constraints that structure political, economic and social interaction' (North, 1991: 97).

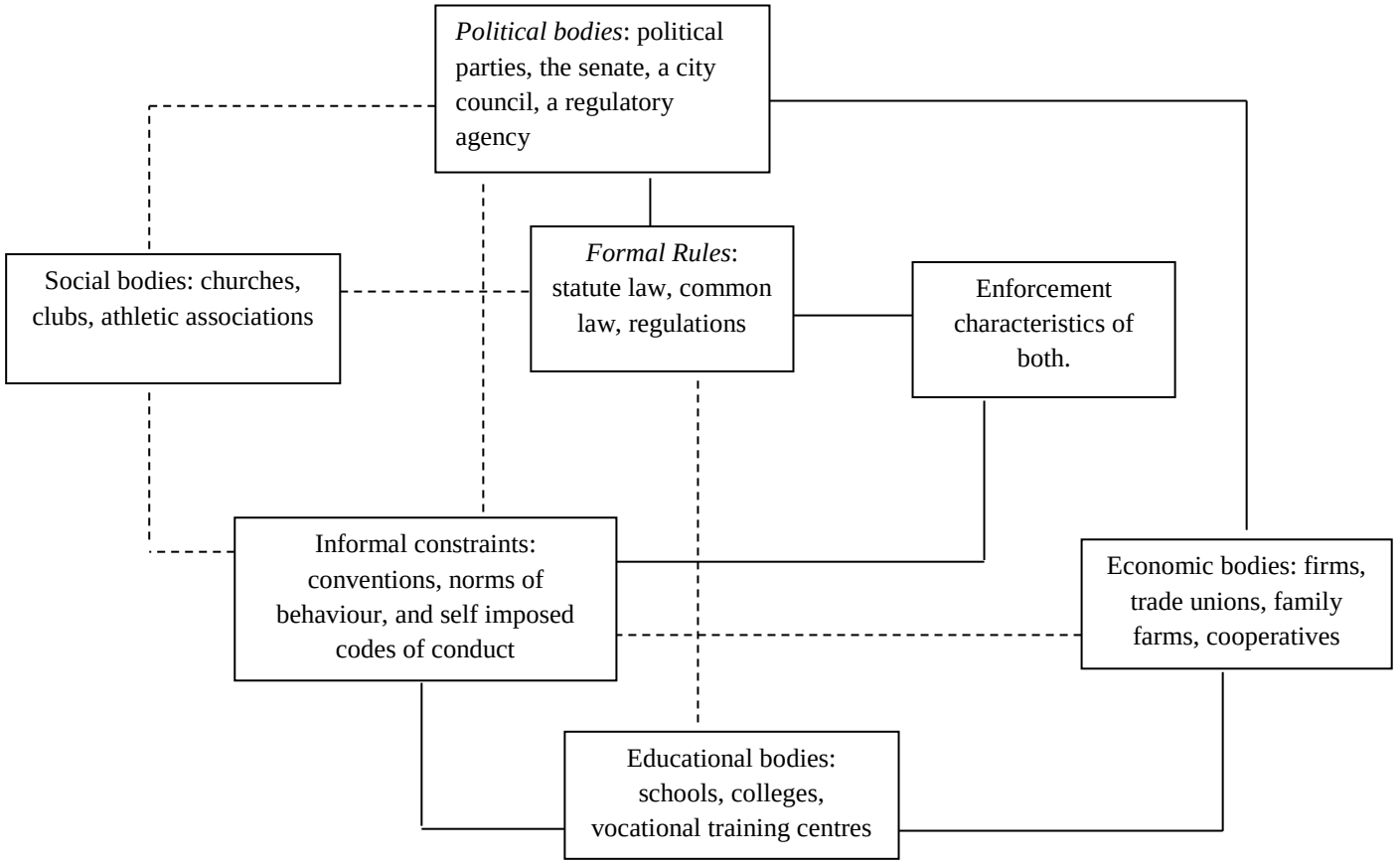
Ostrom's (2008) definition is also useful in the context of research on institutions and the environment – '…institutions refer to the rules that humans use when interacting within a wide variety of repetitive and structured situations at multiple levels of analysis'. A similar rule-based definition was developed by Ostrom in her earlier work (see for example, *Governing the commons*, 1990). This thesis will adopt a definition of institutions that encompasses both North (1991) and Ostrom (2008). North's definition is more generic than Ostrom's but Ostrom's is useful as it is used often in research on natural resource management and has the advantage of explicitly recognising the complexity of issues in natural resource management arising from polity, economics, societal factors and environmental factors. North's definition implies (by omission) that interactions with the environment are secondary to political, economic and social interaction whereas Ostrom (2008) notes that institutions are rules that can be used at *multiple* levels of analysis and her definition does not seem to place priority of one factor over another. So taking these two definitions, the following definition is adopted in this thesis:

> *Institutions are the humanly devised rules that shape interactions at multiple levels and are not limited to anthropogenic interactions but extend to interactions with the natural environment as well.*

The extension to non-anthropogenic interactions is important as it recognises the need to develop institutions that can represent the natural environment.

It is useful to distinguish between institutions and organisations. North's (1993) differentiation of institutions and organisations is helpful in this respect and his definitions have been used to create figure 2.1.

Figure 2.1 – Institutions and organisations [9]



[9] Source: Figure 2.1 has been created using definitions in North (1993).

The unbroken lines in figure 2.1 represent direct relationships between the categories and the broken lines indicate indirect relationships between the categories. The diagram makes evident the embeddedness of economic processes within social and political processes and, more importantly, it indicates that a necessary condition for economic change is the successful interaction between institutions and organisations. While North's definitions refer to the economy as a whole, the diagrammatic framework above can be adapted in order to examine both micro-level and macro-level phenomena.

Political factors need to be considered alongside economic factors whenever analysing any economic phenomena. The importance of this point is reiterated by North: '[i]t is polities that shape economic performance because they define and enforce the economic rules of the game (North, 1993: 7). North also claims that his analysis of the characteristics of institutions implies that '[i]t is essential to change both the institutions and the belief systems for successful reform since it is the mental models of the actors that will shape choices' (North, 1993: 7). Though North is specifically referring to economic change and economic performance as a whole, his analytical framework can be adapted to a micro-level (with which we can then analyse Australian water policy). It will be made clear in this thesis that successful reform of water policy related issues in Australia will require institutional change and a change in the belief systems which underpin the mental models of actors whose choices shape the direction of water reform in Australia. The 'actors' can be any of the organisations categorised under the broad headings of: political bodies, economic bodies, educational bodies and social bodies (categories that are represented diagrammatically in figure 2.1).

Figure 2.1 also shows that ideas, ideologies and mental models are important. It is ideas, ideologies and mental models that shape the organisations and thus shape the policies enacted by the organisations via the appropriate institutions.

2.3 Problems with the Traditional Approach

Orthodox economic analysis – based on neo-classical economic theory – generally does not provide an adequate explanation of the role institutions play in influencing economic phenomena. Markets play a central role in neo-classical economics and it is here that institutions enter (albeit in a frequently rather dismissive manner). Relegating the role of institutions to ensuring the smooth functioning of markets is a narrow and simplistic approach. Similarly, relegating the role of the government to that of a non-interfering facilitator of market interactions also neglects other roles that governments may play.

According to North (1993: 1), two fundamental assumptions of neo-classical theory include:

- Assumption of scarcity and hence competition
- 'instrumental rationality'[10]

[10] 'Rationality is instrumental when it treats things and other persons as means and not ends in themselves. Economists working in this framework assume that individuals have an instrumental attitude' (Caporaso *et al*, 2002: 23).

The first assumption is typically also adopted in new institutional economics. However, the analytical approach to dealing with scarcity and examining competition is different. The new institutional economics tradition recognises that competition is not necessarily the best option when dealing with all types of economic goods.

The second assumption is discarded in new institutional economics as it implies that '…ideas and ideologies don't matter; and efficient markets – both economic and political – characterise economies' (North, 1993: 1).

The second assumption considerably impairs the ability of neo-classical economics to be significantly useful as a methodological framework for analysing economic phenomena. One of the main reasons for this deficiency, as hinted in the quote above, is the relegation of 'ideas and ideologies' despite these factors playing a key role in economic interactions. Neo-classical economics has a tendency to isolate the economic from social factors and from polity. Similarly, institutions are relegated to a secondary role in the analysis. This is a problem because institutions need to be at the centre of any meaningful analysis and especially analysis that leads to the formulation of government policy. Challen notes that '[t]he role of institutions goes well beyond that of supporting markets, … a vast range of decisions for resource allocation are made under institutional arrangements other than those providing for private decisions and market trading. A view of economic behaviour that fails to recognise and explain this diversity of institutions is incomplete' (Challen, 2000: 4).

2.4 The Institutional Economics Approach

In light of the limitations highlighted above the chosen methodological framework for this thesis is institutional economics. Old institutional economics and new institutional economics are the two sub-traditions that comprise institutional economics. Both sub-traditions have some common features that distinguishes them from orthodox (neo-classical) economics – the integration of institutions and institutional arrangements in economic analysis. Additionally, both old and new institutional economics have a critical perspective of many of the neo-classical economics assumptions.

For example, instrumental rationality is completely discarded and is seen as a constraint on meaningful analysis. Engle *et al* (2007: 323) provide an excellent critique of instrumental rationality and provide further support to the idea that institutions do matter. They argue that:

> *'The human mind is not a general problem-solving machine. Instead of deliberately and analytically processing all available information to calculate which action will provide the greatest expected utility, people can and do rely on routines, rules and roles or affect when deciding what to do in a given situation. They can also bring in information technology or experts to provide advice'.*

The concept of evolution is a fundamental tenet of institutional economics. Economic, social and political phenomena are not static and thus conceptual frameworks must also be evolutionary. The evolutionary nature of institutions is acknowledged by the key proponents of both main streams of institutional economics (i.e. new and old

institutional economics). Over the years various policies have been enacted concerning water reform. In order to understand the factors which underpinned the past reforms and to present new pathways for future reform we must understand the crucial impact of institutions on the decision of how to decide (which reforms to enact) and how these decisions have evolved over time.

Notwithstanding the commonality, old and new institutional economics are quite different traditions. The starting point for analysis is one significant difference. The approach of old institutional economics is often referred to as 'methodological holism' Langlois (1989) while the approach of new institutional economics is often referred to as 'methodological individualism' (Rutherford, 1989). This means that old institutional economics takes the view that individual tastes and preferences are not given but are instead constrained by a set of evolving institutions (Hodgson, 1993) and that new institutional economics assumes the position that initially there is an institution-free state of nature (Hodgson, 2003: 155).

Another difference between new and old institutional economics is that, whereas the latter rejects neo-classical economic theory, the former actually seeks to build upon, modify and extend neo-classical economic theory (Rutherford, 1989) in an attempt to take into account a range of factors that are generally ignored by neo-classical theory (North, 1993: 1). This link between neo-classical economics and new institutional economics is important as it means that the new institutional economics approach accepts some of the propositions of neo-classical economics (Hodgson, 1989). For example, markets are central to the neo-classical approach and are considered to be

key institutional structures (and therefore an important phenomenon to be analysed) in the new institutional economics approach. Alongside the acceptance of markets as a means of allocating resources, the neo-classical emphasis on efficiency is retained in new institutional economics (primarily through the new institutional economics emphasis on minimising transaction costs) (Chavance, 2009: 46).

Table 2.1 shows some of the key differences and similarities between old institutionalism and new institutionalism. It shows that while there are key overlaps there are also some clear demarcation lines.

Table 2.1 – Old and new institutional economics

Aspects of comparison	Old Institutionalism	Neo-Institutionalism
1. Generic Scope	Macro-analysis of complete institutions	Macro-analysis of incomplete institutions
2. Assumptions		
▪ **Interdependence**	No	No
▪ **Information**	Complete	Incomplete
▪ **Rationality**	Comprehensive	Bounded
3. Unit of Analysis	Institutional Structures	Institutional Structures
4. Causal explanations	Institutional structures determine individual behaviour	Incomplete institutions create incentives for opportunistic behaviour
5. Focus	On formulation of classification of institutional structures	On opportunities and constraints built into institutional structures
6. Limitations	High level of aggregation Ad-hoc description Individuals do not calculate	High level of aggregation Ad-hoc explanations

Source: Adapted from Saleth and Dinar (2004: 47).

The role of orthodox economic tools in analysis differs between old and new institutional economics. Proponents of new institutional economics believe that 'the

determinants of institutions are susceptible to analysis by the tools of economic theory' (Matthew cited in Williamson, 2000: 595). This is a key distinguishing factor as both streams of thought generally concur that integrating an analysis of institutions into economic analyses is quite complex and so orthodox economic tools may perhaps be ill-suited and inadequate to analyse economic, social and political phenomena in totality. The distinction made by Matthews and Williamson suggests that the above point is one that defines explicitly the difference between new and old institutionalism.

Engle *et al* provide an interesting discussion about the role of institutions on '…the decision of how to decide' (Engle *et al*, 2007: 324). This is an important consideration that provides an insight to *why* certain policies are enacted by policy makers with regard to water reform. One can utilise figure 2.1 and table 2.1 to highlight which institutions play which roles in influencing the decision makers (in this case the decision makers are the organisations presented in figure 2.1).

The preference, in this thesis, for a new institutional economics over old institutional economics is not due to any deficiency in old institutional economics but due a degree of 'paradigm incommensurability' (Thomas Kuhn quoted in Stanfield, 1999: 232). The central unit of analysis in old institutional economics is power (Stilwell, 2005; Stanfield 1999). Old institutional economics primarily seeks to examine the institutions that shape and influence power within an economy. The central unit of analysis in new institutional economics remains the individual and new institutional economics seeks to examine the institutions that shape interactions between

individuals (examples relevant to this thesis include property rights for water and water markets). This aspect of institutional economics places new institutional economics closer to neoclassical economics on the methodological spectrum and distinguishes it from old institutional economics. A new institutional economics approach is taken in this thesis as it goes beyond the narrow prescriptions of neoclassical economics and offers a more structured approach and *relevant* approach to analysis of water resource management.

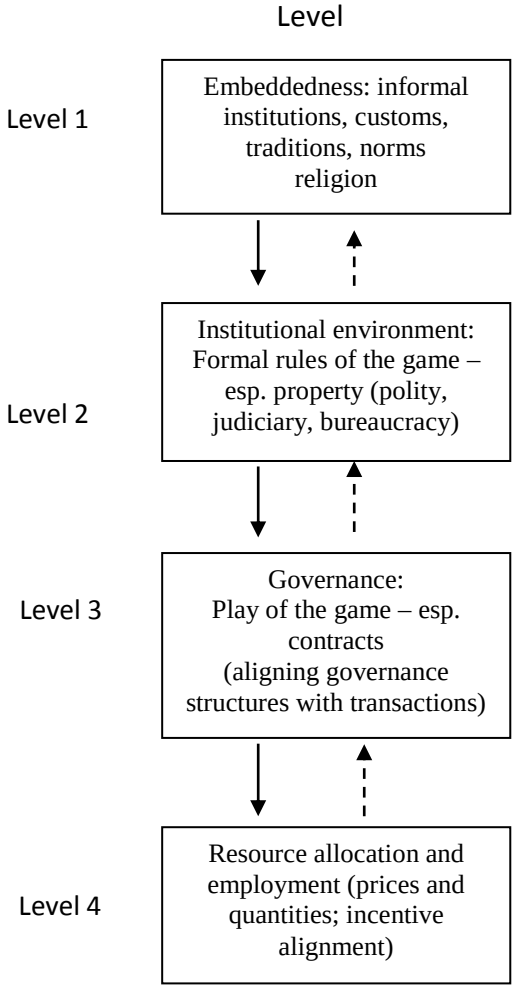
2.5 New Institutional Economics

A new institutional economics approach recognises that economic processes are embedded within social and political processes. It also puts attention on the adequacy of information and what it means to act rationally. New institutional economics takes the view that rationality is bounded (by time and information). Neo-classical economics typically assumes unbounded rationality. In neo-classical theory agents are assumed to have complete or near complete information which then allows the agents to act in a rational manner. North notes that that 'we have incomplete information and limited mental capacity by which to process information…[i]n such a world ideas and ideologies play a major role in choices and transaction costs result in imperfect markets (North, 1993: 1).

This point is especially important as it is asymmetrical information problems that characterise many economic, social and political processes. Searle also notes the importance of ideas, ideologies and mental models by suggesting that '[a]t no point

[is] it ever suggested that the reality described by economic theory [is] dependent on human beliefs and other attitudes…' (Searle, 2005: 1). North's discussion of ideas, ideologies and 'mental models' is particularly pertinent as it highlights the inadequateness of the neo-classical analytical framework and can extend to a variety of issues in water policy reform in Australia. For example, returning to the importance of ideas, ideologies and mental models in new institutional economics, and combining these concepts with Williamson's diagrammatic representation of the economics of institutions (Williamson, 2000: 597), we can clearly shows the applicability of a new institutional economic analytical framework to water policy related issues. Figure 2.2 shows the principal features.

Figure 2.2 - Levels of institutions



Source: Adapted from Williamson (2000).

Note that the idea of economic processes being embedded within social and political processes is also made evident in Williamson's diagram. Williamson asserts that '…NIE[11] has been primarily concerned with level 2 and 3' (Williamson, 2000: 596). He also notes that '[t]he institutions of embeddedness (level 1) are an important but underdeveloped part of the story' (Williamson, 2000: 610). The different levels are differentiated by conceptual focus and by the number of years that it takes to change them (Williamson, 2000: 597). For example, level 1 institutions generally take a long time change compared to the other levels while level 4 institutions are able to be changed relatively quickly.

Williamson's framework illustrates a key feature of new institutional economics that adds to its usefulness as an analytical framework. This feature is its dynamic or evolutionary nature. The different levels of institutions presented above all evolve over time. This means that analysis of phenomena can be assessed over time. For example, changes in governance structures (level 3 institutions) will, over time, have an impact on level 2 and level 4 institutions. Vice-versa also applies. Treating different levels of institutions as evolutionary allows for any analytical propositions to be multidimensional. The multidimensionality aspect of new institutional economics is often seen as a weakness, but it is actually quite useful when the phenomenon of interest (in this case, water resource management) is itself complex and no single solution exists.

[11] Footnote added – NIE: new institutional economics.

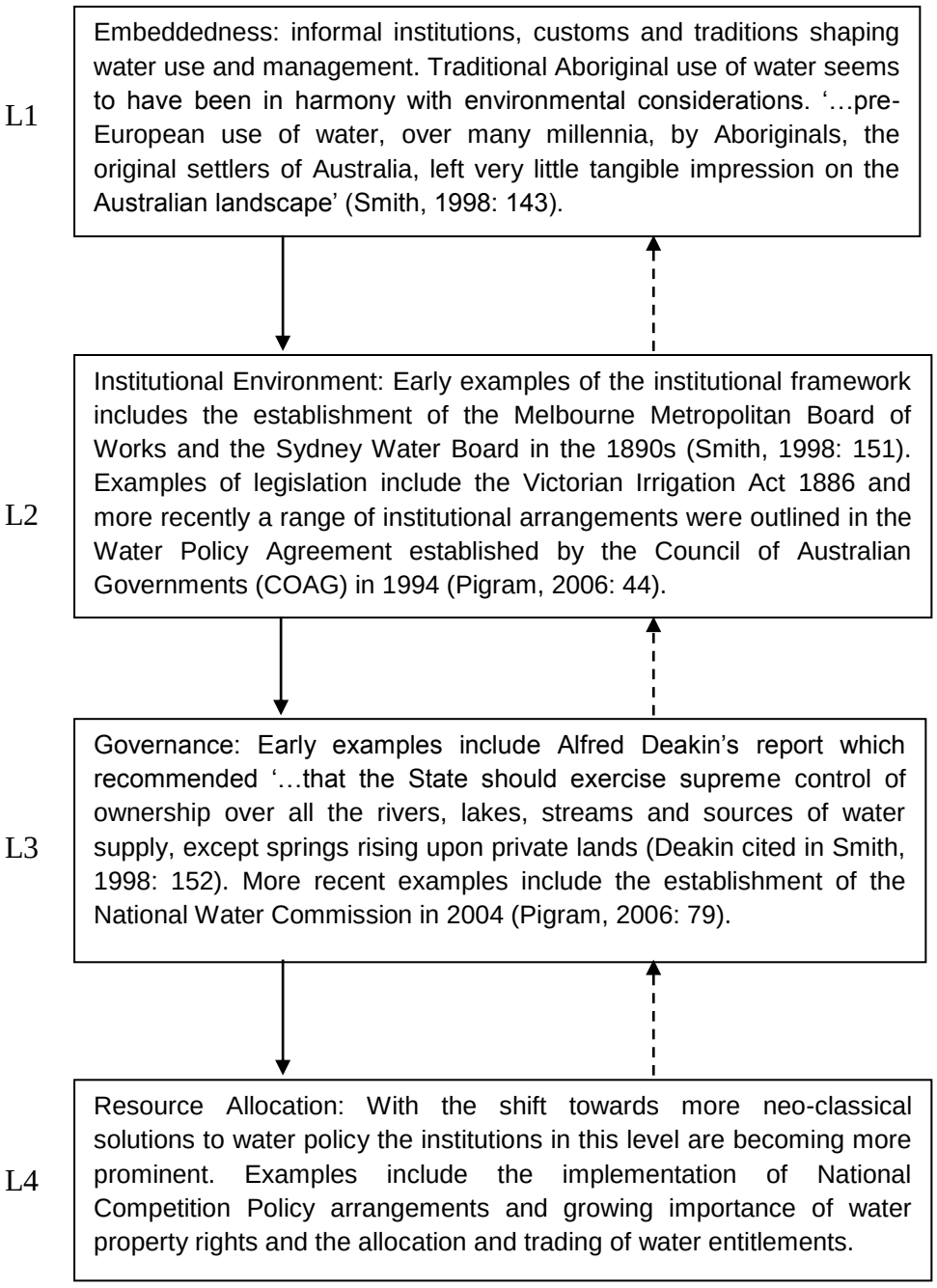
The levels of institutions approach is also particularly useful in analysing the themes raised in chapter 1. For example a central theme in the history of water policy reform has been the lack of commonality in policy approaches to water resource management. An analysis of level 2 and 3 institutions can be used to shed light on this problem and the analysis could be then be used to improve existing institutional arrangements. Recall that another central theme in the literature on water resource management is the 'economic-centred' analytical framework that focuses primarily on markets as a means of solving water resource management problems. The levels of institutions framework suggests the need to examine problems holistically such that norms and informal rules (level 1 institutions) are also incorporated into the analysis.

2.6 Institutional Economics and Water

Turning to Australian water resource management, parallels with the various analyses of water resource management can be identified. For example, there is not an abundance of research (relative to the total amount of research dealing with the economics of water) on the informal institutions, customs and traditions that shaped very early responses to water reform related issues. This is despite the fact, as Alexandra and Eyre note, '[w]ater management in Australia is as much about economics, social and political policies and the power of political parties as it is about hydrology and ecology' (1993: 85). Furthermore, in Australia there has not been much focus on issues concerning level 2 institutions. Indeed, until recently, level 3 and increasingly level 4 institutions had been the focus of most research and reform.

Figure 2.3 below provides an example of how Williamson's framework can be applied to the Australian experience with water resource management, drawing on selected examples of policy initiatives relating to each of the four levels.

Figure 2.3 – Institutions and Australian Water



The unbroken arrows in figure 2.3 link the different levels of institutions and, more importantly, they can be interpreted as indicating the preferred order of the

development of the different levels of institutions. Redressing this imbalance requires more priority and development of level 2 institutions. This would allow for the establishment of new and better 'pathways for reform' of Australian water resource management policies in the face of looming water related problems.

There are many advantages of incorporating an analysis of institutions, as highlighted above. However, institutions (regardless of which level they may be categorised under Williamson's schema) and the interaction of different levels of institutions are *not* a panacea for solving the problems faced by Australian water policy makers. Just as it would be fallacious to ignore institutions, it would be fallacious to *overestimate* the efficacy of institutions. North notes that '[i]nstitutions are not necessarily or even usually created to be socially efficient; rather they, or at least the formal rules, are created to serve the interests of those with bargaining power to create new rules' (North, 1993: 3). Ostrom (2007) also warns against viewing any particular institutional arrangements as a panacea for solving natural resource (and especially common-pool resource) problems due to the heterogeneity and complexity of problems facing different environmental resources.

A balanced view emphasises the development of institutions as an aid to creating more socially acceptable (and also economically acceptable) outcomes. Institutions are necessary in order to create the 'rules of the game' so that, along with the appropriate enforcement of the rules, acceptable solutions can be achieved. This point is reiterated by North in relation to what he calls 'an economic world characterised by impersonal markets…'(North, 1993: 5). In order to achieve an acceptable solution in such a world

North claims that '[t]o overcome them entails the creation of institutions that so structure the rules and their enforcement as to alter the pay-offs to induce the cooperative solutions' (North, 1993: 5). These concepts are relevant as they can be adapted to the present research. For example, the idea of altering pay-offs in order to induce cooperative solutions is necessary with regards to water trading and water allocation disputes that are of increasing importance as water supplies diminish and need to be better managed. One criterion for judging whether an institution is effective could be to examine whether particular institutions 'induce' cooperative solutions (such as the establishment of concise and perhaps standardised water allocation rights and water trading mechanisms) in order not to exacerbate the current water crisis. The establishment of institutions should also ensure that safeguards (such as new management practices) are developed in order to mitigate the adverse impacts of future water related issues.

As emphasised above, the Australian experience with water policy reform has tended to focus on level 4 institutions. This chapter calls for policy focus to shift to level 2 (and level 3) institutions.

2.7 Conclusion

Compared to the neo-classical economics tradition, a new institutional economics approach to resource management broadens the scope for analysis by integrating institutions and institutional arrangements. Relaxing some of the assumptions (such as unbounded rationality and information availability) while retaining others (such as the

concept of efficiency – *vis-a-vis* minimising transaction costs) means that a new institutional economics approach is able to deal with a large range of phenomena, not limited to economic considerations but including social and political considerations as well.

From an epistemological viewpoint, the new institutional economics approach is eclectic. It draws upon knowledge from a range of schools of thought, not only in the economics field but across other related disciplines as well. This eclectic nature of new institutional economics links closely with its dynamism. It recognises the non-static nature of many phenomena of interest and so it is not constrained by the tools and methodologies of any single analytical approach. This is particularly useful for analysing the complexity involved with water resource management.

The following chapter provides an overview of the Murray-Darling Basin in order to provide the contextual backdrop for points of reference throughout the rest of the thesis.

Chapter 3 – The Murray-Darling Basin

3.1 Introduction

This chapter provides an overview of the key institutions and organisations that have shaped water policy for the Murray-Darling Basin. It provides a detailed description of the unique geographical and hydrological features of the Murray-Darling Basin that distinguish it from water resources around the world. These unique features mean that water resource policies used around the world cannot necessarily be applied to the Murray-Darling Basin.

3.2 Features of the Murray-Darling Basin

The Murray-Darling Basin is a crucial cog in the Australian economy and is Australia's most important river system. The river system in the Basin extends through Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia. To put the size in perspective, the Murray-Darling Basin covers approximately 14% of Australia – roughly the size of France and Spain combined (Haisman, 2004: ii) or approximately four times the size of the United Kingdom (Davis and Moore, 1985: 8). Amongst the 23 river valleys (Figure 3.1) that comprise the Murray-Darling Basin, it contains the three longest rivers in Australia, Murray, Darling and Murrumbidgee and its name is derived from the system of rivers stemming from the Murray River and the Darling River (MDBA, 2010: 10). It is considered to be Australia's food-bowl with approximately 65% of total irrigated

crops and pastures in Australia and contributes approximately 39% of national income arising from agricultural production[12].

Figure 3.1 – River catchments in the Murray-Darling Basin

Source: Department of Sustainability, Environment, Water, Population and Communities.

The vast area of the Basin means that a range of climatic and environmental conditions can be found throughout the Basin (Crabb, 1997: vi). Despite this heterogeneity of climatic and environmental conditions, most of the Murray-Darling Basin is considered to be arid or semi–arid (MDBA, 2010b: 10). Even compared with variability in river systems around the world, the Murray-Darling Basin is characterised with such a high level of variability that '…a flood down the Darling can coincide with a drought over the Murray catchment or vice-versa' (Mackay and

[12] http://www.mdba.gov.au/water/about_basin.

Eastburn, 1990: xi). The Productivity Commission notes that '[v]ariance of rainfall over time is a key feature of rainfall patterns in the Basin, with large swings across the seasons, years and decades' (Productivity Commission, 2010: 20). It is this variability that differentiates the Murray-Darling Basin from other similar river systems around the world.

Another defining characteristic of the Murray-Darling Basin is that its rivers have low gradient (MDBA, 2010: 11). The flat gradient of the Murray-Darling basin results in slow water flows (Crabb, 1997: 7). The extremely low gradient means that during extreme weather conditions such as heavy rainfall, areas of the Basin are prone to flooding and some of the waterways in the Basin only contain water when there is flooding (Davis and Moore, 1985: 9; Crabb, 1997: 2). Despite being the fourth largest river system in the world, the Murray-Darling Basin has one of the lowest runoffs in the world (Davis and Moore, 1985: 8). The flat gradient compounds the annual flow variability of the Murray-Darling Basin such that the annual flow variability is two to three times higher than the river systems of North-west Europe and North America (McMahon and Finlayson, 1991: 21). In fact the only other continent with relatively comparable flow variability is Southern Africa (Crabb, 1997: 7; Peel *et al*, 2001; Peel *et al*, 2004; Watson, 2003; MacDonald and Young, 2001). Generally speaking, rainfall is responsible for runoff but the relationship rainfall and runoff in the Murray-Darling basin is particularly tenuous - Craik and Cleaver (2009: 150) estimate that only 5% of the long term average rainfall in the Murray-Darling Basin turns into runoff.

Over the past 100 years, variability in runoff has increased even further with average annual runoff in the Murray-Darling Basin during the 1997-2006[13] decade only averaging around 80% of the average annual runoff during the period 1895 – 2006. The number for average annual runoff (as a percentage of average annual runoff during the period 1895 – 2006) during the middle (2004 – 2006) of the most recent drought (starting in the early 2000s) afflicting the Murray-Darling Basin is even more dire – 60%.

Chart 3.1-Increasing runoff variability in the Murray-Darling Basin (1997–2006)

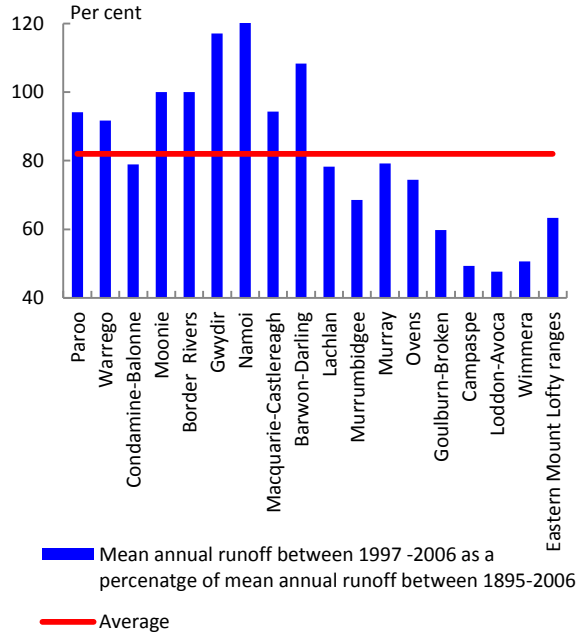
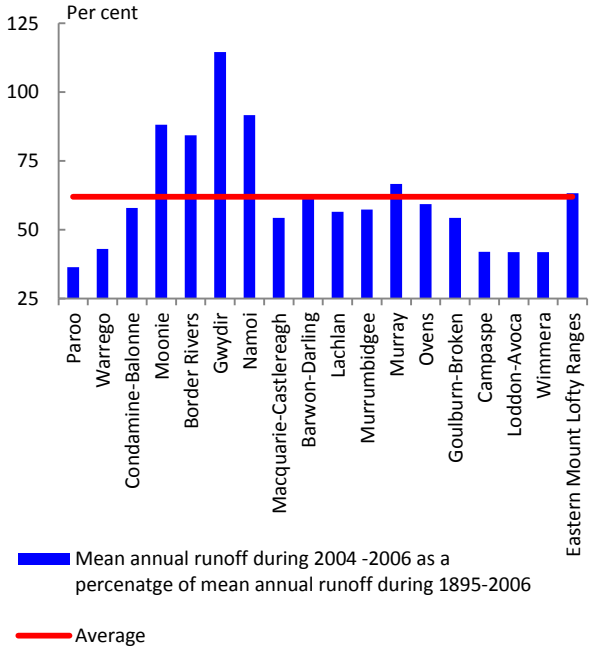


Chart 3.2-Increasing runoff variability in the Murray-Darling Basin (2004–2006)



Source: Data and table adapted from Table 2.1 in Potter *et al* (2008: 9).

Another feature of the Murray-Darling Basin is its role in the Australian economy. Box 3.1 highlights the importance of not only the agricultural industry in the Australian economy but, by extension, the importance of water resources in the Murray-Darling Basin for the Australian economy.

[13] The data used for this discussion was presented in Potter *et al* (2008).

Box 3.1 – Key Murray-Darling Basin Facts

- 65% of total water used in Australia is used by the agricultural industry (ABS, 2006b).
- In 2005-06, 84% of the land in the Murray-Darling Basin was owned by agricultural business (Pink, 2008: 1).
- 67% of the land in the Murray-Darling Basin was used for growing crops and pasture (Pink, 2008: 1).
- 38% of all farmers in Australia reside in the Murray-Darling Basin (Pink, 2008: 1).
- Compared to the national average of 3%, 10% of the Murray-Darling Basin residents were employed in agriculture (Pink, 2008: 1).
- 83% of the water consumed in the Murray-Darling Basin (an amount which is 52% of total water consumed in Australia) was consumed by the agriculture industry (Pink, 2008: 1).
- 66% of Australia's total water consumption in the agriculture industry was consumed by the agriculture industry in the Murray-Darling Basin (Pink, 2008: 2).
- 65% of Australia's irrigated land is in the Murray-Darling Basin (Pink, 2008: 2).
- The capital of South Australia, Adelaide, is reliant on the Murray-Darling Basin for water. It draws an average of 40% of its water needs from the Murray system (MacDonald and Young, 2001: 11). During droughts this dependence increases to around 90% (Murray-Darling Basin Commission, 2006b)

Cereal grains account for the most water consumed in the rural economy and cereal grains and preparations accounted for approximately 22% of total rural exports in 2008 (own calculations from ABS, 2009). This is not an insignificant amount as rural exports comprised approximately 13% of total exports in 2008 (own calculations from ABS, 2009). Cereal grains therefore accounted for approximately 3% of total export values.

The statistics above clearly make evident the fact that the availability of water resources acts as a definite constraint on the economy. The Murray-Darling Basin

provides approximately 40% of gross value of agricultural production (GVAP) in Australia and approximately 44% of the gross value of irrigated agricultural production (GVIAP) (Pink, 2008: 111). These are significant monetary amounts and reinforce the importance of the health of the Murray-Darling Basin as a key indicator of Australia's economic prospects.

The agricultural industry is the largest water user in the Murray-Darling Basin and provides employment to approximately 10% (200,000) of the population (Pink, 2008: 1). So not only does the availability of water have a direct impact on the physical goods produced (agricultural goods) in the Murray-Darling Basin but a lack of availability leading to a reduction in output will have flow on effects to the level of unemployment and eventually on government welfare services. Increasing scarcity of water (for the purposes of the present discussion it does not matter if the scarcity has been caused by human mismanagement, natural factors or a combination of both) requires that water resources be used parsimoniously. Parsimonious use of water resources implies that water be used where it is valued most.

Unless this parsimonious use is achieved, there are both adverse ecological and socio-economic impacts. The loss of entire communities dependent on the Murray-Darling Basin is a possible outcome. Not only are local communities affected by the health status of water resources in the Murray-Darling Basin, but there are potentially national level risks as well. Approximately 33% of Australia's food is provided by the Murray-Darling Basin. The poor health of the Murray-Darling Basin suggests that, even if water usage is transferred to industries and businesses that value it most

highly, there will still be a need to assess Australia's national food supply strategy. This may result in higher levels of food imports. Increases in imports will then have implications for Australia's balance of payments through the current account deficit. This circular inter-dependency is indicative of the fact that it is not feasible (policy wise or analytically) to firstly not recognise that water resources (and more broadly environmental resources) *do* constrain economic growth and secondly to compartmentalise and analyse in isolation the economic, social and environmental impacts of consuming natural resources. By examining each of the aforementioned factors in isolation, incomplete or even incorrect conclusions can lead to inappropriate or incorrect policy design. This isolationist analytical approach is epitomised in the earlier analytical contributions of Hotelling (1931), Solow (1974) and Stiglitz (1974a and 1974b). To his credit, Stiglitz recognises the short-comings of orthodox approaches and has been a recent advocate of a newer and more holistic approach to natural resource management (see Stiglitz, 2006).

Acknowledging the inter-dependency of key factors and recognising that the supply and health of natural resources places a definite constraint on economic growth means that there is a set of clearly defined parameters within which policy formulation must be achieved. The parameters are:

- treating water resources as an exhaustible resource; and
- the inter-connection of economic, social and environmental outcomes.

Treating the Murray-Darling Basin as an exhaustible resource formally in a policy setting can also be considered as one of the first steps in shaping a much needed shift in Australian water culture and behaviour.

3.3 Murray-Darling Basin Institutions

Due to the Murray-Darling Basin's importance as Australia's 'food-bowl' and close linkages with the Australian economy there are a number of institutions that have played a key role in its development. Throughout history, institutions associated with the Murray-Darling Basin have been concerned with management resource allocation This means that, historically, Murray-Darling Basin institutions can be mainly classified as level 3 and level 4 institutions. The sheer size of the Murray-Darling Basin makes the issue of management contentious since, historically, the primary managerial responsibility has been in the hands of the states that the Murray-Darling Basin encompasses. In addition to this federalist approach to management, the institutions of the Murray-Darling Basin have included a range of groups such as irrigators and environmentalists. This is an important point as the de-centralised nature coupled with competing interests between the different groups is one of the main challenges preventing positive reform of the management of the Murray-Darling Basin.

The main groups that comprise the institutional structure of the Murray-Darling Basin can be split in five overlapping groups, the various State Governments, the Federal Government, water resource users (mainly consisting of irrigators), environmental organisations (this is a broad description) and non-government organisations, and water resource managers (such as the Murray-Darling Basin Authority). These five overlapping groups have played a key role in influencing water policy in the Basin by shaping the institutional arrangements concerning the Basin.

3.4 The River Murray Waters Agreement and the River Murray Commission

The first attempt at a coordinated effort to manage the Murray-Darling Basin came as a result, unsurprisingly, of a severe drought between 1895 – 1902 (Quiggin, 2001; Murray-Darling Basin Commission, 2006b) and therefore was an attempt to allocate water resources as much as it was an attempt to establish the institutional arrangements for formal resource allocation (level 2 institutions). The 'Federation Drought' (Bureau of Meteorology, 2011) resulted in a conference organised, interestingly, by non-government groups in 1902 (Murray-Darling Basin Commission, 2006). This first attempt to systematically organise management of the Murray-Darling river system eventually culminated into ratification of the 'River Murray Waters (RMW) Agreement in 1915 – a year which coincided with another severe drought (Jacobs, 1990: 39; Bureau of Meteorology, 2011). The Agreement was ratified by the Commonwealth and the State Governments of New South Wales, Victoria and South Australia. The three main principles of the Agreement are fundamentally unchanged today (Jacobs, 1990: 40) and are an example of how level 4 institutions were the focus of policy makers in history and even today. The three principles are:

- flow at Albury is shared equally between New South Wales and Victoria;
- Victoria and New South Wales retain control of their tributaries below Albury;
- Victoria and New South Wales supply South Australia with a guaranteed minimum quantity of water, or 'entitlement'.

The RMW Agreement also ensured that drought protection, in the form of dams, weirs and locks, was a focus of water policy makers. The construction and regulation of these were to be managed by the River Murray Commission which was established in

1917 (Powell, 2002: 109). The main limitation of the RMW Agreement was the focus on river system navigation and irrigation (Jacobs, 1992; Quiggin, 2001, Powell, 2002). The first was a major concern for South Australia while the latter was a focus for New South Wales and Victoria. Beyond the construction and regulation of water storages (dams, weirs and locks) the Commission did not seem to have much authoritative scope. As a result, environmental concerns and related management issues were largely left up to the State Governments. The somewhat limited authoritative scope the Commission did have was further eroded with the expansion of trade via railways which overtook trade via river during the Great Depression (Jacobs, 1990: 40).

3.5 The Murray-Darling Basin Agreement

Until the ratification of the Murray-Darling Basin Agreement in the late 1980s, management of the Basin was still largely left to State Government agencies and was characterised by an emphasis on irrigation and water-storage infrastructure development (Haisman, 2004: 15). The 'emphasis' is relative to the policy focus in more recent years on sustainability both for water use and for the environment. While the focus was on pure allocation of resources through physical means rather than through prices, it is indicative of the broader policy trend of focusing on level 4 institutions rather than addressing deficiencies in level 2 and 3 institutions.

The RMW Agreement was replaced in 1987 by the Murray-Darling Basin (MDB) Agreement. Initially the agreement signed in 1987 was only an amendment to the original RMW Agreement but in 1992 it was officially replaced by the MDB

Agreement (Murray-Darling Commission, 2009). The MDB Agreement was given full legal status by the Murray-Darling Basin Act 1993 and in 1996 Queensland become a signatory followed by the Australian Capital Territory (ACT) in 1998 (Murray-Darling Basin Commission, 2009). The MDB Agreement established the following institutions to be responsible for management of the Murray-Darling Basin (Murray-Darling Basin Commission, 2009):

- the Murray-Darling Basin Ministerial Council (MDBMC);
- The Murray-Darling Basin Commission (MDBC); and
- The Community Advisory Committee (CAC).

The three new institutions represented an attempt for the policy decision making and implementation process to be inclusive of all interested and relevant parties. The MDBMC represented polity, the MDBC was the bureaucratic arm and CAC provided the input by representing a wide range of interests such as State management bodies, indigenous peoples, conservation groups and farming groups (Haisman, 2004: iv).

The objective of the MDB Agreement was:

> '…to promote and coordinate effective planning and management for the equitable efficient and sustainable use of the water, land and environmental resources of the Murray-Darling Basin' (Murray-Darling Basin Agreement, 2006).

While the policy focus of the MDB Agreement was still heavily centred on level 4 institutions, the MDB Agreement can be considered a watershed moment as it was perhaps the first genuine step towards addressing level 2 and 3 institutions through the creation of the three different institutions whose role was to provide formal representation of key Murray-Darling Basin users ranging from those with pure

economic interests (such as, but not exclusively, farmers) and those with more altruistic interests (conservation groups).

3.6 The Council of Australian Governments

The 1994 meeting by COAG (see section 1.6, chapter 1) was a key moment in history for Australia's water policy reform process. From an institutionalist economics perspective, COAG's involvement in the water policy reform process is important as it was essentially an attempt to *reregulate* water management through the introduction of market mechanisms as panacea-like solutions to water resource management problems. Parts of the reform agenda (key objectives were presented in section 1.6) presented at the 1994 COAG meeting have been introduced as parts of other reform initiatives since 1994. Perhaps the two most important recommendations that have resonated acutely with water policy makers are:

- Environmental requirements to be taken into consideration; and
- water allocation for the environment and treating the environment as a legitimate user of water.

Elements of these two recommendations are evident in almost all water policy reform agendas nowadays either explicitly or implicitly.

The 'Cap'

The first major institutional reform undertaken by the MDBMC was the introduction of a ceiling (referred to as the 'Cap') for diversions from the Murray-Darling river system. The impetus for the introduction of the Cap was concern about over-allocation of water and therefore leaving appropriate amounts of water for the environment. The

Cap was introduced in 1995 by the MDBMC to prevent growth in diversions of water (Quiggin, 2001: 13) and then in 1997 the Cap became a permanent upper limit on diversions (Quiggin, 2001: 13). The Cap was officially defined as (Independent Audit Group, 1996: viii):

> '…the volume of water that would have been diverted under 1993/94 levels of development'.

The Cap was not aimed at reducing diversions but at reducing the growth in diversions. The Cap was also not aimed at preventing new development (in the form of new water infrastructure) but rather, by curbing the growth of diversions it was aimed at improving water use efficiency by forcing water users to either improve their existing water infrastructure in order to increase water consumption within the Cap limits or to purchase water from elsewhere (and thus transferring water to where it was valued most).

The definition of the Cap was aimed at achieving the following stated objectives (Independent Audit Group, 1996: x):

- to maintain, and where appropriate, improve existing flow regimes in the waterways of the Murray-Darling Basin to protect and enhance the riverine environment; and
- to achieve sustainable consumptive use by developing and managing Basin water resources to meet ecological , commercial and social needs.

While documentation outlining the details of the Cap did not specifically refer to the 1994 COAG recommendation to take into account environmental considerations in

future water policy initiatives, the premise of the Cap seems to adhere to that particular idea.

Like the MDB Agreement, the COAG meeting seemed to suggest that policy makers were finally shifting their focus from being entirely on a level 4 institutions to level 2 and 3 institutions. However a better categorisation of the policy focus of the COAG meeting is that it was a mixture of level 2, 3 and 4 institutions with level 4 institutions influencing the amount of focus on level 2 and 3 institutions (and to a lesser extent, level 1 institutions). For example, the 'Cap' clearly was a level 4 institution but it resulted in a change in the way water was managed and placed the environment at the centre of policy-making thought process (a level 1 institution) and affected the governance rules (level 3 institutions) for water allocation.

3.7 The Living Murray

The Living Murray Program (LMP) is a river restoration program that was established in 2002 by a partnership of the Commonwealth, NSW, Victorian, ACT and South Australian governments (Murray-Darling Basin Authority, 2008). In 2004, following a COAG meeting, the LMP was codified through the Intergovernmental Agreement on Addressing Water Allocation and Achieving Environmental Objectives in the Murray-Darling Basin (Grafton and Hussey, 2007: 74). The aim of the LMP is to achieve a healthy working River Murray system for the benefit of all Australians primarily by returning water to the river's environment (Murray-Darling Basin Authority, 2008).

The ‘first step’ of the LMP began in 2004 and its objective was to return, by 2009, 500 gigalitres of water to the Murray River and particularly to six ‘icon’ sites that were chosen for their high ecological, cultural, recreational, heritage and economic value (Murray-Darling Basin Authority, 2008; Murray-Darling Basin Authority, 2011). This first step was taken as part of a broader acknowledgement that water needed to be returned to the environment and came in response to key findings by an Expert Reference Panel (ERP) (Jones *et al*, 2002). The ERP identified the volume of flows required by the environment in order to deliver a healthy working river system (Table 3.1).

Table 3.1 Flow Management Options

Management options	Probability of having a healthy working River Murray System
Do nothing more (current operations)	LOW
A. Improved operations	LOW
B. Improved operations plus 350 GL new environmental flows (Murray source)	LOW
C. Improved operations plus 900 GL new environmental flows (Basin-wide source)	LOW-MODERATE
D. Improved operations plus 1950 GL new environmental flows (Basin-wide source)	MODERATE
E. Improved operations plus 4000 GL new environmental flows (Basin-wide source)	HIGH

Source: Adapted from Jones *et al*, 2002:6.

The return of 500 GL was considered the ‘first step’ as it was an insufficient amount of water that would only result in a low probability (according to the findings in Jones *et al*, 2002) of returning the River Murray system to ‘healthy’ status.

The LMP can be considered as an improved attempt to combine elements of level 2, 3 and 4 institutions. The LMP codified and then implemented direct action to address water shortages for the environment. It involved recognition of the connection

between the informal institutions such as culture, heritage and recreation with the links to ecological and economic factors. While the objective was to boost supply and reliability of water resources, the LMP represented an attempt to achieve this through successful level 2 and 3 institutions. It involved the cooperation of three different State governments and a change in the formal rules concerning water allocation for the environment.

3.8 The National Water Initiative

In more recent years, the Australian water policy reform agenda has been driven by the NWI[14]. COAG developed the NWI in 2003 and it was formally adopted in 2004. It has two major components. First, responsibility of implementation of NWI polices resides with the National Water Commission which was established in December 2004 (Pigram, 2007: 79). Second, through the Murray-Darling Basin Water Agreement, it aims to reduce the level of over-allocation and to achieve better environmental outcomes for Australia's largest inland water system, the Murray-Darling Basin.

Key focus areas for the NWI include the following:

- Water markets and trading.
- Best practice water pricing and institutional arrangements.
- Water resource accounting.
- Water Access entitlements and planning framework.

[14] Since this chapter aims to provide an overview of the main Murray-Darling Basin institutions a deeper analysis of the NWI is presented in the following chapters and particularly in chapter 9.

- Community partnerships and adjustment.

(National Water Commission (2007b))

The main challenge posed by these initiatives is the need for a supporting framework of appropriate institutional arrangements. A supporting framework is required in order to ensure that the initiatives can successfully be implemented. For example, water markets and trading require co-operation between different states and also require the development of regulations to prevent damaging practices such as hoarding water for the purposes of gaining through speculative activity.

3.9 The National Plan for Water Security

The National Plan for Water Security (NPWS) was announced by former Prime Minister John Howard on 25 January 2007. Howard highlighted the need of a new approach to water resource management by stating (Howard, 2007):

> *'The drought which now grips large parts of Australia is the most severe since records began. It has taken a drastic toll on the lives and livelihoods of many Australians. Whether in the city or in the bush, communities are understandably anxious about water, concerned about getting through our present difficulties, and worried about what the future might hold. In the face of this protracted drought and the prospect of long-term climate change we need a radical and permanent change in our water management practices'*

The NPWS outlined 10 key points and set aside $10 billion in funding to implement the plan. However, of the 10 key points there were 3 recommendations – modernising irrigation infrastructure, purchasing water on behalf of the environment in order to address over-allocation and institutionalising a new set of governance arrangements for the Murray-Darling Basin – that would receive the bulk of the $10 billion. The majority of the funding (close to $6 billion) was to be directed at improving and modernising irrigation infrastructure to save water and increase efficiency of water use (Howard, 2007).

$3 billion over 10 years was set aside to address over-allocation in the Murray-Darling Basin (Howard, 2007). This part of the plan was also aimed at taking positive action to treat the environment as a legitimate stakeholder and water user. The Commonwealth Government aimed to purchase water entitlements through water markets and then return the water to the environment.

The NPWS proposed to significantly change the governance structure of the Murray-Darling Basin by recommending centralisation of governance. The NPWS (Howard, 2007: 5) noted that '[o]ne government needs to take control and be responsible for water management in the MDB to ensure key Basin-wide outcomes are realised'. This was a crucial element of the plan and it was claimed that the without agreement on this issue the overall objectives of the rest of the plan would not be realised (Howard, 2007: 5). Howard claimed that the need for significant reform of the management processes came as a result of the States' reticence to cooperate and implement initiatives stemming from the NWI (Quiggin, 2008).

The Water Act 2007

The Water Act 2007 was established as part of Howard's failed NPWS. It forms the main legislative institutional arrangement for the Basin and provides the institutional managerial framework for the Murray-Darling Basin. In this capacity the Act established the following three governance institutions:

1. The Murray-Darling Basin Authority (MDBA);
2. The Commonwealth Environmental Water Holder; and
3. The Basin Plan.

One of the main reasons for the creation of the Act was the refusal of the Victorian State Government to sign on to Howard's NPWS (Crase and O'Keefe, 2009). The Act was an attempt to circumvent Victoria's refusal to defer water resource management powers to the Federal Government by establishing a new single authority – the Murray-Darling Basin Authority – to supersede the Murray-Darling Basin Commission. The MDBA would report to a Commonwealth Water Minister. Under the Act, the MDBA was to deliver a Basin Plan that included (but was not limited to) the following (Water Act, 2007: Section 3):

> *'…to promote the use and management of the Basin in a way that optimises economic, social and environmental outcomes and…to ensure the return to environmentally sustainable levels of extraction for water resources that are over-allocated or overused…'*

3.10 Water for the Future

The Water for the Future (WFTF) program is '…the Australian Government's long-term initiative to better balance the water needs of communities, farmers and the environment' (DSEWPC, 2010)[15]. The WFTF is the successor to Howard's NPWS which stalled largely because of its unilateral nature and Victoria's refusal to hand-over water resource management rights entirely to the Federal Government (Quiggin, 2008: 163). Under the WFTF the Federal Government is investing $12.9 billion over ten years to secure the long-term water supply of all Australians (National Water Commission, 2009a).

The central premise of the WFTF program is the need to address over-allocation in the Murray-Darling Basin. Of the $12.9 billion allocated to the program, $3 billion was set aside to specifically address over-allocation by buying back water entitlements from willing sellers (Waterfind, 2008). By buying water entitlements and returning the water back to the environment the WFTF program aims to increase environmental flows and can essentially be considered as an additional policy initiative to the LMP which also is focused on rejuvenating environmental flows (especially in key 'icon' sites) through Federal Government purchases of water. Like the LMP, the justification for Federal Government purchases of water for the environment is supported by the findings of the ERP. As such, Waterfind (2008: 2) notes that at least 1500 GL will need to be returned to the Murray River system in order for there to be a positive impact on the environment. This target concurs with the findings, in 2002, of the ERP. Moreover, if, as expected, climate change continues to have adverse consequences for

[15] DSEWPC - The Department of Sustainability, Environment, Water, Population and Communities.

rainfall and flow variability in the Murray-Darling Basin it is likely that the target will need to be revised upwards (Waterfind, 2008).

3.11 The Basin Plan

Under the Water Act (2007) the MDBA was required to develop a 'Basin Plan'. The Basin Plan '…will provide for limits on the quantity of water that may be taken from the Basin water resources as a whole and from water resources of each water resource plan area' (Water Act, 2007: Part 2, section 19 page 37). The key focus of the Basin Plan is aligned to the key focus of the Water Act (2007) and there are six key objectives of the Plan (Murray-Darling Basin Authority, 2010: 65);

1) maintain and improve the ecological health of the Basin, and in doing so optimise the social, cultural, and economic wellbeing of Basin communities;
2) establish limits on the quantity of surface water and groundwater that can be taken from the Basin's resources for consumptive use, based on a determination of what is environmentally sustainable at a catchment and whole-of-Basin level;
3) improve the resilience of key environmental assets, water-dependent ecosystems and biodiversity in the face of threats and risks that may arise in a changing environment;
4) maintain appropriate water quality, including salinity levels, for environmental, social, cultural and economic activity in the Basin;
5) improve the transparency and efficiency of water markets in the Basin; and
6) provide a clear transition path for entitlement holders and communities through the period from plan adoption to implementation at a local level.

The Basin Plan proposes sustainable diversion limits (SDL) to constrain diversions from water resources in the Murray-Darling Basin. The SDLs are different to the Cap which is currently in place. The Cap applies to surface water diversions only and is based on historical use of water resources rather than what is sustainable (MDBA, 2009). The SDLs will apply to both surface water and groundwater in recognition of their inter-connectedness and the SDLs will be based on scientific knowledge rather than historical levels. In order to meet SDL proposals the Basin Plan recommends reducing diversions from Murray-Darling Basin water resources by 22% to 29% of current diversion limits – roughly a 3000 GL/y to 4000 GL/y reduction in diversions of surface water (MDBA, 2010). This calculation is based upon MDBA modelling which indicates that the range for the required amount of long-term additional environmental water is between 3000 GL/y[16] and 7600 GL/y (MDBA, 2010a: 73). This would result in annual diversions being reduced from its current average of 13700 GL/y to between 10700 GL/y and 9700 GL/y.

3.12 Key Problems Facing the Murray-Darling Basin

In the opening statement of the 'Basin Plan' the Murray-Darling Basin Authority (MDBA, 2009: 3) notes that:

> *'The Murray-Darling Basin is under enormous stress as a result of past water-allocation decisions, prolonged drought, natural climate variability, and emerging climate change'*

[16] GL/y = gigalitres per year (footnote added).

The Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (DSEWPC, 2011) notes that:

> *'There is insufficient water to maintain the Basin's natural balance and ecosystems, resulting in a marked decline in its ecological health'.*

Jones *et al* (2002: 15) state that '[t]he consensus of expert opinion is that the River Murray System can no longer be considered as healthy'. Jones *et al* (2002: 16) go on to assert:

> *'[t]he future condition of the River Murray System is clearly dependent on our actions now and over coming years. The ecological condition continues to degrade under the present Cap and river operations. If no further imposts on the river system are allowed (ie. no increases to water abstraction, no more dams, no worsening of water quality, no more exotic pests) then ecological conditions will continue to decline for some years before reaching equilibrium'*

The main problems facing the Murray-Darling Basin can be categorised into two broad groups – problems stemming from institutional deficiencies and environmental problems. It is not a stretch of the imagination to place the burden of the environmental problems on institutional deficiencies related to the management of the Murray-Darling Basin. The institutional deficiencies can be traced back in history to European settlement of Australia. European doctrines for managing water resources were adopted by policy makers and as Ward (2009: 6) notes, these were focused primarily on:

> *'...the informal and opportunistic development of water resources. Survival, food and shelter took precedence over a long-term national planning and development strategy and precluded any pioneering environmental consciousness'.*

These were particularly unsuitable to Australia's unique hydrological cycle and the riparian doctrine (Ward, 2009) was therefore unsuitable (see also Haisman, 2004). Given the low gradient, high flow variability and high rainfall variability, riparian rights can be considered as particularly unsuitable. This is made even more apparent when one notes that approximately 500km from its source, the Murray River does not get any contribution to flow from surrounding terrain (Rutherford, 1990: 18). Given these characteristics, upstream and downstream disputes, though not unique to the Murray-Darling Basin, are particularly acute compared to similar disputes elsewhere.

As noted earlier, the Murray-Darling Basin is unique compared to other similar sized river systems. It is characterised by low average rainfall and high variability rainfall (Quiggin, 2001: 68). The concern for the health[17] of the Murray-Darling Basin is not only philosophical – it is supported by concrete evidence. Crase *et al* (2004: 1) note that '[t]he result [of environmental degradation in the Murray-Darling Basin] has been rising water tables and salinity that now impacts large tracts of agricultural land...and in some instances, significant mobilization of acid within soil profiles and extensive biodiversity loss'. Crase *et al* (2004: 1) claim that '[b]y virtually any standard the economic costs of degradation in Australia are nontrivial...it would cost $A65 billion[18] over 10 years to prevent and repair land degradation and...1.2 million hectares of land

[17] 'Health' refers to both water quality and land quality.
[18] These figures were estimated by Madden *et al* (2000) and were cited in Crase *et al* (2004: 1).

in the Murray-Darling Basin alone will be impacted by salt by 2050'. Some of the other main problems facing the Murray-Darling Basin are listed in the box below.

Box 3.2 – The health of the Murray-Darling river system: 5 concerns

1. Over-allocation of water for human use at the expense of the environment. Over-allocation and mis-allocation are significant problems considering the fact that the Murray-Darling Basin experiences high variability in rainfall. The other problems listed below are exacerbated by depleting water reserves.

2. Increasing levels of both water and dry-land salinity. This is a problem throughout the Murray-Darling river system and particularly in the Lower Lakes (the Lower Lakes are located at the mouth of the Murray-Darling river system in South Australia) (Beare and Heaney, 2001). The removal of deep-root native vegetation and inappropriate replacements (shallow root crops) are a major cause of dry-land salinity (Quiggin, 2001: 71).

3. Over-grazing. This has resulted in a degradation of riparian vegetation (Gehrke et al, 2003).

4. Altered river system flow regimes. Flow regimes are important in ensuring the overall health of river systems. A significant adverse impact of over-use and mismanagement of the Murray-Darling Basin has been the altered flow regimes that have led to sediment deposit problems. Sediment deposit (consisting primarily of sand and gravel) loads in the Murray-Darling river system exceed natural loads several times over (Gehrke et al, 2003: 3).

5. Declining populations of fish traditionally found in the Murray-Darling river system (Gehrke et al, 2003: 6).

Over-allocation is perhaps the single most damaging problem for the Murray-Darling Basin. The problem of over-allocation can be linked to the application of European-style water resource use and governance. Over-allocation refers to the allocation of water for anthropogenic consumptive uses over and beyond what is sustainable. The most typical scenario occurs when the allocated volume of water does not leave a sufficient amount for the environment. Continual over-allocation then begins to lead to longer-term environmental problems which then exacerbate allocation problems by reducing the amount available for both the environment and for non-environmental uses. Over-allocation and over-use can be differentiated as follows:

- Over-allocation: refers to water allocation that is not compatible with environmental sustainability. The environment refers to the ecological system

whose survival depends upon the particular water resource. Over-allocation occurs when not enough water is 'allocated' for environmental regeneration.

- Overuse: refers to overuse of a water allocation. Even if an allocation is not classified as over-allocated it can be overused.

3.13 Conclusion

This chapter outlined the key institutions that have shaped water policy for the Murray-Darling Basin. The variety of initiatives highlight the complexity of issues facing the Murray-Darling Basin and the need for a meaningful approach to water policy development. A common theme in past policy initiatives has been a lack of long-term applicability. A levels of institutions approach has the potential to provide a meaningful approach and to provide a foundation for removing the rigidity of policies for the Murray-Darling Basin and for introducing mechanisms for a longer-term approach to policy development. The following chapter presents an analysis of the institutions that have been most involved in water policy for the Murray-Darling Basin from a levels of institutions perspective and it provides the contextual backdrop for the analysis and policy recommendations provided in subsequent chapters.

PART II – A Levels of Institutions Approach to Water Resource Management

Chapter 4 – A Levels of Institutions Analysis

4.1 Introduction

Using Williamson's analytical framework identified in chapter two (see figure 2.2), this chapter focuses on analysing the Murray-Darling Basin institutions described in the previous chapter and also in illustrating the importance of level 2 institutions – institutions which are key focus in new institutional economics. While level 2 institutions are a focus of this chapter it also emphasises the need to develop both level 2 and level 3 institutions *before* shifting focus to level 4 institutions. More detailed analysis of level 3 institutions is provided throughout the thesis and specifically in chapters nine and ten.

Level 1 institutions are also important and are sometimes examined in the new institutional economics tradition. However, level 2 and level 3 institutions are the primary focus of analysis. As Williamson notes, this focus means that in most cases, '...level 1 is taken as given by most institutional economists' (2000: 596). Level 1 institutions are informal and usually the slowest to change. They include religion, social and cultural norms. Level 2 and 3 institutions refer to the institutional environment within which most economic, political and social phenomena occur. These include formal rules and governance structures. Level 4 institutions are the primary focus of neo-classical economic analysis. This level covers resource allocation (mainly via pricing arrangements). In Australia (and elsewhere around the world), level 4 institutions have formed the foundations for water policy. This has led to inadequate policy responses to problems concerning water resources in the Murray-

Darling Basin. This chapter suggests that institutional arrangements, such as well-defined property rights, appropriate regulations for markets and institutional representation for the environment need to be the focus of current water policy reform.

4.2 Level 2 Institutions – Property Rights and Water Markets

An overview of the historical development of water property rights illustrates that water property rights are the main component of level 2 institutions concerning water. Initial water laws in Australia were based upon English common law (Ward, 2009). Rights to water were given to riparian landholders. Riparian rights are rights given to those whose land is adjacent to or encompasses rivers. The riparian doctrine was used in Australia due to the adoption of European-style water resource management practices (Hussey and Dovers, 2006; Ward, 2009). Water was not defined distinctly from land and therefore could not be bought or sold separately from land (Roberts et al, 2006: 57). The riparian rights allowed owners to use water for '…ordinary and domestic purposes provided they did not substantially affect the quality of the water in the river' (Roberts et al, 2006: 57). Growing Australian colonies forced a change in water management. There was a need to secure water supplies for rapidly growing colonies. The push for reform in water management was led by Alfred Deakin in the late 1800s. Deakin had spent time in America studying water management practices and based upon his observations, pushed for state control of water resources. Deakin's push for reform led to restriction of riparian rights and 'vested the right to "the use and flow, and control of water resources" in the Crown' (Woolston, 2004: 1). This meant that in order to secure water supplies, the Crown had the right of use and control of

water in all rivers and lakes (Roberts et al, 2006: 57). This power was vested to States rather than the Commonwealth.

States were also entrusted with water resources development. 'The Commonwealth's only power over water resources came from its power to legislate for defence, trade and commerce and external matters' (Roberts *et al*, 2006: 57). Since the Commonwealth did not have direct control over water resource management and development it was left to the States to develop policies to cater for demand and supply of water. 'Each State developed statutory licensing systems whereby rights to use water were granted, in the form of statutory privileges (such as licenses and permits) to take water' (Woolston, 2004: 2). These water allocations consisted of a mix of riparian rights, licenses and permits and licenses for irrigation needs. While such licenses where issued specifically for irrigation requirements they were still linked to land. This meant that the licenses provided a right to 'use' rather than the right to 'own' water resources. The right to own water resources could only be issued when land property rights were bought and sold. Licenses were granted by state agencies and license holders expected rights to be automatically renewed (see Roberts *at al*, 2006: 57 and Woolston, 2004: 2). The exact details of licensing arrangements were different across different states. In fact, a lack of a coherent approach to reform of water resource management and development is still evident today.

Attitudes towards water management began to change in the 1970s. This was due to increasing demand for water and the fact that '… viable options for increasing supply were diminishing' (Woolston, 2004: 2). The 1970s and 1980s also saw a growing

awareness of increasing environmental damage due to the over-allocation of water. Water allocation was thought to be unsustainable.

In Australia, and particularly in the Murray-Darling Basin, discussion of water allocation typically refers to surface water usage. Water located underground (in underground streams and aquifers) is referred to as groundwater and until recently has not received as much attention or been the focus of much policy related analysis. As mentioned in the previous chapter, the Murray-Darling Basin's hydrological cycle is characterised by a high degree of variability from water flows to rainfall. The volume and quality of groundwater in the Murray-Darling Basin is also variable (Productivity Commission, 2010). The paucity of policy-related analysis (Sullivan, 2009) of groundwater is a reflection of the fact that historically groundwater has accounted for a small percentage of water used in the Murray-Darling Basin (Productivity Commission, 2010 and CSIRO, 2008). Another problem with groundwater research and analysis is that it seems to have generally been conducted in isolation to surface water despite the fact '…the availability of surface water is affected by the use of groundwater…' (Productivity Commission, 2010). In 2009 the Australian Government (the Labor Party, under the leadership of Kevin Rudd, was in power) announced new funding ($82 million) for groundwater research (National Water Commission, 2008a) as the then Minister for Climate Change, Penny Wong noted (Wong and Carr, 2009), '[i]n Australia's water management, groundwater has often been overlooked' and the National Water Commission noted that '…[groundwater] is neither understood nor managed as well as it needs to be if this valuable resource is to be sustained in future'. The National Water Commission goes on to note that:

> *'[t]hrough the $82 million National Groundwater Action Plan the National Water Commission will undertake projects to address groundwater knowledge gaps and progress groundwater reforms agreed to under the National Water Initiative'.*

Despite the relative lack of knowledge of groundwater resources, it is clear that health of groundwater resources, particularly in the Murray-Darling Basin, seem to be heading in the same troubling downward direction that surface water health has taken over the last two decades. For example, Mckay (2006) notes that '[g]round water is often exploited in Australia' and Quiggin and Tan (Quiggin and Tan, 2004: 15), commenting on rates of extraction of groundwater, note that '[s]uch rates of extraction cannot be sustained indefinitely'. Groundwater is used more in dryer seasons when surface water is less available. As scrutiny over surface water usage increased over the last two decades, groundwater usage has increased. Groundwater usage in the Murray-Darling Basin has increased from approximately 7.4% of total water consumption in the Basin in 1995 (Tisdell et al, 2002) to approximately 16% in 2004/05 (CSIRO, 2008). A possible explanation for this is that as the reliability, quality and volume of surface water deteriorates, water users are shifting to the less regulated and harder to analyse groundwater resources.

Parallels can also be drawn with respect to institutional arrangements, in particular property rights, for groundwater management. Groundwater management can be categorised into three phases (McKay, 2006; Quiggin and Tan, 2004). The first phase involved the application of English common law to groundwater (Quiggin and Tan, 2004). While riparian rights were applied to surface water, rights to groundwater were

basically unrestricted to landowners (Roberts et al, 2006: 5). The reason for this was that riparian rights only applied to ground water when the groundwater resource was defined and connected to a defined surface water resource (McKay, 2006: 326). The problem with this approach was two-fold. First, as Quiggin and Tan (2004: 8) note:

> *'[i]t has been observed that 'defined and known' underground channels occurred more often in law reports than in nature. Australian courts held that a course would be considered known and defined if its existence is demonstrated by excavation or could be inferred by observable facts'.*

When underground channels were not known and defined and therefore were considered percolating, the riparian doctrine did not apply and common law prevailed (Quiggin and Tan, 2004). Second, the lack of a groundwater riparian doctrine led to over-exploitation of groundwater resources (Mckay, (2006)

The second phase began in the late 1890s when common law rules were replaced by a licensing system (McKay, 2006). The primary reason for this shift was to control waste and regulating the construction of artesian bores (Quiggin and Tan, 2004). It is important to note that the term 'waste' referred primarily to water lost from bores, some which were uncapped and '…water freely flowed all day and night' (McKay, 2006: 325). The Queensland Department of Natural Resources and Mines noted that in the first half of the twentieth century an estimated 90% of bore water was lost through evaporation, seepage and general wastage (Department of Natural Resources and Mines, Queensland, cited in Quiggin and Tan, 2004: 12). While the focus of the

second phase was on regulation and controlling waste, it did not focus on over-extraction of groundwater.

The third phase involves the recognition that groundwater resources have been severely over-exploited and the need to manage such resources in a more sustainable manner (McKay, 2006; Quiggin and Tan, 2004), As such, the management of groundwater resources has to adhere to Environmentally Sustainable Development management practices (ESD) (Quiggin and Tan, 2004). ESD focuses on ensuring that the environment is taken into account when forming policy related to groundwater usage and licensing.

We could go further and identify a possible fourth phase in institutional reform of groundwater. This is the current phase and overlaps with the third phase. The focus of the fourth phase is on ensuring that groundwater is examined in conjunction with surface water. The distinction between phase three and phase four is subtle but important as it reflects a shift in the first level of institutions – the ones that take the longest to form and change. Changes to institutional arrangements reflecting the transition to phase four include the aforementioned new allocation of Commonwealth funding for groundwater research and recommendation by the National Water Commission to treat surface and groundwater as connected (National Water Commission, 2009b). The National Water Commission (2009b: 36) notes that:

> *'[t]o mitigate the risks to the water resource, the Commission considers that unless and until it can be demonstrated otherwise,*

> *surface and groundwater resources should be assumed to be connected, and water planning and management of the resources should be conjunctive. This is the reverse of the current situation'.*

The 1980s saw a shift towards accepting more market based solutions to water resource management problems. This was perhaps an implicit acknowledgement of the fact that water resources were not finite, and were in fact scarce. Until the last few decades water usage had been seen in isolation to availability of supply. The growing focus on scarcity provided a perfect foundation for neo-classical economic analysis to take hold – after all, neo-classical economics proclaims that economics is concerned with the efficient allocation of scarce resources. Randall (1981) defined this phase as the beginning of a mature water economy. The mature water economy follows the expansionary phase where '…public policy economists seem chiefly concerned with the appropriate rate of expansion and subsidisation of the water economy by the public at large' (Randall, 1981: 196). A mature water economy is characterised by '…sharply rising incremental cost of water supply, more direct and intense competition among different kinds of users and, greatly increased interdependencies among water uses (Randall, 1981: 196). As Quiggin (2006: 426) notes, [e]nvironmental problems and competition for water use became evident during the 1970s and acute during 1980s, signalling the arrival of the mature phase…'. Competition for water use not only came from human use – the environment also was competing for water even if this was not acknowledged formally by policy makers until the early 1990s.

A maturing water economy necessarily requires a change in related institutional arrangements. One of the most significant changes to the institutional arrangements

concerning water came about as a result of the 1983 drought. The ramifications of the drought led to New South Wales and South Australia passing legislation allowing water transfers (trades) between irrigators on the same regulated river system (Pigram, 1993: 1315). These transfers were temporary and were valid for one irrigation year. Multiple year leases followed and finally permanent transfers were introduced in 1989 (Pigram, 1993: 1315). At this stage intersectoral transfers of water were also restricted. Despite the introduction of permanent water transfers several restrictions still remained. Some restrictions remained due to hesitation in allowing increased corporate interaction (through ownership of water rights) and the need to placate fears of foreign ownership (Pigram, 1993: 1315).

In the late 1980s and the early 1990s another significant change entered the water reform process. Focus shifted away from the development of new water resources and infrastructure and further investment in infrastructure to the reallocation of water through trading (Woolston, 2004). This shift in focus of the future direction of water policy was linked closely to the push towards a user-pays system for water. There was an increasing acceptance of a user-pays system (at least amongst water policy makers). Orthodox economic theory suggests that low prices promote efficiency but Musgrave notes that, with regards to water in the 1980s, '…its [water] low price does not promote the most efficient use of water, while revenue from sales does not cover the capital and running costs of the supply system' (Musgrave, 1984, cited in Pigram, 1993: 1315). Even though the idea of water price increases was raised almost two decades ago it is still of great importance today. Level 2 institutions such as property rights are also linked closely (at least theoretically) to markets and prices. If property rights are well defined then prices should reflect closely the intersection between

demand and supply. Ill-defined property rights create uncertainty and therefore can distort prices. The reason for this is that prices tend to act as signals of one's valuation of a particular good or service. Goods and services can be more effectively valued if ownership is well defined. For example, if someone is in the position to sell a particular good or service and the individual owns the good or service then the individual is more likely to place a higher value on it compared with if the seller does not own the good or service. This type of problem is typically encountered in the real estate market. If a real estate agent has a pre-determined commission for agreeing to sell a property then she has little incentive to spend time and effort finding the highest bidder[19].

With the introduction of tradeable water permits Pigram notes that speculation in water markets arose (Pigram, 1993: 1315). He refers to this as signs of 'sophistication' of water permit markets. Speculative trading in water trading could become quite problematic if measures are not taken to ensure the sacrosanctity of water. Rather than being seen as sophistication and maturation of water markets the presence of speculative trading should be seen as a degenerative step in market evolvement and it is absolutely essential that ongoing water reform in Australia shelters the water market from the vagaries of speculative whims. Water has several distinguishing characteristics that mean it cannot *wholly* be treated as an economic good. The most distinguishing feature of water is of course its role in ensuring the continuation of the cycle of life! Speculation should be of great concern as it can have significant

[19] This problem could potentially be partially alleviated through a publication of prices obtained by agents for properties with similar characteristics. This also is closely linked with contract analysis which is an object of analysis in new institutional economics with Nobel Laureate Ronald Coase being the seminal figure in this area.

(generally adverse) consequences for local communities relying on particular water resources. There is danger speculation could pave the way for artificially increased prices. Speculation also leads to volatility which can again have adverse consequences for those who are unable to cope with spikes in prices. The main problem is that speculation is only loosely connected with demand and supply factors. It is generally *expectations* of future demand and/or supply that leads to speculative activity and this typically leads to self-fulfilling prophecies that benefit those with market power and knowledge.

In the early 1990s and mid 1990s significant changes to the institutional arrangements for water policy were established. The catalyst for the change being the 1994 COAG meeting. Increasing emphasis was placed on the development of water markets, improving water allocation arrangements (especially for environmental usage) and pricing reform. There was also increasing focus on the health of the Murray-Darling Basin. Furthermore, in the last couple of years there has been a push for the Federal government to step in and buy back water entitlements in order to preserve the Murray-Darling Basin and to allow it to regenerate. The call for government buybacks and the increasing role of water markets has arisen from the debate about the issue of actual water scarcity. The presence of this debate can be attributed to the lack of a coherent approach to water policy. The two main opposing arguments are:

1. Australia suffers from a *perceived* lack of water. A perceived lack of scarcity typically arises from end users of water not having access to the actual amount of water available for use. The solution to this problem is better management of currently

available water resources (adopting orthodox economic principles is the suggested path for reform proposed by those advocating this particular viewpoint).

2. Water scarcity is not perceived but is in fact the result of attitudes towards water and water usage patterns not changing to adapt to changing climatic conditions.

Water policy reform needs to incorporate both arguments. However, for reasons of policy practicality, more emphasis should perhaps be placed upon utilising existing water resources in a more sustainable manner. The reason for this preference is that it provides a more long term solution. Dealing with perceived scarcity necessitates addressing issues of mismanagement. If effective management practices (comprising a mix of changing attitudes to water and formal institutional arrangements) are established then future policy makers have a framework which perhaps needs only some 'tweaking' to adapt to different situations. Dealing with actual scarcity would only address short-term problems and would not directly deal with systemic management failures. Emphasis on foresight is important due to water being the most essential of all resources.

The traditional economic solution for efficiently allocating scarce resources has been to advocate for the establishment of a market (typically unhindered by distortionary government intervention) for the scarce resource. The reasoning behind this proposition being that market forces (supply and demand), if left unhindered, would

be able to allocate the scarce resources to where they are most needed and at the most acceptable price (in terms of willingness to pay).

Typically, a market is created in order to facilitate the exchange of goods and services. How well a market works is generally determined by its ability to generate efficient outcomes. Defining efficiency can be problematic and there is no clear consensus on an exact definition. Neo-classical economics traditionally links the definition of market efficiency with the concept of *Pareto efficiency*. Pareto efficiency arises in situations where no one can be made better off without someone being made worse off. This means that we can have situations where '…making someone better off at the expense of another is not an indication that an economic situation is inefficient or wasteful' (Taylor *et al*. 2006: 135). It should be clear that within the neo-classical school of thought the concept of economic efficiency is quite distinct from achieving an equitable outcome. In fact, achieving economic efficiency relies on three different types of efficiency being present (Bannock *et al*, 1998: 119):

- Productive efficiency – output is produced at lowest cost (Bannock *et al*, 1998: 119).
- Allocative efficiency – resources are being allocated to the production of the goods and services society most values (Bannock *et al*, 1998: 119).
- Distributional efficiency – output is distributed in such a way that consumers would not wish, given their disposable income and market prices, to spend these incomes in any different way' (Bannock *et al*, 1998: 119).

Allocative and distributional efficiency potentially need to take precedence over productive efficiency with regards to water. The simple reason for this is that regardless of cost, water needs to be available for survival. It is allocative and distributional efficiency that can be impacted significantly through policy reform.

While neo-classical economics focuses heavily on analysing efficiency it pays scant attention to the 'rules of the game', i.e., the rules governing interactions in markets. Mantzavinos notes that '…neo-classical economics seems to neglect thoroughly the role of rules in the market process' (Mantzavinos, 2001: 162). By ignoring the rules of the game, neo-classical economics effectively does not provide adequate analysis of the institutional framework in which market processes take place. Mantzavinos notes that '[t]he market is mainly viewed [in neo-classical economics] as an allocating machine that solves the main problem of society, that is, what to produce, how, and for whom' (Mantzavinos, 2001: 162). It is this neglect of the institutional arrangements surrounding market processes that makes a new institutional economics approach a more attractive and viable approach.

The role of institutions and institutional arrangements concerning markets is often underestimated. The problems of asymmetric information and barriers to entry that are present in most market structures today can to some extent be alleviated by institutions. For example, many industries have regulations prohibiting predatory pricing practices that generally create barriers to entry. In the case for water, the opposite may be necessary. Barriers may need to be erected in order to create and maintain security from market volatility.

We can use Williamson's diagrammatic representation of the different levels of institutions to highlight the role of institutions and institutional arrangements in market processes. Recall that neo-classical economics views the efficient allocation of resources as paramount and it is the market which facilitates the efficient allocation. However, level 2 and level 3 institutions and institutional arrangements need to be dealt with *prior* to level 4 institutions. These are the levels where the institutional environment and governance structures need to be established. The institutions which create formal rules need to be established. These institutions include '…the executive, legislative, judicial and bureaucratic functions of government as well as the distribution of power across different levels of government (federalism)' (Williamson. 2000: 598). The 'distribution of power across different levels of government' is an important issue especially in regards to the current state of affairs in Australia. The blame for a lack of a coherent approach for dealing with water reform in Australia can partially be taken by the different levels of power and authority entrusted to different levels of government in different states across Australia (see chapter ten for a discussion about federalism in Australia).

Level 3 institutions, concerned mainly with governance, provide solidity to the framework established by level 2 institutions. While level 2 institutions establish the formal rules of the game, level 3 institutions deal with the 'play of the game' (Williamson, 2000: 597). The reason for emphasising level 2 and level 3 institutions is their relevance to Australian water policy reform. Policy reform in Australia has generally tended to focus on level 4 institutions. For example, water policy reform has focused heavily on using markets as a means of allocating water. Less attention has been paid to understanding and developing institutional support for markets. In this

instance, institutional support refers to changing social attitudes towards water and also removing some of the political and economic impediments to water markets.

In recent years policy makers have begun to acknowledge that it is levels 2 and 3 where major deficiencies in Australia's water policy lie. As such, the significant steps in the policy reform process in recent years have been the development of the National Water Initiative and National Water Commission. The NWI is also the vehicle through which further development of a clearly defined water property rights framework is to be achieved alongside the expansion of water markets. This is particularly pertinent to what Williamson refers to as 'first order economising' – i.e., establishing the appropriate level 2 institutions (before moving on to level 4 institutions).

4.3 Levels of Institutions Mapping

Williamson's (2000) framework for analysing institutions can be used to map the Australian water policy process. Such mapping provides a useful institutional economics analytical framework which will be drawn upon at various points in the following chapters.

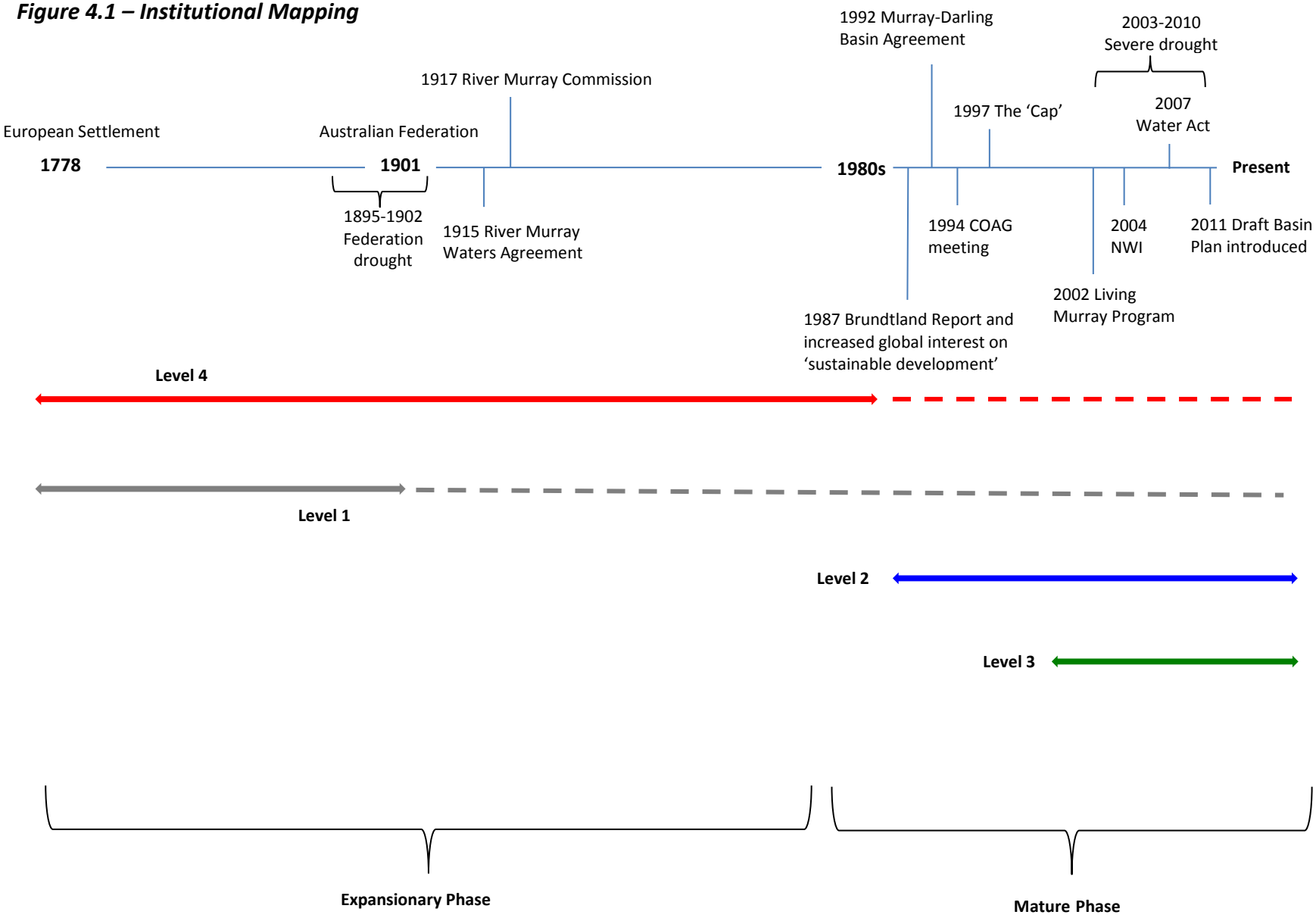
Adapting Williamson's (2000) framework shows that for the most part, Australia's experience with water resource policy has been dominated by level 4 institutions. Level 1 institutions played a role in shaping the initial approach to water policy but did so within the confines of level 4 institutions. The level 1 institutions were adopted

from Europe and in particular the United Kingdom[20]. These institutions include the application of the English riparian doctrine and common law. These are classified here as level 1 institutions as these were traditions that were adopted rather than developed in Australia.

Figure 4.1 shows that level 4 institutions broadly cover the Australian experience with water policy. The bold line indicates that the central focus for water policy makers during the timeline covered was level 4 institutions. The broken line indicates that the contextual background remained level 4 institutions even if the central focus had shifted to other levels of institutions. It should be noted that during the period when level 4 institutions did preoccupy the centre of the water policy reform process level 2 and level 3 institutions did come into play but were not the central focus. For example, emphasis on level 2 and level 3 institutions coincided with extreme events such as the Federation drought and the drought in the early 1900s (see previous chapter for further discussion about these events).

[20] The discussion in this section does not refer to the institutions that were developed by Aboriginals prior to European settlement in 1778 and will focus exclusively on institutions introduced after European settlement.

Figure 4.1 – Institutional Mapping



The dominance of level 4 institutions can be mapped with Randall's (1981) classification of the expansionary phase in Australia's water policy experience. With the beginning of a mature water economy in the 1970 and 1980s (as identified in Quiggin, 2006 and Randall, 1981) water policy focus shifted to level 2 (for example, water markets were developed and debate shifted towards the issue of reforming property rights related to water) and to a lesser extent level 3 institutions. During this time the contextual background of level 4 institutions remained. However, over the past decade policy focus has remained on level 2 and level 3 institutions (particularly in the last four to five years) alone *without* the level 4 institutions contextual constraint. With regards to level 2 institutions, significant policy efforts have focused on reforming water property rights by, for example, unbundling them from land property rights. With regards to level 3 institutions, recent focus on centralised governance of the Murray-Darling Basin (most significantly in the form of the National Plan for Water Security) is an example of the shifting policy emphasis of policy-makers. This period should be considered as a watershed moment in Australia's water policy history as it indicates recognition (perhaps unintentionally!) that different types and levels of institutions need to be considered for water policy reform to be successful and, more importantly, appropriate.

4.4 A Levels of Institutions Assessment of Murray-Darling Basin Institutions

In light of the discussion on institutional mapping, the focus now turns to analysing how the key institutions of the Murray-Darling Basin (see chapter 3) specifically fit within a levels of institutions framework.

A common trend apparent in Australia's water policy decision making process has been the neglect of level 1 institutions and insufficient focus on level 2 and 3 institutions. However, what seems to be a common catalyst underpinning the development of the key Murray-Darling Basin institutions can be identified. It seems that most of the key institutions of the Murray-Darling Basin arose when demand and supply pressures were most acute. For example, the catalyst for the original River Murray Waters (RMW) Agreement was severe drought conditions compounded by inter-state economic rivalry. A similar reason can be found for the establishment of the Murray-Darling Basin Agreement (MDBA) and more recently the National Plan for Water Security (NPWS). While this may seem to be the main reason, a levels of institutions analysis suggests that the underlying problem stems from the fact that a lack of appropriate level 2 and level 3 institutions is made starkly apparent when climatic conditions are most severe. This is particularly the case nowadays when there is relatively vast knowledge and awareness about the impact of extreme climatic conditions on the Murray-Darling Basin. Additionally, as the focus of policy design and implementation shifts to a more holistic approach the likelihood of a well-rounded set of policy initiatives being developed increases.

From a levels of institutions perspective it is clear that that the environment needs to set the parameters of water policy reform. By placing the environment at the centre of the reform process clear policy objectives can be determined. This type of focus has been lacking in most Murray-Darling Basin initiatives throughout history. For example, the central focus of the RMW agreement and the MDBA was on achieving resource allocation (level 4 institutions) that met the demands of the various users with little regard for the environment itself. The 'rules of the game' of these two institutions were developed with the parameters

being developed for optimal resource exploitation between competing groups. This in turn influenced how the governance structures were developed and enforced.

From a new institutional economics perspective the 1994 COAG agreement was an important moment in history as it represented the first coordinated attempt to change the parameters within which future water policy was to be developed. It emphasised the 'environment' as a legitimate user of water resources. Similar to the RMW agreement and the MDBA, the 1994 COAG agreement was an attempt to alter level 2 institutions but unlike the RMW agreement and the MDBA, the 1994 COAG agreement did not attempt to change level 2 institutions by focusing *solely* on level 4 institutions. The order in which different levels of institutions are developed is important as it influences the likelihood of success of policy initiatives. Central focus on level 4 institutions can lead to the overexploitation of environmental resources. As mentioned in the previous section, until the 1980s level 4 institutions characterised Australian water policy and this focus on expansion led to water resources being significantly over-committed (Connell *et al*, 2005: 85). The 1994 COAG agreement was a step in the right direction as, while level 4 institutions were a key focus (primarily in the form of water markets), level 2 institutions (primarily in the form of property rights and reframing the policy discussion by centralising the environment) were also given significant emphasis.

The 'Cap' on water diversions from the Murray-Darling Basin was a continuation of a shift towards developing level 2 and level 3 institutions prior to level 4 institutions. Before it became permanent, the Cap was a stop-gap solution which aimed, at the very least, to halt the rapid deterioration of the Murray-Darling Basin. On a broader level it played an important role in initiating an awareness amongst the wider populace about the plight of the Murray-

Darling Basin. As such, it can be viewed as one of the first steps towards changing level 1 institutions.

The Living Murray Program (LMP) can be considered as a major policy initiative that was focused on centralising the environment within the water policy reform process. As a result, within a levels of institutions approach, its objectives broadly overlap the first three levels of institutions with primary focus on level 1 institutions as it attempted to institutionalise allocations for severely depleted water resources. Consequently it sets the foundation for similar initiatives in the future if they are required. While there is debate about the efficacy specific elements of the LMP (see for example, Grafton and Hussey, 2007), overall, it is step in the right direction.

The LMP was part of the broader NWI introduced by COAG in 2004. While the LMP was specifically focused on the Murray-Darling Basin the NWI provided a blueprint for water policy reform nationwide (notwithstanding this and inevitably, given the significance of the Murray-Darling Basin, the NWI places particular emphasis on water policy reform in the Murray-Darling Basin). Taken as a whole, the NWI is seen by most commentators as another step in right direction. From a new institutional economics perspective, the NWI attempts to cover all 4 levels of institutions (with most focus on level 2, 3 and 4 institutions). However, as commentators note (see for example, Connell *et al*, 2005; Connell, 2007; Connell *et al*, 2009; Grafton and Hussey, 2007; Hussey and Dovers, 2006) the NWI places disproportionate importance on water markets as a panacea-like solution for the problems facing the Murray-Darling Basin. While there certainly is considerable emphasis on water markets in the NWI, it goes further than all the reform initiatives before it. So while the main criticisms of the

NWI centre on its focus on water markets and for not going ‘far enough’ on other aspects of reform such as dealing with conflict between disaffected parties, improving participation in water markets and clearer governance arrangements (level 3 institutions), from a new institutional economics perspective the NWI sets a platform for more optimistic reform in the future that takes a holistic approach by including initiatives to address all 4 levels of institutions.

The slow pace of compliance to recommendations outlined in the NWI was given as the key reason for the introduction of the National Plan for Water Security (NPWS) by former Prime Minister John Howard. The National Water Commission itself highlighted the slow pace of progress in its biennial assessments (NWC, 2007b). However, it is possible to identify another reason for the slow pace of reform – the balance of policy focus shifting once again towards level 4 institutions at the expense of level 2 and 3 institutions. Water market transaction costs, lack of appropriate dispute resolution institutions and an unclear guidance over governance arrangements (relating primarily to the growing tension between State Governments and the Federal Government) can be considered as central compounding factors that diluted the efficacy of the NWI and delayed the complete implementation of key recommendations.

Overall, like the NWI, the NPWS had the right intentions – to address the over-allocation and ensure that environmental assets received an appropriate allocation of water for regeneration. Similarly to the NWI the NPWS can be considered as a having overlapping elements from a levels of institutions perspective. The breakdown on expenditure outlined for the NPWS (Table 4.1) reveals that level 4 institutions are once again the focus of water policy with some

focus also directed to level 3 institutions via spending on governance and administrative arrangements. Most likely indirectly, the expenditure on water entitlement buybacks is a reflection of changing norms and expectations (level 1 institutions) about the centrality of the environment in policy decision making processes.

Table 4.1 – A National Plan for Water Security (costings over 10 years)

	Costs ($m)
Modernising irrigation in Australia	**5885**
Delivery system efficiency gains	3130
On farm efficiency gains	1635
Metering, monitoring and accounting	620
Improving river operations and storage	500
Addressing overallocation in the MDB	**3000**
Purchasing entitlements/structural adjustment	3000
Reforming the MDBC	**600**
Set and administer a new cap	100
MDBC operations	500
Water information	**480**
Modernising and extension program	80
Information management and reporting program	120
Analysis and forecasting services	120
Investigations program and strategic data procurement	160
Northern Australia and the Great Artesian Basin	**85**
Total	**10050**

Source: Howard, 2007.

More than half of the funds were allocated to making improvements in irrigation infrastructure in order to conserve water. A further 30 per cent were allocated to buying water entitlements on behalf of the environment. Significant criticism by several commentators (see for example, (Grafton and Hussey, 2007; Watson, 2007b; Ancev and Vervoort, 2007) about the funding allocation centred on the seemingly contradictory messages being sent by the NPWS. By subsidising the cost of irrigation infrastructure improvements the Federal

Government is sending signals that this can be an effective way of dealing with the water scarcity problem in the Murray-Darling Basin. However, excessive expansion of irrigation throughout history has been one of the key reasons for overallocation (Watson, 2007b). In fact, as Ancev and Vervoort (2007) note, subsidisation of irrigation infrastructure improvements could also lead to a potential further expansion of irrigation – a result that is '…undesirable, and is inconsistent with the idea of reducing water use in agriculture and leaving more water in the water bodies to support their ecological and environmental functions'. Such subsidisation distorts incentives by allowing undesirable practices to continue.

The distortion in incentives problem has also been raised by Watson (2007a) who notes that subsidies will '…distort on-farm decision-making and is inequitable to irrigators who have acted already in response to market incentives to save water'. Grafton (2010) makes a similar point, noting that large investments such as that proposed under the NPWS (and in its successor, the Water for the Future Plan) have the potential to send inappropriate signals about incentives. Trying to appease irrigators by subsidising investment in irrigation infrastructure is not only economically inefficient but also does not offer the certainty of helping to achieve positive environmental outcomes such as more water for the environment. Moreover, the benefits accruing from subsidisation would have been shared equally by the Government and irrigators. In its haste to put forward the NPWS (it was announced early in 2007, with the national elections to be held later in that year) it appears that alternative options were not analysed in detail. Connell and Grafton (2007) note that appropriateness of such large expenditure needs to be assessed against the expected returns from alternatives. Qureshi *et al* (2010b) point out that when considering the two policy options, subsidising irrigation infrastructure investments and directly purchasing water entitlement rights, it is

much more cost effective to purchase water entitlements through water markets (see also Qureshi *et al*, 2010a and Qureshi *et al*, 2011).

The most recent incarnation of water policy for the Murray-Darling Basin, the Basin Plan, was introduced in late 2010. It was met with outrage from irrigator communities (ABC, 2010), and with broad support from environmentalists and water resource researchers. The problem with the Plan, from the irrigators' perspective, was the dominance of 'the environment' in the policy process such that there was significant (yet, not unexpected) opposition to it. A key point of contention related to giving the environment centrality in the policy making process was the impact of 'sustainable diversion limits' (SDL).

> *'The central legal requirement of the Basin Plan is to set environmentally sustainable limits on the amount of water that can be taken in future from the Basin's water resources' (MDBA, 2009: 4).*

The broad opposition to the plan centres on the idea that in its current form, the Plan does not take into account the social and economic impacts of increasing water for the environment (EBC *et al*, 2011). From a levels of institutions perspective this is interesting as it emphasises the importance of level 1 institutions in determining the likelihood of success of any new policy initiative. The fact that the SDLs are to be determined based on what is environmentally appropriate and not on the basis of historical water consumption (which was primarily determined by the norms and traditions of European water users) has generated strong responses from both sides of the debate. Table 4.2 presents a snapshot of the range of responses to the Basin Plan by individuals and table 4.3 presents a snapshot of responses by representative groups.

Table 4.2 – Reaction to the Basin Plan by representative groups

Organisation (Individuals)	View	For / Against
MDB irrigator 1	I am highly critical of the Guide and the mindset which is behind it.	✗
Submission 1	Ultimately without a healthy river those people that burn the plan dont have an income anyway.	✓
Submission 2	Key changes need to be made in the way we use water as a nation, and I feel that the proposed Murray Darling basin plan is an essential first step in this process.	✓
Submission 3	The MDBP seeks to cut off water and thence food, so it is tantamount to genocide under any standard Nuremberg definition. How do you justify being the ones to flick the switch on the gas chambers? Will you have any defence at the Nuremberg trials which are sure to follow? Or do you think that there will be no such trials and, if so, why?	✗
Submission 4	Thank you for the thorough report you have done on the Murray-Darling Basin & for having the courage to say what we all know – that we are drawing too much water out of the system for human needs. This cannot continue.	✓
MDB Resident 1	However I would strongly support the MDBA opt for the higher environmental allocation scenario's preferably 7600Gl scenario. At worst, a 5-6000Gl increase in allocation for environmental purposes should be made.	✓
MDB Resident 2	The current plan to significantly reduce water allocations to murray darling area is flawed. Not only will thousands of farmers lose their livelihood, the factories in the area that run off the back of our primary industry will close.	✗
MDB Farmer 1	Our farmers have cut back water usage and at great cost have put in drip irrigation to conserve the water. Now you are talking about cutting back the amount of water yet again. LEAVE US ALONE!	✗
MDB Farmer 2	Please have the guts to deliver a plan that will seriously deliver health to the rivers and establish sustainable limits to all inland regional development.	✓

Source: Feedback received by the Murray-Darling Basin Authority in response to the Basin Plan. Available at [http://www.mdba.gov.au/communities/having-your-say/feedback-received].

Both the tables emphasise the deep divisions in opinion and present an insight into the challenge faced by policy makers. It is interesting to note that there is a difference of opinion between individual farmers. Some farmers support the Basin Plan while others are vehemently opposed to it. However, amongst representative groups, there is a majority consensus with irrigators and agricultural groups (such as dairy) in opposition to the Plan. Environmental organisations, as expected, support the Plan and some believe it does not go far enough in allocating water for the environment.

Table 4.3 – Reaction to the Basin Plan by representative groups

Organisation (Groups)	View	For / Against
Australian Water Campaigners Inc	My concern is that the MDBA Guide to the Draft Plan, as published is already a compromise...the Irrigators have for too long lived on the false assumption that there is a limitless supply of water. There is not.	✔
Central Irrigation Trust	The guide in its current form is totally unacceptable to our community…If the plan is implemented in its current form we will see significant downsizing of our community…	✘
Citrus Australia Ltd	Whilst Citrus Australia welcomes the need for national water reform to improve river system health we reject the MDBA guide to the proposed Basin Plan due to its total failure to adopt a "triple bottom line" approach. There needs to be urgent and immediate attention to the economic and social impacts of any proposed water reforms to minimize the devastation to the citrus industry, its regional communities, and the wider Australian population.	✘
Concerned residents of the Murray-Darling Basin and environmental groups	To provide the Murray-Darling with a moderate to good chance at revival, and Basin communities with socio-economic certainty about the future, we urge that the water reform process and the delivery of the Proposed Basin Plan not be delayed.	✔
Australian Dairy Industry Council Inc	the Guide has created confusion and increased uncertainty among dairy farmers and their communities about the future availability and security of access to water in their regions.	✘
Environmental Farmers Network	We strongly support the development of the Basin Plan by the independent Murray-Darling Basin Authority as outlined in the Water Act 2007 and urge the Federal Parliament to support the process.	✔
Fonterra (Dairy exporter responsible for 30% of international dairy trade)	The proposed reductions in sustainable diversion limits (SDLs) are very high even at 3,000 GL	✘
Fruit Growers Victoria Limited	We strongly object to the imposition of a plan that neglects to address the wellbeing of all MDB stakeholders.	✘
Mungindi Cotton Growers and Water Users Association	The guide is just bad public policy. Good public policy should achieve a calming influence on society. If this document was intended to create division, it has certainly been successful.	✘
Conservation Council South Australia	To a large extent, the final Basin Plan will be a reflection of the feedback received from the community via these consultation processes. We are aware that there has been a heavy bias towards irrigator interests in the feedback, and regrettably not all irrigators recognise how heavily their livelihoods depend on healthy ecosystems.	✔
Fair Water Use Australia	We can only hope that ... the Authority will resist the inappropriate and sustained pressure which has been applied by a maverick section of the irrigation community, and act to ensure the environmental health of the irreplaceable resource that is the Murray-Darling river system, in the best interests of all Australians'	✔
National Farmers Federation	NFF believes the Guide is so fundamentally flawed that it cannot be used as a basis for moving forward and we need a new approach.	✘
National Irrigators Council	The Act and the Guide give primacy to the environment to the detriment of social and economic outcomes and as such we believe they fail our communities and the nation.	✘

Source: Feedback received by the Murray-Darling Basin Authority in response to the Basin Plan. Available at [http://www.mdba.gov.au/communities/having-your-say/feedback-received].

The strength of this particular set of level 1 institutions is so strong that the Basin Plan is currently under review (following the resignation of MDBA Chairman Mike Taylor) and it is

widely expected that watered down version of the Plan will be unveiled in mid-to-late 2011[21]. As mentioned in the previous chapter, in order to meet SDL proposals the Basin Plan recommends reducing diversions from Murray-Darling Basin water resources by 22% to 29% of current diversion limits – roughly a 3000 GL/y to 4000 GL/y reduction in diversions of surface water (MDBA, 2010). The effectiveness of the opposition to the Basin Plan is due to two main reasons – the strength of existing level 1 institutions that have shaped level 2, 3 and 4 institutions throughout history and the current political reality. The current Labour Government is a minority government and is falling behind the main opposition (a coalition of the Liberal and National parties) in polls. This means it has little (if any) political capital to spend on promoting another unpopular yet necessary environmental policy (the other policy being, a tax on carbon emissions). This situation suggests that while changing level 1 institutions is key for increasing the likelihood of success of reforming level 2 and level 3 institutions, there may be situations when level 2 institutions (particularly the rules of the game) and level 3 institutions (governance) need to play a dominant role in changing inappropriate level 1 institutions. The fact that the SDLs will be calculated based on the latest scientific knowledge rather than historical use (historical use has been shaped by level 1 institutions and was used to define water diversions under the Cap) supports the idea that sometimes level 2 and level 3 institutions need to be used to initiate (at times, forcibly) change of level 1 institutions.

[21] The revised Basin Plan was to be released in mid-2011, but was subsequently pushed back to August, then September and finally November.

4.5 Conclusion

Williamson's (2000) levels of institutions framework provides a useful method of examining two institutions – property rights and markets – that usually underpin most institutional economics analyses. Water resource management in Australia has typically been characterised by emphasis on level 4 institutions instead of level 2 (and 3) institutions. This chapter, using Williamson's framework, emphasises the importance of level 2 institutions and argues that these need to be developed before level 4 institutions. It is only in more recent years that the importance of level 2 and level 3 institutions has been recognised by changes in the policy reform process. Chronological mapping of different levels of institutions emphasises this point further and shows broadly when different levels of institutions dominated the water policy process in the Murray-Darling Basin.

Following this, a levels of institutions assessment shows that despite the attempts of recent policy initiatives such as the NWI, the NPWS and the Basin Plan focus on level 2 and level 3 institutions seems to constantly shift to level 4 institutions. It is also noted that level 1 institutions have played a key role in shaping water policy and also in resisting change. In such situations, level 2 institutions and level 3 institutions could be used to formally impose (through legislation) change on level 1 institutions.

The following chapter turns to identifying the challenges faced by policy makers within the broader context of economic progress and environmental sustainability with a view to defining the Murray-Darling Basin as a resource with a particular set of characteristics. This will set the scene for the analysis in the subsequent chapters.

Chapter 5 – Environmental Sustainability and Economic Growth

5.1 Introduction

This chapter examines the challenge faced by policy makers when dealing with the relationship between economic progress and environmental sustainability. This is a key challenge faced by policy makers and is often used to justify new policies. The first section explores the various definitions of economic progress and environmental sustainability in order to develop a definition appropriate for the purposes of this chapter. The second section investigates the impact that the relationship between economic progress and environmental sustainability has on the policy decision making process. The final section outlines the role institutional economics can play in shaping the debate about economic progress and environmental sustainability. It suggests that the Murray-Darling Basin needs to be treated as an exhaustible (finite) resource in order to increase the likelihood of regenerating a badly degraded water resource system. The overall theme of the chapter is that institutional economics offers alternative pathways for framing not only the debate between the two issues but also for formulation of reformative measures for water resource management (especially in the Murray-Darling Basin).

5.2 Economic Sustainability and Economic Progress

Sustainability needs to be a central concept in managing water. Much of the scarcity of water resources around the world has arisen as a result of unsustainable water usage practices and

inappropriate policy responses. Sustainable water usage needs to be considered in terms of both economic and environmental sustainability.

The concept of environmental sustainability was first raised in a formal setting in the 1980s and more specifically in the Brundtland Report (1987). In more recent years (especially since the signing of the Kyoto Protocol) the environmental sustainability movement has gathered momentum as the concept has been inculcated into educational programs and popular media. In fact, increasing public awareness has resulted in a convergence with popular culture and the sustainability movement (Parr, 2009: 15). The heightened level of awareness of environmental issues locally and on a global scale creates an unprecedented opportunity for implementing policy reform that may otherwise be politically difficult to do so. Despite the increased level of awareness for the environment a significant hurdle faced by policy makers is the lack of a universally accepted definition of sustainable development. Over the years several commentators (see for example, Barbier (1987); Solow (1991); Constanza and Daly (1990); Common and Perrings (1992) and Baumgartner and Quaas (2009)) have explored the sustainable development concept. The definitions in these papers contain elements of the most commonly referred to definition provided in the Brundtland Report.

The Brundtland Report formally developed the idea of sustainable development that has been referred back to over the last two decades. Sustainable development refers to ‘development’ rather than ‘growth’. The reason for this emphasis is the recognition that ‘growth’ is too narrow a concept and can easily be hijacked (as it had in the past and continues to be today) by the orthodox economics discipline and policy makers as well. Focus on ‘development’ is aimed at removing (or at the very least reducing) the primacy of economic considerations as

the sole focus of any debate on future progress socially, environmentally and politically. The term 'development' is considered to be more encompassing of a range of factors (such as the health of the environment) that are traditionally excluded from investigations into growth and progress. In fact, development was considered to be the equivalent of growth (Beder, 1993: 12). The tunnel vision orthodox economists typically have when investigating issues of growth and progress (by ignoring the environment or resorting to the (in)famous assumption of *ceteris paribus* and holding constant the state of the environment) is criticised by Nobel Laureate (2001) Joseph Stiglitz (Stiglitiz, 2006: xv):

> *'The objective of development is to improve and sustain the well-being of those living in developing countries. It is not just to increase GDP. Sustainable increases in living standards require that resources – including all aspects of the environment – be managed well. Resource depletion and environmental degradation are potential threats to sustainable development. Too often, those entrusted with shaping economic policy have put too little attention on the consequences of the policies for natural resources and the environment, and devoted even less attention to shaping policies that might actually improve the quality of the environment and resource management'.*

While Stiglitz is referring to development in developing countries, a similar situation has occurred in the past in developed countries and continues to be present even nowadays. For continued and renewed progress it is useful for researchers and for policy makers to refer back to the Brundtland Report (1987: 40) definition of development:

'Sustainable development seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future'.

It is important that the definition of sustainability be useful not only in a descriptive manner but also as the starting point for effective policy formulation. Within the levels of institutions framework, the definition can be considered as a a combination of a level 1 and level 2 institution. As a level 1 institution it needs to have a certain level of embededness within the entire policy reform process such that the definition becomes the norm. A clearly defined and widely accepted definition can then shape the formulation of appropriate level 2 institutions in the form of the 'rules of the game'. As Solow (1991) notes, the problem with the notion of sustainability is that the definitional ambiguity has hindered policy formulation. Where Solow's (1991) view is more contentious is with the idea that that sustainability imposes a moral obligation, rather than economic obligation, on present generations to ensure resource survival for future generations. The contention is that in the neo-classical tradition morality is quite distinctly isolated from economics. Many neo-classical economists (see elsewhere in this chapter for discussion on this particular issue) acknowledge that human resource consumption behaviour may result in resource exhaustion and degradation but at the same time they do not recognise this as a problem. The notion of sustainability necessarily implies some degree of intergenerational equity and to suggest that humans have a *moral* obligation rather than an economic obligation is only part of the answer. Despite his concerns, Solow (1991: 181) offers a reasonable definition of economic sustainability:

'...it is an obligation to conduct ourselves so that we leave to the future the option or the capacity to be as well off as we are'.

Note that Solow's definition generally concurs with the Brundtland Report definition. Another key commentator to this debate, Herman Daly (see for example, Constanza and Daly, (1992) and Goodland and Daly, (1996)) provides a more precise definition of environmental sustainability – the maintenance of natural capital (Goodland and Daly, 1996). Natural capital is an aggregate (along with natural income) of natural resources – it is the stock which generates a flow (natural income) (Constanza and Daly, 1992). Maintenance of natural capital means that the sum of all natural capital (stock) must be sustained at an appropriate level. The discussion in the rest of this chapter will be based upon these definitions.

In contrast to the definition of economic sustainability, environmental sustainability refers to the notion of ensuring the health (maintenance) of the environment and linking human use of the environment to its health status. This applies to current human use and future human use as well. The connection with current human usage means that humans have a direct incentive in ensuring the health of the environment does not deteriorate in an unsustainable manner.

When analysing environmental problems, the notion of environmental sustainability should act as a constraint on economic sustainability. As Foy (1990) notes, economic sustainability relies on the assumption of efficient inter-temporal allocation of environmental assets. An efficient inter-temporal allocation of environmental assets is an attempt to ensure that future generations are as well off as the current generation. However, this economic-oriented notion of sustainability relies on the designation of monetary benefits derived from the environment. Foy (1990) suggests that rather than simply examining monetary benefits we need to look at minimum levels of environmental assets in *physical* terms. This approach is particularly

suited to water resource management. Water resources provide a host of often explicitly unrecognised benefits that are reliant on the actual physical water resource. For example, Australia's Murray-Darling river system has more than 30,000 wetlands (including 16 internationally significant wetlands) and, at the time of European settlement it was home to 28% of Australia's mammal species, approximately 48% of its bird species and about 19% of reptiles (Department of the Environment, Water, Heritage and the Arts[22], 2010). Since 1900, at least 35 bird species and 20 mammal species have become extinct and a further 16% are listed as endangered (DEWHA, 2010). The biodiversity of the Murray-Darling river system is dependent on the physical amount of water (alongside water quality) – not on how efficiently all components of the ecological system use the water. So, future generations can be as well off as the current generation simply be using less water more efficiently, but, less water will have an adverse impact on the ecological system (through the extinction of more native animal species) and the effect on humans is hard to measure. Therefore, as Foy asserts, it is important to recognise that '...the ecological approach to sustainability should limit the economic approach for decisions involving the allocation of environmental assets' (1990: 771).

Many of the problems with the environment have arisen as a result of myopic tendencies displayed by policy makers and resource users. Over-use of water, air pollution and excessive deforestation are just some of the problems that are the direct consequences of an obsession with economic growth. Commentators (see for example, Stiglitz (2006), Jacobs (2003) and Common (2007)) suggest that the current accounting technique – centring on the calculation

[22] DEWHA.

of a gross domestic product (GDP) or gross national product (GNP) – is not a true representation of a country's progress. Stiglitz (2006: xvii) notes that:

> *'[t]he accounting frameworks used, for instance, for measuring national output do not take into account the depletion of natural resources or the degradation of the environment. Governments are given high marks if GDP goes up, even if the country is actually poorer, as a result of its depletion of its natural resources, and even if, as a result, growth is not sustainable'.*

The isolation of the environment from the economic in official measures is surprising given the fact that '[t]he environment is an essential foundation of economic activity...' (Jacobs, 2009: 209). The 'head in the sand' approach to economic policy making involving the environment and natural resources needs to cease and there is an urgent need for what Stiglitz (2006: xvii) refers to as '...an integrated set of policies'. He states that '[e]nvironmental sustainability requires an integrated set of policies, not just environmental policy' (Stiglitz, 2006: xvii). (Later in this thesis a reframed proposition of the conception of the environment with regards to the economy, society and polity is presented).

5.3 The Orthodox Economics Approach to Natural Resource Management

Direct investigation of economics and natural resource management began in earnest in the 1960s and 1970s – perhaps as a result of the oil shocks and the impact these shocks had on the global economy. The 1960s and 1970s debates on the limits to growth also provided

impetus for research in this area. While the cause of the oil shocks may have primarily been artificial (i.e., the shocks were mainly caused by human intervention in oil supply rather than any specific natural supply constraint) they nevertheless highlighted the (over)dependence of on-going growth of the global economy on natural resources.

A central theme in the orthodox economic approach to environmental resource management is identifying issues such as optimal levels of usage and efficient allocation of scarce resources. The neo-classical approach to water resource management also needs to be understood as part of this general orientation. Both concepts – optimal usage levels and efficient allocation – are recurring in the water management process. For example, determining what the optimal usage level is crucial in the Murray-Darling river system due to its severely degraded state. The concept of 'optimal usage' needs to take into account optimal outcomes for the environment as well as for humans.

One of the first seminal neo-classical economic papers to examine issues such as optimal levels of usage of environmental resources was Harold Hotelling's *'The Economics of Exhaustible Resources'* (1931). In this paper Hotelling presented some ideas about how best to extract the most possible income without exploiting too rapidly, exhaustible resources such as supplies of minerals and forests. The premise for such a paper was *some* concern for the environment but *most* concern for how to benefit economically from (or even at the expense of) the environment. Hotelling (1931) also noted the growing influence of the conservation movement, at the time, in the public policy sphere. He noted that this led to seemingly contradictory policies – '[t]he government of the United States under the present administration has withdrawn oil lands from entry in order to conserve this assets, and has

also taken steps toward prosecuting a group of California oil companies for conspiring to maintain unduly high prices, thus restricting production' (Hotelling, 1931: 138). The seemingly contradictory policy approach (hoarding – by restricting market entry – and placing forceful downward pressure on prices without increasing supply) hints at the tension and conflict of interest between economic objectives and environmental objectives.

These tensions led to the 1970s focus on the role of the environment as an *enabler* of future economic growth and as a *constraint* on future economic growth. (This dual and somewhat contradictory characteristic of the environment continues to be the focus of much debate today as well). Some of the key papers published in the 1970s include Solow (1971), Stiglitz (1974a) and Stiglitz (1974b). While the term 'sustainable development' may not have been in vogue when Hotelling published his paper in 1931 or even when Solow and Stiglitz published theirs in the 1970s, formative notions of the idea can actually be found in these papers. For example, the idea that some thought needs to be given about intergenerational equity is clearly present in Solow (1974) and to a lesser extent in Stiglitz (1974a and b). Solow (1974: 41) claims that:

> *'The finite pool of resources (I have excluded full recycling) should be used up optimally according to the general rules that govern the optimal use of reproducible assets. In particular, earlier generations are entitled to draw upon the pool (optimally of course!) so long as they add (optimally, of course) to the stock of reproducible capital'.*

This is a bold conclusion. It hints at the idea that exploitation of the environment does not constrain economic growth, it in fact enables it. This idea is not unique in the neo-classical tradition and it is also not difficult to find neo-classical literature advocating this particular viewpoint (see for example Grossman and Krueger (1995) and Stokey (1998)). The main problem with the idea is that it suggests that human use of exhaustible resources should not take a conservative trajectory due human ingenuity! Human ingenuity will apparently lead to technological advances such that labour and physical capital will either replace or remove a significant proportion of the burden on natural capital (the environment).

Some commentators (see for example Beckerman cited in Maddox, 1995) question the whole notion of sustainability. Beckerman (1992: 481) states boldly that '[r]esource constraints do not constitute limits to growth...'. Furthermore, a book review entitled *'Sustainable development unsustainable'* (Maddox, 1995) in the respected journal *Nature* essentially criticised longevity in policy formulation dealing with environmental concerns. Maddox (1995: 305) claims that '[n]onrenewable resources would be untouchable unless one generation could persuade itself that its successors will have less need than we have'. He also claims that '[i]t is not a frivolous question to ask how can it be possible with any certainty to know what future needs will be' (Maddox, 1995: 305). While it certainly may not be frivolous to ask such a question, surely the frivolity lies with not erring on the side of caution. Stiglitz (1974a) at the very least acknowledges that the '...inability of the economy to foresee infinitely into the future...' is a problem. While he could not find *conclusive* evidence of policy bias in excessively fast rates of resource exhaustion or excessively slow rates of resource exhaustion, he notes that '...the consequences of the former [excessively fast rates of exhaustion] are, of course, probably far more serious than the latter [excessively slow rates of resource exhaustion brought about by excessively conservative policy approaches] (Stiglitz,

1974b: 151). Stiglitz's conclusion about the environment and economic growth is similar to Solow's (1971). Stiglitz (1974a: 136) claims that:

> *'If one views the simple model presented as a reasonable first approximation, not only is sustained growth in consumption per capita feasible, but the optimal rates of utilization of the resource for reasonable values of the parameters is of the order of magnitude observed for many natural resources. There seems to be no presumption that a situation in which there is "thirty years" reserve of a natural resource is indicative of excessive consumption of the resource'.*

Growth is not, and should not be considered as, primarily a one dimensional concept. The neo-classical tradition has generally treated it as a one dimensional concept. This is why an institutional economics approach is not only better suited but more equipped to provide adequate and appropriate analytical frameworks from which effective policy can be formulated. The dominance of the neo-classical economic approach to environmental resource management is evident when an economist from the Environment Department of the World Bank suggests that sustainability is actually '...an ethical constraint on the classic problem of intertemporal optimization' (Hamilton, 1995: 393). This suggestion highlights the potentially more pervasive problem of attempting to the change the mindset of policy designers and decision makers. It is extraordinary that sustainability (and therefore, by extension, a conservative approach to the management and use of exhaustible resources) can only be considered to be an ethical constraint as opposed to an economic constraint brought about by physical scarcity, degradation or a combination of both.

5.4 A Paradox

An important observation can be taken from orthodox economic literature (and especially from Solow, 1991) on concepts such as sustainability, exhaustible resources and economic growth. If the definition of sustainability is not the one offered by orthodoxy (i.e. one that combines the idea that sustainability needs to integrate *both* a moral and economic obligation for future generations) then we are left with a paradox. By being conservative today, in order to ensure that the welfare of future generations is not compromised, we are essentially making a decision to improve the welfare of future generations at the expense of poor people in the present generation. Solow (1991: 185) states that '[t]here is something inconsistent about people who profess to be terribly concerned about the welfare of future generations but do not seem to be terribly concerned about the welfare of poor people today'.

The paradox can be defined in economic terms – policy adherence to the concept of sustainability requires a decision to be made about savings, investment and consumption (Solow, 1991). By consuming more today we will make today's poor better off and *vice-versa*. Neo-classical economics offers a partial solution to this problem. In order to continue with current rates of resource consumption the rents from the natural resource usage need to be invested in either the resource itself or in new 'backstop technologies' or a combination of both (Solow, 1991). Backstop technologies[23] refer to technological advances that either reduce usage of a particular natural resource or even replace the need to use a particular natural resource. This view of technological progress is also referred to as the 'Cornucopican view' (Pearce and Turner, 1990: 289). Arrow *et al* (1995: 520) disagree with this approach and state that this approach '...has meant that economy-wide policy reforms designed to

[23] The term 'backstop technology' was coined by William Nordhaus and cited in Solow (1992: 162).

promote growth and liberalization have been encouraged with little regard to their environmental consequences, presumably on the assumption that these consequences would either take care of themselves or could be dealt with separately'. Arrow *et al* (1995: 520) go on to note that '...if this base [of global natural resources] were to be irreversibly degraded, economic activity itself could be at risk'.

Another problem with that approach is that the notion of backstop technologies suggests that there is some degree of substitutability. For example, Solow (1974) assumes perfect substitutability between goods provided by natural resources and man-made goods. Technological innovation will lead to replacement or substitution for one good or service for another. Solow's views tend to broadly represent the position of neo-classical economics as Daly (1990: 2) notes that, '[i]n the past the assumption of neoclassical economics has been that manmade capital is a near perfect substitute for natural resources…'. As Gerlagh and van der Zwaan (2002: 331) note, this suggests that '…mankind is allowed to exhaust natural resources such as fossil fuels and minerals – even if the process of exhaustion proves detrimental to the environment – as long as they are usefully replaced by man-made capital'.

However, this argument cannot entirely be used for all environmental resources and particularly water. Water is non-substitutable for both humans and the environment. There are some instances where water as an input into production processes such as agriculture can only be partially substituted, to various degrees, by other inputs such as labour and fertiliser (Cai *et al*, 2008). However, finding ways to reduce water use in particular production processes will only go part of the way in addressing the problems of overuse and degradation.

The presence of the paradox raises an important question – how do policy makers achieve the fine balance between alleviating the plight of the poor today without potentially jeopardising the welfare of future generations? The logical conclusion is that political expediency would result in a more short-sighted approach and this has been the case over the last few decades. The following discussion addresses this question with specific references to water resource management.

5.5 Sustainability, Economic Growth, Water and Time

The economics of exhaustible resources provides the contextual backdrop for the preceding discussion on sustainability and economic growth. Traditionally, water has not been treated as an exhaustible resource. While in the popular media we are constantly bombarded by facts of diminishing oil reserves and mineral deposits, it is only in recent years (particularly in Australia) that a similar view has been taken to water resources. Reports on dam levels in NSW are now common. Despite this heightened level of awareness, water is still being treated as a renewable resource. Natural water cycles will continue and water resources will continue to be replenished during rain periods. However, decades of mismanagement alongside increasing climatic variability raise some doubts about the 'renewable' label. Decades of over-allocation in the Murray-Darling Basin without sufficient regard for environmental concerns have resulted in such a level of degradation that the label 'exhaustible resource' would be a more appropriate term and led to a situation where the number of entitlements issued exceeded the available supply (Bennett, 2008). This meant that seasonal water almost always were a fraction of what was actually entitled (Bennett, 2008).

The two different labels can actually be linked on an intertemporal basis. This would mean any analysis with an economic element of the water resources in the Murray-Darling Basin could be framed with two time periods in mind. In the short to medium term the water resources in the Murray-Darling Basin should be treated as exhaustible (finite) resources and in the long term, if appropriate short to medium term measures have been put in place, the water resources could be treated as renewable. Introducing a time element into the analysis is useful as it allows for policies to be designed and implemented with some level of intergenerational equity. The time element also complements the integration of a sense of economic obligation to future generations in addition to any polices designed specifically to assuage any moral obligations that policy makers may feel are unavoidable (be it for political reasons or a sense of genuine moral sincerity). Furthermore, the time element is important as we move beyond orthodox analysis of natural resources towards an institutional economics approach. The importance of a dynamic analytical framework and the advantages it has over a static analytical framework has been continuously reiterated in this thesis.

5.6 Water Resources in the Murray-Darling Basin: Malthusian Scarcity or Ricardian Scarcity?

The final section of this chapter examines different types of scarcity and how they could be applied to the Murray-Darling Basin case. This is important from an institutional economics perspective, particularly when using the levels of institutions framework as it sets the scene for developing appropriate level 3 and level 4 institutions. How environmental resources are governed can only be determined once the physical constraints (scarcity) are clearly defined.

Typically in environmental economics literature two types of scarcity are identified: absolute (or physical) scarcity and relative scarcity. Absolute scarcity is referred to as Malthusian scarcity and relative scarcity is referred to as Ricardian scarcity. The definitions provided in Barbier (1989) are useful and are provided below.

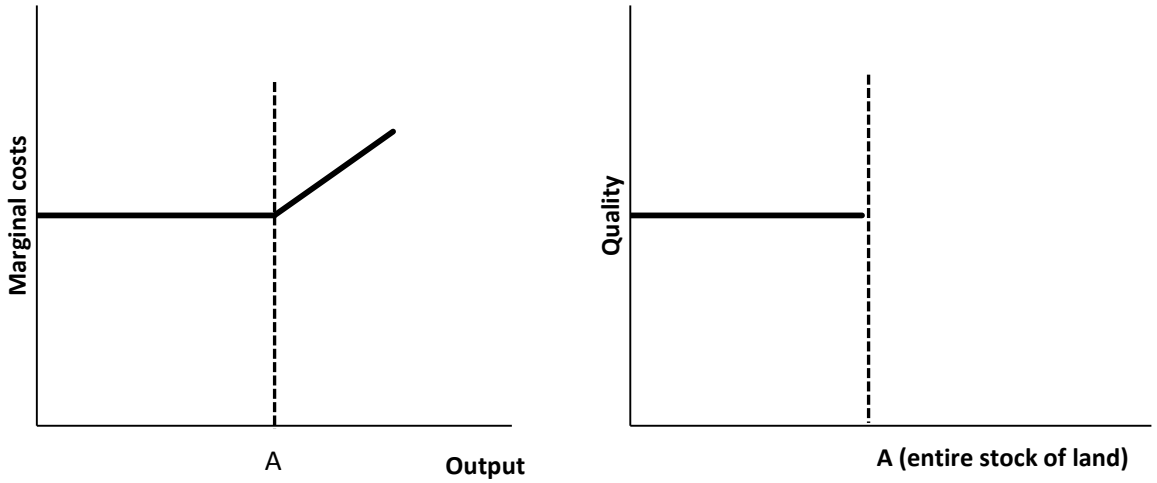
Malthusian scarcity: *'...may occur if an economic activity or a whole system of economic activities depends upon an essential natural resource that has a finite limit on its physical availability...the crucial factor in absolute natural-resource scarcity is the possibility of physical environmental limits on the economic processes of production and the consumption of goods and services'* (Barbier, 1989: x).

Ricardian scarcity: *'...[is at] the heart of modern neo-classical economic analysis...[t]hus a situation of relative scarcity always exists because resources are "limited" with respect to human wants, and human wants are "unlimited" in relation to resources'* (Barbier, 1989: x).

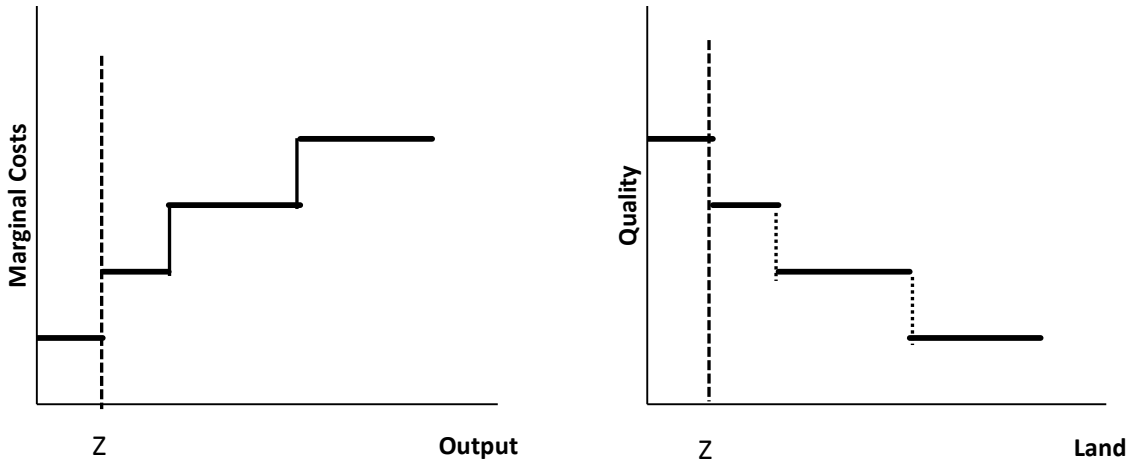
Barbier (1989: xi) goes on to note that '[r]elative natural-resource scarcity would occur, therefore, if a resource essential to economic activities was used increasingly so that it became scarce relative to demand'. The concepts of Malthusian and Ricardian scarcity are graphically presented in figure 5.1 below.

Figure 5.1 – Comparing Malthusian and Ricardian Views of Scarcity

Panel A – Malthusian Scarcity



Panel B – Ricardian Scarcity



Source: Adapted from Barbier (1989: 3)

In panel A we can see that the costs of a particular resource that exhibits Malthusian scarcity only increase once the physical quantity supplied has reached its maximum upper limit (A). In panel B costs begin to rise after the quantity of the resource that is of the highest quality (Z) has been depleted.

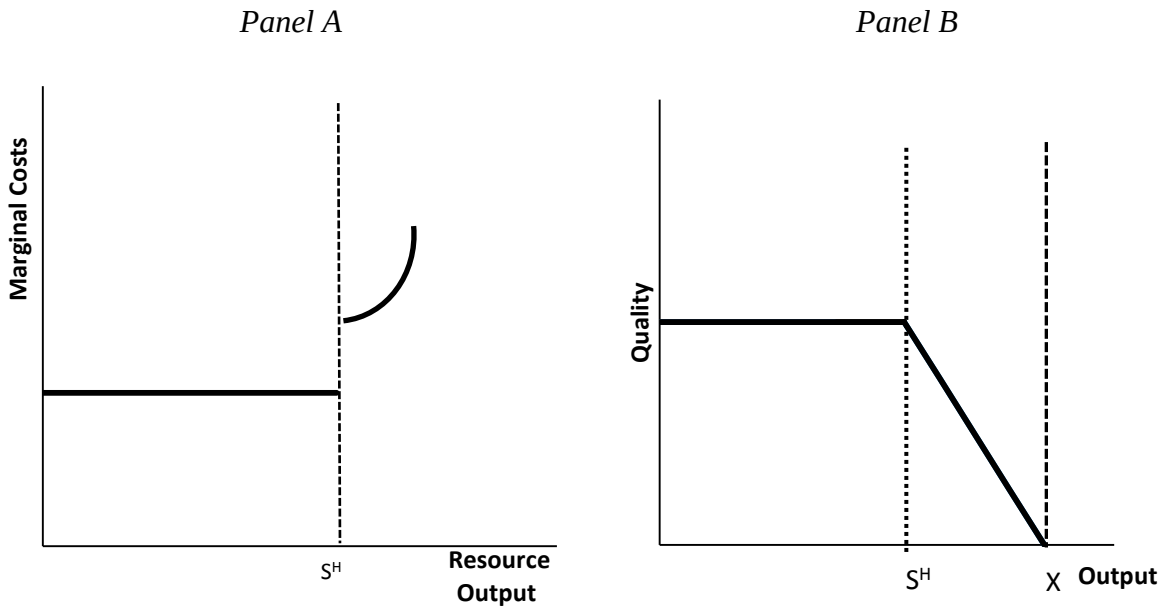
The previous discussion about exploitation of exhaustible resources can also be framed in terms of this distinction. Malthusian scarcity has usually been associated with non-renewable (exhaustible) resources, but there is evidence to support the idea of Malthusian scarcity being linked to renewable resources (Barbier, 1989: xii). This is especially the case when the rate of depletion (of a renewable resource) exceeds the rate of regeneration (Barbier, 1989: xii). Once the rate of depletion exceeds the rate of regeneration then the concept of Ricardian scarcity will not provide the most useful policy recommendations.

Both concepts have potential relevance in the case of the Murray-Darling Basin. Ricardian scarcity is relevant as over-allocation and climate change reduce the quantity of water resources the quality of the resources also begins to be adversely affected. The lack of run-off from upstream states (NSW and Queensland) into the South Australian water resources has resulted in a large increase in salinity levels – thus affecting the quality of water. Malthusian scarcity is also relevant if we treat the water resources in the Murray-Darling Basin as finite (at least in the short to medium term). This would not be inappropriate especially nowadays with the Murray-Darling Basin under severe strain. A limitation of Malthusian scarcity is the homogeneity of quality assumption. We can circumvent this limitation by defining the resource being used as consistent with a sustainable level of human usage. Let us call this level S^H. Usage exceeding S^H results in a deterioration of quality and will deplete the total physical quantity of the resource available.

The cost (price) structure follows the original Malthusian tradition – roughly stable costs for usage represented by O - S^H in figure 4.2 (panel A). Costs then increase (as in the original Malthusian model) after S^H has been breached. However, the cost function is not continuous

as in the original model, instead, it is a discontinuous function and costs jump to a significantly higher level once the sustainable level of usage has been breached. The function also grows exponentially once the sustainable level has been breached – representing the fact that costs rise rapidly once usage exceeds sustainable levels. In panel B of figure 4.2 we can also see that the quality of the water resources in the Murray-Darling Basin will fall once usage exceeds sustainable levels. This is represented by the downward sloping curve from S^H to X. At point X the stock of resources is exhausted.

Figure 5.2 – Model 1



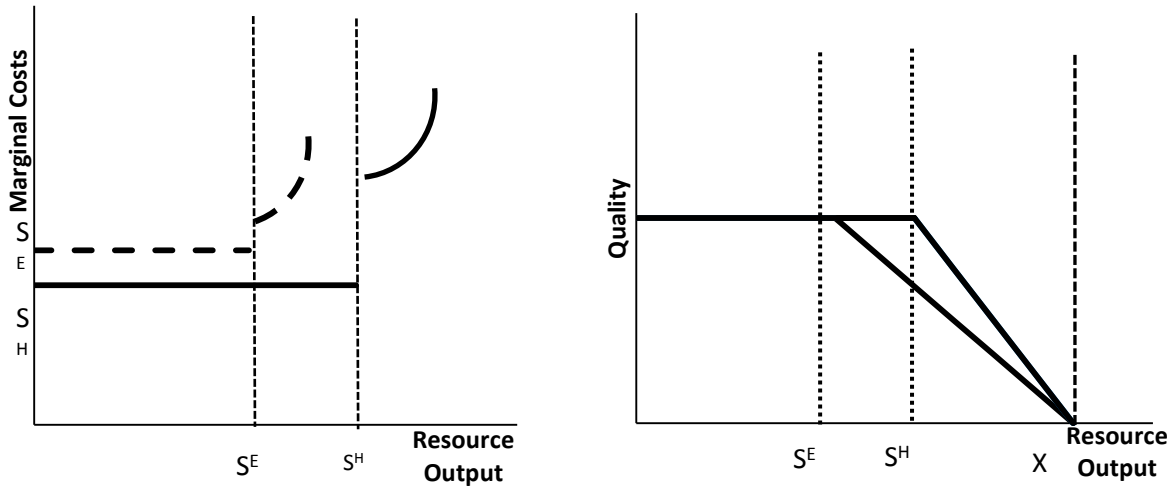
We can actually improve the model presented above (henceforth referred to as Model 1) by not neglecting 'the environment' as a legitimate stakeholder (the physical environment could be viewed as a proxy for the interests of future generations). Model 1 defined sustainable usage levels based on only human consumption of water resources. In Model 2, environmental considerations are incorporated and this adjusts the point at which usage is considered sustainable. The new sustainable limit (S^E) will be located such that the following condition is satisfied:

$$S^E < S^H$$

This means that the new sustainable limit will be at a point less that the sustainable limit with human consumption only. In order to account for the higher standard set for the sustainability level the marginal cost curve is higher from O – SO^E. Once the sustainable usage level has been breached the cost curve follows an exponential path. As with Model 1, the cost curves are discontinuous.

Figure 5.3 – Model 2

Panel A *Panel B*



The discussion above and the formulation of a model to frame analysis of water resources in the Murray-Darling Basin becomes even more useful once combined with a model for effective water governance. An effective water governance model is developed in chapter nine. Both that chapter and the present contribute to the literature on alternative approaches to water resource management by including a variety of factors (of which the environment is most important). Once again the usefulness of an institutional economics approach to water resource management is highlighted. Rather than relying on a sustainable usage limit defined by mathematical derivations (as presented in Hotelling (1931) and Solow (1974)), sustainable

limits are defined by recommendations from the environmental science field – a recognition of the eclectic nature of institutional economic approaches.

5.7 Conclusion

Defining the notion of 'sustainable' sets the scene for analysing the tension that exists between economics and the environment. As this chapter has shown, neo-classical economics, in the tradition of Hotelling (1931), Solow (1974), Stiglitz (1974a and b), Grossman and Kreuger (1995) and Stokey (1998), often neglects the most obvious tension between economics and the environment – that the state of the environment limits growth.

The orthodox perspective is referred to as the 'Cornucopian view' and is based upon a foundational assumption that technological innovation will replace any natural resource that has been exhausted through human usage. As a result, according to the neo-classical tradition, there is no *economic* obligation to ensure a resource is available in sufficient quality and quantity for future generations to benefit from. At most there is only a moral obligation. The view taken in this chapter is that the neo-classical economic outlook does not provide appropriate policy advice as it treats the relationship between the environment and economic progress as a zero-sum game. Neo-classical economics suggests that economic growth is *not* constrained by natural resources due to the development of backstop technologies. This chapter has highlighted the fallacy of such an argument and proposes that the environment does actually create a constraint on economic growth. It also posits that the state of the environment is inclusive of both quality and quantity and that temporal considerations are crucial in dealing with environmental concerns.

The water resources in the Murray-Darling Basin used by the Australian economy provide a concrete case where the environment is a constraint on economic growth. The current state of the water resources in the Murray-Darling Basin warrants it being treated as an exhaustible resource (especially in the short to medium term). By treating the water resources in the Murray-Darling Basin as exhaustible resources a model incorporating the concepts of Malthusian and Ricardian scarcity is developed. This model provides a useful framework for designing policy for managing water resources in the Murray-Darling Basin.

The issue of scarce natural resources leads to a discussion about appropriate methods for valuing the resources. Chapter 6 examines existing approaches to natural resource valuation and identifies potential improvements that could be applied to water resource management policy.

Chapter 6 – Valuing and Conserving Common Resources

6.1 Introduction

In the preceding chapter, the economic and environmental approaches to sustainability was explored. Neo-classical economic definitions of sustainability referred to the need to ensure that future generations are as well off (in a monetary sense) as the current generation. This definition implies that valuation of environmental resources is straightforward. In order to ensure the well-being of future generations we must be able to place a value on environmental resources today. The process of valuation is linked to the issue of scarcity which was also discussed in the previous chapter. In the economics discipline, increasing levels of scarce resources leads to an increase in the value of the available resources. As such, it is important to gain an understanding of the commonly used methods of valuation.

This chapter outlines some of the traditional approaches to analysing water valuation. It focuses on the much cited 'tragedy of the commons' and discusses at some length how it can be interpreted. The solutions proposed from the tragedy of the commons approach to environmental resource management are particularly relevant to the debate about management of the Murray-Darling Basin. An institutional economics approach, incorporating the work of Nobel Laureate (2009) Elinor Ostrom, highlights the problems with the tragedy of the commons approach. Turning to water valuation specifically, this chapter also highlights the superficial attractiveness of the traditional economic approach to water policy and the occasional usefulness as well. The discussion in this chapter forms the foundations for suggestions presented in the following chapter.

6.2 The Tragedy of the Commons – a Brief History

Historically, water resources around the world have been viewed as common resources. However, in recent years, water resource managers are realising that water is an unique resource that cannot entirely be viewed as common nor entirely a private resource. The reason for this complexity is that unlike most resources, the way water is used and the amount that is used in one particular location has immediate consequences for the quality and quantity of water in another, but, connected location (for example, downstream). With other resources, such as a patch of grazing land, the close inter-connectedness is not present. For example, if a patch of land is rendered useless by over-grazing the land immediately surrounding the patch is not necessarily affected as well. Berkes *et al* (1989: 91) refer to this problem as 'subtractability' – where '…each user [of a resource] is capable of subtracting from the welfare of others'.

An analysis of the tragedy of the commons is useful in understanding the weakness of treating water as an entirely common resource. The discussion then turns to identifying how the tragedy of the commons scenario can be modified and applied to the some of the problems facing the Murray-Darling Basin. The modifications can potentially be used by policy makers to address issues such as how to best allocate water to different users.

The tragedy of the commons problem was originally formalised to define the degradation of the 'commons' in the 17th, 18th and 19th centuries in England. The commons referred to arable land that was used as pastured land by the nearby populace. Nowadays usage of the 'commons' tends to refer to resources over which clear ownership is difficult to delegate.

According to the orthodox interpretation the 'tragedy' occurs as a result of a perceived lack of incentive to maintain the quality and quantity of the commons with a view towards long term sustainable usage (which necessarily entails an acknowledgement that the resource is finite in the short term and only infinite in the long term if measures are taken to ensure the resource can renew itself). The lack of incentive leads to over-use and therefore degradation.

The most commonly referred to adaptation of the tragedy of the commons problem is in Hardin (1968). It is worth quoting at length Hardin's (1968: 1244) characterisation of the tragedy of the commons:

> *'The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy'.*

In order to maximise gain each herdsman would like to ideally add more cattle to his herd (cattle being the source of his income) and this would consequently mean more cattle grazing on the common land (Hardin, 1968: 1244). The reason for this, Hardin claims, is that in order to maximise utility the herdsman needs to take into account two components of his utility function:

- ‘The positive component...from the sale of the additional animal’ (Hardin, 1968: 1244).
- ‘The negative component...[caused by] the additional overgrazing created by one more animal’ (Hardin, 1968: 1244).

Since the negative utility from overgrazing is shared by the other herdsmen as well, Hardin claims that the negative utility will be less than the positive utility. The difference between the negative utility and the positive utility means that ‘[a]s a rational being, each herdsman seeks to maximise his gain...the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd’ (Hardin, 1968: 1244). This course of action (the attempt by the herdsman to maximise gain) leads Hardin (1968: 1244) to conclude that:

‘Therein lies the tragedy. Each man is locked into a system that compels him to increase his herd without limit – in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in freedom of the commons. Freedom in a commons brings ruin to all’.

6.3 The Modern Adaptation

As noted by Feeny *et al* (1990: 2), Hardin’s conceptualisation of the tragedy of the commons has been adopted by many disciplines including neo-classical economics. According to orthodox literature the ‘tragedy of the commons’ problem relates to a resource (the most common example being generically referred to as ‘the environment’) and the relative overuse of the particular resource. The problem here is that the resource is overused relative to the

joint optimum – the optimum allocation when the resource is being used jointly. The relative optimum would be where everybody is better off not by increasing their use of the resource but by actually decreasing their use of the resource. There is an element of both inter-generational and intra-generational equity here. Overuse of a resource not only adversely impacts the current generation of users (through the degradation of resource quality) but also reduces the availability and quality of the resource for future generations of users. The tragedy of the commons can be modelled using a game theory framework[24].

The Nash Equilibrium (NE)[25] of the game occurs where everyone overuses the resource. The 'tragedy of the commons' scenario presents a case when the NE is *not* the optimal solution. In this scenario, the NE results in each individual using a resource without taking into consideration usage by other individuals. If individuals *do* take into account usage other than their own then they consume an amount *less* than the amount consumed when not taking into account other users.

The tragedy of the commons scenario highlights the necessity of having well defined institutional arrangements concerning water resources. Young notes that '[i]n many parts of the world, water has been plentiful enough to be regarded as a free good and until recently institutional arrangements for managing water scarcity have not been of serious concern' (Young, 2002: 24). For example, there needs to be a clear definition of 'users' of water

[24] Appendix A provides detailed derivations of the tragedy of the commons problem. It provides a formal mathematical justification for the assertion made in this chapter that open-access natural resources tend to be overused *relative* to optimum amount if other users are taken into consideration.

[25] A Nash equilibrium has the property that no player benefits from changing their strategy when playing with a particular set of strategies.

resources along with well defined water property rights. It is surprising that the fact that the 'environment' is a legitimate user was only formally codified in 1994 in Australia (COAG, 1994). The tragedy of the commons problem suggests the number of users needs to be clearly established. This will allow optimal usage amounts to be calculated. Water data collection agencies will need to play an important role in calculating the total amount of water available for sustainable use and so formal arrangements will need to be made concerning the sharing of crucial information between agencies in different states.

6.4 Extending the Tragedy of the Commons to Water Resources

The orthodox interpretation of the tragedy of the commons scenario can (with little deviation) be applied to water resources. Overuse is a significant problem in Australia and the over-allocation of water is also a matter for significant concern. The tragedy of the commons could be used to model optimal use of water in order to prevent over-allocation. For example, in accordance with the Council of Australian Governments (COAG) guidelines, one of the users of water could be the 'environment' and based on scientific information of environment water usage, policy makers could establish more sustainable water allocations. For example, suppose that each year there is K amount of water available for use. We could assign an environment usage allocation and a general usage allocation. The environment usage allocation would be the amount of water required to ensure the health of the ecological system dependent on, for example, the Murray-Darling river system. The general usage allocation represents usage by humans. Now suppose that E is a certain percentage of K and that it represents the environment usage allocation. The general allocation is calculated *after*

E has been calculated and is therefore, equal to: (1-E)*K[26]. α is divided amongst all human users. In the previous section it was noted that when all users are taken into consideration (let this be case 2), the optimal level of usage by each individual is less than when all users are not taken into consideration (case 1). In the current scenario (case 3), where the environment is a legitimate resource user and where a certain percentage (E) has been explicitly set aside for its consumption, the optimal level of usage by each individual is less than usage in cases 1 and 2.

This scheme would ensure a safety-net for environmental usage. The reason behind not explicitly providing a value for E is due to the fact supply of water is variable. The determination of E would therefore depend on the climatic conditions (during periods of shortage E would be high and during periods of above average supply E could be lower).

One consequence of the degradation and depletion of Australia's water resources is that in some cases E could be greater than 1 (E >1). This point is significant, (not only because the algebra above is incorrect if that is indeed the case!) as it would require an adjustment of the value 1. This value would have to be representative of an *appropriate* and *scientifically* chosen historical value. The reason for the emphasis on 'appropriate' and 'scientific' is that with the current uncertainty over future climate patterns it would be inappropriate to choose an historical value which does not relate to potential climatic conditions in the future. The adjustment of 1 does not necessarily also lead to an adjustment of K as well. It is crucial that

[26] For ease of exposition, (1 – E)*K will be referred to as α.

K be calculated according to recent information otherwise we run the risk of solving circular equations devoid of useful insights for policy making.

6.5 The Myth of the Tragedy of the Commons

While the sections above provide a simple adaptation of the tragedy of the commons problem to the water resources in Australia, there are several commentators (see for example Ostrom, 1990, Ostrom 1997, Berkes *et al*, 1989, Bromely and Cernea, 1989; Appell, 1993; Dietz *et al*, 2003 and Angus, 2008) who suggest that Hardin's (1968) analytical framework is illogical and incorrect. This section explores some of the main criticisms.

The first question to be posed is "were the commons really common?" Some commentators (see for example, Humphries, 1990, Shaw-Taylor, 2001 and Clark *et al*, 2001) have noted that the use of the word 'common' perhaps did not have the same interpretation we have today, namely, that common land is land for which there is open access for all users. Between the 15th century and 19th century, agricultural land in England that was referred to as 'common' was defined as:

1. '...open-field arable and meadow that were common for only part of the year...' (Clark *et al*, 2001: 1009).

2. '... "stinted" (limited-access) pastures...' (Clark *et al*, 2001: 1009).

3. Common waste.

Most villages also had land that was enclosed in the sense that it was '...land free of common right' (Shaw-Taylor, 2001: 642). This type of land would have the closest resemblance to the

notion of private land today. According to Cox (1985), over the years, the tragedy of the commons scenario has become subject to *Tonypandy*[27]. Whilst Cox acknowledges that the tragedy of the commons may occur, she asserts that '...that it regularly occurred on the common lands of medieval and post-medieval England is [*not*][28] true' (Cox, 1985: 50). Cox actually suggests that agricultural land classified as 'common' can actually be decomposed into two categories (essentially Cox's classification is a simplified version of the categorisation presented above) (1985: 54):

- Common appendant.
- Common appurtenant.

According to Cox '[c]ommon appendant is the right of villagers who owned their own land with the manor to feed their animals used in agriculture upon the lord's "waste", i.e., that land within the borders of the lord's domain that was not under cultivation' (1985: 54). Animals could graze upon these lands in the seasons when food crops were not being grown. 'Common appurtenant in contrast, originated either from a grant by the lord to a villager or by "peaceful, uninterrupted and known usage". It could be granted to both tenants of the manor and to outsiders...' (Cox, 1985: 54). Based on this knowledge Cox comes to the conclusion that:

'[t]he English common was not available to the general public but was only available to certain individuals who owned or were granted the right to use it. Use of the common even by these people was not unregulated' (Cox, 1985: 55).

[27] Tonypandy refers to a '...situation which occurs when a historical event is reported and memorialized inaccurately but consistent until the resulting fiction is believed to be truth' (Cox, 1985: 49).
[28] Emphasis added.

It is clear that Hardin's usage of the word 'commons' can only be loosely linked to what was referred to as 'common waste'. However, as noted above, even common waste land was essentially land owned by someone. Berkes *et al* (1989) and Ostrom (1997) suggest that Hardin's conceptualisation of the tragedy of the commons problem fails to disentangle common property from open access and that Hardin's characterisation of the problem was more applicable to a tragedy of open access. Open access problems occur when there is a high exclusion cost and is present in many common-resource related problems. Ostrom *et al* (2003) assert that the problem with Hardin's work was his confusion between common property and open access. They do not disagree with general observation that open access leads to inefficient outcomes but argue that Hardin's work has been incorrectly interpreted to include common resources.

Common waste land was also regulated. The issue of communal regulation of common resources has been well documented in Ostrom (1990; 1997 and 1999) and in Berkes *et al* (1989). Ostrom (see for example, Ostrom 1990; 1997 and 1999) illustrates several cases where local governance of common resources actually works well. Effective management of common resources at a local level is also highlighted in Berkes *et al* (1989) who provides examples where wildlife hunters in James Bay (Canada) were able to hunt in a sustainable manner governed by locally derived institutional arrangements.

Making assertions similar to Ostrom and Berkes *et al* about communal regulation, Cox notes that '[t]he earliest records for communal farming regulations are [from] the...mid-thirteenth century' (Cox, 1985: 55). In fact, regulation was quite diverse and complex – issues regulated include access to the land for outsiders, cropping, fencing and how much fieldworkers were

to be paid (Cox, 1985: 56). Hardin's usage of 'commons' does not encompass such issues. The modern interpretation instead refers to land over which there is no clear ownership and therefore regulations covering issues of maintenance and appropriate usage are also lacking. Angus notes that Hardin ignored the fact that '...self-regulation by the communities involved [could occur]' (Angus, 2008). The practice of self-regulating was referred to as 'stinting' (Angus, 2008) and this involved establishing regulation which created limits '...for the number of cows, pigs, sheep, and other livestock that each commoner could graze on the common pasture. Such 'stints' protected the land from overuse...' (Angus, 2008). In fact, according to Angus the '...only significant cases of overstocking found by the leading modern expert on the English Commons involved wealthy landowners who deliberately put too many animals onto the pasture in order to weaken their much poorer neighbours' position...' (Neeson, 1993 cited in Angus, 2008).

While there may have been a decline in the quality of the commons approximately at the same time as the enclosure movement gained traction, there are other reasons that need to be taken in to account – such as the increased levels of productivity in agricultural industries (Cox, 1985: 59). Furthermore, common waste was not the best land available – usually it was reclaimed marsh or forest land (Cox, 1985: 59). Increased productivity on poor quality land led to faster depletion and degradation rates. Cox suggests that presence of such facts mean that one cannot come to the conclusion that it was the commons arrangement that was to blame for (if any) degradation of land (Cox, 1985).

The fundamental assumption behind Hardin's (1968) work is that property rights and privatisation of common land can help alleviate degradation problems. This is based on the

simple claim (typically put forward by proponents of orthodoxy) that private ownership creates incentives for owners to ensure the value of their assets. This would entail undertaking necessary measures for longer-term sustainability as opposed to shorter-term gains (obtained through, for example, increasing the size of stock for some years). While this proposition does have its merits, it is important to note that there was little evidence of deterioration in the commons prior to the beginning of the enclosure movement. Angus notes that '...a community that shares fields and forests has a strong incentive to protect them to the best of its ability, even if that means not maximising current production, because those resources will be essential to the community's survival to come' (Angus, 2008). There is a distinct pessimistic undertone in Hardin (1968) - '...freedom in a commons brings ruin to all' (Hardin, 1968: 1244). It seems little scope is given for some sort of altruism to play a role! Cox goes as far as suggesting that rather than a 'tragedy of the commons' what existed in the commons in England was actually a 'triumph' of the commons! (Cox, 1985: 60) and Berkes *et al* (1989) refer to successful examples of local level governance of common-resources as the 'benefits of the commons'.

6.6 More Lessons from the 'Tragedy of the Commons' Problem

Notwithstanding these different views on 'correct' and 'incorrect' usage and definition of the word 'commons', the broad tragedy of the commons framework has obvious relevance to Australian water resources. Water resources (especially in the Murray-Darling Basin) cannot be defined as a *purely* common resource as there are institutional arrangements in place (ranging from riparian rights to full property rights). In some cases these arrangements may be quite inadequate but the skeletal framework is at least present. The problem of the Murray-Darling Basin – indeed of Australian water resources in general – is, instead, that water

resources have been treated (and in some cases are still being treated as) as common (a modern interpretation of the definition is adopted here). That means water users have been doing the equivalent of overgrazing – overusing. In addition, overuse is being aided by a water allocation system that does not properly take into account the environment as legitimate stakeholder – over-allocation is the single most significant problem facing the Murray-Darling Basin. So, while the actual resource cannot be defined as common, the usage patterns of the resource indicate that it is being treated as common. A corollary of this conclusion is that the popular solutions (for example establishment of governmental control or another regulatory body, establishment of well-defined property rights and perhaps even the development of markets[29]) to the tragedy of the commons problem can perhaps be applied to water resources as well.

However, it should be acknowledged that only select solutions offered by traditional analyses can be applied to the Murray-Darling Basin. For example, in section 6.4 a generic tragedy of the commons framework was adapted for the Murray-Darling Basin. This was used to provide a simple illustration of an alternative allocation arrangement where the environment is central. The discussion about a significant body of scholarship that critiques the traditional Hardin conceptualisation of the tragedy of the commons problems provides examples about the various governance arrangements that have been successfully been used to manage common resources. Through an institutional economics lens, Ostrom (1997) lists the conditions under which self-governing/localised governance institutions can form and be successful (Table 6.1). These conditions can be split into 'resource attributes' and

[29] The creation of markets would presumably create some sort of incentive to develop sustainable usage patterns with an eye to long-term gains.

'appropriator[30] attributes'. Resource attributes refer to those attributes that are conducive to an increased likelihood of the formation of self-governance. Likewise for appropriator attributes. Ostrom (1997) identifies four resource attributes and seven appropriator attributes that need to be present for there to be an increased likelihood of the formation of self-governing institutions.

Table 6.1 – Attributes conducive to self-governance common-pool resources

	Resource Attributes (LHS)	Appropriator Attributes (RHS)	
R1	**Feasible improvement**: Resource conditions are not at a point of deterioration such that it is useless to organize or so underutilized that little advantage results from organizing.	**Salience**: Appropriators are dependent on the resource system for a major portion of their livelihood.	**A1**
R2	**Indicators**: Reliable and valid indicators of the condition of the resource system are frequently available at a relatively low cost.	**Common understanding**: Appropriators have a shared image of how the resource system operates (attributes R1, 2, 3, and 4) and how their actions affect each other and the resource system.	**A2**
R3	**Predictability**: The flow of resource units is relatively predictable.	**Discount rate**: Appropriators use a sufficiently low discount rate in relation to future benefits to be achieved from the resource.	**A3**
R4	**Spatial extent**: The resource system is sufficiently small, given the transportation and communication technology in use, that appropriators can develop accurate knowledge of external boundaries and internal microenvironments.	**Distribution of interests**: Appropriators with higher economic and political assets are similarly affected by a lack of coordinated patterns of appropriation and use.	**A4**
		Norms of trust, reciprocity, and punishment: Appropriators trust one another to keep promises and related to one another with reciprocity.	**A5**
		Autonomy: Appropriators are able to determine access and harvesting rules without external authorities countermanding them.	**A6**
		Prior organizational experience: Appropriators have learned at least minimal skills of organization through participation in other local associations or learning about ways that neighbouring groups have organized.	**A7**

Source: Adapted from Ostrom 1997: 8.

For example, Ostrom's framework suggests that for self-governance to work the resource system must be sufficiently small (R4), the flow of resource units is relatively predictable (R3) and from the appropriator perspective there must be a common understanding of the

[30] Appropriators are those who withdraw resource units (e.g., water, fish, trees etc) from a resource system (Ostrom, 1990: 30).

resource units (A2) and an ability trust one another (A5). While all of the conditions in Ostrom's framework do not guarantee successful formation of self-governance institutions they increase the likelihood of development.

Applying this analytical framework to the Murray-Darling Basin (Table 6.2) suggests that while an exact appropriation of Hardin's simple generalisation solution to the common-resource problems is problematic, the key lesson of developing an alternative allocation strategy holds, but calls for private ownership as a means to solve problems is too simplistic. Ostrom's significantly more complex analytical framework suggests that in the Murray-Darling Basin case, the conditions for the development of self-governing institutions may not entirely be present and that alternative arrangements need to be explored.

For example, the Murray-Darling Basin is a vast and unpredictable resource system over which there is no clear common understanding and significant distrust amongst appropriators (particularly upstream and downstream appropriators and inter-state appropriators). Moreover, the Murray-Darling Basin covers several jurisdictional boundaries and is, in certain river valleys (see discussion in chapter 3), in a severely degraded health.

Table 6.2 – Ostrom's 'conducive attributes' and the Murray-Darling Basin

	Resource Attributes (LHS)	Appropriator Attributes (RHS)	
R1	✔ / ✗	✔	A1
R2	✔ / ✗	✗	A2
R3	✗	✔ / ✗	A3
R4	✗	✔ / ✗	A4
		✗	A5
		✗	A6
		✔ / ✗	A7

The key lesson from Ostrom's work is that there is no single solution to the problems facing the Murray-Darling Basin. Similarly, solutions derived from Hardin's original work can be successful in certain situations and in other situations, alternative solutions can be found (Ostrom, 1990). It is more important to learn from a particular set of institutions and then adapt (or develop new) these to other problems that on the surface may appear the same but actually are different when viewed from a micro level.

6.7 Resource Valuation

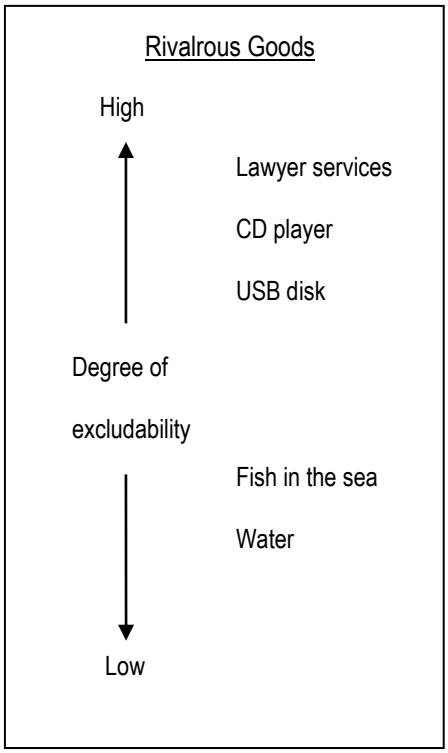
In line with sequence suggested by the levels of institutions analytical framework, this section turns from consideration of level 2 (property rights) and level 3 institutions (governance/regulation) that arise from the 'tragedy of the commons' problem to level 4 institutions and specifically some of the traditional approaches for determining the economic value of water. Economic valuation of water needs specific consideration since water has some unique characteristics that distinguish it from other natural resources. Drawing on Young's (2002) categorical framework, six distinguishing features of water can be specified as follows.

Hydrologic and Physical Attributes of Water

Water is a mobile resource and this poses particular challenges for measurement (Young, 2002: 4). Due to mobility, water has a high exclusion cost which in turn creates problems for defining and enforcing property rights. Water can also to some extent be considered a rivalrous good – a good whose consumption by someone precludes its consumption by

someone else. Rivalrous goods can be categorised with regards to the level of excludability. Figure 6.1[31] provides an example of where water would fit in a scale of excludability.

Figure 6.1 – Water as a rivalrous good



Since water has a low degree of excludability, it has high exclusion costs. We can link the tragedy of the commons problem with the fact that water is a rivalrous good with a low degree of excludability. Goods that experience the tragedy of the commons problem are generally rivalrous and have low excludability (Jones, 2002: 82). Because water can be considered a rivalrous good it cannot theoretically be considered to be wholly a public good. Public goods are characterised by 3 conditions (Bannock, 1998: 339):

1. public goods are non-rivalrous;

2. public goods are non-excludable;

[31] Source: An altered version of figure 4.1 in Jones (2002).

3. public goods are non-rejectable.

Water resources definitely do not satisfy the first condition. However, the second and third conditions do hold to some extent. Water has a low degree of excludability and to an extent can also be considered non-rejectable (as humans cannot survive without water). Bannock *et al* (1998: 339) suggest that some goods may exhibit both public and private good characteristics. Water would be placed in this category.

Variable Supply

Basic water supplies are highly variable and can be unpredictable. Supply can tend to be outside the bounds of human control which can create difficulties in measuring and valuing water resources (Young, 2002: 4). Supply is a crucial factor when devising water policy. To account for variable supply it was suggested earlier that policy makers could determine a value for E (the amount of water allocated to environment usage).

Interdependency among users

The use of water by upstream users will have an impact on the quantity and quality of water available for downstream users. Interdependency results in externalities. For example wasteful useful use of water will have degrading spill-over effects on the environment (Young, 2002: 4).

'One size does not fit all'

Water related problems are location specific and therefore policy needs to be adapted to local conditions (Young, 2002: 5). This point is especially pertinent in Australia's case as there are many drought declared areas alongside non-drought declared areas where water resources obviously need to be managed in a different manner.

Natural Monopoly Characteristics

Young notes that water supply facilities tend to experience economies of scale. This means that supply of water is usually facilitated best by public utilities due to a preference for public natural monopolies as opposed to private natural monopolies (Young, 2002: 6). This is an interesting point considering the recent trend towards significantly more private involvement in all facets of the water industry.

Water Culture

'Water culture' is a unique characteristic which is not taken into account by neo-classical models. As mentioned earlier, water culture plays a significant role in water usage and therefore water management. The impact of ethnicity and religious views are also important factors concerning water usage (see for example Smith and Ali, 2006) and this fact is only recently being realised by researchers and water management authorities (Smith and Ali, 2006: 203). This can potentially be problematic as it is difficult to envisage how or even whether policy makers need to address this particular issue. Smith and Ali note that '…the idea that ethnic background and religion may both form a fundamental basis for water consumption norms and practices is largely overlooked' (Smith and Ali, 2006: 203).

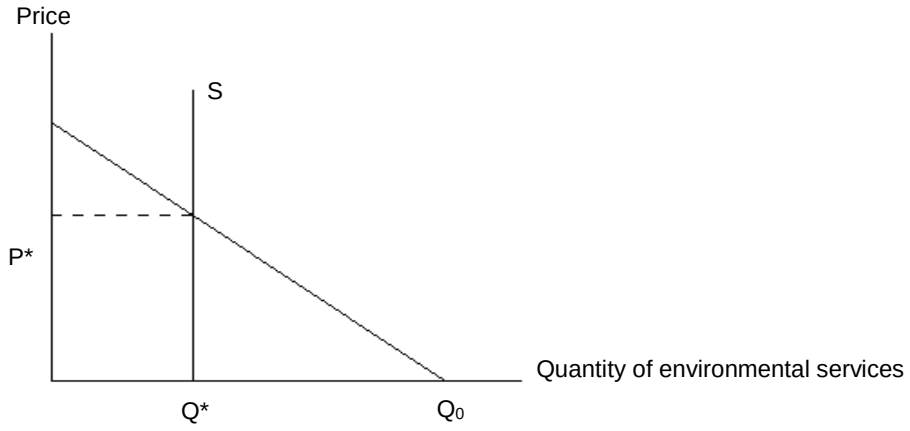
6.8 Methods of Evaluation

The unique characteristics of water, outlined above, mean that there are several competing methods of evaluating water resources and management practices. Identifying economic values for water resources is generally considered to be problematic due to the fact that non-rivalrous goods tend to be difficult to value. The main reason for this is that '…economic valuation is based firmly upon human preferences' (Tietenberg, 2006: 18). This means that it

is not unreasonable to expect different valuations of the same resource. Conflicting interest and personal preferences can significantly influence valuation techniques and consequently valuation results.

Difficult as it is, valuation of natural resources has yet more importance where the resource (such as water) is essential for human survival. This is in fact one of the key reasons for attempting to calculate a numerical value for water. One cannot rely on humans to consistently arrive at mutually beneficial agreements concerning water use (the tragedy of the commons being a case example). Moreover, as Libecap notes, '[a]lthough non-rivalrous public goods [such as water] are notoriously difficult to value, there are techniques in economics such as contingent valuation, for estimating their values' (2008: 274). Pearce *et al* (1989) provide simple diagrammatic reasoning in support of the need to value natural resources, as shown in figure 6.2.

Figure 6.2 - the importance of economic valuation



Source: Pearce *et al* 1989: 6.

The supply of resources is assumed to be fixed at some quantity Q^*. If there is no formal valuation of the resource the price of the resource is effectively zero. At zero price demand

for the resource is Q_0. Clearly Q_0 results in overuse of the resource The price should correspond with the interaction between demand and supply. So as a minimum the price of the resource should be P^*. P^* should be seen as a minimum value since if the resource has already been overused (as is the case for water in many parts of Australia) then P^* could be adjusted accordingly.

The problem with using the price mechanism to manage the demand side of water policy reform, however, is that it does not take into account factors such as water culture. Australians (especially in urban areas) have not generally tended to be 'smart' users of water. For example, sport is an important part of Australian culture and this has consequences for water usage as grassed sporting grounds need to be maintained. Even during times of severe water shortage (for example over the last few years) local governments have continued to water sports grounds during the middle of the day (a time when a significant proportion of water is lost due to evaporation). Other evidence of Australia's unique water culture is the fact that unsustainable farming practices are sometimes not openly criticised as this would be seen as 'having a go' at the 'battling Aussie farmer'. As noted earlier in this thesis, agricultural irrigation is the largest user of water in Australia. So, since the price mechanism is not adequately taken into account in water culture, trying to curb excess usage through price signals may only have a limited positive benefit. This may particularly apply to urban areas where well-off people may be quite willing to pay higher prices for water in order to maintain a certain lifestyle. Price increases are likely to have more of an impact on the less well-off. However, the obvious problem with this is that the less well-off people are also less likely to use excessive amounts of water in the first place. If well-off people are willing to pay then price signals perhaps might not be the best policy response. On the other hand, in rural areas where many are struggling with poor harvests an increase in input costs may well

have a significant effect. Such considerations point to the need to carefully take elasticities of demand, including the differing elasticities of population sub-groups, into account when considering responses to market signals.

Notwithstanding the limitations of the price mechanism, water should be recognised as an economic good. This proposal was first put forth at the International Conference on Water and the Environment (ICWE) in 1992 (organised by the United Nations in Dublin, Ireland, January 1992). Water needs to be treated as an economic good due to the need for urgent reform of water resource management (not only in Australia but in many places around the world). Treating water as an economic good broadens the scope for devising potential solutions (as long as policy makers do not limit themselves to only neo-classical economics frameworks). It also means that an attempt must be made to designate water an economic value. By giving water an economic value, policy makers are effectively creating a potential limit on its use.

Economic values can be decomposed into three main types (Tietenberg, 2006: 33):

i. *Use value* – the direct value obtained from the use of a particular resource (for example, water obtained from a river for farming purposes). Obtaining use values is relatively easy as in most cases usage can be observed and thus quantified.
ii. *Option future value* – the value placed upon future use of a resource. '[O]ption value reflects a desire to preserve a potential for possible future use' (Tietenberg, 2006: 33).

iii. *Non-use value* – refers to the value people are willing to pay for the preservation of a resource which they do not intend to use. 'Nonuse values apply when individuals who do not use or intend to use a given environmental asset would nevertheless feel a deprivation if the asset were to vanish or be withdrawn' (Young, 2002, 40).

The three values are commonly used to determine the total willingness to pay (TWP) for a resource and therefore are used to determine a resource's economic value.

TWP = use value + option future value + nonuse value

Typically, determining use values and option values is straightforward compared with non-use values. A common technique for obtaining non-use values is by contingent valuation. Contingent valuation refers to obtaining survey data which indicates consumers' willingness to pay for the preservation of a resource which they do not use and do not intend to use. The most obvious problem with this approach is that there is a tendency for overestimation. Those not intending to use a particular resource typically tend to place a higher value on the preservation of that particular resource. One possible remedy for this problem is to determine lower bounds and upper bounds (Tientenberg, 2006: 35). The very fact that attempts are made to calculate (or estimate) nonuse values is another indication that perhaps Hardin (1968) was being overly pessimistic about the ability of humans to come to mutually beneficial agreements. Tietneberg (2006) also notes a number of other concerns with contingent valuation methods:

i. strategic bias – biased answers provided in an attempt to influence outcomes.
ii. information bias – occurs when respondents are asked to provide valuations for something they have little experience with.

iii. starting point bias – occurs when respondents are pigeonholed into selecting 'answers from a predefined range of possibilities' (Tietenberg, 2006: 35).

iv. hypothetical bias – occurs because the 'respondent is being confronted by a contrived, rather than an actual, set of choices…[s]ince he or she will not actually have to pay the estimated value, the respondent may treat the survey casually, providing ill-considered answers' (Tietenberg, 2006: 35).

In the United States, the National Oceanic and Atmospheric Administration (NOAA) convened a panel led by two Nobel prize winning economists, Kenneth Arrow and Robert Solow, that came to the conclusion that, despite having concerns, contingent valuation methods could provide reasonable estimates for passive use values (Young, 2002: 141). The NOAA report's conclusion was that 'cv[32] studies can produce estimates reliable enough to be the starting point of a judicial process of damage assessment, including lost passive use values' (Arrow *et al*, 1993, cited in Young, 2002: 141). This suggests that contingent valuation methods could be usefully applied in Australia to determine passive use values for water resources. For example, contingent valuation could be used to determine the upper and lower bounds for what people are willing to pay for the preservation of the Murray-Darling water basin. It may also be useful to determine what sort of impact media coverage of a particular issue has on contingent valuation responses.

The water quality and quantity problems associated with the Murray-Darling water basin have been well documented in recent years and it would be reasonable to believe that the coverage has had an impact on people's personal valuation of passive use values. This line of

[32] Footnote added – cv: contingent valuation.

thinking is not intended to suggest that generally media coverage has adverse consequences for obtaining unbiased and reasonably precise estimates of passive use values. Instead, it has been put forward to make policy makers more aware in the decision making process. The other extreme (having little or no media coverage) is potentially more undesirable than having too much coverage as it could lead to lower upper bound estimates.

It must be noted that, while the discussion above has highlighted some concerns about the determination of passive use values, the other extreme – namely to designate a passive use value of zero – is highly undesirable. Designating a passive use value of zero provides a perverse incentive for negligent use and/or overuse of a resource which generally results in degradation of the environment.

6.10 Water as an Economic Good

An economic good is a good that can be bought and sold in market. The price of an economic good is typically subject to market forces – demand and supply. Most economic goods are relatively easy to transport (to and from the market), relatively easy to measure and relatively easy to value. Furthermore, most economic goods are rival goods and have a high level of excludability. Water does not satisfy any of these pre-requisites (except the rivalrous condition). Moreover, water has one key defining characteristic (in addition the unique characteristics highlighted earlier in this chapter) – it is essential for survival. In fact, it is not unusual to come across views that describe water as a basic human right. The idea that water is both rivalrous and essential for human survival seems contradictory. Yet, this is what

makes water a very unique type of good and this section argues that it is possible to take into account both these features when developing markets for water.

Viewing water as an human right is not unusual. While this particular viewpoint is not new, it was only recently that a United Nations body – the United Nations Committee on Economic, Social and Cultural Rights – began the process of formally recognising water as a human right (Langford, 2005: 275). This is significant as it raises the question whether a price can be placed on something that is considered a human right. Should rights be able to be bought and sold like any other commodity? It is suggested that the parlous state of water resources around the world (and especially in the Murray-Darling Basin) necessitates that water be treated as an economic good and therefore should be subject to appropriate valuation.

Treating water as an economic good should not stop the philosophical discussion about treating water as an human right. This discussion should continue *concurrently*. Rather than being seen as mutually exclusive, finding a combination of the economic good argument and the human right argument should be considered as a long-term objective for water policy makers.

Treating water as an economic good provides it with a certain degree of protection. One can argue that, since the vast majority of users pay for water and water services, we are already treating and accepting water as an economic good. However, simply paying for water does not necessarily mean that we are treating it as a normal economic good. The reason for this is that in the vast majority of cases worldwide (and most certainly in Australia) the pricing

structure for water is not an accurate representation of its true value. While this seems to lead back to the perennial question about water valuation techniques – we can momentarily ignore that question *if* we accept that water is currently *undervalued*. Acceptance of this idea implicitly implies that whilst the vast majority of users have been paying for water, the prices have been too low for most to register anything more than cursory concern for water availability and water conservation and management policies.

6.11 What Type of Good?

Once we begin to accept water as an economic good the next step is to determine what *type* of economic good best describes water and its unique characteristics. Perry *et al* (1997) observe that this is almost as controversial as classifying water as an economic good in the first instance. Determining the type of good is important as it sets the fundamental parameters/constraints.

The most basic distinction of different types of economic goods is whether they are public goods or private goods. While there does not seem to be consensus on treating water as an economic good, most economists seem to agree that that water can actually be considered to have some public good and some private good characteristics. In fact, in some cases (and especially in developing countries) water can even be classified as a merit good: Perry *et al* note that '...access to clean water for washing and personal hygiene has health benefits (reduced incapacity for work; reduced medical costs) that generally exceed the cost of providing water' (1997: 6). Evidently, water is an economic good with special characteristics. The facts that (1) water has the characteristics of different types of goods and (2) the quantity

of water determines the type of good it is does not necessarily classify water as a special economic good. These characteristics along with the following unique features make water a special economic good:

a) Variable supply
b) Interdependency amongst users
c) 'one size does not fit all'
d) Natural monopoly characteristics
e) Water culture

Bakker (2005), commenting on the neoliberal perspective of treating natural resources (such as water) as economic goods and utilising the market as a force for good, notes that the orthodox position is '...employing markets as allocation mechanisms...will...simultaneously [address] concerns over environmental degradation and inefficient use of resources' (2005: 543). These ideas come under the broad umbrella of 'market environmentalism' (Anderson and Leal 2001, cited in Bakker, 2005: 543).

The main deficiencies in the orthodox position are (1) a lack of analysis focusing on water's unique characteristics and (2) the demoting of water to the status of a typical economic good. These deficiencies have led political economists to label 'market environmentalism' as a form of 'green imperialism' (Bakker, 2005: 543). Treating the environment and environmental degradation (a by-product of the capital accumulation process) as commodities presents opportunities for profit-seeking agents (Bakker, 2005: 543). Similarly, the treatment of water as an economic good also presents opportunities for profit-seeking agents. Rather than remaining inactive – and leaving aside, momentarily, the moral concerns with this attitude – the narrowness of the orthodox approach should be viewed as an opportunity for an

institutional economics approaches to step in and fill in the gaps. While some elements of the orthodox approach are useful, we can adapt and change other elements to develop a better solution. This approach also follows in the eclectic tradition of new institutional economics and is helpful for developing a more broad and useful approach to policy making process.

One final point to take into consideration is that it is common practice to use neo-classical welfare theory to derive economic values and also to inform policy makers. This is especially the case when determining producer welfare (in the form of producer surplus). Valuation for producers' uses of water is important since '…the largest consumptive users of water in the world are, by a significant margin, the producers' goods types' (Young, 2002: 50). This is also the case in the Australia with agriculture accounting for the largest use of water (see table 2 in chapter one). Neo-classical welfare theory is used to measure the effects of changes in prices, quantities or technology. However, the welfare theory used '…employs the highly abstract model of the firm as an optimising subject to a known production function and known input and output prices…' (Young, 2002: 55). Young (2002) notes that there are more realistic models (he refers to Rickets (2002)) that '…rely on a more realistic description of human actors in the firm and the role of organisation theory in understanding the behaviour of the firm' (Young, 2002: 55). Analysis in this thesis steers clear of abstract modelling with the objective of providing a realistic analysis of water policy reform in Australia.

6.12 Conclusion

Williamson's (2000) levels of institutions approach emphasises that level 2 and level 3 institutions be considered before the level 4 institutions that have been the focus of orthodox

economics. This chapter examined level 2 institutions such as rights using the commonly used analytical framework – the 'tragedy of the commons' as popularised by Hardin (1968). This chapter argued that Hardin's tragedy of the commons scenario has often been misinterpreted. An alternative interpretation of the scenario suggests that the 'commons' referred to in Hardin were actually not common resources and the problem Hardin was referring was that of open access. Hardin's suggestion that private ownership was the best solution for circumventing a tragedy of the commons also seems to be too simplistic. However, broad lessons for the Murray-Darling Basin can be learnt from Hardin's work and from critiques of Hardin's work. For example, a selection criterion developed through Elinor Ostrom's career provides the conditions required for the development of self-governance institutions that can go some way in circumventing the over-exploitation of common resources. Applying this criterion and Hardin's broad framework to the Murray-Darling Basin suggests that policy-makers need to be flexible in the management process. Throughout history, and despite the fact that there are property rights based institutional arrangements in place, the Murray-Darling Basin has been used as though it were a common resource. This has led to over-use and degradation of the Murray-Darling river system. Water from the Murray-Darling river system has been used without consideration of the long-term effects on the environment. The environment needs to be considered as a legitimate 'user' of water. Using a game theoretical framework, it was shown that individual usage levels are higher than usage levels if other parties and the environment are also taken into consideration.

Determining how much water to consume requires water to be given a value (which is a level 4 institution). This is particularly important when a key objective of water policy reform is to direct water to where it is valued most. A discussion of different valuation techniques

provides policy makers possible avenues for estimating the value of water allocations. Furthermore, designating a value to water is part of the process of developing mature water markets. The following chapter examines water markets.

Appendix A[33]

The tragedy of the commons scenario can be modelled using a game theoretical framework. The following presents the steps used to derive the solutions presented in this chapter.

Commons: a resource with the properties:

a) anyone can use/access it
b) it depletes or deteriorates in quality the more intensely it is used.

Players: $\mathrm{N} = \{1,...,\mathrm{N}\}$ the resource owners/users

$$s_i: R_+\{X_i | x_i \geq 0\} \qquad (1)$$

Where:

s_i = strategy of player *i* (i.e., how much of the resource player *i* decides to use)

R_+ = All player have 'non-negative' choices, i.e., they consume some positive amount of the resource.

x_i = consumption/intensity of resource use by player *i*.

Player *i*'s payoff is evaluated from the following utility function:

$$u_i(x_i,...,x_n) \qquad (2)[34]$$

Player *i*'s payoff can actually be decomposed into 2 components; player *i*'s use of the resource and everyone's (including *i*) use of the resource. This can be expressed as the following:

[33] The derivations presented in this chapter have been adapted from Sengupta, 2005.

[34] Where u_i is the utility for player *i*.

$$f_i(x_i,\ x_1+...+x_n) \qquad (3)$$

Where:

$$f_i(\ \underbrace{x_i}_{\substack{\text{payoff function with only i's use}}}\ ,\ \underbrace{x_1+...+x_n}_{\substack{\text{payoff function with aggregate use}}}\ ) \qquad (4)$$

The Nash Equilibrium (NE) of the game occurs where everyone overuses the resource. The 'tragedy of the commons' scenario presents a case when the NE is *not* the optimal solution.

Let k = total amount of resource available.

Player *i*'s payoff (incorporating *i*'s own use and aggregate use) can now be expressed as:

$$u_i(x_1,...,x_n)=x_i\left[k-\left(x_1+...+x_n\right)\right] \qquad (5)$$

Equation (5) clearly shows that the more player *i* uses the resource the higher the resulting payoff. Increasing aggregate use lowers *i*'s payoff.

Player *i*'s best response is given by the following:

$$\frac{\partial\, u_i(x_i,...,x_n)}{\partial\, x_i}=0 \qquad (6)$$

Solving for player 1 (*i* = 1). Differentiating equation (5) with respect to x_1 gives player 1's best response:

$$\frac{\partial\, u_1(x_1,...,x_n)}{\partial\, x_1}=0$$

$$\therefore k-2x_1-x_2-...x_n=0$$

$$\therefore \quad x_1 = \frac{k - \sum_{j \neq 1} x_j}{2}$$

Similarly for player 2:

$$k - x_1 - 2x_2 - ...x_n = 0$$

And similarly for all n players.

$$k - 2x_1 - x_2 - ...x_n = 0$$

$$\vdots$$
$$\vdots$$

$$k - x_1 - x_2 - ...2x_n = 0$$

The above system of equations can be solved for x_i using the generic equation:

$$nk - (n+1)(x_1 + ... + x_n) = 0 \qquad (7)$$

Solving for x_i:

$$\therefore \sum_{i=1}^{n} x_i = \frac{nk}{n+1} \quad \rightarrow$$ This is the amount of the resource used by all players jointly.

Dividing this result by the number of users (n) gives the following result:

$$x_i = \frac{k}{n+1}$$

This is how much each player individually consumes.

Therefore, the Nash Equilibrium occurs when each player consumes $x_i = \frac{k}{n+1}$

Joint Optimum

We can use a similar process as above to determine usage when the resource is used in consideration of others. Previously we only examined *individual* pay-off functions. Now we examine V – the joint pay-off function. The joint pay-off function is equal to the sum of all the individual pay-off functions.

$$V = x_1\left[k-\left(x_1+x_2+...+x_n\right)\right]+x_2\left[k-\left(x_1+x_2+...+x_n\right)\right]+...$$
$$+x_n\left[k-\left(x_1+x_2+...+x_n\right)\right]$$

Differentiating the joint pay-off function yields the following result:

$$\frac{\partial V}{\partial x_1} = k-2x_1-2x_2-...-2x_n$$

We now solve for x_i by setting $\frac{\partial V}{\partial x_1}=0$

This yields the following:

$$\frac{k}{2}=\sum_{i=1}^{n}x_i$$
$$\therefore \quad \sum_{i=1}^{n}x_i=\frac{k}{2}$$

So $\frac{k}{2}$ is the optimal amount for *all* users.

Note that $\frac{k}{2}\neq\frac{nk}{n+1}$.

Recall that $\frac{nk}{n+1}$ was the total amount consumed when users did not take into consideration other users of the resource.

In fact, $\frac{k}{2} < \frac{nk}{n+1}$.

$\frac{k}{2}$ is *total usage*, so individual usage is given by: $\frac{k}{2n}$.

$\therefore \quad \frac{k}{2n}$ is the amount each user should consume for the optimal result.

Note that $\frac{k}{2n} < \frac{k}{n+1}$ (the optimal amount when overuse was the result).

This result suggests that resource use policy needs to ensure that resource consumers change their resource behaviour to incorporate the use of other consumers. This approach means that the amount of the resource consumed would have to be less than the case where consumers only consider the impact of individual use.

Chapter 7 – Markets for water

7.1 Introduction

Water markets are increasingly being touted as a means of alleviating water scarcity problems. This is broadly consistent with the tendency of policy-makers to focus on level 4 institutions. Policy makers around the world, including in Australia, have begun to introduce water markets as part of water resource management strategies. As such, it is useful to analyse the effectiveness of markets. Heterodox economics approaches commonly acknowledge the potential benefits of markets while being critical of misleading interpretations in neo-classical economic theory. New institutional economics is one particular school of thought that recognises, once adequate regulation is in place, the gains that can be realised through markets.

7.2 Markets – Positive Potential

Advocates of the use of water markets such as Pigram (2007: 69) identify potential advantages that include:

- new and expanding users [can] gain access to the resource;
- existing users [can] realise the value of efficiency gains in water use;
- users [can] exit the water industry through the sale of their licence;
- the government [can] enter the market to acquire water licenses and subsequently retire them.

The second and fourth points above can be considered to be the main benefits of water trading. A major advantage of water markets[35] is that water use is transferred from low value use to high value use. This type of transaction should also lead to a more thoughtful approach to water consumption. It forces water users to identify areas of consumption that can be cut back and will encourage more parsimonious usage in areas where water usage cannot be totally eliminated. The incentive to identify such savings comes from the potential financial gain to be obtained by trading. The fourth point is particularly interesting as it provides a significant opportunity for the government to demonstrate leadership and to protect Australia's fragile water eco-system.

The main problem with water markets and government involvement is the concern that the government may be lured by short-term political expediency. For example, approximately 10% of the Murray-Darling Basin population is employed in industries that consume significant amounts of water, this represents a significant number of potential votes and if the government decides to not get involved in order to give the impression of saving jobs then there will be serious ramifications in the long run. The irony about this situation is that while saving jobs in the short (or maybe even medium) term, such a policy approach does not guarantee long term job security. If there is insufficient water, jobs are not going to exist either! Given the current parlous state of the water eco-system in the Murray-Darling Basin and the fact that concern for environmental issues seems to be 'in vogue' we can perhaps take the optimistic view that it would *not* be politically expedient to seen to be playing politics with so much at stake.

[35] It is useful to define what will be traded in water markets. There are two obvious candidates for trade, 1) water (the physical resource) and 2) water use entitlements. Water use entitlements are analysed in more detail due to the relevance to the Murray-Darling Basin.

Another advantage (especially concerning the Murray-Darling Basin) of creating water markets is that the process of developing a prudential framework necessarily requires cooperation between states. The lack of cohesion in interstate responses to the Murray-Darling water problem is the single largest impediment towards progressive water policy reform. Chapter ten presents a discussion on the benefits of a cooperative federalism and the option of supporting a centralist system if inter-state rivalry cannot be set aside in the short term. However, the extension of markets also has pitfalls, and these are considered in the next section of this chapter.

7.3 Problems and Pitfalls of Markets

According to North, '[t]he major role of institutions in a society is to reduce uncertainty by establishing a stable (but not necessarily efficient) structure to human interaction' (North, 1990: 6). This is a useful definition with which we can draw parallels with a definition of markets. One of the most basic reasons for markets existing is that they are a channel through which economic agents attempt to shackle uncertainty and sometimes even take advantage of uncertain situations.

In orthodox analysis, markets are considered to be the primary means for economic interaction. The central role of markets in neo-classical economic analysis is further illustrated by the fact that market performance (particularly share market performance) is an important measure used to assess the performance of particular industries and the economy as a whole. At first this may not immediately seem to be problematic. However, if we recognise that economic behaviour (and therefore market behaviour) is modelled according to certain

behavioural assumptions it is obvious that there are significant deficiencies in giving markets primary importance. A point to note here is that the *centrality* of markets in economic analysis is mentioned earlier while the preceding sentence refers to *primary importance*. The subtle difference is important. While it is difficult to remove markets from the central role they play in economic analysis, markets should not be considered as the *most* important institution in economics. For neo-classical economics, centrality seems to imply that freely functioning markets are a panacea for economic problems. Instead, centrality should be interpreted as exactly that – central but not necessarily the most important. Markets remain central in the proposed adaptation because they can act as the conduit through which exchange is facilitated but they are not considered the solution to the problem at hand – rather they may be *part* of the solution.

7.4 Assumptions about Markets

The assumptions underpinning much of neo-classical theory are the main points of contention between neo-classical economic theory and new institutional economic theory. New institutional economics approaches argue that there is a significant divergence between neo-classical economic assumptions and reality. Commenting on the divergence between neo-classical theory (in general) and reality, North (1990: 11) notes that:

> *'[t]here is persistent tension in the social sciences between the theories we construct and the evidence we compile about human interaction in the world around us. It is most striking in economics, where the contrast*

> *between the logical implications of neo-classical theory and the performance of economies (however defined and measured) is startling'.*

With regards to markets, North (1990: 11) further states that:

> *'[c]ertainly neo-classical theory has been a major contribution to knowledge and works well in the analysis of markets in developed countries. At the other end of the scale, however, it does not provide much insight into such organisations as the medieval manor, the Champagne fairs, or the suq (the bazaar market that characterizes much of the Middle East and North Africa). Not only does it not characterize these organisations' exchange process very well, it does not explain the persistence for millennia of what appear to be inefficient forms of exchange'.*

It should be clear that the general inability of neo-classical economics to explain many instances of market behaviour and the resilience of inefficient forms of exchanges leaves plenty of potential for there to be inadequate treatment of water (with its unique characteristics) as an economic good. The main inadequacy is treating water as a typical economic good without appropriately accounting for the fact that it is the most basic and most important necessity. The rigidity of neo-classical economics is a significant weakness. Economic phenomena are not static and therefore analysis should not be static. Neo-classical behavioural assumptions that are used to explain and analyse market behaviour are particularly rigid. This view is supported by North (1990: 17) who asserts that '...[the] traditional behavioural assumptions have prevented economists from coming to grips with

some very fundamental issues and that a *modification of these assumptions*[36] is essential to further progress in the social sciences'.

7.5 Modifications of Market Analysis

To deal with these inadequacies of existing economic theory, three modifications are proposed: an integration of institutions, integration of case specific rules and emphasising the importance of markets and evolution.

Integration of Institutions

The main modification that is required to the neo-classical view of markets as the solution to most problems is the need to incorporate institutional elements (particularly elements from level 2 and 3 institutions) into the analysis. The most important institutions that need to be integrated into conventional analysis are the social norms and rules that have formed over hundreds of years. Society generally tends to view water as a right – this is the social norm. The problem with neo-classical economics is that it disembeds markets from social structures (Mantzavinos, 2004: 162). Once again the rigidity of neo-classical economic analysis (this rigidity is in fact seen, by proponents of neo-classical economics, as sign of strength and is referred to as 'robustness') prevents it from adapting and incorporating institutions that are evolutionary by nature. Mantzavinos (2001: 162) notes that '[t[his abstraction from the institutional framework within which every exchange process takes place is justified by the proponents of the neo-classical research program by their conscious attempt to provide exact

[36] Emphasis added.

economic laws that are, in turn supposed to explain how the economy overcomes the ubiquitous phenomenon of scarcity'.

These problems with neo-classical economic analysis of markets are not so evident in the earlier work of Adam Smith. Most economists link Smith's views about the 'invisible hand' with the neo-classical proposition that freely functioning markets are the best allocating mechanisms and the best solutions to most problems. However, Buchanan (cited in Mantzavinos 2002: 162) claims that Smith's analysis was not devoid of institutions. Rather, 'A. Smith was engaged directly in comparing alternative institutional structures, alternative sets of constraints within which economic agents make choices'. Mantzavinos (2002: 162) also supports this idea by noting that '...[Smith] practiced comparative institutional analysis...This type of institutional analysis has been avoided in economic theory to the extent that it has essentially disappeared from the neo-classical research paradigm'. It is this broader tradition in analysing markets in social and historical contexts that is adopted here.

Integration of Case Specific Rules

Markets do not and should not function without rules. The rules referred to here are not those created by freely functioning markets but the rules that need to be imposed due to the nature of the economic good that is being traded. Mantzavinos (2002: 164) notes that '...(a) markets always work within rules and (b) market competition is an evolutionary process'. These are useful notions and we will deal with (b) in the next section.

‘Case specific rules’ refer to rules that take into account the fact that while there is some commonality of problems (the most obvious being scarcity and mismanagement), water resource related problems are quite diverse and can be quite location specific. For example, the main problem afflicting the Murray-Darling Basin is a combination of mismanagement (resulting from years of overallocation) and scarcity. This combination of problems is being compounded by the institutional quagmire arising from interstate political tension and federal and state level tension as well.

In other locations pricing rules may need to be established in order to ensure that less well-off people are not disadvantaged by being priced out of the market. This is of special concern in developing countries where the poor do not usually have the political or economic strength to have their immediate concerns addressed adequately (the international experience with markets – both in developed and developing countries is analysed later in this chapter).

Markets and evolution

Markets are dynamic. Evolution is embedded in market structures and consequently evolution is embedded in market competition. Mantzavinos (2002: 164) states that ‘[m]arket competition does not only lead to resource allocation, as in neo-classical economics, but is also mainly a knowledge-creating and knowledge diffusing mechanism’. The obvious implication of this observation is that competition forces economic agents to learn and adapt in order to stay ahead of others. The capacity to learn and adapt means that market interactions are dynamic and therefore market analysis needs to be evolutionary (Mantzavinos, 2002: 164). Due to the importance of water, the capacity and to learn and

adapt and the tendency to try and get ahead of others means that an appropriate prudential framework needs to be developed in order to limit adverse market behaviour such as speculation. Taking advantage of asymmetric information must be limited in order to ensure that Keynes' 'rentiers'[37] do no not influence water markets as they have influenced financial markets in the past. One possible measure to limit the activity of rentiers is to place strict restrictions on market participants.

In addition to developing safeguards against undesirable behaviour, policy makers need to ensure that water market regulation is designed with the scope for rapid change to cater for the uncertainty surrounding water resources. The main form of uncertainty is climatic variability.

7.6 The Australian Experience

Australia's experience with water markets centres on the Murray-Darling Basin. Currently there are two main water products that are bought and sold in water markets – water entitlements (also referred to as permanent transfers) and seasonal water allocations (also referred to as temporary trade) (Productivity Commission, 2010: 40). A water entitlements is defined as '…a perpetual or ongoing entitlement, by or under a law of a State, to exclusive access to a share of water resources of a water resource plan' (Water Act 2007). A seasonal allocation is '…the specific volume of water allocated to water access entitlements in a given water accounting period' (Water Act 2007).

[37] Rentiers are people who make a living through speculating on market movements, or more generally, those who derive income without adding to aggregate social product.

Water entitlements are conditional on whether the water supply is regulated (in the form of storages) or unregulated (based on river flows) (Productivity Commission, 2010: 41). For example, Seasonal allocations are conditional on both regulated and unregulated water supply (Productivity Commission, 2010: 41).

Water markets were first created by NSW and South Australia. In 1983 South Australia introduced trade in both permanent water rights and temporary water rights (Bjornlund, 2003a: 555). NSW introduced trading for temporary water rights in 1983 and then trading for permanent water rights in 1989 (Bjornlund, 2003a: 555). The delayed introduction of trade in permanent water rights was due to '...community concern regarding the impact of local communities if large volumes of water were traded away' (Bjornlund, 2003a: 555). Victoria began to experiment with trade in temporary water rights in 1987 and formally codified temporary water rights trade in 1989 (Water Act 1989) (Bjornlund, 2003a: 555). Regulations for trade in permanent water rights were introduced in 1991 – community concern again being the reason for the delay (Bjornlund, 2003a: 555).

The COAG meetings in 1992 and 1994 provided further impetus for water market creation and promotion. Turral *et al* (2005: 2) note that the '...intended consequences on the rural water sector were':

1) the separation of water allocations from land titles;

2) reservation of environmental flow allocation;

3) transfer of water to highest-value end users within the limitations of social, physical and economic constraints of catchments; and

4) groundwater allocations and transfers.

State governments were responsible for implementing the reforms recommended by COAG and they were encouraged to do so by a series of tranche payments[38]. This 'encouragement' was in line with the recommendations established by the National Competition Policy (NCP) and fell under the broad umbrella of microeconomic reform (Turral *et al*, 2005: 3). In addition to the COAG recommendations, the NCP framework added to the water reform agenda by creating the additional conditions for the payment of second and third round tranche payments (Tisdell *et al*, 2002: 44). Some of the conditions are listed below:

- Interstate trade to be encouraged and 'trading arrangements must be consistent between jurisdictions and facilitate trade';
- Institutional arrangements must be established in order to remove impediments to trade;
- Environmental allocations for distressed water systems need to be put in place (Tisdell *et al*, 2002: 44).

In 1995 the MDBMC responded to increasing concern for the long-term health of Murray-Darling Basin by introducing an interim 'Cap' on water diversions from the Murray-Darling Basin. Diversions from the Murray-Darling Basin were capped at 1993/94 levels. The main objectives of the Cap are to protect the environment by improving 'flow regimes', promoting

[38] In the form of conditional redistribution of federal tax revenue.

'sustainable consumptive use' and catering for ecological, commercial and social needs (Tisdell *et al*, 2002: 55). Two reviews investigating Cap compliance were conducted soon after the introduction of the Cap and the results were mainly encouraging. The reviews showed that diversions in South Australia did not exceed the Cap; in 1996-97 Victoria may have exceeded the Cap; New South Wales exceeded the Cap during both the reviews but was heading in the right direction (Tisdell *et al*, 2002: 46). It should also be noted that if diversions exceed the Cap in a particular year the amount that is exceeded needs to be 'repaid' by staying below the Cap by a corresponding amount during the next year (Turral *et al*, 2005: 2).

In 1997 the MDBMC agreed to maintain the Cap and therefore restrict future extraction from the Murray-Darling Basin (Crase *et al*, 2004: 4). This was a significant moment not only for the development of water reform in the Murray-Darling Basin but for water policy reform throughout Australia. As Crase *et al* (2004: 4) note, '[o]ne of the primary implications of the cap was that "new" irrigation developments could only occur by sourcing water from existing extractive users'. More significantly, they note that:

> *'It is against this background that water trading was first proffered as a vehicle for assisting the allocation of water resources to higher-value uses...'*

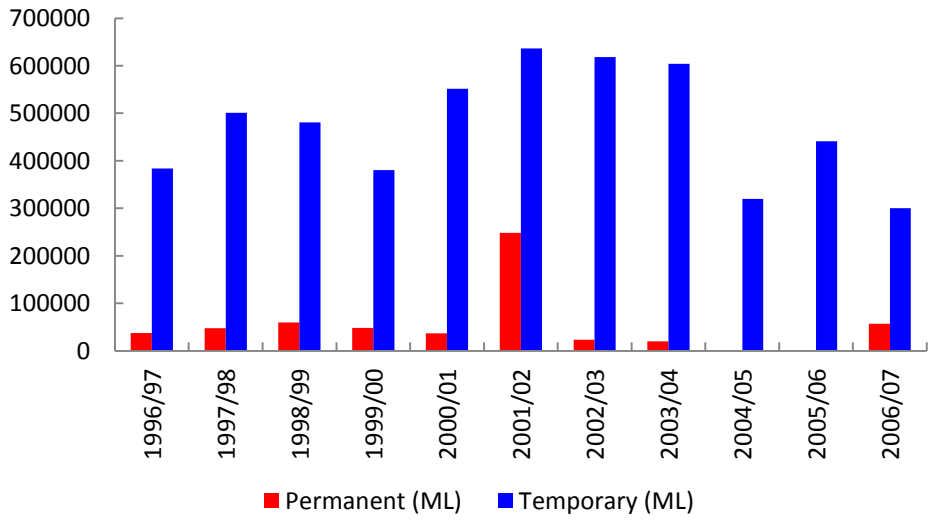
Earlier in this chapter it was noted that the transfer of water from low value use to higher value use is one of the central arguments in favour of water markets. The introduction of the Cap and increasing promotion of water trade is being used as institutional backing to help achieve this outcome.

7.7 Evaluating effectiveness

How effective has been Australia's recent experience with markets for water? Qualitative and quantitative analysis can show the consequences of trading, with special focus being given to New South Wales and Victoria due to the availability of comparable data.

First it is pertinent to note the significant difference between the volume of permanent water transfers and temporary water transfers. In NSW, the volume of temporary water trade has consistently been significantly more than the volume of water traded permanently (see figure 7.1).

Figure 7.1 – Temporary and Permanent Water Trade (NSW)

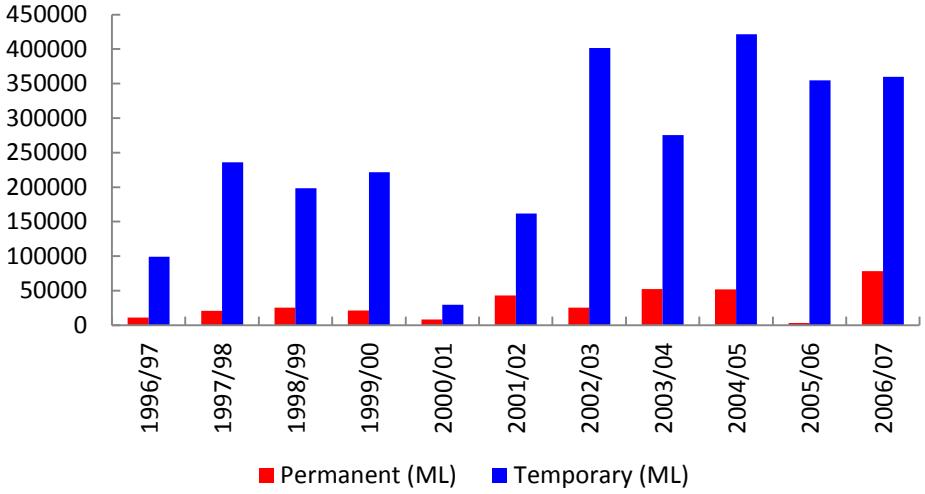


Source: MDBA Water Audit Monitoring Reports from 1996 – 2008.

A similar difference between permanent and temporary trade volumes is also found in Victoria (see figure 7.2). There is also a significant difference in trade volume between NSW

and Victoria. Trade in NSW consistently exceeds the approximate 400000ML[39] that seems to be the ceiling for water trade in Victoria during the period from 1996 till 2006.

Figure 7.2 – Temporary and Permanent Water Trade (Victoria)



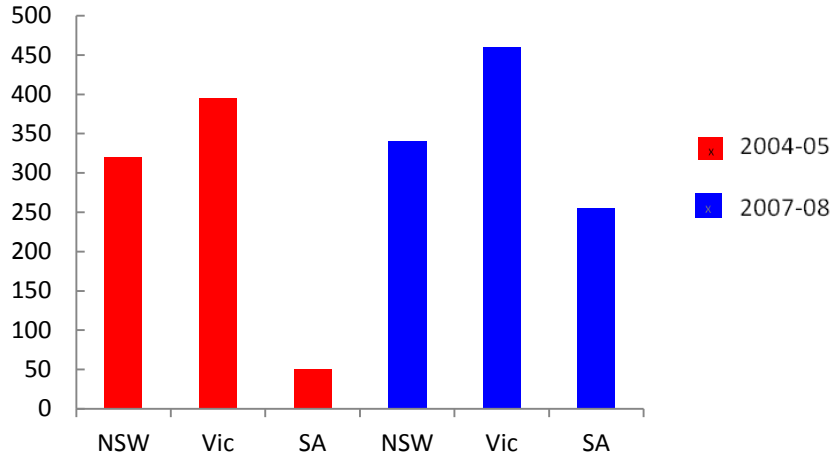
Source: MDBA Water Audit Monitoring Reports from 1996 – 2008.

Both figure 7.1 and figure 7.2 highlight the fact that temporary trade has continued to dwarf permanent trade in recent years.

Since the introduction of water markets, temporary water trade has shown an upward trend. This is the case for both within state and interstate temporary water trade (Oliver *et al*, 2009: 5). Figure 7.3 provides contemporary evidence that that temporary transfers (within state) have continuted to increase during the last 4 years.

[39] ML – megalitre.

Figure 7.3 – Within state temporary water transfers.



Source: Oliver *et al* (2009: 5). Units: Gigalitres.

In addition to the limited permanent water trade in the Murray-Darling Basin, another feature of water trade in the Basin has been limited intersectoral trade (Turral et al, 2005: 3). Temporary water transfers once again dominate permanent water transfers in intersectoral water trade but it must be noted that even intersectoral temporary water transfers are not prevalent. Intersectoral trade refers to trade between different industries. For example, trade between the dairy industry and the horticulture industry. Turral et al (2005: 3) note that '...movement between sectors, for instance from agriculture to industry...' has been limited and that '...apart from mining only small volumes have moved between sectors'.

Paucity of interstate permanent water trade is a defining feature in the Murray-Darling Basin. In 2007-08, no permanent interstate states were recorded (Oliver *et al*, 2009: 5). This may have more to do with permanent water market thinness rather than any interstate issues specifically.

7.8 Water Market 'Thinness'

An examination of water trading characteristics in the Murray-Darling Basin reveals that, despite efforts by researchers and (at various times) government policy makers to highlight the advantages of water markets, the tendency to participate frequently in the temporary market still dominates the frequency of permanent water transfers. The difference is significant – up to 10 times more water is transferred in temporary markets than in permanent markets (Bjornlund, 2003b: 65).

A number of reasons are put forward to explain the relative thinness of permanent water markets and they revolve around the relatively higher barriers to trade (Qureshi *et al*, 2009) It is interesting to note that not all barriers are economic. One of the major impediments to a more robust market for permanent water that is commonly cited is cultural rather than an economic issue. Many water resource owners view the resource as being an important part of their property. Some of the main reasons for permanent water market thinness are transaction costs; policy uncertainty; impact of water sales on property values; and cultural issues.

Transaction costs

Transaction costs are a major impediment to trade in permanent water markets. The transactions costs involved in permanent water trading significantly exceed the transactions costs associated with temporary water trading (Crase *et al*, 2000: 316). The search costs for price information is often cited as one of the main barriers to trade (Crase *et al*, 2000: 316). Price information is more readily available and accessible in temporary water markets (Crase *et al*, 2000: Bjornlund, 2003a). Furthermore, Crase *et al* (2000: 316) note that '...permanent

trades are usually conducted by private treaty, where price information, in particular, remains confidential'.

A survey conducted by Bjornlund (2003a) found that 39% of buyers in permanent water markets found it too difficult to buy water in the permanent market compared with the temporary market and 32% said that transactions costs associated with permanent water transfers were too high.

Policy Uncertainty

Policy uncertainty is particularly pertinent in the current water policy reform climate. There is always some level of uncertainty about future water allocations – this point is especially important nowadays due to the need for allocating water for the environment. The uncertainty about the Murray-Darling Basin Cap also is an obstacle (Bjornlund, 2003b: 65). Bjornlund (2003b: 65) provides a neat summary of the problem:

> *'If an irrigator buys 1 unit of water on the temporary market, he or she can be certain of receiving 1 unit of water for the price paid. However, when an irrigator buys 1 unit of water on the permanent market, there is no guarantee that he or she will receive 1 unit in all future years'.*

Impact of water sales on property values

Bjornlund's (2003a) survey found that '...79% of the sellers of permanent water and 64% of the sellers of temporary water said that the potential impact on property values influenced their decision to use the temporary market [instead of the permanent water market]'.

PriceWaterhouseCoopers (PWC) (2006) found another potential explanation for the thinness prevalent in permanent water markets, PWC noting that '[a]necdotal evidence suggests that a substantial proportion of permanent trades of water relate to land sales' (2006: 14). This point is particularly interesting as it lends credence to two ideas raised earlier. First, permanent water sales (that exclude land sales) have an impact on the capital value of land in which the permanent entitlement is enclosed. Second, that the paucity of participation in permanent water markets appears to be more of a cultural issue than an economic issue – i.e., reflecting a close affinity to water in rural communities that has been unaccounted for in previous literature and in past policy reform initiatives. Chapter eight deals in more detail with this last aspect by providing some guidelines for incorporating cultural issues in the water policy making process.

7.9 Participation in Water Markets in the Murray-Darling Basin

Having discussed the extent of temporary and permanent trade and provided some reasons to explain the thinness of water markets for permanent transfers, this section reviews some of the reasons underpinning participation in water markets (both temporary and permanent). It considers the main reasons for entering the market and the main reasons for not entering. This is important as it sets the scene for the water market policy prescriptions that will be proposed

in the following chapters. The data presented in this section is sourced primarily from Oliver *et al* (2009), Ashton *et al* (2008), Bjornlund (2003a) and Bjornlund (2003b).

Table 7.1 below provides the reasons (given by irrigation farms in the Murray-Darling Basin[40]) for not buying and not selling water. It illustrates the dominance of temporary trade relative to permanent trade. An estimated 23% of irrigation farms participated in temporary water transfer markets compared with only 2% participating in permanent water transfer markets. For dairy and broadacre farms the main stated reason for not buying water was due to the price being too high and for horticulture farms the main stated reason for not buying was that extra water was not required.

Table 7.1 – Water trading by irrigation farms, Murray-Darling Basin, 2006-07

	Dairy	Broadacre	Horticulture	Murray-Darling Basin
Percentage of farms trading				
Permanent Entitlements	3	1	4	2
Temporary Irrigation water	31	20	23	23
Reasons for not buying water				
Trade of water restricted	10	20	8	13
Price too high	42	40	10	25
No irrigation water available	12	17	8	13
Not interested	5	11	14	11
Extra water not required	17	19	46	31
Other	5	3	6	5
Reasons for not selling water				
No or low allocation	8	20	7	12
Trade of water restricted	9	14	9	11
Used all water available	56	36	37	40
Prefer to carry over water	7	16	18	14
Not interested	8	5	18	12
Uncertainty of allocations	13	11	18	14
May have needed it	28	20	28	26

Source: Oliver *et al* (2009: 6). All figures are expressed as percentages.

[40] Irrigation farms in the Murray-Darling Basin are the main water consumers.

It is interesting to note that the majority of irrigation farms (40%) in the Murray-Darling Basin did not *sell* water because they had used all the water available to them. This may be a reflection of the dire health status of the Murray-Darling Basin and also the severe impact of drought.

Australian Bureau of Agricultural and Resource Economics (ABARE) survey results (Ashton *et al*, 2008: 16) also indicate that 16% of farmers say they would like to purchase more temporary water in the next few years and 4% of farmers say they would like to sell all of their permanent entitlements. While 16% of farmers would like to purchase more temporary water, only 7% of farmers want to sell more temporary water.

Additionally, 17% of farmers said they would like to expand the area under irrigation and 11% of farmers want to reduce the area under irrigation. The two main constraints against expanding the area irrigated that were revealed by this investigation were 1) insufficient irrigation water (44% of farmers provided this response) and 2) uncertainty of water allocations (70% of farmers provided this response).

These results have implications for water market policy. Some of the concerns raised by farmers are more easily addressed than others. For example, water market policy reform needs to incorporate institutional change in order to significantly reduce the transactions costs associated with trade and particularly the costs associated with permanent water trade. Addressing transactions costs is something that can be done relatively easily (for example, administration costs involved with water trading can be reduced and standardised across

states) compared to reducing uncertainty over water allocations (which are largely dependent on seasonal climatic fluctuations).

7.10 Water Policy

The previous section presented an argument in favour of using water markets, notwithstanding the special characteristics water has, as a vehicle for achieving more efficient and sustainable water outcomes. Some of the benefits and the problems with water markets were also discussed. The remainder of this chapter will attempt to provide policy suggestions that address some of the key concerns associated with water markets. Evidence from water trading activities in Queensland, New South Wales, Victoria and South Australia will be drawn upon to inform the policy suggestions. Specific suggestions and discussion of the following issues is provided:

- removing impediments for permanent water trading;
- reducing institutional transaction costs associated with water markets and trading;
- reducing monetary transaction costs associated with water markets and trading.

Water Market thinness – removing the impediments for permanent water trading

The last section identified one of the main problems associated with water markets and trading as a general reluctance of potential buyers to actually enter the market. If an agent has entered the market there also seems to be a general reluctance to stay in the market. This problem is called - 'market thinness'. It is relatively easy to place the blame for permanent water market thinness on the presence of transaction costs. While the transaction costs associated with permanent water trading are indeed higher (this is especially the case in the

Murray-Darling Basin in particular) there are some other impediments that need to be addressed before turning the focus onto transaction costs. These impediments are concerned with institutions. Addressing the impediments created by institutions is consistent with the levels of institutions analytical framework referred to earlier in the thesis.

Institutional impediments are prevalent in water markets across the world. Institutional impediments can be economic and non-economic. The main non-economic institutions include are level 1 institutions – cultural norms and traditions. Water trading involves much more than simply buying and selling the right to use a particular water resource (for a particular season or permanently). This concern applies more so for permanent water trades than for temporary water trades. Bjornlund (2003a), in a survey of Victorian irrigators, found that '...traditionally irrigators do not see themselves as water traders but as farmers...' and that '[i]t would be against their culture and tradition to sell water to gain an income, rather than grow a crop (2004: 49). This is a significant concern for policy makers and highlights the problem of simply analysing the economic impediments to trading. Simply telling farmers that water trade will alleviate scarcity problems by transferring water to locations (or industries) where it is valued the most is not a complete situation.

Another impediment is the concern amongst irrigators that water trading is not beneficial as it activates 'sleeper' entitlements. Sleeper entitlements are those entitlements where water has not been traditionally used. This means that the water allocation available to this particular type of entitlement is surrendered (Frontier Economics *et al*, 2007: 37). Water trading can potentially activate the sleeper entitlements as it provides the owners of these entitlements incentives to participate in the market in order to realise some financial gain. Sleeper

entitlements are the side-effects of unbundling water rights from land rights and, once activated, can increase demand for water (Quiggin and Tan, 2004; Quiggin, 2006).

The concern with sleeper entitlements centres on market related concerns and water-supply related concerns. There are concerns that that sleeper entitlements can cause distortions in the market. The market is affected in two ways:

1. More participants in the market potentially distorting the price of water artificially. 'Artificially' because owners of sleeper entitlements would not normally be participants in the market. The entry of participants who have not traditionally used water also increases the environmental strain on water resources as allocations that were previously surrendered are 'unsurrendered'. This reduces the share of each allocation (Bjorlund, 2005).
2. Speculation – this is a significant concern amongst irrigators. It should be an issue of significant concern for policy makers as well. Speculation has the potential to permanently distort prices.

With regards to water supply there are concerns that the activation of sleeper entitlements would lead to water allocation reductions in an already severely strained system. A survey conducted in the early 2000s when the pace of water policy reform started to gather momentum, revealed significant concern with sleeper entitlements coming on to water markets. This concern was primarily from the community rather than irrigators themselves (Tisdell *et al*, 2001). The community strongly supported the idea of extinguishing licenses that have not been used for five years while irrigators strongly rejected this notion (Tisdell *et al*, 2001).

7.11 Policy Proposal 1 – Market Entry Restrictions

In order to prevent market distortions created by the activation of sleeper entitlements market entry needs to be restricted. Market entry needs to be restricted in the temporary water trade market. Entry does not need to be restricted in the market for permanent water. The obvious reason for the need to distinguish participants in different types of markets is that the activation of sleeper entitlements is presumably more of a problem in the temporary water market rather than in the permanent water market. One way of determining whether and entitlement is a sleeper or not could be to check historical records to see if allocations had been surrendered regularly over a period of 5 years.

A 'warm-up' phase could be introduced in order to facilitate the transition of entitlements from sleeper status to tradeable status. This would allow other market participants time to adjust and plan future behaviour and would not prevent, in totality, the entry of genuine market participants.

In addition to the above two measures, entry fees could be introduced only for entitlements that been given sleeper status. While market entry fees are in principal viewed as impediments to trade it must be noted that that entry fees should only be imposed on sleeper entitlements. Entry fees should be considered as *necessary impediments.* The need for necessary impediments provides support for the idea that water is a unique commodity and therefore a unique set of measures need to be imposed on any market based instruments that are used to facilitate trade of water. Market entry restriction will also go some way in providing a barrier to the entry of those owners who wish to use their water resources as a means for speculation only.

While one of the central themes in this thesis has been to support the removal of institutional impediments to better management of water resources, another central idea theme has been the introduction of institutional arrangements that safeguard the special characteristics of water. So, while policy proposal 1 seems to be introducing more transactions costs, it must not be viewed as a transaction *cost*. It is a safeguard measure that addresses key concerns of irrigators and one of the distinguishing features of this analysis has been the integration of economic, environmental and social concerns in the water policy reform process.

We can use the 'double edged sword' analogy for characterising sleeper entitlements and to support the imposition of market entry restrictions. The activation of sleeper entitlements has the potential to reduce the overall amount of water that is available in any particular year for allocation. This will, of course, place further strain on water users and has the potential to substantially increase the pressure on the environment as well. On the other hand, allowing sleeper entitlements to be traded in water markets could go some way to ensuring that water is transferred to where it is valued most. As long as policy is biased towards the latter, sleeper entitlements can be used to support positive water policy reform.

7.12 Policy Proposal 2 – Reducing (Institutional) Transaction Costs

The main impediment to increased permanent water trade seems to be more of a cultural impediment than an economic impediment. Mitigating cultural impediments (level 1 institutions) – rather than removing in totality – needs to be the focus of policy reform. Mitigating the impact of cultural impediments to permanent water trade is a more formidable task than removing economic impediments to permanent water trade. However, using

Williamson's (2000) institutional framework as a template for creating better policy we can attempt to circumvent the impacts of cultural impediments by focusing on removing existing economic and institutional impediments. Key economic and institutional impediments include the time taken to process different types of water trade (permanent and temporary).

The processing time for permanent trade is longer than that of temporary trade since permanent trade involves a change in ownership. Interstate trades take longer to process than both permanent and temporary trade. By focusing on institutional impediments (primarily level 2 and level 3 institutions) policy makers can potentially initiate a change in level 1 institutions by reducing the reasons for resisting change and providing additional incentives to partake in trade. This strategy is potentially useful in light of the Commonwealth Government's moves towards purchasing water entitlements in order to return them to the environment (this initiative is a component of the Basin Plan).

7.13 Summary of the Process Required for Permanent Trade

Permanent water trades (formally referred to as water access entitlement transfers) typically involve 4 steps (NWC, 2008b: 120):

1. A contract of sale needs to be organised between buyers and sellers.
2. Regulatory approval needs to be sought if the transfer is likely to impact on water resources and the environment in general. Regulatory approval is required if the trade will involve changing an entitlement's attributes (for example, the location, subdivisions and amalgamations). Regulatory approval is also required for interstate

trade. Some jurisdictions do not require regulatory approval (usually the case if the trade involves a straightforward change in ownership).

3. Settlement occurs once buyers and sellers exchange documents and sign relevant transfer papers.
4. The final step involves registering the trade. Registration involves the lodgement of transfer papers by buyers to relevant water entitlement registries. The relevant authorities then provide a certificate of approval.

A commonly used yardstick for measuring market efficiency is the amount of time taken for transactions to be lodged and approved (for water access entitlement transfers the conclusion of a transaction occurs once a certificate of approval is granted). A comparison of the transaction times and the institutional differences between different states is provided below[41]. Firstly, procedural arrangements and time-frames for completing permanent trade is outlined. Secondly, the procedural arrangements and time-frames for completing temporary trade is outlined before a comparison between states is made directly in order to develop policy suggestions for minimising transaction times.

7.14 Transaction Time for Water Access Entitlement Transfers

A significant contributing factor to high transactions costs is the time taken to complete a particular transaction. The incentive to engage in a particular transaction is reduced if there are significant delays or if it takes a long time to complete the transaction. The amount of steps involved in completing a transaction adds to the time involved and also reduces incentives to participate. Data from three states (Queensland, New South Wales and South

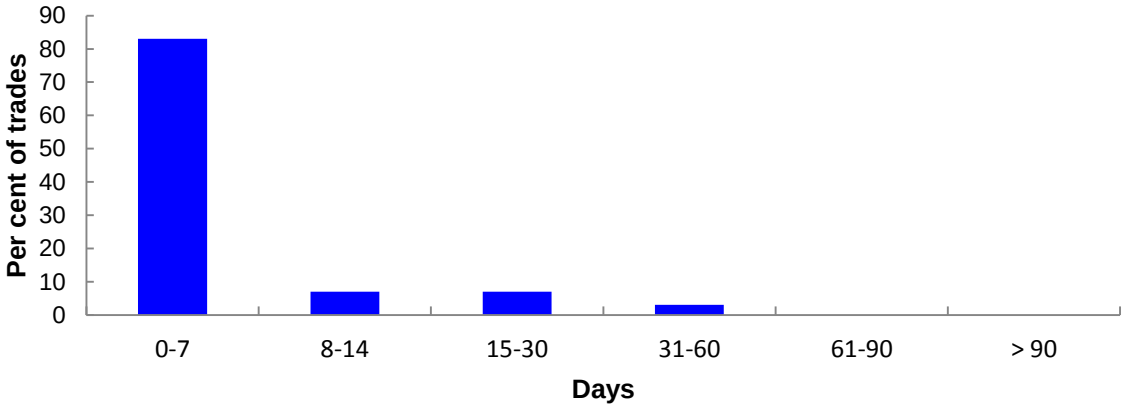
[41] The data and information provided in this sub-section was sourced from the National Water Commission's Annual Water Markets Report (NWC, 2008b).

Australia)[42] is used to identify one particular aspect of water trading in the Murray Darling Basin where improvements can be made.

Queensland

Unlike other states, in Queensland no approval is required for water access entitlement transfers (known as allocations in Queensland) unless changes (such as locational changes, subdivisions and amalgamations) are made. Approximately 80% of water transfers gained approval within 7 days in Queensland (see figure 7.4). Registration takes an average of 4 business days and is done after approval is granted.

Figure 7.4 – Approval times for water allocation subdivision, amalgamation and location changes in Queensland (2007/8)



Source: Adapted from NWC (2008b: 121).

New South Wales

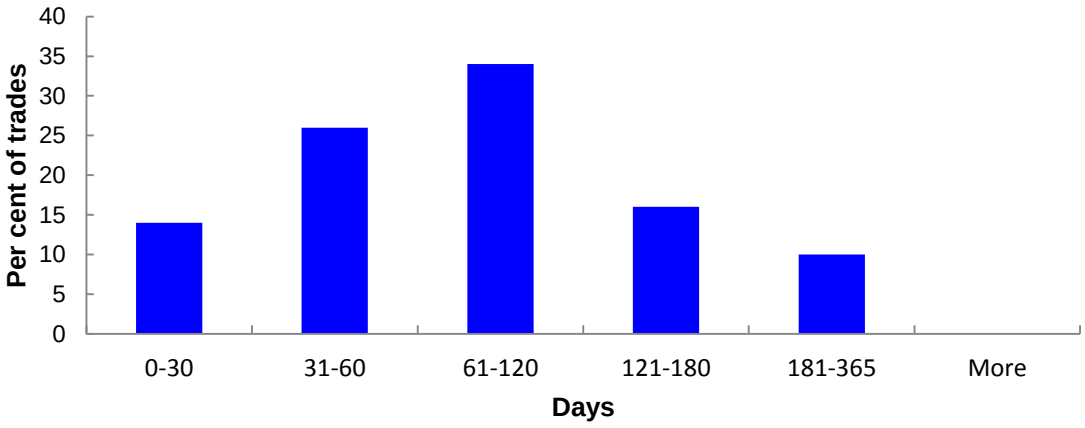
In NSW water access entitlement transfers are referred to as water access licence transfers. Transfers that occur within the same water source do not require approval from an authority. Transfers not within the same water source require approval from the Department of Water and Energy and transfers involving changes (such as locational changes, subdivisions and

[42] Data for transaction times for water access entitlement transfers in Victoria was not provided to the NWC.

amalgamations) also require approval. In 2007-08 the approval time for such transfers was 30 days.

Once buyers and sellers reach settlement the buying party needs to lodge transfer documents with the NSW Department of Land and the transfer needs to be registered with the Water Access License Registry. Figure 7.5 below illustrates the times taken for processing a complete trade (from lodgement to registration. Approximately 75% of transfers were completed with 120 days.

Figure 7.5 – processing times for water access licence transfers – NSW (2007/8)

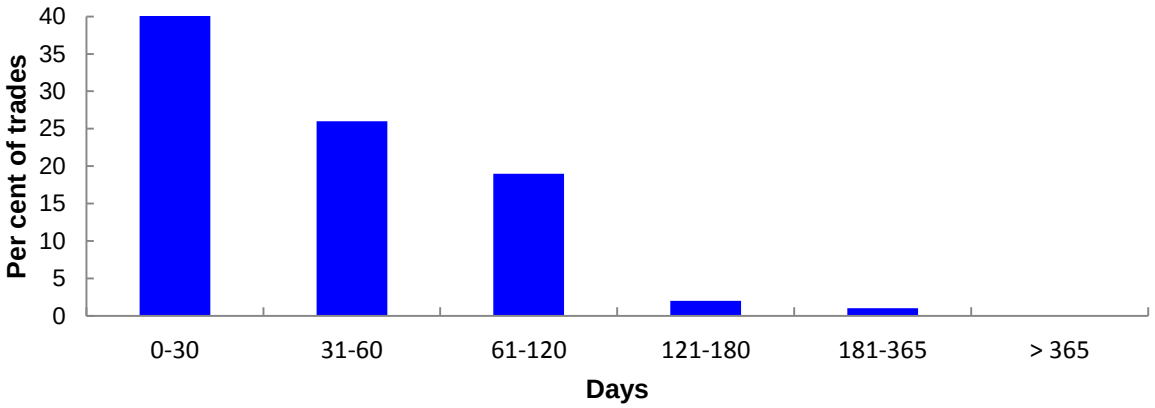


Source: Adapted from NWC (2008b: 124).

South Australia

Like in NSW, water access entitlement transfers are referred to as water license transfers in South Australia. Regulatory approval is required for water access entitlement transfers. Approximately 50% of transfers were granted approval within 30 days (see figure 7.6).

Figure 7.6 – Approval times for water licence transfers – South Australia (2007/8)



Source: Adapted from NWC (2008b: 123).

7.15 Summary of the Process Required for Temporary Trade

Evidence from four states (Queensland, New South Wales, Victoria and South Australia)[43], as with the case for permanent trade, reveals that there are aspects of temporary water trading that can be improved. Temporary water trade (formally referred to as water allocation trades) does not require as many steps as water access entitlement transfers since trade does not result in ownership change. There are 3 steps required for completing a water allocation trade:

1. *Contract of sale*

2. *Regulatory approval*

3. *Sale finalisation and payment*

Unlike water access entitlement transfers where the need for regulatory approval differs across states, water allocation transfers typically require regulatory approval (NWC, 2008: 121). Commonality between water access entitlement transfers and water allocation trades occurs with different processing times for water allocation trades. The following provides an outline of the distinguishing features of water allocation trades in different states.

[43] Four states are examined instead of three due to the availability of evidence from Victoria.

Queensland

In Queensland water allocation trades are referred to as seasonal assignment trades. Sunwater[44] is responsible for granting approval for most seasonal assignment trades in Queensland and the average processing time is 1 day (Sunwater cited in NWC, 2008b: 121).

Victoria

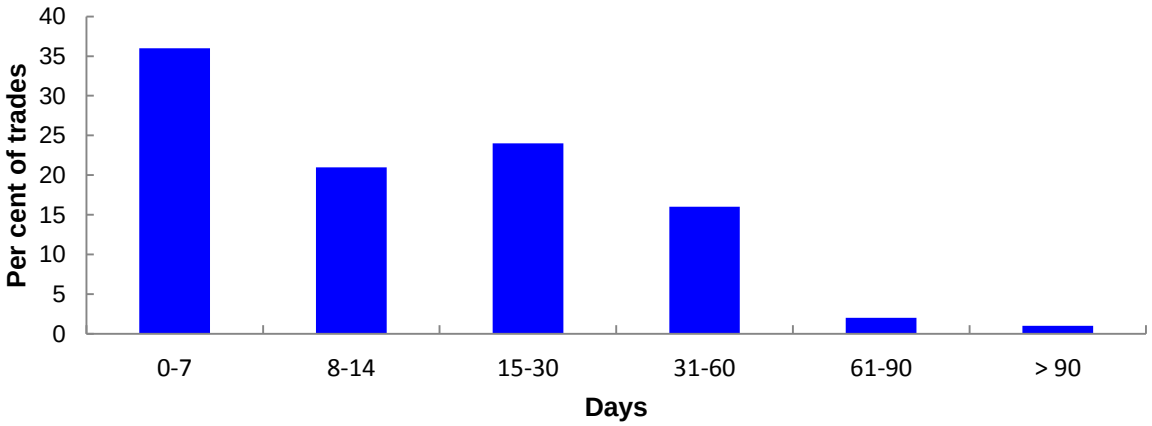
In Victoria, 90% of applications for water allocation trades were processed (processing involves granting approval or disapproving transfers) within 11 days, on average, during 2007-08. The average process time for interstate water allocation trades ranged between 35 to 40 days.

New South Wales

Figure 7.7 below illustrates the approval times for water allocation trades in NSW. Approximately 55% of water allocation transfers were granted approval within 14 days. However, the NWC notes that unlike in other jurisdictions, the approval times did not taper off for transfers requiring longer processing times – '...there was a long 'tail' in the frequency distribution of approval times...' (NWC, 2008b: 124).

[44] A water supply and services firm.

Figure 7.7 – Approval times for water allocation trades in NSW (2007/8)[45]

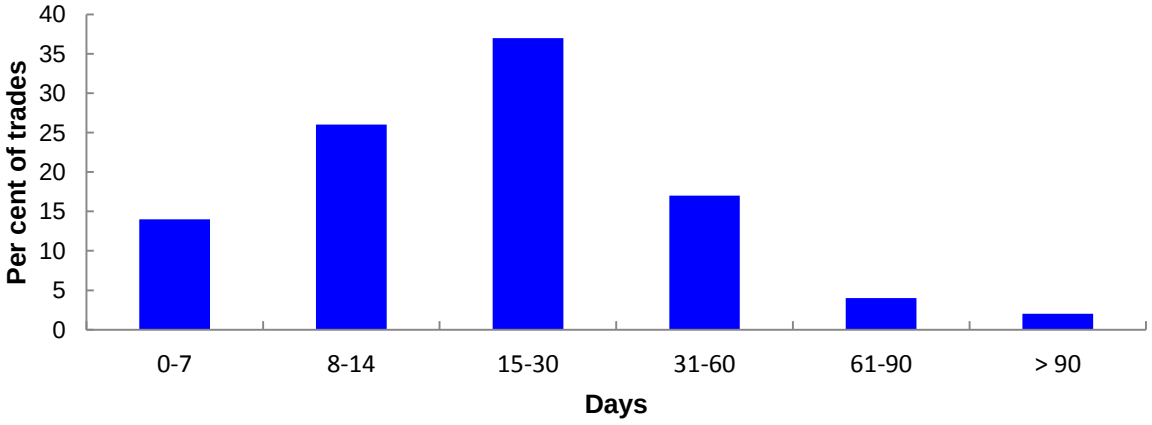


Source: Adapted from NWC (2008b: 124).

South Australia

Transaction times are longer in South Australia due to the fact that unlike in other states, water rights are not unbundled from land property rights (NWC, 2008: 122). Furthermore, the administrative process for water allocation trades is similar to that for water access entitlements (NWC, 2008b: 122). Figure 6.7 illustrates the longer approval times for water allocation trades in South Australia. Only 14% of water allocation trades are granted approval within 7 days. This does not compare favourably with the other Murray-Darling Basin states.

Figure 7.8 – Approval times for water allocation trades – South Australia (2007/8)



Source: Adapted from NWC (2008b: 123).

[45] The data excludes interstate water allocation transfer processing times.

Tables 7.2 and 7.3 provide a summary of the transaction times for temporary and permanent transfers. It is clear that that there is no uniformity in transaction time between states for the same type of transfers.

Table 7.2 – Percentage of temporary transfers processed within 7 days in 2007/8

State	Temporary
Queensland	100
NSW	36
Victoria	90
South Australia	14

Table 7.3 – Percentage of permanent transfers processed within 30 days in 2007/8

State	Permanent
Queensland	99
NSW	15
Victoria	N/A
South Australia	53

Source: NWC, 2008b.

Reducing transaction times is essential to decreasing economic impediments (and by extension cultural impediments as well) to trade. One way of reducing transaction times is to provide incentives to the relevant authorities to complete processes within a certain time-frame. The Allen Consulting Group (Allen Consulting *et al*, 2006: 24) suggest introducing time-limits for approvals. A penalty for exceeding the time-limit could be transaction-fee waivers for the buyers and sellers involved in the transfer.

7.16 Policy proposal 3 – Reducing (Monetary) Transaction Costs

Markets are not cost free. Both the public sector and the private sector incur costs generated by markets. For example, the public sector faces administration costs, water use monitoring costs and enforcement costs (Allen Consulting *et al*, 2006: 3). These costs are also ongoing and need to be taken into account when assessing the gains and losses generated by using the market as a means of allocating water. Some of the main costs incurred by the private sector are brokerage fees, information search costs and registration costs (Allen Consulting *et al*,

2006: 3). There are a number of water trade brokerage firms that facilitate trade between buyers and sellers. Table 7.4 provides a guide to the fees charged by 3 major brokerage firms.

Table 7.4 – Brokerage fees

Broker / Trade type	Temporary	Permanent
Watermove	Buyer: $55 per trade plus GST. Seller: 3% of total value plus GST, or a minimum fee.	Buyer: $110 per trade plus GST. Seller: 3% of total value plus GST, or a minimum fee of $550 up to a maximum fee of $4,400.
Water Exchange	Seller: 2.5% of total value. A minimum fee of $50 and a maximum fee of $750.	Seller: 2.5% of total value. Minimum fee of $50 and a maximum fee of $750.
WaterFind	Buyer: 1.5% of total value. Seller: 3% of total value.	Buyer: 1.5% of total value. Seller: 3% of total value.

Source: Allen Consulting *et al*, 2006: 16.

Changing the cost structure of administration (which can be classified as a level 3 institution) fits within the suggested ordering of the levels of institutions framework. The incentive to change the allocation of water, facilitated by markets, can be assisted by ensuring that the preceding levels of institutions do not interfere in significant ways (such as high administrative costs). It is difficult for governments to forcefully impose pricing restrictions on private firms to reduce the costs. However, the cost of lodging water transfer documents for approval is one area where the government can lead by example. Table 7.5 highlights the significant differences in government fees and charges between different states. When coupled with the differences in transaction times for trades to be completed they add to significantly as barriers to trade. This is particularly the case with permanent trade which not only takes longer to process but costs more as well – permanent trade costs an average 245% more to administer than temporary trade[46].

[46] Calculation based on data in table 7.5.

Table 7.5 – Government fees and charges

State	Type of trade	Application fee for approval	Fee for registration of trade
NSW	Temporary	$75	Not applicable
	Permanent	$250	$73.25
Queensland	Temporary	No government approval required within 'supplemented' schemes. Trades managed by Sunwater did not incur a cost. Approval must be sought for trades of unsupplemented water – application fee for this type of trade is $111.80	A lodgement fee may have to be paid depending on type of trade. The lodgement fee ranges from no payment required (e.g., for a standard trade) to $124.20 (this could apply to trades not defined in the Water Act 2000).
	Permanent	$282.30 for transfer of ownership.	$131.50
Victoria	Temporary	70.6	Not applicable
	Permanent	$158.60	$101.80
South Australia	Temporary	$205	Not applicable
	Permanent	$349	Not applicable

Sources: 1. Allen Consulting *et al* (2006: 15). 2. http://www.derm.qld.gov.au/water/trading/types.html#fees.
3. http://www.water.nsw.gov.au/Water-licensing/About-licences/Water-Act-12/act1912_fees/default.aspx.
4. http://www.dwlbc.sa.gov.au/assets/files/ra_rma1_v1.pdf. 5. http://www.dwlbc.sa.gov.au/assets/files/ra_rml3_v1.pdf.
6. http://www.waterregister.vic.gov.au/Public/ApplicationFees.aspx.

The obvious policy proposal for reducing the monetary transactions costs involved in water trading is to introduce uniformity of fees and charges across different jurisdictions. This would reduce the number of negative incentives to not participate in trade between different states. Perhaps the least expensive options from the table below could be designated as the limit for fees and charges. Introducing uniformity of fees and charges would also provide more incentive to participate in interstate trade.

7.17 Conclusion

This chapter has put the case for the use of water markets and has illustrated how water markets can introduce flexibility in water resource use. At this stage there is insufficient evidence to suggest, as some market advocates claim, that the introduction of water markets can help achieve environmentally sustainable outcomes in the Murray-Darling Basin. However, as more data becomes available in the coming years we can reassess this point with

regards to the Commonwealth Government's participation in water markets in order to purchase water for the environment.

As noted in earlier sections, there are many concerns with water markets and there are major impediments to market based reform. Three key impediments to water trade have been identified and corresponding possible policy reform options proposed. These involve removing impediments for permanent water trading, reducing institutional transaction costs associated with water markets and trading and reducing monetary transaction costs associated with water markets and trading. Additionally, the 'sleeper entitlement activation' concern was addressed with the recommendation that entry into temporary water markets be restricted.

Another impediment to emerge from the analysis is a cultural aversion to the development of trade in water. These cultural concerns are intertwined with economic concerns which are, in the short-term, easier to deal with than cultural concerns. It may be posited that addressing economic impediments should have positive flow-on effects on remaining cultural concerns in the long run through increasing the level of water trade. However, a proper assessment of this requires more careful consideration of the cultural concerns, their nature and malleability in the context of different water policy approaches. The following chapter addresses cultural concerns by examining social factors and water policy reform.

PART III – Governance Structures and Conclusion

Chapter 8 – Social Attitudes and Water

8.1 Introduction

While the economic reasoning behind a change in approach to water resource management is relatively straightforward, policy change cannot be successfully achieved without a parallel change in social attitudes. The role of institutions is particularly important in facilitating the process of attitude change that is integral to successful policy reform. This chapter addresses this concern by looking at social attitudes as an important level 1 institution. As mentioned in the first few chapters, level 1 institutions tend to develop slowly and take time to change. Over the last three decades and particularly during the last two decades there has been a noticeable shift in social attitudes towards the environment. Social awareness of the urgency required to address environmental problems has resulted in a rather hastened convergence of social goals and environmental goals. This chapter analyses this convergence. A brief historical overview of social attitudes (in Australia) towards the environment and specifically towards water is discussed first and is linked to a discussion of the importance of a change in social attitudes. Then comes a discussion of the political, economic and social contexts and the factors, such as education and public policies, which can support and guide these required social attitude changes. Finally, the chapter considers adaption versus mitigation as alternative aspects in the process of attitudinal change.

8.2 The Need for Change

Social attitudes shape behaviour and are therefore crucial in affecting demand for water and public responses to water policy changes. Social attitudes towards water are quite closely linked to water culture. Social attitudes are the views people have towards water and these views then shape water culture – how water is actually used.

The importance of these attitudinal factors in Australia is commonly noted, for example, Dovers (2008: 81) notes that:

> *'On any international comparison Australians use water rather profligately; in rural irrigation systems, in industrial processes, at tourist resorts, on sporting fields and golf courses, and in houses and gardens. Against increasing scarcity, there is reasonable expectation that there are ripe, low-hanging fruit in efficiency gains. Australians, at least urban ones, have never really been told to be frugal (the odd mild water restriction aside) but, rather, have been encouraged to splash it about in all sorts of ways. That is a hard legacy to shift and involves much more than changing immediate behaviours concerning appliances and orifices'.*

While it may be difficult to rapidly change water behaviour, the current concern about global climate change and localised concerns about regional environmental problems provides an unique opportunity to begin the process of change. The potential for a change in social attitudes towards water to be inculcated into the general populace now is enhanced by the increasingly open debate about human interaction with the natural environment (focus on climate change mitigation being a case in point). Indeed, it seems reasonable to posit, for this

reason, that more people are open to attitudinal and behavioural changes than at any other time in recent history.

One aspect of social attitudes towards water that could be a key element in attitudinal change is the distinctive separation between rural water and urban water. This separation is quite evident in literature – Dovers (2008: 85) notes that '[r]elative to population and economic activity, far more resources are expended in rural water and related research in natural resource management (NRM) than in the urban domain, despite the fact that major urban centres contain some 85 per cent of the population, and the bulk of social and economic activity'. Dovers (2008) suggests that research needs to begin to focus on integrated management (he notes that the NWI does suggest the linking of rural and urban water management). A convergence in social attitudes towards water would then be much easier to deal with and would have the added benefit of presenting a united front to any potential wavering (to continue with or to speed up the process of water policy reform) on the political scene.

While level 1 institutions such as social attitudes tend to change slowly, extreme events can increase the pace of change. For example, social attitudes towards water and in particular towards the Murray-Darling Basin have changed over the last two decades. Attitudes have even changed during the past year (this change is attributable to two main factors – the breaking of a decade long drought in the Murray-Darling Basin and the Commonwealth Government's Basin Plan proposal). For example, prior (June 2010) to the Basin Plan being released in October 2010, 7% of survey respondents believed that no change in water

allocations was needed (Basin Pulse, 2010)[47]. Following the release of the Basin Plan this number increased to 14%. The proportion of people who do not see their natural environment as a risk or in poor condition also increased from 16% in June 2010 to 26% in October 2010.

Values that underpin social attitudes also have started shifting. Evidence that attitudes are shifting is often seen through changes in action. An example of this the Australian Government's commitment to spending a significant amount of money on purchasing water for the environment and spending money on improving water infrastructure (this is most evident in recent initiatives such as the Government buyback scheme and the Living Murray Initiative).

8.3 The Political, Economic and Social Contexts

In order to integrate social attitudes and then potentially influence them we must examine the main elements that comprise policy reform. Policy reform does not exist in a vacuum. An important nexus exists between potential policy prescriptions and the potential for the policy prescriptions to have the desired effect. In order for policy reform to be successful (as judged by the completion of objectives and/or the resolution of particular problems which the policy sought to address) there are three factors (aside from the actual problem being addressed by the policy) which need to be taken into consideration, the political context, the economic context and the social context.

[47] Basin Pulse surveys are surveys conducted by Inovact Consulting Pty Ltd. Inovact interviewed a random sample of 511 Murray-Darling Basin respondents which reflected the population distribution of regions in the Murray-Darling Basin.

Political context

The political context can be a double-edged sword, especially when policy debate is focused on an issue that creates deep division about the correct policy response. On one hand, a particular policy position can be used to differentiate and therefore provide a viable alternative policy and on the other hand political expediency can constrain policy reform agendas as political parties seek votes rather than solutions that require necessary but unpopular decisions. This is especially the case with environmental issues. Environmental policy is particularly controversial due to the myriad of 'expert' opinions on whether a particular environmental problem exists and the lack of a clear consensus about the best possible policy response. The political context becomes particularly complex when different levels of government (and political parties on differing ends of the political spectrum) have different responsibilities with regards to management of the environment. This complexity is present in Australia and is especially prevalent in the water resources arena.

Time is an important consideration especially with regards to the political cycle. So new policies need to be planned for the long-term and with scope for adjustments. Long-term planning is necessary to ensure that policies are actually implemented in the longer-term even if a different party is in power. Connell (2007: 43) notes that '[t]he environmental management regime agree on that the water planning process needs to be politically viable for a reasonable period of time'.

Economic context

The economic context is important in itself and in relation to the political context. It is also closely interconnected with the environmental context. Traditionally economists have used the economic context to provide the parameters within which viable policy is created. Chapter nine provides an argument for re-framing policy framework by formally giving priority to the environment in the policy design and implementation process. This means that the parameters for viable policy would then be created by environmental requirements and these requirements would shape the role of the economic element of policy design and implementation. The environmental context identifies what policy should and should not be implemented and the economic context places limits on what can and cannot be implemented. The political context would then play a crucial role by reducing the gap between what should be implemented based upon environmental concerns and what can economically be implemented. The aim of the political context should be to create a convergence between the 'should' and the 'can' and the 'should' needs to be treated as the fixed variable (in relation to the economic constraint). The constraint on policy design and implementation created by the economic context may generate the impression that it is also the most important factor for consideration, but the discussion in previous chapters has highlighted the fallacy of that particular argument.

The social context

In order for the policy implementation to be successful the social context must also be considered. Environmental concerns typically cannot be isolated from social objectives and policy changes require social attitudinal changes as well. Weigel and Weigel (1978: 3) asserted that 'it is widely recognized that resolution of our ecological dilemma will

necessitate not only technological changes but also changes in the attitudes and behaviours of people who will utilize and be affected by altered technologies'. The NWC recommends the installation of new standardised water meters (NWC, 2007b: 21) in order to gain a better understanding of water usage with a view to improving policy responses to water related problems. Not only is technical change part of the policy reform process but water consumers will be forced to pay more attention to water use and this could alter their attitudes – especially when the advances in water metering can reduce the informational asymmetries present in water markets (circumventing the information asymmetries that are hindering market efficiency through the use of advanced metering technology is another recommendation of the NWC (NWC, 2007b: 10)). Social acceptability of new policies is crucial (for any policy issue). The importance of the social context is supported in Williamson's (2000) analytical framework (see figure 2.3 in chapter 2) that has been the theoretical basis for much of the discussion in this thesis.

Social acceptability forms the most important element of level 1 institutions. With regards to water resource management, the social context has largely been relegated to a lower level of importance than the economic, environmental and perhaps even the political elements. However, for successful reform social acceptability is a must. Social norms play an important role not only for shaping the success of current policies but also in shaping the design of policies in the future. In turn, polity can influence the positive probability of social acceptability in three main ways:

1. Changing institutional arrangements.

Changes in institutional arrangements (such as but not limited to regulatory changes) are usually aimed at stopping a particular behavioural attitude or encouraging a change in behaviour.

Marketisation of water resources, for example, aims to change behaviour so that water is not only valued differently but also consumed differently. However, changing institutional arrangements is only the first step and the success of institutional changes is limited by social acceptability (even if the institutional changes are aimed at changing the social attitudes themselves). The problem of water market thinness (especially in the permanent water transfer market) is a case in point. The reluctance to trade water on the permanent water transfer market is linked closely to social and cultural norms. In addition to appropriate institutional changes and in order to increase the likelihood of institutional changes being acceptable on a social level public education programs can be used as a means of changing both behaviour and social norms.

Ostrom (2007) provides a good example of how social norms can play an important role in ensuring a particular policy is successful in achieving its intended objectives. Harvesting egg-bearing female lobsters was made illegal in the 1970s in order to prevent the population of lobsters in Maine (locational description) falling below natural regeneration levels (Ostrom, 2007: 15185). By offering monetary rewards for egg-bearing females the authorities provided an incentive for co-operation by fishermen (Ostrom, 2007: 15185). Authorities would mark egg-bearing female lobsters and prosecute fishermen trying to sell marked lobsters (Ostrom,

2007: 15185). The success of this approach was based upon the voluntary participation of local fishermen who also took up the practice by marking and releasing egg-bearing females caught in their traps (Ostrom, 2007: 15185). This self-monitoring practice became the norm and further developed to include group-enforcement with fishermen destroying the traps of any fishermen breaching the rules (Ostrom, 2007: 15185). The key factor in the Maine lobster fishery case was that the need for collective action (self-monitoring and enforcement) converged with the self-interest of local fishermen. The self-interest in this case was ensuring the preservation of the Maine lobster population. This point is important as '[c]ollective action is more likely to occur and to be effective when it is consistent with the self-interest of the affected individuals' (Wilson *et al*. 2007: 15212). Social norms institutionalised a particular behavioural pattern and provided practical solidity and positive enforcement for formal policy changes.

2. Public education

A shift in policy requires change in the values and social attitudes of both decision-makers and the general populace. These are interdependent. Public education is strong tool available to policy makers to help change the values underpinning social attitudes of the general populace. Raising awareness amongst the general population provides a strong impetus for social acceptability. By influencing the way people analyse and respond to important issues policy makers can strengthen the chances of new policies not only being accepted but embraced as well. An example of a public education campaign is the NSW Government's Water for Life Program which includes a Water for Life Education Program. The Government states that 'The aim of the Education Program is to engage the community to reduce demand for water, increase recycling, and improve the community's understanding of

water supply and demand issues' (NSW DWE[48] *et al*, 2009: 2). The catalyst for the Water for Life Program was water scarcity arising from a severe drought over the last seven years.

Changing the attitudes of policy makers is an essential step for eventually changing the attitudes of the general populace. With regards to the Murray-Darling Basin and the water reform process in Australia evidence that the attitudes of policy makers is changing is evidenced by commitments to improving knowledge of water resource problems. For example, Cullen (2007a) notes that 'knowledge investments' are being made in recent years through initiatives such as 'Raising National Water Standards Program'. One of the three central objectives of this program is to improve knowledge and understanding of water resources (National Water Commission, 2010a). Furthermore, as mentioned in chapter 3, there is particular knowledge gap about groundwater resources. Part of the program includes a component aimed at 'knowledge and capacity building' (National Water Commission, 2010b) with specific focus on groundwater resources.

Another example of a public education/awareness program is the California Water Awareness Campaign. A severe drought (during 1987 and 1992) was the catalyst for the Californian initiative. The California Water Awareness Campaign aims to provide citizens with information about water related issues in order to 'ensure the Golden State maintains a plentiful supply of clean water, grow food power the state's robust economy and to sustain the environment'.

[48] DWE – Department for Water and Energy.

Public education programs occur on an international scale as well. An example is the Asian Development Bank's (ADB) Water Awareness Program that ran between 2002 and 2005.

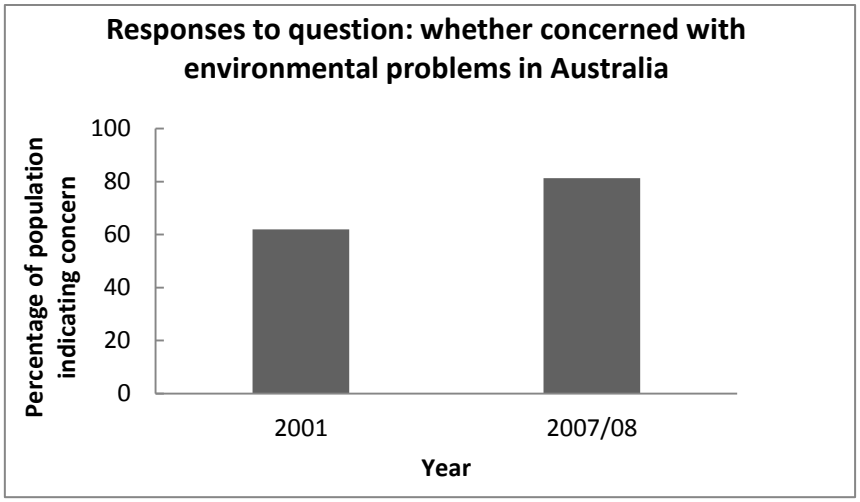
Some of the key objectives of the Water Awareness Program were:

- Increase public awareness and understanding of water issues
- Encourage dialogue among water stakeholders towards a common agenda for water reform
- Educate children and youth about the water crisis and their role in finding solutions

Empirical evidence suggests that growing public awareness of key environmental issues does actually change attitudes and behaviour. Changing views and behaviour towards the environment in Australia is reflected by survey data gathered by the Australian Bureau of Statistics (ABS). The 2003 *Year Book Australia* (ABS, 2003) was published with the environment as its major theme – reflecting not only the growing concern towards the environment but also the importance of knowledge transfers in order to better educate Australian citizens. Furthermore, in 2007, the ABS published a catalogue containing data dedicated solely to environmental issues. This particular dataset (entitled *Environmental Views and Behaviour*) provides data on several issues ranging from involvement in environmental activities to opinions about environmental issues. It is first dataset of its kind in Australia and once again emphasises the shift environmental issues have made from the periphery (both in the policy spectrum and social awareness arena) towards the centre.

A graphical comparison of the data in 2001 (while the year book was published in 2003, 2001 environmental data was used) and 2007 is provided below in figure 8.1 and figure 8.2.

Figure 8.1 – Concerns with environmental problems in Australia

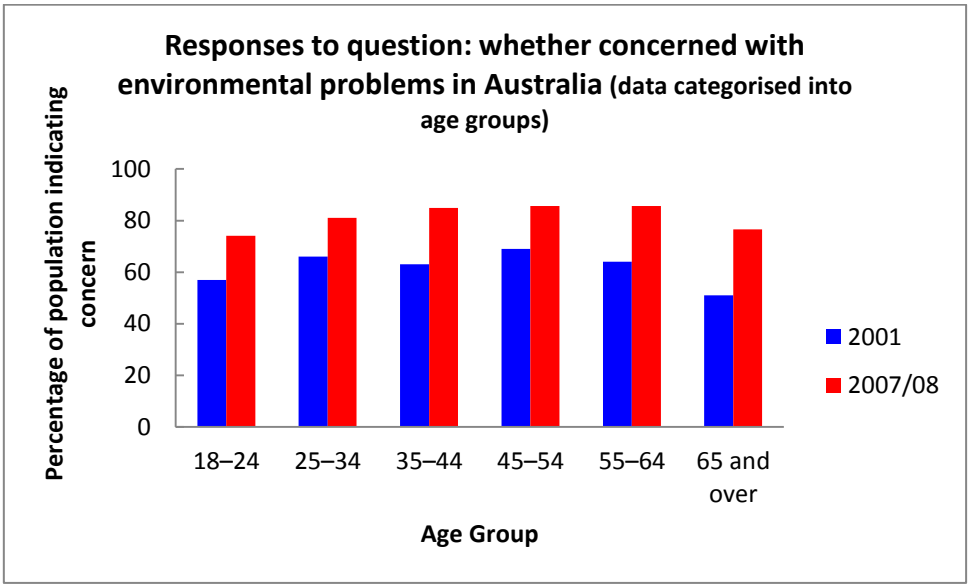


Source: Chart created from data in ABS (2003) and ABS (2007).

Figure 8.1 shows that concern for the environment increased significantly between 2001 and 2007. In 2001, approximately 62% of the population indicated that they were concerned about environmental problems in Australia. In 2007 approximately 81% of the population indicated that they were concerned about environmental problems.

Decomposing the dataset into age groups suggests that concern for the environment increased across all age groups. The largest increase was in the 65 and over age group. Approximately 51% of this age group were concerned about environmental problems in 2001 and in 2007 this percentage increased to approximately 77%. In 2001, age groups 25-34, 35-54 and 55-64 contained the largest proportion of people concerned with environmental problems – 66%, 69% and 64%. This changed in 2007 with age groups 35-44, 45-54 and 55-64 containing the largest proportion of people who were concerned with the environmental problems – 84.9%, 85.6% and 85.7% respectively. The smallest proportion (74.1% in 2007) of people showing concern for environment were those in the 18-24 age group (in 2001 the smallest proportion (51%) was in the 65 and over age group).

Figure 8.2 – All age groups concerned with environmental problems in Australia



Source: Chart created from data in ABS (2003) and ABS (2007).

It is interesting to note the proportional differences between views and actions. While approximately 62% of people in 2001 expressed concern for environmental problems, only 20% of people donated money or time towards environmental protection (ABS, 2003a: 153). The corresponding statistics for 2007 are 81.3% and 14.7%[49] (ABS, 2007: table 61). Without having any more data (in future surveys questions could be asked about why actions were taken and why not) there are three potential reasons for the gap between views and actions. Firstly, it could represent a lack of opportunity for people to contribute (either money or time) to environmental causes. Secondly, the gap could be a result of inability to contribute. For example, it would be interesting to investigate whether concern for the environment is correlated to the economic position of an economy. During periods of strong economic growth concern for the environment is likely to be higher than in periods of economic stress. Finally, the gap may actually represent a degree of satisfaction with current environmental policy!

[49] Note that the 2001 statistic, 20%, cannot be directly compared with the 2007 statistic, 14.4%, since the questions asked in 2001 and 2007 differ in wording. In 2001 both the words 'time' and 'money' were used while in 2007 only 'time' was used. This means that the 2001 statistic potentially deals with a larger subset of the population – i.e., those that donate time but not necessarily any money.

The crucial role public education and awareness campaigns play in influencing social attitudes towards not only water but towards increasingly fragile ecological systems is being recognised on a global scale as well. The Directorate General Communication (DGC) (Europe) note that the 2007 Nobel Peace Prize was awarded to environmental activist Al Gore and the Intergovernmental Panel on Climate Change (IPCC) for 'their efforts to build up and disseminate greater knowledge about man-made climate change and to lay the foundations for the measures that are needed to counteract such change' (DGC, 2008: 3).

Not only is it important to raise awareness about environmental problems in general but it is also vital that a direct link is clearly highlighted between quality of life and the health status of the environment. An increasing majority of citizens in the Europe Union already have identified the link between the state of the environment and quality of life – in 2004, 72 per cent of respondents in a survey ('Attitudes of European citizens towards the environment') claimed that the state of the environment was a factor influencing their quality of life and this percentage increased to 80 per cent in 2007 (DGC, 2008: 31).

3. Public involvement in the policy reform process

Involving the public in the policy reform process shifts part of the ownership of the process into the public sphere. By providing a stake in the success of the reformative process there tends to be more incentive for positive social action and behavioural changes. Public involvement can occur on a broad national scale as well as on a more localised level. Local communities directly involved in the policy reform process can adjust behaviour by altering

what is acceptable socially. A localised approach is particularly useful when dealing with smaller and distinct ecosystems within a larger environmental system.

International evidence also suggests that the public mood for engagement with environmental issues (for example through the absorption of information about environmental problems) is positive. For example, a survey for the DGC found that 30% of respondents believed that the provision of more information on environmental issues would be the most effective way of tackling environmental problems. Furthermore, 86% of European survey respondents believe that they individually have a role to play in protecting the environment (through a variety of actions such as reducing energy use, reducing water consumption, recycling etc) (DGC, 2008: 74). While these results do not provide information specific to water related issues, extrapolation to water issues can be undertaken without too much hesitancy.

The importance of public involvement in the environmental policy reform process is supported by Hemmati and Röhr (Hemmati and Röhr, 2007 cited in Gidley *et al*, 2009: 428). Referring specifically to climate change, they note that adapting views and behaviour towards climate change '...requires that all members of the affected communities be part of climate change planning and governance process'. This view can also be extended to the water policy process.

It may seem strange that the environmental context has not been listed in the discussion above (other than the casual references in the economic context discussion), given the emphasis on the environment in the previous chapters. The reason for the exclusion here is

that the political context, the economic context and the social context of policy design and implementation should be treated as the variable elements. Political goals, economic objectives and social attitudes need to be changed rather than the fixed or given environmental needs. Of course, in reality, the environmental needs are also continuously changing, especially with increasing global and local climatic variability. However, a moveable target is much harder to reach and gives opportunity for excuses for a weak policy response or even a non-response. This approach is also useful as it allows for explicit goal setting. Water resource management needs to change so that the environment shapes the political, economic and social approaches. Environmental needs can be adjusted by the chain reaction that starts from the environment before flowing on to the political, economic and social elements.

8.4 Adaptation versus Mitigation

An important question arises when investigating the role social institutions currently have and can potentially have in water resources management: do social attitudes towards water conservation and ensuring water ecosystem sustainability lead to adaptive changes or changes aimed at mitigation? This is an important question as it frames the approach formal institutions (such as regulatory bodies and governments) take towards water resource management. Ideally, a combination of adaptive changes and mitigation would be preferable but adaptation is perhaps more likely a strategy. Peter Cullen (an eminent Australian environmental scientist and one of the founders of the Wentworth Group of Concerned Scientists) noted that 'I believe that irrigators will have to get used to around half the water they have been accustomed to last century' (Cullen, 2007b).

Mitigation strategies generally require non-local and broad scale cooperation compared to adaptive strategies (Gidley *et al*, 2009: 428). Gidley *et al* (2009: 428) note that the reason for this is that '...even if greenhouse (GHG) emissions were stabilized today, the accumulated GHGs in the atmosphere and associated climate change events would still require significant adaptation'. While the authors are referring specifically to adaptation and mitigation arising from climate change, their analysis can easily be applied to the water policy reform process as well. Even if water usage is curtailed now, we still would have to account for the degradation in water quality and reduction in water availability arising from past usage patterns. Adaptation is also more closely linked to social attitudes since mitigation requires a significantly more co-ordinated effort.

Success of adaptation is dependent on a number of elements including the three elements listed earlier (institutional arrangements, public education and public involvement). Another important element is the likelihood that environmental changes will have directly on different people. A 1990 survey in Orange Country (in California in the United States of America) found that people whose lives were being adversely affected or whose lifestyles were being threatened by environmental problems were more likely to engage in positive environmental practices (such as recycling, conserving water etc) (Baldassare and Katz, 1992: 602). In fact Baldassare and Katz (1992) found that the direct threat from environmental problems was more significant predictor of environmental practices compared with demography and political (and thus ideological) affiliation. This is an interesting but not unexpected result. It highlights the importance of a holistic approach to water policy reform. Social support (whether it is developed through public education, public involvement and/or institutional changes) can provide polity with the strength to begin policy reform or to even broaden the scope of policy reform. The results in Baldassare and Katz (1992) suggest that if the public

(both major water consumers and minor water consumers) can be made aware the direct threat to their standard of living as a result of water scarcity arising from climatic variability and grossly-mismanaged water resources the chances of changes in not only environmental practices but attitudes will increase.

8.5 Conclusion

This chapter has highlighted the importance of incorporating social attitudes in the water policy reform process. The link between social attitudes and the environment is often ignored in discussions of the policy reform process that put more emphasis on economics and politics of reform. Integrating the role social attitudes play in shaping policy reform and its effectiveness results in a more complete and holistic approach to water management. Social attitudes, norms and values are level 1 institutions that are typically slowest to change and take time to develop. The discussion emphasises the link between the probability of success and the social acceptability of a particular policy reform measures. The chapter has indicated three methods of shaping and influencing social attitudes – institutional changes, public education and awareness programs and public involvement strategies.

Institutions play a key role in all these aspects of evolutionary process. As Williamson (2000) argues, more analytical focus is placed on lower level institutions which impacts on the completeness and adequacy of analysis. This top level designation implies that social attitudes take time to change but can be powerful forces that should be part of any policy reform process and especially water policy reforms due to the strong social and cultural links people have with water.

Finally, this chapter proposes that the current heightened level of concern and awareness regarding climate change provides an unprecedented opportunity to begin the process of changing social norms, attitudes and eventually behaviour towards the environment in general (and water particularly). It is reasonable to presume that the majority of people (and by extension the representatives of the people responsible for formalising policy reforms) would agree that a change in attitudes and behaviour (even if the current climate change is reversed naturally with time) can be beneficial for the environment and the resources it provides. However, there are major obstacles and contrary forces inhibiting the required attitudinal and behavioural change. Some of the obstacles result from the inappropriate governance arrangements that do not facilitate attitudinal change. Governance arrangements are discussed in the following chapter.

Chapter 9 – A water governance model

9.1 Introduction

Governance plays a key role in new institutional economics. The relationship between economic, political and social aspects of phenomena examined by new institutional economics is defined by governance structures. We can analyse the interaction between the three aspects by examining the governance structures that support and facilitate the interaction. For example, recall in Williamson (2000) (see chapter two), governance structures form part of the level two and level three institutions and need to be established prior to transactions and resource allocation (level four institutions). The work by Nobel Prize winner Ronald Coase emphasises the importance of identifying governance structures that can reduce transaction costs. This may mean that the government needs to play a role in market processes. For example, as suggested earlier (chapter seven) the government has a role to play in preventing speculative activity in water markets and can play a role in establishing market rules such as entry restrictions.

This chapter examines the role of Coasean economics, as a subset of new institutional economics, in providing an analysis and possible solutions for water policy reform in Australia. Before drawing upon Coase's work, the complexity and multi-dimensionality of environmental problems is examined using insights from Elinor Ostrom. This is an important discussion as it illustrates the problem of adopting one-dimensional panacea-like solutions for environmental resource management. Coase's work is then drawn upon to create a framework for analysis. Using this framework, a water governance model that introduces an alternative method of analysing water resource related issues is developed.

9.2 Panaceas and the Multi-dimensionality of Environmental Problems

Increasing focus on governance structures and developing adaptive measures has the potential to provide enormous benefits in terms of informing policy makers but, prudence is required when adopting particular recommendations. It is particularly necessary when recommendations arise from one-dimensional analytical frameworks that take inadequate account of the connection between ecosystems and human (social-political-economic) systems. Ostrom refers to the nexus of natural and human ecosystems as social-ecological systems (Ostrom, 2007). Ignoring this complexity is fallacious. Ostrom (2007: 15181) observes that there has been '...perverse and extensive uses of policy panaceas in misguided efforts to make social-ecological systems...sustainable over time'. The problem of one-dimensionality is particularly prevalent in conventional economic reasoning. As Willis (2006: vi) observes:

> *'...economic analyses usually assume that the life support services of the environment are unaffected by the environment; this greatly simplifies economic analysis by allowing economists to ignore the wider ecological impacts of human resource use, and their consequences for the future of human societies'.*

The lure of adopting panaceas is the misguided belief that the ecosystems with generally similar features can be dealt with a one size fits all policy. This is supported in Ostrom *et al* (2007: 15176):

> *'[a] core aspect of panaceas is the action or tendency to apply a single solution to many problems. In the governance of human-environment interactions, a panacea refers to recommendations that a single governance-system blueprint (e.g., government ownership, privatization, community property) should be applied to all environmental problems'.*

A whole of system approach may work well on a regional level but it should not be automatically assumed that an approach that has worked well in one ecosystem can be applied to another ecosystem with similar but not identical characteristics.

The economics discipline bears a heavy burden (if not the heaviest) for advocating singular approaches to complex, seemingly similar but subtly distinct problems. This is particularly the case with economic solutions to environmental problems. Ostrom (2008) notes that '[s]cholars have tended to recommend 'optimal' solutions for coping with open-access problems related to common-pool resources such as fisheries, forests and water systems'. While Ostrom is referring specifically to open-access problems a similar situation applies to water resource problems around the world including the Murray-Darling Basin.

The complexity of social-ecological systems means that '[t]he problems of overharvesting and misuse of ecological systems are rarely attributable to one cause' (Ostrom, 2007: 15187). This point reiterates the fallacy of singular analytical approaches and highlights the need for a multi-pronged approach.

Ostrom (2007) provides an useful multi-tier framework for analysing social-ecological systems. She identifies seven variables that can be used as a starting point for analysis. Solutions to particular problems can then be conceptualised by decomposing the seven variables into an exhaustive (but definitely not exclusive) list of second-tier variables (Ostrom lists forty-seven second-tier variables). The analytical framework in Ostrom (2007) is provided below.

Table 9.1 – A multi-tier framework for analysing social-ecological systems

Social, Economic and Political Settings (S)	**Related Ecosystems (ECO)**
S1 - Economic Development.	ECO1- Climate patterns.
S2 - Demographic trends.	ECO2- Pollution patterns.
S3 - Political stability	ECO3- Flows into and out of focal SES.
S4 - Government settlement policies	
S5 - Market incentives	**Governance System**
S6 - Media organization	GS1- Government organizations
	GS2- Non-government organizations
Resource System (RS)	GS3- Network structure
RS1- Sector (e.g., water, forests, pasture, fish)	GS4- Property-rights systems
RS2- Clarity of system boundaries	GS5- Operational rules
RS3- Size of resource system	GS6- Collective-choice rules
RS4- Human-constructed facilities	GS7- Constitutional rules
	GS8- Monitoring & sanctioning processes
RS5- Productivity of system	
RS6- Equilibrium properties	
RS7- Predictability of system dynamics	**Users (U)**
RS8- Storage characteristics	U1- Number of users
RS9- Location	U2- Socioeconomic attributes of users
	U3- History of use
Resource Units (RU)	U4- Location
RU1- Resource unit mobility	U5- Leadership/entrepreneurship
RU2- Growth or replacement rate	U6- Norms/social capital
RU3- Interaction among resource units	U7- Knowledge of SES/mental models
RU4- Economic value	U8- Dependence on resource
RU5- Size	U9- Technology used
RU6- Distinctive markings	
RU7- Spatial & temporal distribution	**Outcomes (O)**
	O1- Social performance measures
Interactions (I)	(e.g., efficiency, equity, accountability)
I1- Harvesting levels of diverse users	O2- Ecological performance measures (e.g., overharvested, resilience, diversity)
I2- Information sharing among users	
I3- Deliberation processes	O3- Externalities to other SESs
I4- Conflicts among users	
I5- Investment activities	
I6- Lobbying activities	

Even a cursory examination of the table above illustrates the complex and diverse range of variables linked to social-ecological systems and the policy responses to problems within these systems. The prevalence of panacea like policy prescriptions is somewhat strange in light of frequent failures (Ostrom *et al*, 2007: 15176). Ostrom *et al* (2007: 15176) claim that '[t]he track record of the use of panaceas is one of repeated failures'. They provide five examples to support their assertion.

Perrings (2007) identifies another significant pitfall of adopting panaceas in ensuring environmental sustainability– the increased risk of failure resulting from rapidly evolving environments. Catering for all possible scenarios in rapidly evolving environments is not possible. The following discussion draws upon Coase's work and develops an adaptive governance structure that could be used as a first step step in mitigating the risk of policy failure.

9.3 The Nature of the Firm

The link between Coase's work and water policy starts to form when Coase's definition of the firm is expanded to include any form of organisation (i.e., including, but not exclusively, commercial businesses) which attempts to reduce transaction costs. While Coase was particularly interested in profit making firms, broad conceptual lessons can be taken and adapted to other forms of organisation. Historically there has been overlap between water regulatory bodies in different states and there has been considerable conflict between various interested parties. If effective institutional arrangements are in place then the conflict and overlap can potentially be circumvented (or at least mitigated). Establishing institutional

arrangements and organisations to implement and enforce creates enormous potential to minimise transaction costs that arise as a result of different approaches to water policy reform between different states and territories in Australia. This point will be further elaborated upon later in this chapter.

Ronald Coase, in his seminal paper. '*The Nature of the Firm*' (1937), provided a definition of a firm '...which is not only realistic in that it corresponds to what is meant by a firm in the real world, but is tractable by two of the most powerful instruments of economic analysis...the idea of the margin and that of substitution... (Coase, 1937: 386). Coase's definition of the firm arises from his criticism of the neo-classical interpretation of the economic system. A common orthodox description of the economic system is given by:

> *"The normal economic system works itself. For its current operation it is under no central control, it needs no central survey. Over the whole range of human activity and human need, supply is adjusted to demand, and production to consumption, by a process that is automatic, elastic and responsive'* (Salter, cited in Coase, 1937: 387).

Co-ordination within this 'normal economic system' is achieved through the price mechanism. There is therefore no role for (government) 'intervention' in this economic system because intervention only attempts to do what the price mechanism already does (Coase, 1937). According to Coase, a firm arises because the number of transactions, or the cost of transactions, in the market, required for production, is reduced within a firm. The role

of the price mechanism in co-ordinating and facilitating production is superseded by the role of the entrepreneur within a firm (Coase, 1937: 588). Coase states that '...the distinguishing mark of the firm is the supersession of the price mechanism' (Coase, 1937: 389). Some of the main reasons why the role of the price mechanism as a co-ordinator is superseded by the role of the entrepreneur are:

1. Some people may prefer to work under the direction of a particular person. This would render the price mechanism redundant as presumably under the price mechanism people will work they receive the highest compensation (Coase, 1937: 390).

2. 'Firms might also exist if purchasers preferred commodities which are produced by firms to those that are not produced' (Coase, 1937: 390).

3. '...it is profitable to establish a firm...[because] there is cost of using the price mechanism. The most obvious cost of 'organising; production through the price mechanism is that of discovering what the relevant prices are' (Coase, 1937: 390).

4. The existence of uncertainty provides incentive for a firm to be established. Coase asserts that '[i[t seems improbable that a firm would emerge without the existence of uncertainty' (Coase, 1937: 392). Coase does not provide an adequate explanation for this assertion. A possible explanation could be that the existence of uncertainty creates an environment ripe for exploitation by establishing a firm. For example, firms could be established in order to purchase risk created by uncertainty. This could perhaps reduce the costs of re-negotiating short term contracts which would presumably be prominent in an uncertain environment.

5. Governments and regulatory bodies also play a significant role in creating an environment conducive for establishing a firm. Coase notes that '...exchange transactions on a market and the same transactions organised within a firm are often treated differently by governments or other bodies with regulatory powers' (Coase,1937: 393). The example highlighted in Coase (1937) is that of a sales tax. Sales tax is clearly a tax on transactions in a market rather than similar transactions within a firm' (Coase, 1937: 393).

Coase claims that the first two reasons listed above are less significant than the third reason. The cost of discovering relevant prices is an age-old dilemma and even by organising through the firm (rather than the price mechanism), the firm will not totally eliminate such costs. Instead these costs are reduced. Coase points out that'[t]he costs of negotiating and concluding a separate contract for each exchange transaction which takes place on a market must also be taken into account' (Coase, 1937, 391). The amount of time taken (and the amount of costs incurred) to organise the contracts for transactions is obviously reduced if organisation is done within a firm. The idea that one of the primary reasons for the existence of a firm is due to the need to reduce transaction costs is succinctly expressed by Coase, '...the operation of a market costs something and by forming an organisation and allowing some authority (an 'entrepreneur') to direct the resources certain marketing costs are saved' (Coase, 1937: 392).

While the first three points listed above provide the reasons for the existence of firms, the fourth and fifth points provide reasons for not only the existence of firms but also for the growth of firms (both of existing firms and the establishment of new firms).

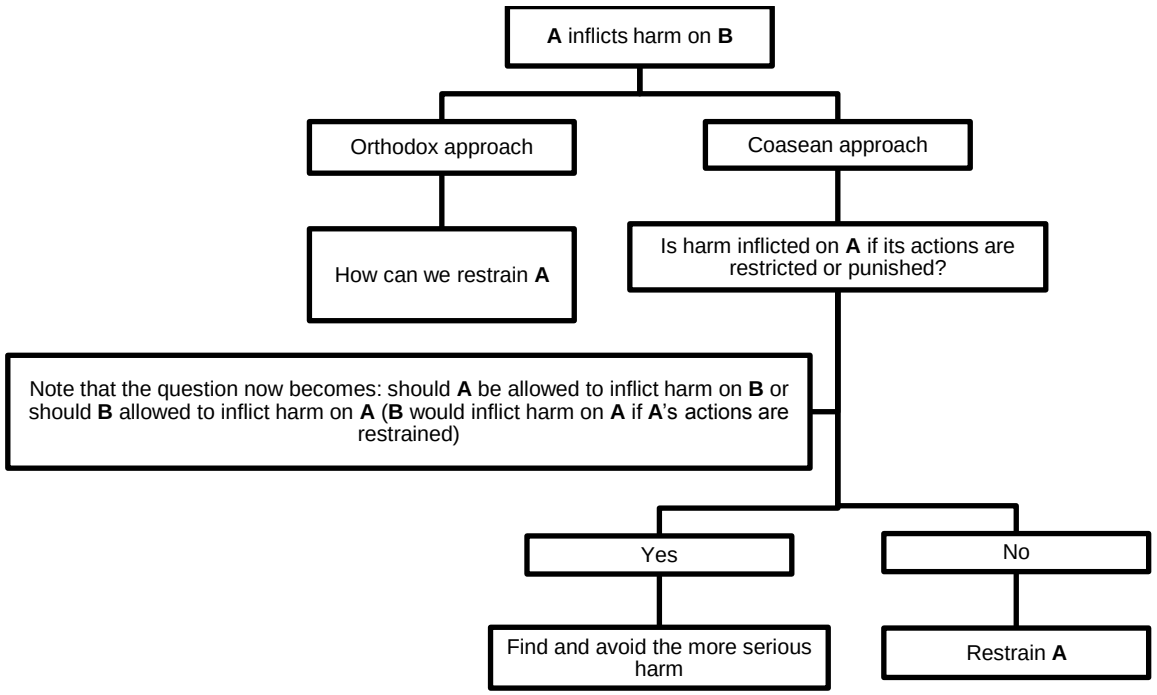
The reasons for the existence of a firm provided by Coase can be adapted to provide reasons for the existence of better water policy reform institutions. For example, the fourth point listed above is particularly pertinent for the present analysis as there is growing impetus for utilising the 'power' of the market to alleviate scarcity issues. Scarcity necessarily implies a certain degree of uncertainty and as Coase pointed out, an uncertain environment creates an environment ripe for exploitation through the creation of firms. In this case the firms could potentially be agencies or agents specialising in speculative manipulation. The danger of speculation in a water market has been alluded to before and while it seems that a transaction costs approach to water policy formulation may be a potential source of creating more problems it should also be noted that a transaction costs approach is a double edged sword. In order to minimise the problems created by uncertainty, the fifth point highlighted above comes into play. It is crucial that the government (various levels) maintain significant control so that that water markets are not totally unfettered. While this thesis contends that part of the solution to water related problems is a need to designate some form of economic value for water, it is acknowledged that water has some unique characteristics that create the need to shelter water from typical market related problems (such as price volatility arising from speculative activity).

The next section analyses Coase's other seminal paper '*The Problem of Social Cost*' (1960). Following that analysis will be a more explicit formulation of the framework referred to at the beginning of this section in combination with the ideas raised through an analysis of '*The Problem of Social Cost'*.

9.4 The Problem of Social Cost

'*The Problem of Social Cost*' deals with '...those actions of business firms which have harmful effects on others' (Coase, 1960:1). Actions taken by one party that have negative impacts on another party are quite prevalent and are the source of most conflicts in the Murray-Darling Basin. The most direct link between the ideas Coase presents in this paper and the realities in the Murray-Darling Basin are the effects of different water usage patterns of upstream users and the flow-on effects on downstream users. Coase notes that traditional economic analysis has examined this issue by looking at the divergence between private and social products. Coase disagrees with this approach. According to Coase (1960), the problem with the orthodox approach is that it does not recognise that the problem being dealt with has a reciprocal nature. The reciprocal nature of the problem is the defining feature of the Coasean analytical framework. An illustrative example of the reciprocal nature of the problem is presented below (it has been adapted from Coase (1960).

Figure 9.1 – The reciprocal nature of the problem



Source: Author's own adaptation from Coase (1960

The orthodox approach usually advocates the use of punitive measures (usually through a tax or fine) in order to restrain the party causing the harmful effects. The size of the punishment is determined through the pricing system. The problem is that the costs of using the pricing system are not included in the analysis (Coase, 1960: 15). Imposing a tax or fine necessarily involves the price mechanism and therefore the market. Attempts by party A to avoid punishment will also involve interaction with the price mechanism and the market. Coase (1960: 15) identifies some of the main costs associated with using the market (these are the costs party A will encounter in order to avoid punishment):

1. '...discover who it is one wishes to deal with...'
2. '...inform people that one wishes to deal and on what terms...'
3. conducting negotiations
4. drawing contracts
5. making sure that the contract is being observed

The authority responsible for imposing the punishment will also incur similar costs. For example, legislation outlining the repercussions of actions that have harmful effects on other parties will need to be drawn (this process will replace costs 3, 4 and 5 above), the enforcement costs will be incurred in order for the legislation to be effective and possible amendments in the future will need to be made in order to ensure the legislation remains relevant. Determining the magnitude of the tax or fine will also involve interaction with the market. For example, suppose that the authority imposes a tax on the gain obtained by party A. In order to determine an appropriately size tax, the authority will need to observe (or estimate) the size of the benefit gained by A and compare that to the size of the loss (cost) faced by B. The revenue from the tax (after accounting for the costs associated with enforcement) could used to compensate B. (A similar example could be constructed if a fine

rather than a tax is imposed). The imposition of a tax (or fine) seems to be an acceptable and simple solution but Coase (1960) notes that for a tax to have the desired effect (restraining actions leading to harmful effects) the revenue needs to be commensurate to the damage inflicted and it needs to be actually distributed to the disaffected party(ies) (Coase, 1960: 41). Determining commensurate compensation is problematic as it involves measuring the fall in production (or cost of harm) faced by party B. Measuring these costs is difficult – Coase (1960: 42) refers to this as the '...problem of calculation...'.

The point here is to highlight the fact that the 'restrain A' option is not as simple as the first impression gives and is a rather blunt policy option. The traditional 'restrain A' option does not wholly take into account the transaction costs involved and therefore punitive measures are not necessarily the best option for dealing with the actions of agents that have harmful effects on other agents. In his earlier paper, '*The Nature of the Firm'* (1937) Coase suggested that the creation of a firm could be used to reduce transaction costs. When dealing with the harmful impacts of actions taken by one party on another party the establishment of a firm is a possible solution – for example, a organisation could be created in order to facilitate negotiations between parties in similar situations to A and B above. A firm such as this would arise when the market costs exceed administration costs (Coase, 1960: 17). However, Coase (1960) notes that another solution also exists – the government. The government can be considered as an alternative solution especially when a diverse range of activities need to be controlled by a single organisation. The government could be seen as a possible solution when administrative costs are high (Coase, 1960: 17). High administrative costs could be as prohibitive as high markets costs and therefore any firm that is designated administrative responsibilities also needs to be a firm that minimises this particular set of costs. The government can be seen as a 'super-firm' with one crucial difference – it can avoid the

market (Coase, 1960: 17). Coase (1960: 18) suggests that government control could be beneficial when there are a large number of people involved.

It is interesting to note that the preceding discussion seems to imply that Coase was a strong advocate of government involvement. However, Coase asserts that the government is not always the solution and in fact '[i]t is [his] belief that economists and policy-makers generally have tended to overestimate the advantages which come from government regulation' Coase (1960: 18). His discussion about the government as an *alternative* solution to the problem arose as a criticism of orthodoxy which, almost in *all instances*, emphasises the panacea like effect of the market solution.

9.5 Water Governance

Having provided the theoretical background and support for better governance of water, it is now necessary to consider the theoretical justification for the creation of an organisation(s) to deal exclusively with water resource management. Coase's work is helpful here too: his *The Problem of Social Cost* (1960) provided the theoretical justification for a different approach to conflict. By adapting and adding to the ideas raised in his papers we can develop a model for effective water governance. An effective water governance (EWG) model will also illustrate the advantage of developing a more cooperative form of federalism (an idea that is explored in the following chapter).

Developing any model necessarily requires defining and understanding clearly the problem at hand. In the following discussion an understanding of what is meant by *effective water governance* is developed.

9.6 New Institutional Economics and Governance

Water governance encompasses both the ideas raised earlier about the creation of a 'super-firm' type of organisation and the need to resolve conflict in a heterodox manner. A distinction needs to be made between 'government' and 'governance'. Traditionally governance and government have been treated as synonyms (Stoker 1998, 17). However, during the last two decades there has been a growing amount of literature (see for example Rhodes, 1996, Stoker, 1998 and van Kersbergen and van Waarden, 2004) dealing with the subtle yet definitive distinction between governance and government. Rhodes (1996) suggests that treating governance and government interchangeably is incorrect. Rhodes (1996: 652) notes that '...'governance' has several distinct meanings'. In fact, the significance of the distinction between governance and government has given rise to a separate academic field – governance theory.

A direct link between Coase's contribution to institutional economics can be made here with reference to the ideas presented in both *The Nature of the Firm* (1937) and *The Problem of Social Cost* (1960). Stoker (1998: 18) states that '[t]he value of the governance perspective rests in its capacity to provide a framework for understanding *changing* processes of governing'[50]. Another link between institutional economics and governance theory becomes

[50] Emphasis added.

apparent here. Institutional economics places significant focus on *evolution* and the treatment of social, political and economic phenomena in a dynamic framework.

An important and common point in most governance literature is that the term governance tends to imply a decline in central government's involvement in society and the economy (Jordan *et al*, 2005: 480). This point is supported in Stoker (1998: 17) when he notes that 'governance recognizes the blurring of boundaries and responsibilities for tackling social and economic issues'. This assertion is particularly pertinent when developing an appropriate definition of *effective water governance*. Using the Murray-Darling Basin as a case example, it is clear that there are several affected parties (irrigators, environmentalists and governments) and that effective management of the Murray-Darling Basin requires a more co-ordinated and *multi-pronged* approach. The discussion earlier in this chapter about the complexity of environmental issues necessitates a multi-pronged approach. *However*, this thesis does not wholly concur with the idea that the term governance necessarily implies a decline in the involvement of a central government in society and the economy. Increasingly social and economic phenomena are inextricable from the state of the natural environment. Managing the natural environment is increasingly falling into the domain of central governments (the most obvious example being the current global debate about regulating greenhouse gas emissions). The discussion in chapter 5 identified (using Ostrom's (1997) analytical framework) situations when a more centralised governance approach could play a role. This thesis contends that rather than a decline in central government involvement, governance can actually refer to a situation where there is a *different* role for the central government. So, rather than the government involvement being analysed on a single vertical scale (covering simply a high level or low level of involvement), a horizontal scale can be

introduced in order to develop a more complete model for effective water governance. Traditional literature on governance typically implies a reduction in government.

By including Stoker's (1998: 19) proposition that 'governance refers to a complex set of institutions and actors that are drawn from but also beyond government' we can begin to develop a better model for effective governance and we can use this model as a foundational framework for a more detailed effective water governance model. A related argument is presented in Livingstone (2005). Livingstone, (referring specifically to water allocation) presents a discussion about the micro-level[51] and meso-level[52] perspectives for assessing the role and efficacy of institutions involved with water resource management. A means of assessing institutions is important as it allows the policy reform process to be dynamic.

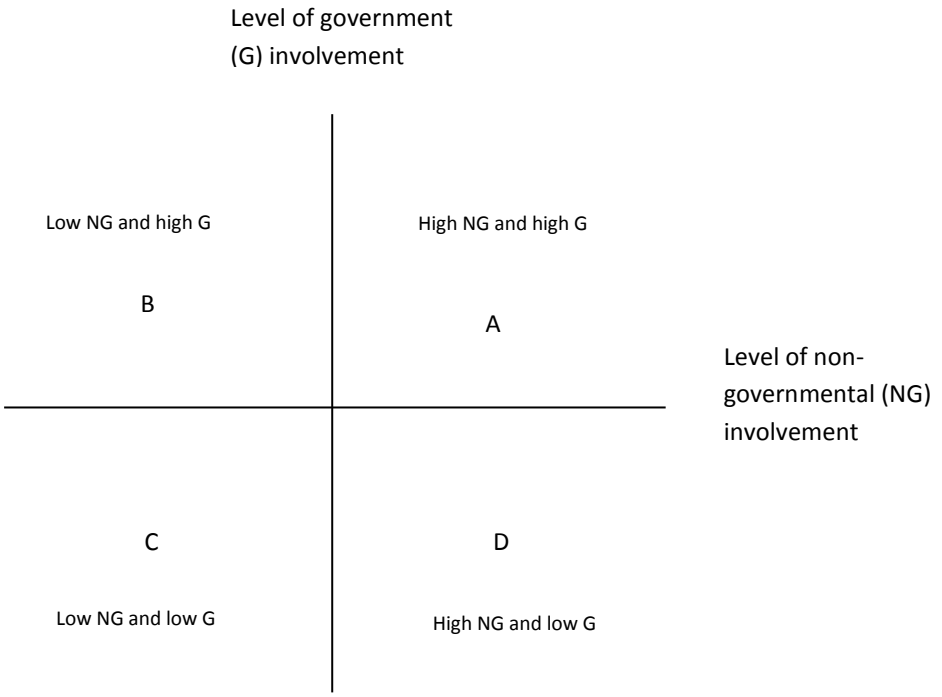
Incorporating ideas from Stoker and Livingstone, Figure 9.2 is a diagrammatic representation of the role of the government under a broader governance structure than the simple high or low government involvement model. The horizontal scale (the x-axis) represents the level of involvement by organisations *other than the government and institutions not directly related to the government*. The vertical scale (the y-axis) represents the level of involvement by the government. The combination of level of involvement by the government and other actors is now divided into four quadrants. Quadrant A represents a high level of involvement by both the government and other organisations. Quadrant B represents a low level of involvement by other institutions and a high level of involvement by the government. Quadrant C represents a

[51] 'The micro-level refers to the fundamental forces that generate pressure for institutional innovation, often deriving from individual human values and interests' (Livingston, 2005: 22).

[52] 'The meso-level refers to the structure and dynamics of the actual process of institutional change and the factors that may facilitate or pose obstacles to innovation' (Livingston, 2005: 22).

low level of involvement by both the government and other organisations. Quadrant D represents a high level of involvement by other institutions and a low level of involvement by the government. Figure 9.2 allows us to analyse the *combination* of movement between the government and other organisations.

Figure 9.2 – A broader governance structure



For ease of exposition the framework illustrated in Figure 9.2 will henceforth be referred to as the quadrant framework. It is particularly useful in the context of this thesis as it allows assessment of the role a *combination* of organisations and institutional arrangements play in water resource management. This is unique as typical analysis focuses on the role individual organisations or institutional arrangements play in the policy design and implementation process and subsequently the impact success of particular roles in achieving policy objectives.

By evaluating the success of policy outcomes the quadrant framework can be used to assess what sort of impact different combinations of involvement have in the policy process. In fact, the simplicity of the quadrant framework can lead to misconceptions about its potential advantages. The quadrant framework can be used at *different* stages of the policy design and implementation process. This could allow for a better analysis of what levels of involvement work well and at which stages in the process they worked well.

Other institutions include informal institutions. Informal institutions (such as societal attitudes and opinions), until quite recently, have been neglected in resource management models – societal attitudes. Selling, and then implementing any new policy requires society to not only accept but also to embrace change. Selling new policy requires a high level of public education and grass-root involvement by citizens in order for the benefits of a new policy to be understood, accepted and embraced. The Federal Government's attempts to 'sell' the latest water reform policy – the Basin Plan[53] – attests to the importance of a coherent and effective policy information component of any policy reform process. (The Federal Government's mismanaged attempts to sell a Carbon Pollution Reduction Scheme and a Mineral Resources Rent Tax also provide good examples of this point). The initial Basin Plan was released in late 2010 and was met with great vehemence from irrigators, farmers and rural communities (Jopson and Arup, 2010). Copies of the Plan were burned in public bonfires and attempts to explain the Plan at local town-hall meetings was often met by aggressive heckling behaviour (Higgins, 2010).

[53] See chapter 3 for an overview of this plan.

The incorporation of societal attitudes – level 1 institutions – as part of the other institutions provides a direct link with the broad institutional analytical framework in Williamson (2000) that was examined earlier in this thesis. Level 2 and level 3 institutions are taken into account by the interaction between the horizontal and vertical axes. Figure 9.3 is particularly useful as a foundational framework as it incorporates a broad interpretation of governance and it provides a basic structure for analysing the role of the government and the role of other institutions. This foundational framework can be used to analyse the success of a particular governance structure.

Having established a framework for analysing governance structures we can formally define 'governance'. As mentioned in the preceding discussion the term governance has been interpreted and defined differently many different scholars. Notwithstanding the myriad of definitions, and keeping in mind the institutional economics ideological position taken in this thesis, there is one particular definition of governance that is most relevant for developing an understanding of effective water governance. This is the preferred United Nations definition:

> *'Governance is the exercise of economic, political and administrative authority to manage a country's affairs at all levels...it comprises the mechanisms, processes and institutions through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences'* (United Nations Development Programme, 2001 cited in Rogers and Hall, 2003: 7).

While this definition refers to governance across states it can also be usefully adapted to more specific policy areas (such as water policy reform). What is particularly pertinent is the reference to the mechanisms, processes and institutions that can be used as vehicle for not

only implementing policy but improving policy. An effective water governance model needs to incorporate mechanisms through which citizens and groups can articulate their interests and mediate their differences.

9.7 An Effective Water Governance Model

Despite several definitions of the term governance we noted that some commonality could be found in most of them. Similarly some commonality can also be found with definitions of water governance. Some of the commonly used interpretations are provided below.

Box 9.1 – Definitions of Water Governance

1. 'Water governance refers to the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society' (Global Water Partnership, 2002 cited in Rogers and Hall, 2003: 7).

2. 'Water governance is like the operating system software of a sophisticated computer system. It is the very environment that either enables or constrains what financing and infrastructure are attempting to accomplish. Without good water governance there is a gap between the intended and actual results' (Um cited in Arriens, 2009).

3. 'Water governance is about knowledgeable people making the right decisions in managing water as a resource and service. It is about people working together effectively to implement these decisions and deliver practical and sustained results' (Arriens, 2009).

4. 'Institute of Water Policy understands water governance broadly as the set of water laws, policies, programs and projects adopted by a country or a State to develop and manage its water resources to meet the current and future needs of its population' (Institute of Water Policy cited in Briscoe, 2009).

5. 'The notion of governance, when applied to water refers to the capability of a social system to mobilize energies, in a coherent manner, for the sustainable development of water resources. The notion includes the ability to design public policies (and mobilize social resources in support of them) which are socially accepted, which have as their goal the sustainable development and use of water resources, and to make their implementation effective by the different actors/stakeholders involved in the process. An adequate level of governance performance is one aspect of the development of water resources, other aspects being the technical/physical and the economic' (Rogers and Hall, 2003: 1).

6. 'A process which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems' (Global Water Partnership cited in Arriens, 2009).

The last definition in Box 9.1 actually is a definition for 'integrated water resources management' and this is particularly useful for our purposes in developing a definition for effective water governance. With regards to specificity, each of the definitions in the box above is somewhat different. However, on a broader, generic level each of the definitions hints (and in some cases makes quite obvious) the importance of the governance umbrella to

cover *all* of the economic, environmental, social and political elements related to water governance. An effective water governance model will be similarly multifaceted.

9.8 Developing an Effective Water Governance Model

Governance and water governance literature typically focuses on designing frameworks in developing countries. This is based on the view that countries with sound political and economic systems will tend to already have appropriate water governance systems (and if that is not the case then it is easier for them to adapt governance structures already present in other policy areas, to water). However, the state of governance systems in developed countries may not be as complete as is generally assumed. This section seeks to illustrate the areas for improvement in already present water governance systems.

An effective water governance model (EWGM) should incorporate *all* relevant elements of environmental responsibility, social education and acceptance, broad-minded economics, political support and action and an effective administrative system. These features are considered individually as follows.

Environmental responsibility. This concern implies that a radical shift is needed with regards to understanding environmental responsibility. The institutional economics school of thought emphasises the importance of multi-disciplinary research. With this tradition in mind it is essential that each of the elements in the EWGM be dealt with sequentially. This means that when developing the guidelines for what is environmentally responsible (for example, environmentally responsible levels of water allocations from water resources) those with

relevant knowledge must be placed in-charge. Environmental scientists need to be developing the environmentally sound guidelines.

Political action and support. Once environmentally responsible guidelines have been developed they need to be acted upon and need to be supported on a political level. The political element can perhaps be considered as the driver of the vehicle. The driver has been given a vehicle (water resources) and it is now up to the driver to learn to live with the vehicle and to ensure that others (water users) understand and accept what has been given to them. If the political system does not adhere to the guidelines established by the environmental scientists the probability of failure increases.

Political action (in the form of, for example, social education programs, creation and enforcement of legal rules and establishment of administrative institutions) needs to coincide with political support. Political support is needed for the those responsible for creating the environmentally responsible guidelines – especially if the guidelines require action that society (and even polity) may consider undesirable (examples of undesirable policy could include the significant reduction of seasonal water allocations that could have major impacts on particular industries or communities). In an ideal world political support will be bi-partisan. One step that can be taken in order to increase the probability of bi-partisan support is ensuring that the body or bodies created to create environmentally responsible guidelines encompasses a wide range of knowledgeable opinions. If the environmental scientists selected to these bodies are selected based upon their academic and research status (as determined by their peers rather than political organisations), then the probability of ensuring bi-partisan support increases.

The emphasis on bi-partisan support is important as it indirectly increases the likelihood of a successful social education program and it even increases the likelihood of the policy reform process being successful as a whole.

Social education and acceptance. Continuing with the used vehicle analogy, the political system has the important responsibility of educating not only heavy water users (such as the irrigation farms in the Murray-Darling Basin) but average citizens as well. This can be done through public education programs and can even be integrated into primary schooling syllabi. Education is needed in order to change the current psyche. Water culture in Australia needs to evolve alongside the changing environmental status of its main water resources. Societal acceptance of need the to change water culture and water consumption behaviour is vital for water policy reform to be effective. Social acceptance will also go some way in ensuring that political expediency does not create barriers for future reform.

While polity plays an important role in social education, another key institution – social norms and informal rules created by society itself – can play an equally, if not more, important role. Societal participation in the water policy reform process is necessary for ensuring the success of the reform process. Social norms and informal rules are considered to be level 1 institutions and therefore need to adapt in order for any new policy to be effective. Societal participation should not be underestimated – peer pressure plays an important role in changing behaviour. Societal disapproval of wasteful or negligent use of water resources can ensure the correct political response and action is taken regarding water policy reform.

Broad-minded economics. Referring once again to the used vehicle analogy, in order to get the best advice to repair and maintain the vehicle (the environment in general or water resources more specifically), it is important that a diverse range of opinions are taken into consideration. Heterodox schools of thought (such as institutional economics) have much to offer and environmental economic analysis can only improve by investigating a range of solutions.

Equally as important as not being restricted to using orthodox economic instruments and analysis is the need for economic issues to not be positioned as the main consideration in policy determination. Suggestions put forth at earlier stages in the governance structure may entail significant expenditure (an example of this the Australian Government's water entitlement buyback scheme)[54]. However, it is likely that the short to medium term costs will be less than the costs in the long term arising from severally degraded natural resources. The long term environmental costs will only add to the economic costs.

Effective administrative systems. A good governance model also needs effective administrative systems. An effective administration system needs to institutionalise a legally enforceable dispute resolution mechanism. The mechanics of a dispute resolution body can be developed using the ideas in Coase (1960). This means that the dispute resolution body will follow the process outlined in the right arm of the Figure 9.1 (presented earlier in this chapter). The organisations in charge of creating the environmentally responsible guidelines need to play a role in the dispute resolution process. This idea is developed further later in this chapter.

[54] The objective of the buyback scheme is for the Australian Government to purchase water entitlements and then 'return' them to the environment.

Adaptive Governance. As Walker *et al* argue '...sustainable ecosystem management requires institutional regimes, which can adapt to necessarily variable and often unpredictable conditions' (Walker *et al*, 2002: cited in Dreischova *et al*, 2008: 286). Drieschova *et al* (2008) suggest that the idea of *adaptive governance* is useful when designing management systems for natural resources. The authors note that '...instead of aiming to maintain a fixed management regime,...[the adaptive approach]...includes management rules, which are sufficiently flexible to meet unexpected conditions' (Drieschova *et al*, 2008: 286). According to Drieschova *et al* (2008: 286) '[f]lexibility can mean either the ability to change the rules of the game, for example in order to allow for the incorporation of new scientific knowledge, or the option to apply a variety of polices in the face of changing conditions'. This is an interesting assertion and it is similar to the idea raised in chapter five of this thesis about the need to adjust optimal water allocation amounts depending on the state of health of the Murray-Darling Basin. In chapter five we introduced the 'environment' into a simple game theoretical framework and showed that this could reduce or increase optimal allocation amounts depending on the value of E (recall that E was the amount of water allocated to the environment each year) in a particular year.

Once again, the organisation/s in charge of creating the environmentally responsible guidelines for policy have a role to play in ensuring governance is actually adaptive. The responsibility of assessing the state of the natural resource and adapting guidelines for usage will lie with these organisations.

9.9 Re-framing the Policy Context

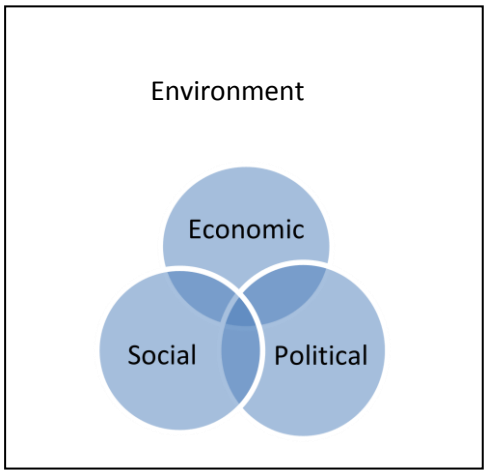
The above discussion of the elements required for the construction of an effective water governance model can usefully be interpreted in terms of the relationship between political, economic and social phenomena. The traditional economy-centred model treats the *economics* of environmental resource management (including and especially water resources) as the dominating element and economic factors shape the role the political and social elements play. The political and social elements have individual features and a level of interconnectedness.

An alternative traditional model places the social element as a subset of the economic element. The link between the political element and the social element occurs through the economic rather than a direct connection between the two elements. The reason for this representation is that much of water resource management traditionally focused on the economic benefits that could be obtained from the particular resource. These benefits would have flow on effects to the social element. The contextual backdrop for the alternative traditional model is polity. The political element determines how economic benefits and which type of economic benefits are to be realised from the management of a particular water resource. A co-operative nexus between the three elements is missing from this particular model since the social element is a subset of the economic element.

Effective water governance refers to the range of policy options that become available as a result of the creation of a co-operative nexus between the elements listed above. Moreover, effective water governance needs to be contextualised with the environment as the policy

backdrop – therefore, the state of the environment sets the parameters for policy development, implementation and reform. This requires a re-positioning of the three elements (economic, social and political) and the inclusion of an additional element – the environment. Furthermore, each of the elements needs to have an individually separate connection with the environment as well as connections individually with the other elements and a shared connection between all elements. This new model is presented below in Figure 9.6.

Figure 9.3 – The New Model



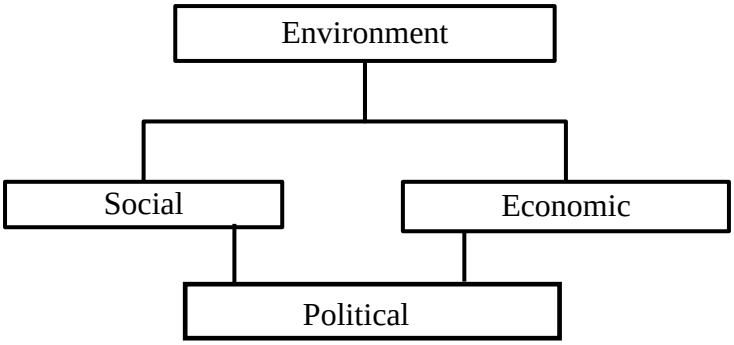
An initial impression of the new model might lead one to conclude that it is rather simplistic (and perhaps even an obvious model for appropriate water resource management). However, it is unique in the sense that traditional approaches to water resource management firstly did not even include the environment as a legitimate stakeholder in the policy design and implementation process and secondly, even if the environment was considered a legitimate stakeholder its role was shaped by the other elements. The new model suggests that the environment should shape the role of the other elements. The environment should be given first priority and it is this proposition that Connell (2007: 42) labels as a '...radical proposition in the context of Australian water management'.

Elements of the new model can be identified in more recent Murray-Darling Basin reform initiatives such as the Basin Plan and the Living Murray Initiative. One of the main reasons why the Basin Plan received so much opposition form irrigators was that it seemed to prioritise the environment over the three other factors. In fact, this controversy led to the resignation of former MDBA Chairman Mike Taylor. Taylor indicated that the Basin Plan had been developed according to the specifications of the Water Act (2007) which seemed to prioritise environmental objectives over social and economic objectives. In his resignation statement he asserted that the MDBA could not '…compromise the minimum level of water required to restore the system's environment on social or economic grounds' (Taylor, 2010).

The presence of a co-operative nexus in the EWGM is essential as it ensures that governance is adaptive. Recall that in the previous section it was suggested that any effective governance model will need to integrate mechanisms to allow for adaptive governance. This particularly applies to the Murray-Darling Basin due to the general climatic and specific ecosystem variability. The Productivity Commission (2010: 91) also notes the need for adaptive governance due to this uncertainty – '[i]t is…important that the water recovery policy remains flexible'.

An EWGM re-prioritises the status of the 'players' in the 'game'. It implies that political expediency and the economic element should no longer be treated as the primary players. Instead, statuses need to be re-prioritised as follows:

Figure 9.4 – A re-prioritisation of elements



The environment receives first priority in the policy decision making process and in *actual implementation*. Second priority is given to social and economic needs which then define the role the political element has to play in facilitating the realisation of environmental, social and economic objectives.

9.10 Effective Water Governance in Australia – the National Water Initiative

It is pertinent to compare these theoretical models and principles with recent Australian experience. In July 2003 the Wentworth Group of Concerned Scientists (group of eminent environmental scientists) released a 'Blueprint for a National Water Plan'. The Wentworth Group outlined five guiding principles for the foundation a National Water Plan (Cosier *et al*, 2003: 7):

1. All Australians have a right to an adequate supply of safe water for domestic use;

2. We all have a responsibility to use water efficiently

3. Our rivers, groundwater systems and landscapes must be managed to maintain the health of our ecosystems so they can provide for the variety of current and future needs;

4. Those who use fresh water to create wealth need investment security and should take responsibility for their part in sustainable water management; and

5. Australians must become water literate and understand the effects that water use has on our environment and other people.

The *Blueprint for a National Water Plan* (2003) provided significant impetus for generating debate about the plight of Australia's water resources (especially of the Murray-Darling Basin). It put forth policy suggestions for both urban and rural water use. It is also one of the few documents at the time that took on board the suggestion raised at COAG meetings in early 1990s about the need to treat the environment as a major stakeholder and the need to prioritise the needs of the environment. For a national water plan to be successful Cosier *et al* (2003: 5) asserted that '[t]he environmental needs of Australia's rivers have a guaranteed first priority call on water required to keep them healthy'.

The success and significant influence of the blueprint lay with fact that it '...[imposed] coherence on a complex body of policy proposals that had been debated for a number of years' (Connell, 2007: 33). The blueprint can be considered as a useful starting point for the development of a comprehensive and effective water governance model. However, the blueprint was exactly that – a blueprint and a not a complete policy statement. The National Water Initiative (NWI) was supposed to be the complete policy document that would drive

the water policy reform process and would outline new governance and management structures.

The NWI provides the institutional framework for water resources management in Australia. The National Water Commission is responsible for facilitating the NWI and for assessing progress and its key objectives are listed below

Box 9.2 – NWI Objectives

Full implementation of the [NWI]will result in a nationally-compatible, market, regulatory and planning based system of managing surface and groundwater resources for rural and urban use that optimises economic, social and environmental outcomes by achieving the following:

i) clear and nationally-compatible characteristics for secure *water access entitlements*;

ii) transparent, statutory-based water planning;

iii) statutory provision for *environmental and other public benefit outcomes*, and improved environmental management practices;

iv) complete the return of all currently overallocated or overused systems to *environmentally-sustainable levels of extraction*;

v) progressive removal of barriers to trade in water and meeting other requirements to facilitate the broadening and deepening of the water market, with an open trading market to be in place;

vi) clarity around the assignment of risk arising from future changes in the availability of water for the *consumptive pool*;

vii) water accounting which is able to meet the information needs of different water systems in respect to planning, monitoring, trading, environmental management and on-farm management;

viii) policy settings which facilitate water use efficiency and innovation in urban and rural areas;

ix) addressing future adjustment issues that may impact on water users and communities; and

x) recognition of the connectivity between surface and groundwater resources and connected systems managed as a single resource.

Source: NWI (2007: 3)

The list above is quite broad and covers some of the key issues concerning water resources management (particularly in the Murray-Darling Basin) such as the need to cease overallocation and to develop environmentally sustainable levels of extraction. There is no doubt that the NWI should be considered as an important step in the water policy reform

process. It has important aims, highlights urgency by demanding results by strict deadlines and provides recommendations and guidelines for policy implementation.

However, the NWI does have some significant shortfalls. The NWI stresses the need for urgency in implementing reforms and gives the impression that policy recommendations will be undertaken, by the various signatory governments, in good faith and in a timely fashion. But, the *First Biennial Assessment of Progress in Implementation* conducted by the NWC (NWC, 2007b) notes the following problems:

1. 'Overallocation of water resources continues to be a central national challenge. It is still not being managed as envisaged under the NWI. A number of states have not delivered on their commitment to move to sustainable levels of water extraction' (NWC, 2007b: 3).

2. 'There is a growing need for more effective compliance and enforcement action by the governments if the integrity of Australia's water management is to be preserved' (NWC, 2007b: 3).

3. 'Governments will need to continue to build the necessary institutions and conditions for markets to function smoothly' (NWC, 2007b: 3).

4. 'There is a serious and growing shortage of skilled water resource professionals to support water reform and the necessary water investments in Australia. There is a role for governments to address this' (NWC, 2007b: 4).

The speed of implementation of reform measures is of considerable concern. Increasing climatic variability leading to severe drought problems in the Murray-Darling Basin require

prompt and proper action. Despite the strict deadline exhortations present in the NWI agreement the first biennial assessment of the reform process makes it clear that the somewhat lethargic response by different governments to some of the NWI recommendations is a severe limiting factor. This was one of the reasons put forward by former Prime Minister Howard for developing the National Plan for Water Security. This is especially the case when assessing the success of implementation of measures to address overallocation. The success and progress of reforms in other areas of water resource management are not independent of the progress made (or not made) on the issue of overallocation. The NWI makes this clear by stating that addressing overallocation '...[is] a first step which is fundamental to the long-term sustainability of the resource base...' (NWC: 2007b: 18). The concern for the speed of policy reform regarding overallocation has been present for several years now.

The first biennial assessment report is not the first influential statement addressing the slowness of reform. The need to address overallocation (by returning overallocated systems to environmentally sustainable levels) was raised in the National Competition Policy (NCP) process in 1999 (NWC, 2007b: 27). The NCP process identified the need to tackle overallocation across Australia (especially but not limited to the Murray-Darling Basin). The NCP process recommended that overallocation existing at the time needed to be dealt with by 2005. The NWC (2007b: 28) notes that some states (New South Wales Victoria, South Australia, Northern Territory and the Australian Capital Territory) have met their obligations but the other states have been slower to implement the reforms.

A significant impediment arising from a seemingly trivial problem of definition seems to be the major obstacle for improving the speed of reform and implementation of already

established recommendations. According to the NWC '...the Commission[55] has found there is now no shared national understanding of what is meant by overallocation' (NWC, 2007: 18) and that '[t]his is because debate continues over the meaning of sustainable levels of water extraction in practice and by extension, the definition of 'overallocation'' (NWC, 2007b: 30).

Using the levels of institutions framework we can analyse this problem on two levels. Firstly, the problem highlights the need to place environmental scientists at the centre of the water policy reform process. Having water experts design a scientifically supported definition of over-allocation is important in ensuring not only environmental sustainability but economic prosperity in future. If the environmental scientists cannot unanimously come to an agreement, the problem is raised to an institutional level. Earlier in this chapter it was suggested that the water reform process and the development of new governance models required a contextual re-framing. We suggested that the first element of an improved water governance model would be the 'environment'. Representing the environment would be environmental scientists chosen on account of their academic and research standing rather than any organisational affiliation or political appointment. It should be noted, this idea is not unique. The NWI has stressed the need for more water professionals to be involved in the water policy reform process. And, as mentioned in earlier chapters, the Federal Government is continuing to invest in water knowledge through schemes such as the Raising National Water Standards program and promoting research on groundwater resources through its Groundwater Action Plan. The NWC refers to the water professionals as 'environmental managers'. This proposal can be classified under the first three levels in Williamson's (2000)

[55] Footnote added – the Commission is the NWC.

levels of institutions framework. Its broad categorisation is due to the fact that expert knowledge is important for influencing changes in informal institutions such as customs, traditions and social attitudes (level 1 insitutions). Widening the knowledge base is important for developing the overarching institutional environment including the formal 'rules of the game' (level 2 institutions). Expert knowledge can then be used to inform the development of appropriate governance structures (level 3 institutions), which, when combined with changes and developments in the other levels should be used to design the appropriate level 4 institutions.

Where the proposed plan is different from the NWI is that the environmental scientists would have *binding authority* at an institutional level. It was suggested earlier in this chapter that a dispute resolution mechanism is required for a water governance model to be effective. To complement this mechanism an effective governance model ideally needs to have authority to make binding decisions. One suggestion for the creation of a binding decision making process could be to incorporate a voting system to reach policy conclusions in the absence of unanimity amongst the environmental scientists. Since it is now over a decade since the first set of direct policy recommendations concerning overallocation it is even more urgent that institutional arrangements are adjusted so that binding decisions can be made. The NWI has its own definition of overallocation:

> *'...a situation where with full development of water access entitlements in a particular system, the total volume of water able to be extracted by entitlement holders at a given time exceeds the environmentally sustainable level of extraction for that system'* (Connell, 2007: 30).

This definition needs to be adopted (at least until a time when a shared national agreement can be achieved) and more importantly, needs to be enforced.

In addition to the problems highlighted by the NWC (and listed above), Connell (2007) identifies distinct contradictions in the NWI. The discussion in Connell (2007) raises questions about morally (and scientifically) responsible policy reform recommendations and the tenuous link with *actual* policy implementation.

One problem identified by Connell (2007: 42) (and this problem supports the discussion presented earlier in this chapter about the need for a contextual re-framing of water policy reform in Australia) is that, despite numerous references to environmental sustainability and environmental responsibility, the recommendations in the NWI all have an economic undertone. This economic undertone is present despite assertions in the NWI emphasising the environment as first priority:

> *'[m]uch of the NWI focuses on the promotion of economic activity but there are many sections that state the principle that all water bodies, no matter what level of modification is accepted as appropriate, must be maintained in or restored to an environmentally sustainable condition as the first priority' (Connell, 2007: 42).*

Connell (2007: 42) claims that the term 'environmentally sustainable' is problematic in the NWI. According to him, there is a distinct contradiction between policy reform recommendations placing environmental sustainability at the centre and water management policies in Australia not only in the past but current policies as well. The reason for this

contradiction is that environmentally sustainable policies apparently jeopardise social and economic objectives (Connell, 2007: 42). This point was raised earlier in this chapter and is a significant and on-going sore point in the water policy reform process for the Murray-Darling Basin. According to Connell (2007: 42), water policy makers and water managers seem to preaching one thing and practicing another – '[o]one of the perverse features of the ongoing debate about the future of Australian water management is that almost no one puts forward an explicit in principle defence of unsustainable management but so many take that approach in practice' (Connell, 2007: 42).

Despite the NWI seemingly placing priority on environmental concerns over economic concerns, Connell (2007: 42) states that '...the case for unsustainable practices is usually a defence of social and economic benefits threatened by efforts to achieve reform'. Connell (2007: 42) goes on to indicate that this contradiction is hampering the progress of reform and is myopic in nature as the continued emphasis on economic elements in the short run actually jeopardises the economic security in the future:

> *'Rarely is there any effort to confront the possibility that the capacity to maintain them [social and economic benefits] will be eroded by continued business-as-usual. It seems that many people involved in water management do not accept the proposition that environmental sustainability is a necessary long-term foundation for economic activities'.*

Similarly to the problem of definition for the term 'overallocation', Connell (2007: 42) suggests that part of the problem with institutionally explicit emphasis on environmental sustainability and the implementation of fundamentally opposing policies is definitional. Rather than interpreting environmentally sustainable as referring to environmental

sustainability of the whole ecosystem *and* individual ecosystems, the NWI focuses on management of water resources as a single resource (Connell, 2007: 43). According to Connell (2007: 43), this is a fallacious interpretation as '...Australian ecosystems are highly variable, poorly understood and subject to unpredictable threshold changes...'. To account for this variability a more unique definition of environmental sustainability needs to be developed and this needs to take into account varying levels of health in different individual ecosystems comprising a larger resource.

The preceding discussion makes clear that the NWI is an important first step in developing effective water governance structures. However, there is still room for significant improvement, especially at an institutional level. Disagreements about definitions, the need for a contextual re-framing of policy reform, the absence of a binding decision making process that incorporates those with considerable expertise in water resource management (the environmental scientists) and the lack of a formal and binding dispute resolution process are some the main impediments to reform. An effective governance model will account for these problems in an appropriate manner and some suggestions are provided in the following discussion.

In order to prevent the water policy reform process form stalling, the Federal Government needs to be the main player. Once the rate of progress improves and once long-lasting but adaptive institutional arrangements have been established the Federal Government should be able to relinquish some of its responsibility and perhaps there would be some room for a more localised level of management such collective-management, as suggested in Ostrom (1990) (see chapter 5). In addition to improving the rate of progress and establishing new

institutional arrangements, the Federal Government can play a vital role in promoting a more co-operative form of federalism.

Dispute Resolution

A formal dispute resolution process needs to be established to deal with conflict in the Murray-Darling Basin. The current process is inadequate and places strain on achieving a co-operative form of federalism and hinders the success of implementation of reformative policy. Prior to the shift towards a more orthodox economic approach to water resource management, disputes were settles by water users themselves (or mediators from the community) (Connell, 2007: 28). Politicians and administrators were also used to resolve disputes. However, Connell (2007: 29) notes that the shift towards orthodox economic instruments to manage water resources has seen a change in the dispute resolution process. The introduction of the NWI in more recent years has exacerbated the change. The NWI places significant emphasis on clearly defining water rights. This in itself is not a problem. The problem lies with the consequences of a rights based system of management. Connell (2007: 29) notes that the rights based system has resulted in the current dispute resolution process – '...when disputes become intractable they are likely to end up in the courts to be solved by lawyers and arbitrators rather than administrators or politicians'.

Using an institutional economics analytical framework the main implications of such a dispute resolution process is the presence of high transaction costs. Those involved in the legal system do not necessarily have adequate water knowledge. The dispute resolution process may find a 'winner' but the gains of the winner should not only be compared to the

'loser' (the other party in the dispute). The environment is also a legitimate stakeholder and without adequate water knowledge the gains realised by one party may be significantly outweighed by losses realised by the environment. Transactions costs remain high even if the legal system enlists the services of those with appropriate water knowledge. This is due to the costs incurred when searching for the water professionals and then the cost of compensating the water professionals for their time and expertise.

Furthermore, the time taken to process disputes may be greater (and may result in the continuance of harm for longer periods). This situation clearly lends itself to the proposal in Coase (1937) for the internalisation of transaction costs in order to reduce them. Internalisation of transaction costs can be achieved by the establishment of a firm or even a 'superfirm'. A separate and independent dispute resolution organisation needs to be developed.

An appropriate dispute resolution body could be incorporated in the Murray-Darling Basin Authority (MDBA). A dispute resolutions committee could be comprised of independent members chosen on the basis of independent peer-reviewed merit. A pre-requisite for the committee members would be a professionally recognised standing in water resource management thus reducing the transactions costs occurred as a result of a lack of adequate water knowledge. In order to ensure that this does not further entrench advocates of orthodox approaches only, the committee members could be chosen on the basis of the breadth of their professional standing rather than simply the depth of their professional standing.

There are two elements of the proposed dispute resolution process that facilitate the progress of future reform. First and foremost, all disputes should be analysed through the new frameworks provided earlier in this chapter (see figures 9.1 and 9.4). This means that the implications for the environment of any decision taken by the dispute resolution committee *must* be assessed prior to a final binding decision being made. At this stage Coase's (1960) proposal about the need to alter dispute resolution processes by choosing the action that results in the least harm plays a central role. This is the defining principle by which disputes should be settled. The second element of the dispute resolution process will be the binding nature of decisions. If decisions are not unanimous then a vote must be taken with results being binding. The presence of a voting mechanism should send a clear signal to all water users about the transparency and the knowledge-directed democratic resolution process.

As most serious disputes in the Murray-Darling Basin centre on water allocation, the dispute resolution process would form an important part of an EWGM as it would (by default due to the nature of current problems) play a role in accounting for level 4 institutions (which are primarily concerned with resource allocation). This would of course change as the nature of problems facing the Murray-Darling Basin change.

Using expert knowledge at various stages of the EWGM (from policy design to dispute resolution) ensures that there is some form of institutional consistency throughout the management process. This thesis has emphasised the disconnect in the Murray-Darling Basin water policy reform process and so this proposition provides a suggestion for filling the gap in current institutional arrangements.

9.11 Conclusion

The issue of governance is important in analysis of water management and reform. Governance can be considered at a non-specific level and specifically in relation to water governance. The issues surrounding the interpretation of the term 'governance' have been analysed in this chapter, including a list of elements that would define effective water governance. How to reframe the contextual backdrop for analysing water governance has also been considered.

Evolutionary and adaptive institutional approaches provide an attractive option for analysing and informing the policy debate concerning water resource management. The idea of adaptive governance needs to be incorporated in any water governance model and especially water governance models for the Murray-Darling Basin. One feature of adaptive governance is that it will allow up-to-date scientific knowledge to drive the water policy reform process *alongside* economic and political considerations.

In order for a water governance model to be truly effective a re-prioritisation of elements (environmental, economic, social and political) is needed. A re-prioritisation results in the environment receiving first priority in the policy decision making and implementation process. This in itself is not an unique proposition: rather, the novelty appears once we examine the effective water governance model as a whole. The effective water governance model would include an organisation whose exclusive role is to represent the environment (now considered as a legitimate stakeholder in the water policy reform process). This organisation will also be responsible for dispute resolution and disputes should be resolved

using the principle, suggested in Coase (1960), that the best solution is the one that results in the least harm being incurred. Responsibility for ensuring that the resolution of any dispute has minimal adverse impact on water resources will lie with this organisation. Furthermore, the organisation needs to have the authority to make binding decisions. The creation of an organisation comprising of environmental scientists should help dampen transaction costs in an effective water governance model. Such an organisation would internalise the transaction costs typically incurred in traditional approaches to dispute resolution.

An important characteristic of an effective governance model is the opportunity to evaluate the role different stakeholders play. This chapter has created a framework for evaluating the role of the government *combined* with other organisations and institutions. The framework allows analysis of government involvement in the management of water resources concurrently with the involvement of other organisations and institutions. This is a more complete and informative approach for evaluating institutional changes and water resource management. Policy impact can be analysed and can be altered by adjusting the level of involvement.

There is also an important connection with federalism. Chapter ten provides an analysis of the state of federalism in Australia and the implications for water policy, arguing that the state of federalism has been and continues to be somewhat fractured especially with regards to water resource management.

Chapter 10 – Federalism

10.1 Introduction

Differences over approaches to water resource management in the Murray-Darling Basin arise not only as a result of economic tension (with different states attempting to maximise economic output from water resources within their own jurisdictions and in some cases to the detriment of the economic output realised in different jurisdictions) but from environmental tension arising from the rapid deterioration in the health of the Murray-Darling Basin water resources. With the Federal Government exerting increasing levels of influence over the management of the Murray-Darling Basin, despite significant reservations of many commentators and going against the orthodox economic prescriptions of the role of the government, this chapter puts forward a case for a more centralist approach to management of the Murray-Darling Basin.

Federalism is an important issue in the water policy reform context as it is considered to have played a role in creating some of the major problems surrounding water resource management. The main problem arising from Australia's unique form of federalism is the myriad of authoritative bodies that are responsible for various aspects of water resource management. Complicating matters further is the lack of uniformity across different jurisdictions and inter-state rivalries. While water resources have unique geographical characteristics, the over-arching institutional framework needs to have some level of coherency in order to minimise transactions costs where commonality of water related problems can be found across jurisdictions and also to learn from the experiences of other jurisdictions. This chapter seeks to identify the areas where reform of federalism in Australia

can have significant benefits for alleviating immediate problems with water policy and management and potentially establishing the regulatory scaffolding for water policy in the future.

10.2 Federalism – an Abbreviated Chronology

A brief chronological overview of federalism in Australia can help to show the nature of the concerns with the present system in relation to management of the Murray-Darling Basin. Australia's federal system was established in 1901 and is one of the oldest federal systems in the world (Bennet *et al*, 2007). It is a three-tiered system consisting of the Federal Government, State governments and local governments. The powers of the three levels of government are specified in the Constitution of the Commonwealth of Australia. Section 51 of the Constitution specifically identifies the powers of the Federal Government and the remaining power left for the State governments (Bennet *et al*, 2007). Demarcation between Federal and State powers was initially heavily centred on fiduciary matters (such as collection and imposition of taxes).

The move towards establishing a federation began many years before 1901. In 1883 an inter-colonial convention proposed the establishment of a Federal Council of Australasia (Bennett and Webb, 2007).The Federal Council of Australia was formally established in 1885 with only NSW not becoming a member (Bennett and Webb, 2007). The process of creating and codifying a constitution began to gather pace towards the end of the 19th century. In 1891, at a National Australasian Convention held in Sydney a draft constitution was developed but not ratified (Bennett and Webb, 2007). Further drafting was conducted at conferences in 1897-98

and a ‘Secret Premiers’ Conference in 1899 made some changes to the draft constitution (Bennett and Webb, 2007). The Commonwealth of Australia was inaugurated on January 1, 1901.

The move towards federalism was not quite straightforward. Despite there being several contentious issues in need of resolution, many of the former colonies were actually reluctant to join a federal nation (BCA, 2006: 3). A key player in the development of the Australian federation, Alfred Deakin, noted that:

> *‘To say it was fated to be is to say nothing to the purpose; any one of a thousand minor incidents might have deferred it for years or generations. To those who watched its inner workings...its actual accomplishments must always appear to have been secured by a series of miracles’* (Deakin cited in BCA, 2006: 3).

The rather reluctant union of states resulted in blurred lines of responsibilities between State governments and the Federal government. Fiscal relations between the Federal Government and State Governments have been a particular focus for such tensions

In more recent years there had being an increasing debate about the powers of the Federal Government concerning issues such as state health systems and environmental resources as well. While fiscal concerns still remain (especially with regards to funding of different projects within state jurisdictions), the main focus has shifted to the aforementioned issues.

10.3 The Benefits of a Federal System[56]

Notwithstanding several disagreements and the more recent centralist trend, the Australian federal system has existed since 1901.This longevity raises some doubts over the veracity of the claims that the recent gravitation towards centralism is not only beneficial but perhaps inevitable. The longevity of the federal system also suggests that there must be some benefits associated with federalism. For the Australian federal system to have survived for more than one hundred years implies that the benefits are not simply theoretical but have been *realised* benefits.

The list[57] below presents some of the main benefits associated with a federal system:

- protection for the individual by checking the concentration of power;
- choice and diversity;
- the customisation of policies to meet local needs;
- competitive incentives;
- increased policy scrutiny in order to achieve increased levels of cooperation;
- stability;
- blunder isolation.

Combined, these provide a robust case for federalism. For example the democratic ideal – the freedom to choose one's political representatives – is manifested in the federal system. Twomey and Withers (2007: 9) note that '[p]eople can, and often do, choose to support a government of one political party at the State level and another at the Commonwealth level, because they prefer different approaches to different policy issues'. The division of power is

[56] In this chapter, the use of the term 'federal system' refers to the current system with legislative powers divided between the different levels of government – Federal, State and Territory. It is important to note that the debate is not about federalism itself, rather, it is about the division of power within the federal system

[57] Source of first 5 benefits: Twomey and Withers, 2007: 8. Source of the last two benefits: Walker, 2001.

also important as it ensures an increased level of accountability – '...governments are under greater pressure to defend their decisions publicly, leading to more moderate and considered outcomes' (BCA cited in Twomey and Withers, 2007: 8).

One other purported benefit of a federal system is the co-existence of cooperation and competition. Twomey and Withers (2007: 14) note that '[w]here competition is not appropriate because too great an overlap exists between functions, co-operation may be needed to achieve outcomes of national significance'. A key current issue where this reasoning can be easily extended to is the management of the Murray-Darling Basin. The Murray-Darling Basin extends over four jurisdictions (Queensland, New South Wales, Victoria and South Australia) and policy decisions in one jurisdiction almost always have a flow-on impact in other jurisdictions. The advantage of a federal system is that governments face greater scrutiny for policy decisions and this can lead to a more transparent and consultative approach to decision making.

The ensuing discussion takes into account the benefits listed above and then provides an explanation and justification for a more centralist approach to water resource management in the Murray-Darling Basin.

10.3 Federalism and Water Resource Management

It is not difficult to see the importance of the federalism debate and its relation to water resource management in Australia. While the list in the previous section outlines the benefits

associated with federalism it is not difficult to construct a corresponding list highlighting how deficient federalism has resulted in mismanagement of the Murray-Darling Basin. Johnson and Rix note that '[t]he authority of the states has been superimposed on the natural structure of Australia with little regard for biological reality' (1993: 255). Mismanagement leading to severe degradation has arisen from the very principles that are supposed to engender a successful federal system.

The customisation of policies to meet local needs

The customisation principle can be misappropriated by policy makers. Customisation is used as a Trojan horse for protectionism. Protection of intra-local/intra-regional interests that are typically short-term (i.e., linked to the political cycle) at the expense of longer term inter-regional interests. For example, irrigators in Queensland plan on expanding irrigation systems on the Warrego River (a major tributary of the Murray-Darling river system) using funding from foreign investors – this is despite the fact that there are widespread calls for water extractions from the Murray-Darling to be reduced significantly (Roberts, 2009). Upstream extraction resulting from new expanded irrigation works have downstream impacts and NSW farmers (downstream from Queensland) and water experts are concerned that the expansion will negate the impact of Federal government water entitlements downstream from the Warrego River (Roberts, 2009). Customisation of policies to meet local needs does not seem to be an attractive feature of federalism and Roberts (2009) makes it clear that the Queensland State government does not welcome any intervention – '...the Bligh Government bluntly [told] Senator Wong [former federal Water Minister] that they [the irrigation works expansion plans] will proceed with state support'. The example above illustrates the how customisation of policies to meet local needs can easily result in sub-optimal outcomes.

Competitive incentives

While there is no doubt that competition can lead to improved outcomes for a range of issues, the benefits of competition have not been realised in the water resource management sphere. Competitive pressures have led to less than ideal outcomes for the Murray-Darling Basin. In fact, as mentioned in earlier chapters, an increased level of competition for water is a characteristic of a maturing water economy (Randall, 1981) and requires careful management. The refusal of upstream jurisdictions to release water for downstream users is a significant and constant source of contention amongst the Murray-Darling States. For several years South Australia has complained about the upstream States' reticence in ensuring sufficient water flows down to the water systems' mouth (the Lower Lakes). The current salinity problems in the Lower Lakes has been blamed on the myopic policy stance of upstream States.

The competitive incentives principle, rather than being viewed as a benefit only, should be considered a double-edged sword. In order to avoid being cut it may be prudent to re-frame the competitive incentives principle so that it does not encircle resources or policy issues that are intertwined in a complex manner such that changes (however minor) have far-reaching consequences for the whole system. For example, the competitive incentives principle should only be usefully applied to a situation where different jurisdictions have similar but *independent* resources so that policy decisions can be isolated and compared.

Increased policy scrutiny in order to achieve increased levels of cooperation

For many years increasing focus on the plight of the Murray-Darling Basin resulted in States taking a defensive approach. For example, Victoria staunchly defended a cap on trading water and it is only recently that it has finally relented and has accepted the need to ease restrictions on trading. While proponents of federalism may see this as a victory, it should not necessarily be viewed as such. While there is no doubt increasing scrutiny did play a role in Victoria's accession, another important factor played a role as well. The Commonwealth Government has played an ever-increasing role in shaping water policy in the Murray-Darling Basin. So Victoria's decision to defer to recommendations that it ease trading restrictions can actually be considered to be, in part, the result of indirect coercion rather cooperation. The expansion of irrigation works along the Warrego River also supports the idea that an increased level of policy scrutiny seems to strengthen the resolve of State governments to vigorously defend their own policies at the expense of inter-state harmony.

Blunder isolation

Similar to the competitive incentives principle, 'blunder isolation' has not eventuated with regards to water resource management. The reason for this is similar to that for the competitive incentives principle – the connectivity of river systems in the Murray-Darling Basin means that policy blunders cannot be isolated, leading to inevitable system wide implications. The highly variable flow and low runoff levels that characterise the Murray-Darling Basin also mean that policy blunders have a particularly acute effect on different river valleys within the Murray-Darling Basin. The reluctance to release more water downstream example presented above applies here as well.

The examples provided above present a rather different story of the impact of a federal system on the management of water resources in the Murray-Darling Basin than the theoretical impacts arising from the list of federal system benefits outlined in the previous section.

10.4 A Case for Centralism

Existing arrangements within the Australian federal system have failed the Murray-Darling Basin. Inter-state rivalries, leading to politically expedient but environmentally inappropriate policy decisions seem to have characterised the (mis)management of the Murray-Darling Basin. The failure of the federal system suggests that solutions to the Murray-Darling Basin mismanagement problem may be found in a more centralist approach.

The idea of the federal government taking control of key policy areas is currently fashionable - Walker (2001) notes that the current '...attitudes towards federalism range from viewing it as a necessary evil to, as one recent work puts it, 'waiting for an appropriate time in which to abolish our spent State legislatures''. Modern Australian federalism is not only a topic of debate amongst academics but is increasingly a point of contention across the political sphere.

Under the former Prime Minister Howard, Australian federalism developed into what Brown refers to as 'pragmatic or regulatory federalism' (2007: 6). Brown observes that '[f]ederal governments have extended their reach into almost every area of public policy and

administration, whether collaboratively or coercively, using many mixtures of executive fiat, funding control and direct regulation' (2007: 6). The current Australian Treasurer, Wayne Swan considers the development and facilitation of a modern federalism as one of the three most important issues he needs to address (Swan, 2008). Swan (2008) refers to the need to modernise Australia's federal system in order to halt 'creeping centralism'. Another commentator, Twomey (2007) describes the current state of federalism in Australia as 'opportunistic federalism'. Whether one refers to the evolving Australian trend as 'pragmatic/regulatory' federalism, as 'creeping centralism' or as 'opportunistic federalism', it is clear that federal government involvement in a broad array of policy issues and across executive boundaries has increased significantly and the unusual centralist trend seems to have occurred in an unplanned manner (Brown, 2007: 3).

Creeping centralism is apt description of the federalism architecture in Australia in recent years. As Brown (2007: 5) notes '[o]ver the last ten years, the federal government has made strategic extensions into areas of local and regional decision-making that would previously would have been unthinkable'. This shift away from federalism towards centralism is unique amongst federal nations (Twomey and Withers, 2007). Walker (2001) further illustrates the uniqueness of Australia's position by claiming that '[w]orldwide support for federalism is greater today than ever before'. Twomey and Withers (2007: 7) note that in several European countries (such as France, Spain, Switzerland and Italy) there is increasing evidence indicative of a shift towards decentralisation and a greater division of powers between different levels of government.

The advantages of a more centralist approach to management of the Murray-Darling Basin include:

1. The cessation of inter-state hostilities that have direct impacts on the Murray-Darling Basin (such as the reluctance of upstream states to release more water to replenish the Lower Lakes in South Australia). Complete cessation of inter-state hostilities is perhaps impossible but hostilities leading to adverse outcomes for the Murray-Darling Basin can be limited to political posturing rather than policy stoushes!

2. Achieving *voluntary cooperation* rather *coercive cooperation*. Once lower tiers of government realise that the Commonwealth government intends to maintain a permanent managerial presence they may be more open to voluntarily cooperation in order to influence inter-governmental interactions in other policy areas.

3. Perhaps the most compelling argument for a more centralist approach to management of the Murray-Darling Basin is that only the Commonwealth government has the sufficient amount of funding available to deal with a problem of such magnitude. Twomey and Withers (2007: 27) note that '...the Commonwealth's claim to manage the Murray-Darling Basin seems to be more based on its ability to fund the buy-back of existing water rights than on any superior management capacity'.

4. The Commonwealth government has more expendable political capital. This is perhaps the weakest advantage as it relies on the Commonwealth government gaining surplus political

capital through the implementation responsible policy decisions in response to other areas of concern. Sufficient political capital will allow the Commonwealth government to make politically unpopular but otherwise quite responsible decisions (such as increasing water allocations for the environment).

Given that the existence of the federal system is likely to continue for the indefinite future, the proposal presented in this chapter does not mean a shift towards *total* centralism. A more realistic proposal is for a shift towards more centralism in the case of water resource management in the Murray-Darling Basin. This would entail shifting responsibilities of managing different levels of institutions from their current allocations. In particular, this means that the Federal Government should take responsibility for managing level 2 and level 3 institutions. This would place responsibility of developing the rules of the game and the appropriate governance structures at a federal level and the responsibility of allocation (level 4 institutions) would reside with the state governments. The development of level 2 and level 3 institutions could be achieved with consultation from state level representatives in order for the policy making process to be inclusive. This particular model for a more centralist approach should be particularly useful when water resources are already in a severely degraded condition as they are in the Murray-Darling Basin. This is because the *timeliness* of policy development is particularly important when environmental resources are in a critical condition. As noted earlier in this chapter and in chapter 3, the experimentation in the Murray-Darling Basin with mutual/collective governance has tended to yield unsatisfactory results.

10.5 Conclusion

This chapter has outlined the current Australian federal system and has presented the benefits associated with federal systems. It has argued that, due to the interconnectedness of the Murray-Darling Basin that transcends geographic and political boundaries, the principles underlying the benefits associated with federalism actually have had a *negative* impact on the capacity for effective water resource management in the Murray-Darling Basin. For the benefits of a federal system to be realised, a certain degree of isolation of the area of concern (for example a river system) is required so that policy issues could be trialled in isolation without mistakes having system wide impacts. Policy responses to the Murray-Darling Basin cannot be isolated and therefore the benefits of a federal system cannot be achieved. A more centralist approach would provide a fresher pathway for water policy reform.

Chapter 11 – Conclusion

11.1 Introduction

Living on the driest inhabited continent in the world, most Australians are aware of the importance of water resources. Despite this awareness, the approach to water resource management throughout history has typically been rather apathetic. Policy inaction, self-interest, isolating environmental from economic considerations, a lack of well-defined property rights and bitter inter-state rivalry are just some of the characteristics of water resource management. These problems have had particularly damaging consequences in the Murray-Darling Basin. But a more systematic policy engagement is possible. Economic valuation of water and water markets can play a crucial role in allocating water resources. This does not necessarily imply a neo-classical economic approach. A new institutional economics approach, combined with recognition of the challenges of governance, can provide an alternative and more holistic approach to water resource management.

There is a growing amount of research focusing on finding solutions to environmental problems. Increasingly the methodological approach of this research is based upon economics (and primarily applied neoclassical economics). The economics discipline played a major role in shaping environmental policy during the second half of the twentieth century and into the twenty-first. Environmental policy has been shaped by economists mainly from the neo-classical school of thought. Increasingly during the last few decades of the twentieth century the neo-classical school of thought widened its reach to almost all aspects of environmental policy including water resource management. While the dominance of neo-classical economic perspectives shaping water resource management policy coincided (for the most

part) with the ascendancy of the neo-liberal agenda it has also been due to increasing awareness and acknowledgement of the severe problems faced by water policy makers around the world. Neo-classical economics aims to investigate how best to allocate scarce resources. Increasing levels of natural physical scarcity (as a result of natural environmental changes) and artificial scarcity (caused by human mismanagement and over-use) are the main problems faced by water policy makers around the world. The problem of scarcity is especially acute in Australia in the Murray-Darling Basin – the so called 'food-bowl' of the nation – where policy makers, due to the complexity of issues, face the almost Sisyphean task of reforming water policy.

This concluding chapter of the thesis summarises the main findings, policy implications and implications for future research

11.2 Summary

Orthodox economic approaches to most of the problems of water resource management have centred on treating water as an economic good. This necessarily means that water needs to be designated an economic value. The argument against treating water as an economic good stems from the fact that water is considered by many as an human right. No other economic good is so fundamentally essential for human existence. Furthermore, water has some unique characteristics that makes it difficult to be treated as a simple homogenous economic good. The limitation of neo-classical economic analysis has been the treatment of water as an homogenous economic good. Notwithstanding the validity of the 'water as an human right'

argument and taking into account its unique characteristics, this thesis has presented an argument in favour of designating an economic value for water (see chapters five and six).

This thesis argues that the orthodox economic approach to water resource management has been limited and one-dimensional. Traditionally the environment has been treated in isolation to the economy. Moreover, orthodox economic approaches do not treat the environment as a constraint on future economic growth. This is based upon the misguided presumption that human ingenuity leading to technological innovation is capable of creating replacements for environmental resources (or at the very least, technological innovation will result in a reduction of the burden placed on environmental resources). So, analysis of the environment and economics generally focuses on deriving optimal rates of depletion (chapter five). This thesis argues that this is a weak approach and provides evidence that suggests that the environment can be a constraint on future economic growth. Statistics from the Murray-Darling Basin are presented in order to highlight its importance to the Australian economy. The increasingly dire health status of the Murray-Darling Basin (chapter three) threatens not only the well-being of the 200, 000 people engaged in employment that relies on water resources (primarily the agricultural industry) but Australia's economic prospects in terms of food exports and their contribution to Australia's gross domestic product.

The limitations of the orthodox approach to environmental resource management leaves potential for alternative approaches to environmental policy. Particularly, there is room for alternative approaches that are multi-dimensional. The new institutional economics tradition offers one such alternative. New institutional economics is attractive as it offers an opportunity to utilise elements from different schools of thought that are not limited to the

economics discipline. This is particularly useful, considering the complexity of the inter-dependency of environmental, economic, social and political factors. The neo-classical economic approach analyses each of these factors in isolation. However, using Williamson's (2000) analytical framework (introduced in chapter two), this thesis has emphasised the importance of a more holistic approach to water resource management. This framework uses a levels of institutions approach to analysis. There are four levels of institutions. Level 1 institutions tend to be informal institutions such as customs, societal attitudes and traditions. Level 2 institutions are the rules of the game such as property rights; while level 3 institutions take into account governance structures. Level 4 institutions are primarily concerned with resource allocation mechanisms such as prices and quantities. Simple demand and supply issues come under the umbrella of level 4 institutions. This holistic approach re-frames the relationship between the above factors such that the environment is given greater prominence relative to (traditional) economic factors.

Placing the environment at the centre of analysis means that institutional arrangements need to be organised appropriately. These institutional arrangements include well defined property rights, a clear demarcation of responsibilities between different organisations (both inter-state and intra-state) and the development of a more co-operative form of federalism. Unlike orthodox literature, this thesis argues that institutions such as social norms and behaviours play a crucial role in determining the likelihood that water policy reform is successful or not. Well defined property rights are especially essential if the main benefit of water markets – the transfer of water to where it is valued the most – is to be realised. The current institutional arrangements between the main Murray-Darling Basin states (NSW, Victoria, Queensland and South Australia) are not effective enough to foster the level of harmony required to best manage the water resources of the Murray-Darling Basin. Current (and historic) inter-state

relations revolve around economic more than environmental concerns. The pursuit of economic interests by the major water users has led to decades of over-allocation of water and more recently has led to a hoarding mentality. Increases in water as a result of significant rainfall leads up-stream users and up-stream states to hoard water by not releasing water to downstream users in order to have secure supply of water for a longer period of time. This practice has adverse ramifications for the environment as run-off (from upstream) is crucial for managing salinity levels downstream. The Federal Government is playing an increasing role in water resource management in the Murray-Darling Basin in order to mitigate the problems caused by inter-state rivalry.

The introduction of markets to alleviate scarcity is characteristically a neo-classical economic response. It can also be compatible with a new institutional economic approach which also recognises the benefit of markets as long as market transaction costs are not higher than the costs incurred when operating without formal markets. This latter qualification is significant though because, as this thesis suggests, the transaction costs involved with water trade (especially in the market for permanent water) are substantial and there is potential for these costs to be reduced (chapter seven). The administrative process involved in water trade is cumbersome and time-consuming in some States compared with others. Evidence is presented which suggests that the water markets for temporary water allocations are faring significantly better than permanent water market transfers as determined by the participation rates and number of trades. Relative success of markets for temporary water allocations and permanent water market thinness are features of the Murray-Darling Basin that are also present in water markets around the world. In the Murray-Darling Basin case, evidence suggests that the main reason for permanent water market thinness is a mix of cultural

aversion to trade in permanent water and institutional hurdles created as result of caps in trade and interstate partisanship (chapter seven).

Examination of water governance structures in the Murray-Darling Basin also reveals that an alternative approach could be beneficial. This thesis provides a framework (the quadrant framework discussed in chapter nine), informed by institutional economics, for assessing the viability and success of particular governance arrangements. The quadrant framework is an holistic approach that incorporates organisations and institutional arrangements other than the government in the governance process. An effective water governance model then builds upon the quadrant framework by integrating the epistemological eclecticism of institutional economics by recommending that water governance be undertaken based on advice given by environmental scientists rather than economists. The knowledge of environmental scientists can determine the parameters within which economists need to operate. The parameters for governance should not be determined by economic considerations alone. Utilising the ideas in Coase (1960), a dispute resolution mechanism is developed. This can alleviate some of the problems facing water management in the Murray-Darling Basin that have stifled the progress of reformative measures.

11.3 Beyond Panaceas for Water Resource Management

While water markets have the potential to assist with water resource allocation, it is important to recognise that they are not a panacea. Chapter seven provided evidence suggesting that water markets have produced mixed results. Integrating sustainability into the environmental policy making process is integral in ensuring longevity of natural resources. Chapter five

provided a detailed discussion in support of sustainability and measures that could be taken in achieving sustainability in the Murray-Darling Basin. In the orthodox economics literature markets are seen, among other things, as instruments that can ensure sustainability through the price mechanism. Prices accordingly adjust the demand and supply pressures. Consumption (depletion) of a natural resource can be slowed down when prices increase as a result of supply pressures. This may seem like a neat solution but empirical evidence that markets for water operate effectively in this way in practice is not entirely conclusive. For example, different countries have had different results with the introduction of water markets to alleviate allocation and scarcity problems. In the Murray-Darling Basin markets for temporary water transfers are working considerably better than markets for permanent water transfers. While the rationale for introducing water markets may be theoretically sound (in an economic sense), the reasons for less than spectacular outcomes contain distinctly non-economic factors as well as economic ones. Moreover, Solow (1991: 182) notes that:

> *'It is often asked whether...the goal or obligation of sustainability can be left entirely to the market. It seems to me that there is no reason to believe in a doctrinaire way that it can. The future is not adequately represented in the market, at least not the far future...there is no doctrinaire reason for saying, "Oh well, ordinary supply and ordinary demand market behaviour, will take care of obligations to the future'.*

In order to support markets as a means of allocating water resources, this thesis argues that robust institutional arrangements and conditions for relatively easy access need to be developed. In addition to these factors, and potentially more importantly, is the need for markets to be accepted on a social level. Social norms play a crucial role in dictating behaviour and also in providing a platform for successful policy outcomes. For example, social norms in the Murray-Darling Basin have resulted in a reluctance to enter permanent

water markets. Policy uncertainty surrounding future permanent allocations creates a further obstacle..

11.4 Policy Implications

Important implications for policy arise from this review of the issues, the arguments and the experiences. Utilisation of the new institutional economics approach and specifically a levels of institutions analytical framework offers alternative pathways for reform and also adds to existing reformative measures. The problems facing the Murray-Darling Basin (and water resources around the world) are complex and therefore addressing the problems requires an approach that is dynamic and holistic. The most important recommendation is that the water policy design and implementation process be re-contextualised with the environment as the primary factor of consideration. Additionally, an increased level of priority needs to be given to Level 1, Level 2 and Level 3 institutions. Placing priority on these levels and then ensuring that future policies are 'packaged' with ideas from these levels can enhance the efficacy of policies addressing problems in the Murray-Darling Basin. Such packaging would ensure that policies cover key factors, environmental, economic, social and political, in conjunction rather than in isolation. The policy proposals in this thesis are packaged in this way. Four of the main policy implications are presented below.

Treating the Murray-Darling Basin as a finite resource

In chapter five, an argument that the water resources in the Murray-Darling Basin need to be treated as finite resource (at least in the short to medium term). Historical mismanagement of the Murray-Darling Basin and changing environmental conditions necessitate this

recommendation. A combination of scarcity concepts – Malthusian and Ricardian – provide a useful starting point for developing policy for the management of the Murray-Darling Basin. Treating the Murray-Darling Basin as a finite resource means that the economics applied in analysis of water resource management needs to change as well. Sustainable usage rather than optimal depletion needs to be the centre of analysis. This approach could also be applied to water resources facing similar problems as the Murray-Darling Basin. Treating the Murray-Darling Basin as a finite resource will expand the breadth of analysis and the scope for development of alternative reformative policy measures.

Water markets, market activity and transaction costs

The performance of water markets in the Murray-Darling Basin needs to improve in order to fully realise the benefits markets can bring. As noted in chapter seven, while markets for temporary water allocations have performed well, there is still considerable potential for the reduction of transaction costs. This thesis supports the NWI (National Water Initiative) backed recommendation for an improvement in water data collection and analysis to help with water trade. Improving information about prices and water availability will reduce hesitancy to enter water markets and will help prevent some market participants to gain an unfair advantage.

In chapter seven it was argued that in order to reduce permanent water market thinness, policy needs to focus on two issues – social norms and transaction costs. Social norms dictate social acceptance of new ideas. Some of the aversion to participate in permanent water markets stems from social norms. Chapter eight provides a detailed discussion about how

level 1 institutions such as social attitudes and norms can be used to make new policy effective. This chapter proposes that the current heightened level of awareness of environmental problems should be exploited (by, for example, environmental awareness programs) in order to introduce new environmental policies that are beneficial in the long-run. Promoting permanent water markets as a means of helping alleviate the severe problems facing the Murray-Darling Basin is an important policy consideration. Reducing the transaction costs involved with trading permanent water also has the potential to increase participation in the permanent water market (see chapter seven). A significant proportion (32%) of farmers (recall the agricultural industry is the largest consumer of water in Australia) do not participate in the permanent water market due to the high transaction costs (Bjornlund, 2003b).

One crucial institutional element related to water markets is the definition of allowable market participants. In an acknowledgement of the unique characteristics water has, market entry needs to limited to genuine participants. Market entry restrictions need to be put in place in order to limit the extent of speculative activity and to prevent activation of 'sleeper' entitlements for the purposes of speculative gain. Ideally all trading based purely on speculation should be curbed but this is difficult to enforce and one possible solution is to limit participation to those already in industries using water or those entering such industries. This would have the added benefit of partially guaranteeing that water market participants have some stake in ensuring that water resources are in good health.

The creation of a formal dispute resolution body with binding authority

A recurrent theme in the history of water resource management in the Murray-Darling Basin has been the bitter disputes between the four states in which the Murray-Darling Basin is situated. A proposition for a formal dispute resolution body with binding authority was presented in chapter nine. In order to increase the likelihood of disputes being solved, with the environment setting the parameters (rather than the nature of the dispute), it is essential that a certain number of the decision making members be chosen from the environmental science field. These members will determine the parameters and will act as representatives for the environment. The ideal solution should result in the environmental health of water resources remaining the same or improving.

A case for centralism

In order to reduce the incidence of disputes, the Federal Government needs to play a more significant role in the management of the Murray-Darling Basin. An increased level of involvement by the Federal Government has the added benefit of a genuine representative for the environment in the policy design and implementation process. The Federal Government is more likely to see problems in the Murray-Darling Basin through a broader lens than the State governments. This thesis argues (specifically, chapter nine) the case for centralism as means of circumventing progress-impeding disputes that have historically been a characteristic of the Murray-Darling Basin management process. Increasing centralism may be an uncomfortable proposition for the State Governments but is necessary due to the perilous state of the Murray-Darling Basin. In fact, the threat of a reduction in state powers may even act as an incentive for a more co-operative form of federalism to develop.

11.5 Future Research

The new institutional economics approach to water resource management has several advantages over the orthodox neoclassical economics approach. One of the main advantages is the dynamism in the analytical approach. New institutional economics emphasises the need for analysis to be evolutionary in order to more accurately reflect the dynamic nature of economic, social and political phenomena. By using a combination of elements from different schools of thought, new institutional economics is able to adapt analysis to constantly changing issues.

In order for continuing dynamism, it is crucial that a means of assessing strategies to manage particular problems with water resources is developed. This thesis offers a way (the quadrant framework) of conceptualising the problem, but there is always room for a more sophisticated assessment framework. Ostrom's (2007) work on panaceas provides a warning about placing too much emphasis on simplistic approaches to complex problems. Future research could focus on developing measures to ensure that water resource management does not become stagnant due to complacency arising from policy measures that have been achieving reasonably successful outcomes. For example, the levels of institutions framework could be used to design more localised governance arrangements in future. Each of the four levels would need to be accounted for in governance processes but contextual primacy needs to remain with the environment.

A deeper exploration into Level 1, Level 2 and Level 3 institutions would be useful in future research. Level 1, Level 2 and Level 3 institutions have historically been neglected when

analysing water resource management policies, relative to Level 4 institutions that are primarily concerned with the economics of water resource management. This thesis has highlighted the importance of these institutions and institutional arrangements that place significant weight on developing the 'rules of the game', governance structures and social and cultural norms. Future research could usefully focus on how to enact policies that can *change* these institutions. Particular importance needs to be placed on developing policies that can change Level 1 institutions in a relatively short period of time. The time frame is particularly important when dealing with rapid changes in environmental conditions. This research would need to analyse the efficacy of various methods of promoting more emphasis on environmental policy, with a view to providing suggestions for the development of a cooperative nexus between environmental policy objectives and the objectives of social and economic policy.

An emphasis on research and analysis of water resource management issues is important in improving policy formulation and implementation. The policy design and implementation process needs to be reoriented away from sectional interests and political manoeuvring in order to effectively address – both in the short term and the long term – the problems faced by the Murray-Darling Basin. Initiatives of this sort could also have important implications for the management of water resources in other environmentally sensitive regions around the world.

Bibliography

ABC, (2010) *2010 in review - The Murray-Darling Basin Plan,* Available at [http://www.abc.net.au/rural/news/content/201012/s3104348.htm]. Last Accessed June 30 2011.

ABS, (2003) *'Year Book Australia 2003'* ABS, Catalogue No. 1301.0, No. 85, Canberra.

ABS, (2005) *'Year Book Australia 2005',* ABS, Catalogue No. 1301.0, No. 87, Canberra.

ABS, (2006a), *Water Access Entitlements, Allocations and Trading 2004-05,* ABS, Catalogue No. 4610.0.55.003, Canberra.

ABS, (2006b) *'Water Account, Australia, 2004-05*', ABS, Catalogue No. 4610.0, November 28, ABS, Canberra.

ABS, (2007) *'Environmental Views and Behaviour 2007-08',* (2nd issue), ABS, Catalogue No. 4626.0.55.001, Canberra.

ABS, (2009) '*Value of principle agricultural commodities produced: preliminary – 2007-08',* ABS, Catalogue. No. 7501.0, Canberra.

ACIL Tasman Pty Ltd, (2005) *'Institutional Arrangements in the Australian Water Sector',* prepared for the National Water Commission, viewed 30 October 2007, [http://www.nwc.gov.au/resources/documents/institutional-arrangements-aus-water-secotr-pub-1205.pdf].

Alexandra, J., Eyre, D. (1993) 'Water and the Environment' in *Water in Australia: Managing Economic, Environmental and Community Reform*, Johnson, M., Rix, S. (eds), Pluto Press in association with the Public Sector Research Centre, University of New South Wales, pp. 85-120.

Allen Consulting Group, (2006) *Transaction costs of water markets and environmental policy instruments*, The Allen Consulting Group.

Ancev, T., Vervoort, W., (2007) The National Plan for Water Security: Taking Over the Role of a Market? *Connections*, Paper 18. Available at [http://www.agrifood.info/connections/2007/Ancer_Vervoort.html]. Last accessed 18 January, 2011.

Angus, I., (2008) 'The Myth of the Tragedy of the Commons' *Monthly Review*, 25 August.

Appell, G. N., (1993) 'Hardin's Myth of the Commons: The Tragedy of Conceptual Confusions. With Appendix: Diagrams of Forms of Co-ownership' *Social Transformation and Adaptation Research Institute*, Working Paper 8, available at:

[http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/4532/HARDIN.pdf?sequence=1]. Last viewed 18 August 2009.

Arriens, W. L., (2009) 'A Map of Challenges and Opportunities' Presentation at the *Improving New Thinking on Water Governance: A Regional Consultation Workshop on Improving Water Governance,* 1 - 3 July 2009, ADB, Singapore. Available at: [http://www.adb.org/documents/events/2009/Improving-Water-Governance/Session1-Warriens-presentation.pdf]. Last viewed 21 September 2009.

Arrow,K, Bolin, B., Costanza, R., Dasgupta, P., Folke, C., Holling, C. S., Jansson, B., Levin, S., Mäler, K., Perrings, C., Pimentel, D., (1996) 'Economic growth, carrying capacity and the environment' *Environment and Development Economics,* Vol. 1, No. 1, pp. 104 - 110.

Ashton, D., Oliver, M., (2008) *An economic survey of irrigation farms in the Murray-Darling Basin: Industry overview and region profiles,* Research Report 08.9, November, Australian Bureau of Agricultural and Resource Economics, Canberra.

Australian Associated Press General News (AAP), (2007) 'NSW: Acute distress because of drought: farmers', 13 September, viewed 24 September 2007, Factiva, document: AAP0000020070913e39d001uy.

Australian Bureau of Statistics (ABS), (2001) *Directory of Electricity, Gas, Water and Sewerage Statistics,* ABS, Catalogue No. 1140.0, Canberra.

Bakker, K., (2005) 'Neoliberalizing Nature? Market Environmentalism in Water Supply in England and Wales' *Annals of the Association of American Geographers,* Vol. 95, No. 3, pp. 42 - 565.

Baldassare, M ., Katz, C., (1992) 'The personal threat of environmental problems as predictor of environmental practices' *Environment and Behavior,* Vol. 24, pp. 602 - 616.

Bannock, G, Baxter, R.E., Davis, E., (1998) *The Penguin Dictionary of Economics,* Penguin Books, New York.

Barbier, B. E., (1989) *Economics, Natural-Resource Scarcity and Development: Conventional and Alternative Views,* Earthscan Publications limited, London.

Barbier, E. B., (1987) 'The Concept of Sustainable Development' *Environmental Conservation,* Vol. 14 No. 2, pp. 101-110.

Baumgartner, S., Quaas, M. F., (2009) 'Ecological-economic viability as a criterion of strong sustainability under uncertainty' *Ecological Economics,* Vol.68, No. 7, pp. 2008 - 2020.

Beare, S., Heaney, A. (2001) *Irrigation, water quality and water rights in the Murray-Darling Basin, Australia,* ABARE Conference Paper 2001.15, Conference Proceedings – International Water and Resource Economics Consortium and Seminar on Environmental and Resource Economics of Girona, Spain. Available at

[http://adl.brs.gov.au/data/warehouse/pe_abarebrs99000655/PR11872.pdf]. Last Access 25 January, 2011.

Beckerman, W., (1992) 'Economic growth and the environment: whose growth? whose environment?' *World Development*, Vol. 20, No. 4, pp. 481 - 496.

Beder, S., (1993) *The Nature of Sustainable Development*, Scribe Publications, Newham.

Bennett, J. (2008) 'Defining and Managing Environmental Flows: Inputs from Society', Vol.27, No.2, *Economic Papers*, pp.167-183.

Bennett, S., Webb, R., (2007) 'Chronology of Australian Federalism' *Chronologies Online*, Parliamentary Library. Available at [http://www.aph.gov.au/library/pubs/online/AustFederalism.htm]. Last accessed 18 May 2008.

Berkes, F., Feeny, D., McCay, B.J., Acheson, J.M. (1989) 'The benefits of the commons', Vol.340, 13 July, *Nature*, pp. 91-93.

Bjornlund, H., (2003a) 'Efficient Water Market Mechanisms to Cope with Water Scarcity' *Water Resources Development* Vol. 19 No. 4 pp. 553 - 567.

Bjornlund, H., (2003b) 'Farmer participation in markets for temporary and permanent water in southeastern Australia' *Agricultural Water Management* Vol. 63 pp. 57 - 76.

Bjornlund, H., (2004) 'What Impedes Water Markets', *Water*, Vol. 31, No.7, pp 47 - 51.

Bjornlund, H., (2005) *Irrigators and the new policy paradigm – An Australian Case Study*, Water Policy, pp.581-595.

Briscoe, J., (2009) Reforming Water Institutions and Organizations: What have we learned? Presentation at the *Improving New Thinking on Water Governance: A Regional Consultation Workshop on Improving Water Governance*, 1 - 3 July 2009, ADB, Singapore. Available at: [http://www.adb.org/documents/events/2009/Improving-Water-Governance/Session1-Jbriscoe-presentation.pd]. Last accessed 7 April 2010.

Bromley, W. D., Cernea, M. M., (1989) *The Management of Common Property Natural Resource: Some Conceptual and Operational Fallacies*' World Bank Discussion Paper, No. 57.

Brown, A. J., (2007) 'Reshaping Australia's Federation: The Choices For Regional Australia' *Public Administration Today*, Vol. 13, pp. 5 - 17.

Brundtland, G.H., (1987) *Our Common Future: The World Commission on Environment and Development*, Oxford University Press, Oxford.

Bureau of Meteorology (2011) *Climate Education: The 'Federation Drought' 1895 – 1902* available at [http://www.bom.gov.au/lam/climate/levelthree/c20thc/drought1.htm] Last viewed March 1 2011.

Business Council of Australia (BCA), (2006) *Water under pressure: Australia's man-made water scarcity and how to fix it*, Business Council of Australia, Melbourne.

Cai, X., Ringler, C., You, J. (2008) 'Substitution between water and other agricultural inputs: Implications for water conservation in a River Basin context' *Ecological Economics*, Vol.66, pp. 38-50.

Caporaso, J. A., Levine, D. P., (2002) *Theories of Political Economy*, Cambridge University Press, New York.

Challen, R., (2000) *Institutions, Transaction Costs and Environmental Policy: Institutional Reform for Water Resources*, Edward Elgar, Cheltenham.

Chavance, B., (2009) *Institutional Economics*, Routledge, London.

Clark, G., Clark, A., (2001) 'Common Rights to Land in England, 1475-1839' *The Journal of Economic History*, Vol. 61, No. 4, pp. 1009 - 1036.

Coase, R.H., (1937) 'The Nature of the Firm' *Economica* Vol. 4, No. 16, pp 386 - 405.

Coase, R.H., (1960) 'The Problem of Social Cost' *Journal of Law and Economics* Vol. 3, pp 1 - 44.

Coase, R.H., (1988) *The Firm, the Market, and the Law*, The University of Chicago Press, Chicago.

Common, M., Perrings, C., (1992) 'Towards an ecological economics of sustainability' *Ecological Economics*, Vol. 6, No. 1, pp. 7 - 34.

Common, M., (2007) 'Measuring national economic performance without using prices' *Ecological Economics*, Vol. 64, No. 1, pp. 92 - 102.

Connell, D., Dovers, S., Grafton, R.Q. (2005) *A Critical Analysis of the National Water Initiative*, Vol.10, No.1, The Australasian Journal of Natural Resources Law and Policy, pp.81-107.

Connell, D., (2007) *Water Politics in the Murray-Darling Basin*, The Federation Press, Canberra.

Connell, D., Grafton, R.Q., Ward, J. (2009) *The case for a revised National Water Initiative for northern Australia*, Chapter 23 in Northern Australia Land and Water Science Review Full Report, Northern Australia Land and Water Taskforce. Available at

[http://www.nalwt.gov.au/files/Chapter_23-Case_for_revised_NWI_for_NA.pdf]. Last accessed 7 June, 2011.

Constanza, R., Daly, H.E., (1992) 'Natural Capital and Sustainable Development' *Conservation Biology*, Vol.6, No.1, pp. 37-46.

Cosier, P., Cullen, P., Flannery, T., Harding, R., Morton, S., Possingham, H., Saunders, D., Thom, B., Williams. J., Young, M., (2003) *Blueprint For A National Water Plan*, WWF Australia.

Council of Australian Governments (COAG), (1994) *Attachment A - Water Resource Policy*, COAG, 25 January. Available at [http://www.coag.gov.au/coag_meeting_outcomes/1994-02-25/docs/attachment_a.cfm]. Last viewed 25 March 2009.

Cox, B. J. S., (1985) 'No Tragedy of the Commons' *Environmental Ethics*, Vol. 7, pp. 49 - 61.

Crabb, P. (1997) *Murray-Darling Basin Resources*, Murray-Darling Basin Commission, Canberra.

Craik and Cleaver in Productivity Commission (2009) *Promoting Better Environmental Outcomes*, Roundtable Proceedings, Productivity Commission, Melbourne.

Crase, L., O'Reilly, L., Dollery, B., (2000) 'Water markets as a vehicle for water reform: the case of New South Wales' *The Australian Journal of Agricultural and Resource Economics* Vol. 44 No. 2 pp. 299 - 321.

Crase, L., Pagan, P., Dollery, B., (2004) 'Water markets as a vehicle for reforming water resource allocation in the Murray-Darling Basin of Australia' *Water Resources Research*, Vol.40, pp.1-10.

Crase, L., O'Keefe, S. (2009) The Paradox of National Water Savings: A Critique of 'Water for the Future*'' Agenda*, Vol.16, No.1, pp. 45-60.

CSIRO (2008) *Water Availability in the Murray-Darling Basin. A Report to the Australian Government from the CSIRO Murray-Darling Sustainable Yields Project*, CSIRO, Australia.

Cullen, P. (2007a) *Knowledge investments underpinning national water reform*, in Australian Rivers: Making a difference, 5th Australian Stream Management Conference, Albury.

Cullen, P., (2007b) *Adapting to water scarcity: A Global challenge for the 21st century*, Presentation to Australian Society of Limnology and New Zealand Freshwater Sciences Society, December 2007, Queenstown, New Zealand. Available at [http://www.wentworthgroup.org/docs/Adapting_to_Water_Scarcity1.pdf]. Last viewed 23 April 2009.

Daly, H.E., (1990) 'Toward Some Operational Principles of Sustainable Development' *Ecological Economics*, Vol.2, pp.1-6.

Davis, S. P., Moore, J. P. (1985) *Who owns the Murray? A South Australian Perspective*, River Publications, Magill.

Davison, G., (2007) *Down the Gurgler: Historical Influence on Australian Domestic Water Consumption*, ASSA Symposium.

Department of Sustainability, Environment, Water, Population and Communities, (2011) *Murray-Darling Basin*, Department of Sustainability, Environment, Water, Population and Communities. Available at [http://www.environment.gov.au/water/locations/murray-darling-basin/index.html]. Last accessed 2 April 2011.

Department of Sustainability, Environment, Water, Population and Communities, (2010) *Water for the Future*, Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available at [http://www.environment.gov.au/water/publications/action/pubs/water-for-the-future.pdf]. Last viewed April 2011.

Dietz, T., Ostrom, E., Stern, C. P., (2003) 'The Struggle to Govern the Commons' *Science*, Vol. 302, No. 5652, pp. 1907 - 1912.

Directorate General Communication (DGC), (2008) Attitudes of European citizens towards the environment, *Special Eurobarometer*, No. 295, Wave 68.2.

Dovers, S., (2008) 'Urban Water: policy, institutions and governance' in *Troubled waters: confronting the water crisis in Australia's cities*, ANU E Press, pp.81-98, Canberra.

Drieschova, A., Giordano, M., Fischhendler, I., (2008) Governance mechanisms to address flow variability in water treaties, *Global Environmental Change*, Vol.18, No.2, pp. 285-295.

EBC, RMCG, Marsden Jacob Associates, EconSearch, McLeod, G., Tim Cummins, T., Guy Roth, G., Cornish, D. (2011) *Community impacts of the Guide to the proposed Murray-Darling Basin Plan. Volume 1: Executive Summary.* Report to the Murray-Darling Basin Authority, Murray-Darling Basin Authority, May 2011. Available at [http://www.mdba.gov.au/files/bp-kid/257-EBC-Vol1-exec-summary.pdf]. Last accessed July 7 2011.

Engle, C., Weber, U. E., (2007) 'The impact of institutions on the decision how to decide', *Journal of Institutional Economics*, Vol. 3, No. 3, pp. 323 - 349.

Feeny, D., Berkes, F., McCay, J. B., Acheson, M. J., (1990) 'The Tragedy of the Commons: Twenty-two years later' *Human Ecology*, Vol. 18, No.1, pp. 1 - 19.

Foy, G., (1990) 'Economic Sustainability and the Preservation of Environmental Assets' *Environmental Management*, Vol. 16, No. 6, pp. 771 - 778.

Frontier Economics, Tim Cummins and Associates, Watson, A., Barclay, E., Reeve, I., (2007) *The Economic and Social Impacts of Water Trading: Case studies in the Victorian Murray Valley*, Rural Industries Research and Development Corporation, Publication No. 07/121.

Gehrke, P., Gawne, B., Cullen, P., (2003) 'What is the status of river health in the Murray-Darling Basin?' CSIRO, available at [http://www.clw.csiro.au/issues/salinity/documents/murrayriver_health.pdf]. Last accessed 9 February, 2010.

Gerlagh, R., van der Zwaan, B.C.C., (2002) 'Long-Term Substitutability between Environmental and Man-Made Goods' *Journal of Environmental Economics and Management*, Vol.44, pp. 329-345.

Gidley, M. J., Fien, J., Smith, J., Thomsen, C. D., Smith, F. T. (2009) 'Participatory Futures Methods: Towards Adaptability and Resilience in Climate-Vulnerable Communities' *Environmental Policy and Governance*, Vol. 19, No. 6, pp. 427 - 440.

Goodland, R., Daly, H.E. (1996) 'Environmental Sustainability: Universal and Non-Negotiable' *Ecological Applications*, Vol.6, No.4, pp. 1002-1017.

Grafton, Q.R., Hussey, K. (2007) *Buying back the living Murray: at what price?* Australasian Journal of Environmental Management, Vol. 14, June, pp. 74-81.

Grafton, R. Q., (2010) *Economics of Water Reform in the Murray-Darling Basin*, CWEEP Research Paper 10-04. Available at [http://cweep.anu.edu.au/pdf/publications/research_papers/10-04_EconWaterReform.pdf]. Last accessed 30 May 2011.

Grossman, G. M., Krueger, A. B., (1995) 'Economic Growth and the Environment' *The Quarterly Journal of Economics*, Vol. 110, No. 2, pp. 353 - 377.

Haisman, B. (2004) *Murray-Darling River Basin Case Study: Australia*, Available at [http://siteresources.worldbank.org/INTSAREGTOPWATRES/Resources/Australia_MurrayDarlingFINAL.pdf]. Last accessed on 14 March, 2011.

Hamilton, K., (1995) 'Sustainable Development, the Hartwick Rule and Optimal Growth' *Environmental and Resource Economics*, Vol. 5, No. 4, pp. 393 - 411.

Hardin, G., (1968) 'The Tragedy of the Commons' *Science*, Vol. 162, No. 3859, pp. 1243-1248.

Higgins, E., (2010) *Outrage and missiles as farmers vent fury*, The Australia, 15 October. Available at [http://theaustralian.newspaperdirect.com/epaper/viewer.aspx]. Last accessed June 20, 2011.

Hodgson, M.G., (1989) 'Institutional Economic Theory: the Old versus the New' *Review of Political Economy*, Vol.1, No.3, pp. 249 – 269.

Hodgson, M. G., (1993) 'Institutional Economics: Surveying the 'Old' and the 'New'' *Metroeconomica*, Vol.44, No.1, pp. 1 – 28.

Hodgson, M. G., (2003) 'Institutional Economics: Old and New' in *Economics as a Social Science: Readings in Political Economy*, Argyrous, G. and Stilwell, F. (eds), Pluto Press, Sydney.

Hodgson, M. G., (2006) 'What are institutions' *Journal of Economic Issues*, Vol. 40, No. 1, pp. 97 - 112.

Hotelling, H., (1931) 'The economics of exhaustible resources', *The Journal Political Economy*', Vol.39, pp. 137 - 175.

Howard, J. (2007) *A National Plan for Water Security*, Available at [http://pandora.nla.gov.au/pan/10052/20070321-0000/www.pm.gov.au/docs/national_plan_water_security.pdf]. Last accessed 3 May, 2011.

Humphries, J., (1990)'Enclosures, Common Rights, and Women: The Proletarianization of Families in the Late Eighteenth and Early Nineteenth Centuries' *The Journal of Economic History*, Vol. 650, No. 1, pp. 17- 42.

Hussey, K., Dovers, S., (2006) *Trajectories in Australian Water Policy*, Issue 135, Journal of Contemporary Water Research and Education.

Independent Audit Group (1996) *Setting the Cap: Report of the Independent Audit Group*, Murray-Darling Basin Ministerial Council. Available at [http://www2.mdbc.gov.au/__data/page/86/SETTING_THE_CAP.pdf].

Independent Audit Group (1996) *Setting the Cap: Report of the Independent Audit Group*, Murray-Darling Basin Ministerial Council. Available at [http://www2.mdbc.gov.au/__data/page/86/SETTING_THE_CAP.pdf].

International Conference on Water and the Environment (1992) *The Dublin Statement on Water and Sustainable Development*, International Conference on Water and the Environment, January 31, Dublin.

Jacobs, M., (2003) 'Measuring success' in *Economics as a Social Science: Readings in Political Economy*, Argyrous, G., Stilwell, F., (eds), Pluto Press Australia, pp. 208 - 210.

Jacobs, T., (1990) 'River Regulation' in *The Murray*, MacKay, N., Eastburn, D., (eds), Murray-Darling Basin Commission, Canberra.

Johnson, M., Rix, S. (1993) 'Better Water Ways' in *Water in Australia: Managing Economic, Environmental and Community Reform*, Johnson, M., Rix, S. (eds), Pluto Press in association with the Public Sector Research Centre, University of New South Wales, pp. 254 - 280.

Jones, C.I., (2002) *Introduction to Economic Growth*, W.W. Norton and Company, New York.

Jones, G., Hillman, T., Kingsford, R., McMahon, T., Walker, K., Arthington, A., Whittington, J., Cartwright, S. (2002) *Independent Report of the Expert Reference Panel on Environmental Flows and Water Quality Requirements for the River Murray System*, Cooperative Research Centre for Freshwater Ecology, Canberra. Available at [http://thelivingmurray2.mdbc.gov.au/__data/page/1482/ERPreport1.pdf] Accessed January 31 2011.

Jopson, D., Arup, T., (2010) *Irrigators vent fury at proposed water cuts*, The Sydney Morning Herald, 14 October. Available at [http://smh.newspaperdirect.com/epaper/viewer.aspx]. Last accessed June 20, 2011.

Jordan, A., Rüdiger W. K. W., Zito, A., (2005) 'The Rise of 'New' Policy Instruments in Comparative Perspective: Has Governance Eclipsed Government?' *Political Studies*, Vol 53, pp. 477 - 496.

Langford, M., (2005) 'The United Nations Concept of Water as a Human Right: A New Paradigm for Old Problems' *Water Resources Development*, Vol. 21, No. 2, pp. 273 - 282.

Langlois, R. N., (1989) 'What is wrong with the old institutional economics (and what is wrong with the new)?' *Review of Political Economy*, Vol.1, No.3, pp. 270 – 298.

Libecap, G.D., (2008) 'Transaction Costs, Property Rights and the Tools of the New Institutional Economics: Water Rights and Water Markets' in *New Institutional Economics: A Guidebook*, Brousseau, E., Glachant, J., (eds), Cambridge University Press, Cambridge, pp. 272-291.

Livingston, M. L., (2005) 'Evaluating changes in water institutions: methodological issues at the micro and meso levels' *Water Policy*, Vol. 7, pp. 21 - 34.

MacDonald, D.H., Young, M. (2001) A Case Study of the Murray-Darling Basin: Final Report for the International Water Management Institute, *CSIRO Land and Water*, Canberra. Available at [http://www.myoung.net.au/water/publications/MDB-IWMI.pdf]. Last accessed on 24 February 2011.

Mackay, N., Eastburn, D. (1990) *The Murray*, Murray Darling Basin Commission, Canberra.

Maddox, J., (1995) 'Sustainable development unsustainable' *Nature*, Vol. 374, No. 6520.

Mantzavinos, C., (2001) *Individuals, Institutions, and Markets*, Cambridge University Press, Cambridge.

McDonald, T., (2007) *'Agricultural industries face collapse as drought wears on'*, Australian Broadcasting Corporation Transcripts, 13 September, viewed 24 September 2007, Factiva, document: ABCTRS0020070913e39d000dz.

McKay, J. (2006) *Groundwater as the Cinderella of Water Laws, Policies, and Institutions in Australia*, Paper delivered at the International Symposium on Groundwater Sustainability, January 2006, Spain. Available at [http://aguas.igme.es/igme/isgwas/Ponencias%20ISGWAS/21-Mackay.pdf]. Last accessed 14 April, 2011.

McMahon, T.A., Finlayson, B.L., (1992) 'Australian Surface and Groundwater Hydrology – Regional Characteristics and Implications' in *Water Allocation for the Environment*, Pigram, J. J., Hooper, P. B., (eds), Centre for Water Policy Research, pp.21-40, Armidale.

Meinzen-Dick, R., (2007) 'Beyond panaceas in water institutions' *PNAS*, Vol.104, No.39, pp. 15200 - 15205.

Morris, S., (2007) 'PM fishes for water votes' *The Australian Financial Review*, 21 September, viewed 30 September 2007, Factiva, document AFNR000020070920e39l0002h.

Murray-Darling Basin Authority (2008) *The Living Murray*, Murray-Darling Basin Authority. Available at [http://www.mdba.gov.au/programs/tlm] Accessed February 2011.

Murray-Darling Basin Authority (2009) *The Basin Plan: a concept statement*, MDBA Publication 02/09, Murray-Darling Basin Authority, Canberra.

Murray-Darling Basin Authority (2010a) *Guide to the proposed Basin Plan: Technical Background*, Murray-Darling Basin Authority, Canberra.

Murray-Darling Basin Authority (2010b) *Guide to the Proposed Basin Plan, Overview*, Murray Darling Basin Authority, Canberra.

Murray-Darling Basin Authority (2011) *The Living Murray Annual Implementation Report and Audit of the Living Murray Implementation Report 2009-10*, Murray-Darling Basin Authority, Canberra.

Murray-Darling Basin Commission, (2006a) *Murray-Darling Basin Agreement*, Murray-Darling Basin Council. Available at [http://www2.mdbc.gov.au/__data/page/44/Murray-Darling_Basin_Agreement_full.pdf]. Last accessed 2 February 2009.

Murray-Darling Basin Commission (2006b) *A Brief History of the Murray-Darling Basin Agreement* Available at [http://www2.mdbc.gov.au/about/history_mdbc.html] Last accessed on March 2011.

Murray-Darling Basin Commission (2007) *The River Murray System* Available at [http://www2.mdbc.gov.au/rmw/river_murray_system.html] Last accessed on March 1 2011.

Murray-Darling Basin Commission (MDBC) (1998) *Water Audit Monitoring Report 1996/97*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (1999) *Water Audit Monitoring Report 1997/98*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (2000) *Water Audit Monitoring Report 1998/99*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (2001) *Water Audit Monitoring Report 1999/00*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (2002) *Water Audit Monitoring Report 2000/01*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (2003) *Water Audit Monitoring Report 2001/02*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (2004) *Water Audit Monitoring Report 2002/03*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (2005) *Water Audit Monitoring Report 2003/04*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (2006) *Water Audit Monitoring Report 2004/05*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (2007) *Water Audit Monitoring Report 2005/06*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (2008) *Water Audit Monitoring Report 2006/07*, MDBC, Canberra.

Murray-Darling Basin Commission (MDBC) (2009) *Water Audit Monitoring Report 2007/08*, MDBC, Canberra.

National Water Commission (NWC), (2005) *Australian Water Resources 2005 - A baseline assessment of water resources for the National Water Initiative - Key Findings of the level 2 assessment: Summary Brochure*, National Water Commission, Canberra.

National Water Commission (2007a) *National Water Initiative – How does is affect me?* National Water Commission, Canberra.

National Water Commission (2007b) *National Water Initiative: First Biennial Assessment of Progress in Implementation*, National Water Commission, Canberra. Available at: [http://www.nwc.gov.au/www/html/523-2007-biennial-assessment-of-progress-in-implementation.asp?intSiteID=1].

National Water Commission (2008a) *Groundwater position statement*, National Water Commission. Available at [http://www.nwc.gov.au/resources/documents/Grounwater-PS-240608.pdf]. Last accessed 20 May. 2011.

National Water Commission, (2008b) *Australian Water Markets Report 2007-2008*, National Water Commission, Canberra.

National Water Commission, (2009a) *National Arrangements: Water for the Future*, National Water Commission, Canberra. Available at [http://www.nwc.gov.au/www/html/2349-water-for-the-future.asp]. Accessed on 20 April 2011.

National Water Commission (2009b) *Australian Water Reform 2009: Second biennial assessment of progress in implementation of the National Water Initiative*, September, National Water Commission, Canberra.

National Water Commission (2010a) *The Raising National Water Standards Program*, National Water Commission, Canberra. Available at [http://www.nwc.gov.au/www/html/347-introduction-to-rnws.asp]. Last accessed 20 February 2011.

National Water Commission (2010b) *National Groundwater Action Plan*, National Water Commission, Canberra. Available at [http://www.nwc.gov.au/www/html/350-groundwater-action-plan.asp?intSiteID=1]. Last accessed 20 February 2011.

National Water Initiative (NWI), (2006) *Intergovernmental Agreement on a National Water Initiative,* Available at: [http://www.nwc.gov.au/resources/documents/Intergovernmental-Agreement-on-a-national-water-initiative.pdf].

North, D. C., (1981) *Structure and Change in Economic History*, W. W. Norton, New York.

North, D. C., (1990) *Institutions, Institutional Change and Economic Performance*, Cambridge University Press, Cambridge.

North, D. C., (1991) 'Institutions' *Journal of Economic Perspectives*, Vol. 5, No. 1,

North, D. C., (1993) 'The New Institutional Economics and Development' available at http://129.3.20.41/eps/eh/papers/9309/9309002.pdf [Last accessed 2 November 2007].

North, D.C., (1997) 'Prologue' in '*The Frontiers of the New Institutional Economics*', Drobak, J.N and Nye, J.V.C (eds), Academic Press, Sydney.

North, D. C., (2006) *Understanding the Process of Economic Change*, Academic Foundation, New Delhi.

O'Connell, M., (2007) *Pessimistic Crop Forecast*, World News Australia, SBS TV, 18 September, viewed 24 September 2007, Factiva, document: SBSTWN0020070918e39i0000k.

Oliver, M., Dyack, B., Ashton, D., (2009) *Irrigation in the Murray-Darling Basin: Farms trading temporary water in 2006-07*, Research Report 09.8, May, Australian Bureau of Agricultural and Resource Economics, Canberra.

Ostrom, E. (1990) *Governing the Commons*, Cambridge University Press, New York.

Ostrom, E. (1986) 'An agenda for the study of institutions', Vol.48, *Public Choice*, pp. 3-25.

Ostrom, E. (1997) *Common-pool resources and institutions: towards a revised theory*. Workshop In Political Theory and Policy Analysis, Indiana. Available at [http://www.acadiau.ca/~sskjei/cgi-bin/2713/Readings/ostrom.pdf]. Last accessed 20 April, 2011.

Ostrom, E. (1999) 'Coping with tragedies of the commons', *Annual Review of Political Science*, Vol.2, pp. 493-535.

Ostrom, E., Janssen, M. A., Anderies, J. M., (2007) 'Going beyond panaceas', *PNAS*, Vol.104, No.39, pp. 15176 - 15178.

Ostrom, E., (2007) 'A diagnostic approach for going beyond panaceas', *PNAS*, Vol.104, No.39, pp. 15181 - 15187.

Ostrom, E. (2008) 'Institutions and the environment', Vol.28, No.3, *Economic Affairs*, pp. 24-31.

Ostrom, E., Stern, C. P., Dietz, T. (2003) *Water rights in the commons*, Vol. 5, No.2 Water Resources Impact, pp. 9-12.

Pacific Institute, (2009) *Water Conflict Chronology List*, Pacific Institute. Available at [http://www.worldwater.org/conflict/list/]. Last Accessed 11 June, 2011.

Parr, A., (2009) *Hijacking Sustainability*, MIT Press, Cambridge.

Pearce, D., Markandya, A., Barbier, B. E. (1989) *A Blueprint for a Green Economy*, Earthscan Publications Ltd, London.

Pearce, D. W., Turner, R. K., (1990) *Economics of natural resources and the environment*, Harvester Wheatsheaf, New York.

Peel, M.C., McMahon, T.A., Finlayson, B.L., Watson, F.G.R. (2001) *Identification and explanation of continental differences in the variability of annual runoff*, Journal of Hydrology, Vol. 250, pp 224-240.

Peel, M.C., McMahon, T.A., Finlayson, (2004) *Continental differences in the variability of annual runoff – update and reassessment*, Journal of Hydrology, Vol. 295, pp 185-197.

Perrings, C., (2007) 'Future Challenges' *PNAS*, Vol. 104, No.39, pp. 15179-15180.

Pigram, J. J., (1993) "Property Rights and Water Markets in Australia: An Evolutionary Process Towards Institutional Reform", *Water Resources Research*, Vol.29, No.4, pp.1313-1319.

Pigram, J. J., (2006) *Australia's Water Resources: from use to management*, CSIRO Publishing.

Pigram, J. J., (2007) *Australia's Water Resources: from use to management*, CSIRO Publishing.

Pink, B., (2008) 'Water and the Murray-Darling Basin – A Statistical Profile: 2000-01 to 2005-06' *Australian Bureau of Statistics*, ABS Catalogue No. 4610.0.55.007, Canberra.

Potter NJ, Chiew FHS, Frost AJ, Srikanthan R, McMahon TA, Peel MC and Austin JM (2008) *Characterisation of recent rainfall and runoff in the Murray-Darling Basin. A report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project*, CSIRO, Australia.

Powell, J.M. (2002) 'Environment and Institutions: Three episodes in Australian water management 1880 – 2000', *Journal of Historical Geography*, Vol.28, No.1. pp. 100-114.

Pricewaterhousecoopers (PWC) (2006), National Water Initiative Water trading study, Report commissioned by the Prime Minister and Cabinet.

Productivity Commission (2002) 'Trends in Australian Infrastructure Prices 1990-91 to 2000-01', Productivity Commission, Melbourne.

Productivity Commission (2010) *Market Mechanisms for Recovering Water in the Murray-Darling Basin,* Final Report, March, Productivity Commission, Melbourne.

Quiggin, J. (2001) 'Environmental Economics and the Murray-Darling river system', *The Australian Journal of Agricultural and Resource Economics*, Vol.45, No.1, pp. 67 - 94.

Quiggin, J. (2006) 'Repurchase of renewal rights: a policy option for the National Water Initiative', Vol.50, *The Australian Journal of Agricultural and Resource Economics*, pp.425-435.

Quiggin, J. (2008) 'Managing the Murray-Darling Basin: Some Implications for Climate Change Policy', *Economic Papers*, Vol.27, No. 2, pp. 160-166.

Quiggin, J., Tan, P. (2004) *Sustainable Management of the Great Artesian Basin: an analysis based on Environmental Economics and Law*, Murray Darling Program Working Paper 3/M04, Risk and Sustainable Management Group. Available at [http://www.uq.edu.au/rsmg/WP/WPM04_3.pdf]. Last accessed 7 January, 2011.

Qureshi, M.E., Shi, T., Qureshi, S.E., Proctor, W. (2009) 'Removing barriers to facilitate efficient water markets in the Murray-Darling Basin of Australia', Vol.96, *Agricultural Water Management*, pp.1641-1651.

Qureshi, M.E., Ranjan, R., Qureshi, S.E. (2010) 'An empirical assessment of the value of irrigation water: the case study of Murrumdigee catchment', Vol.54, *The Australian Journal of Agricultural and Resource Economics*, pp. 99-118.

Qureshi, M. E., Schwabe, K., Connor, J., Kirby, J. (2010) 'Environmental water incentive policy and return flows', Vol. 46, *Water Resources Research*.

Qureshi, M.E., Grafton, R. Q., Kirby, M., Hanjra, M.A. (2011) *Understanding irrigation water use efficiency at different scales for better policy reform: a case study of the Murray–Darling Basin, Australia*, Vol.13, Water Policy, pp.1-17.

Randall, A. (1981) 'Property entitlements and pricing policies for a maturing water economy', *The Australian Journal of Agricultural Economics*, Vol.25, No.3, pp. 195-220.

Rhodes, R. A. W. (1996) 'The New Governance: Governing without Government' *Political Studies*, Vol. 44, No. 4, pp. 652 - 667.

Roberts, R., Mitchell, N., Douglas, J., (2006) 'Water and Australia's Future Economic Growth' *Economic Roundup*, Summer 2006, pp. 53 - 72.

Roberts, G., (2009) 'Rebel irrigation plan for the north', 24 January, *The Australian*. Available at [http://www.theaustralian.com.au/news/nation/rebel-irrigation-plan-for-the-north/story-e6frg6nf-1111118652348]. Last accessed 27 January 2009.

Rogers, P., Hall, A. W., (2003) 'Effective water governance' *Global Water Partnership TEC Background Papers*, No.7.

Rutherford, M., (1989) 'What is wrong with the new institutional economics (and what is still wrong with the old)?' *Review of Political Economy*, Vol.1, No.3, pp. 299 – 318.

Rutherford, I., (1990) ‘Ancient River, Young Nation’ in *The Murray*, MacKay, N., Eastburn, D., (eds), Murray-Darling Basin Commission, Canberra.

Saleth, R. M., Dinar, A. (2004) *The Institutional Economics of Water: A cross-country analysis of institutions and performance*, Edward Elgar, Cheltenham.

Searle, J., (2005) ‘What is an institution?’ *Journal of Institutional Economics*, Vol. 1, No. 1, pp. 1 - 22.

Sengupta, A., (2005) *Tragedy of the Commons*, Unpublished lecture notes from Intermediate Microeconomics Honours (ECON2902), Sydney.

Shaw-Taylor, L., (2001) ‘Parliamentary Enclosure and the Emergence of an English Agricultural Proletariat’ *The Journal of Economic History*, Vol. 61, No. 3, pp. 640 - 66.

Sheil, C. (2000) *Water’s Fall: Running the risks with economic rationalism*, Pluto Press, Sydney.

Smith I. D., (1998) *Water in Australia: Resources and Management*, Oxford University Press, Melbourne.

Smith, A., Ali, M., (2006) ‘Understanding the impact of cultural and religious water use’ *Water and Environmental Journal*, Vol. 20, No. 4, pp.203-209.

Solow, R. M., (1974) ‘Intergenerational Equity and Exhaustible Resources’ *The Review of Economic Studies*, Vol. 41, pp. 29 - 45.

Solow, R. M., (1991) ‘Sustainability: An Economist’s Perspectives’ in *Economics of the Environment: selected readings*, Dorfman, R., Dorfman, N. S. (eds), W.W Norton & Company, New York.

Stanfield, J.R., (1999) ‘The Scope, Method, and Significance of Original Institutional Economics’ *Journal of Economic Issues*, Vol.33, No.2, pp. 231 - 255.

Stiglitz, J. E., (1974a) ‘Growth with Exhaustible Natural Resources: Efficient and Optimal Growth Paths’ *The Review of Economic Studies*, Vol. 41, pp. 123 - 137.

Stiglitz, J. E., (1974b) ‘Growth with Exhaustible Natural Resources: The Competitive Economy’ *The Review of Economic Studies*, Vol. 41, pp. 139 - 152.

Stiglitz, J. E., (2006) ‘Foreward’ in Lopez, R., and Toman, M. A., (eds), *Economic Development and Environmental Sustainability: New Policy Options*, pp. xv – xviii, Oxford University Press,

Stilwell, F. (2005) *Political Economy: The Contest of Economic Ideas*, Oxford University Press, Melbourne.

Stoker, G. (1998) 'Governance as theory: 5 propositions' *International Social Science Journal*, Vol. 50, No. 155, pp 17 - 28.

Stokey, L. N. (1998) 'Are there limits to growth?' *International Economics Review*, Vol. 39 No. 1, pp 1 - 31.

Sullivan, R. (2009) *Addressing our groundwater crisis*, In ECOS Magazine, CSIRO Publishing. Available at [http://www.ecosmagazine.com.au/?paper=EC151p14]. Last Accessed 7 May, 2011.

Swan, W. (2008) *'Modern federalism not creeping centralism'* address to the Institute of Public Administration, Queensland, 30 July, No. 025.

Syme, G. J. (2007) 'The role of communication and attitudes research in the evolution of effective resource management arrangements' in *Managing Water for Australia: The Social and Institutional Challenges*, Hussey, K. and Dovers, S. (eds), CSIRO Publishing.

Taylor, M., (2010) *Plan for the Murray-Darling Basin – Role for Authority Chair*, Press Release 7 December 2010, Murray-Darling Basin Authority. Available at [http://www.mdba.gov.au/files/Media-release-Role-of-Authority-Chair_0.pdf]. Last accessed June 20, 2011.

The Weekly Times, (2007) 'Farms need rescue plan', 12 September, viewed 24 September 2007, Factiva, document: HERWEK0020070911e39c0000z.

Tietenberg, T. (2007) *Environmental Economics and Policy*, Pearson Education (5th edition), Sydney.

Tisdell, J., Ward, J., Grudzinski, T. (2001) *Irrigator and Community Attitudes to Water Allocation and Trading in the Murrumbidgee Catchment*, Technical Report 01/1, Cooperative Research Centre for Catchment Hydrology, Griffith.

Tisdell, J., Ward, J., Grudzinski, T., (2002) 'The Development of Water Reform in Australia' *Cooperative Research Centre for Catchment Hydrology*, Technical Report 2, May 2000, Griffith.

Tisdsell, J. G. (2003) Enhancement of the Water Market Reform Process: A Socioeconomic Analysis of Guidelines and Procedures for Trading in Mature Water Markets, Cooperative Research Centre for Catchment Hydrology, Griffith.

Topsfield, J., Rood, D., (2007) 'PM attacks Victoria's 'selfish' water stand', *The Age*, 21 September, viewed 30 September 2007, Factiva, document AGEE000020070921e39l00006.

Turral, H. N., Etchells, T., Malano, H. M. M., Wijedasa, H. A., Taylor, P. (2005) 'Water trading at the margin: The evolution of water markets in the Murray-Darling Basin' *Water Resources Research* Vol. 41 pp. 1-8.

Twomey, A. (2007) 'Australian Federalism – Options for Reform', *2007 National IR Conference*, Brisbane, 11 September 2007.

Twomey, A., Withers, G. (2007) 'Australia's Federal Future: Delivering Growth and Prosperity' *Federalist Paper 1*. Report prepared for *The Council for the Australian Federation* (April 2007). Available at: [http://www.caf.gov.au/Documents/AustraliasFederalFuture.pdf].

van Kersbergen, K., Van Waarden, F., (2004) 'Governance' as a bridge between disciplines: Cross-disciplinary inspiration regarding shifts in governance and problems of governability, accountability and legitimacy' *European Journal of Political Research* Vol. 43, pp 143 - 171.

Veness, P. (2007) 'Rudd and Howard battle for farm vote' *The Age,* 21 September 2007, [http://news.theage.com.au/national/rudd-howard-battle-for-farm-vote-20070921-107z.html]. Last Accessed 18 November 2007.

Walker G. de Q.(2000/2001) 'Ten advantages of a Federal Constitution' *Policy*, Vol. 17, No. 4, pp. 35 - 41.

Ward, J., (2009) Palisades and pathways: Historical lessons from Australian water reform, Chapter 14 in Northern Australia Land and Water Science Review Full Report. Available at [http://www.nalwt.gov.au/files/Chapter_14-Palisades_and_pathways_historical_lessons_from_Aust_water_reform.pdf]. Last accessed 7 June, 2011.

Water Act (2007) *Water Act 2007*, Office of Legislative Drafting and Publishing, Attorney-General's Department, Canberra.

Waterfind, (2008) *Waterfind Analysis of the Federal Government Buyback*, Waterfind, June 2008, Adelaide. Available at [http://www.myoung.net.au/water/policies/Waterfind_Analysis_Fed_Gov_Buyback.pdf] Last accessed April 14, 2011.

Watson, A. (2003) 'Approaches to Increasing River Flows', *The Australian Economic Review*, Vol.36 No.2, pp. 213-224.

Watson, A. (2007a) A National Plan for Water Security: Pluses and Minuses, *Connections*, Paper 3. Available at [http://www.agrifood.info/connections/2007/Watson.pdf]. Last accessed 18 January, 2011.

Watson, A. (2007b) The Howard-Turnbull National Plan for Water Security of January 2007: Rescue or Rejection?, Vol.27, No.2, Economic Papers, pp.146-159.

Weigel, R., Weigel, J. (1978) 'Environmental concern: the development of a measure' *Environment and Behavior*, Vol. 10, pp 3 - 15.

Williamson, E. O., (2000) 'The New Institutional Economics: Taking Stock, Looking Ahead' *Journal of Economic Literature*, Vol. 38, No. 3, pp 595 - 613.

Willis, I., (2006) *Economics and the Environment: A signalling and incentives approach*, Allen & Unwin (2nd edition), Crows Nest.

Wilson, J., Yan, L., Wilson, C., (2007) 'The precursors of governance in the Maine lobster fishery' *PNAS*, Vol. 104, No. 39, pp. 15212 - 15217.

Wong, P., Carr, K. (2009) *$30 million for new Groundwater Centre*, Media Release, 22 January, Department of Innovation, Industry, Science and Research, Canberra. Available at [http://minister.innovation.gov.au/Carr/MediaReleases/Pages/$30MILLIONFORNEWNATIONALGROUNDWATERCENTRE.aspx]. Last Accessed 11 May, 2011.

Woolston, M., (2004) 'Registration of water titles: key issues in developing systems to underpin market development' *ACIL Tasman Pty Ltd*, August, Melbourne. Available at: [http://www.ipa.org.au/library/0804paper_woolston.pdf].Last Accessed 7 August 2008.

Young, M., (2002) *Determining the Economic Value of Water: Concepts and Methods*, Resources for the Future, Washington, DC.

Webpages

Asian Development Bank, viewed 11 December 2009, [http://www.adb.org/Water/WAP/default.asp]

California Water Awareness Campaign, viewed 1 December 2009, [http://www.wateraware.org/]

Council of Australian Governments, viewed 20 August 2008, [http://www.coag.gov.au/coag_meeting_outcomes/1994-02-25/docs/attachment_a.cfm]

Department of Environment and Resource Management, 2010, Queensland Government, viewed 11 May 2010, [http://www.derm.qld.gov.au/water/trading/types.html#fees]

Department of Sustainability and Environment (Victoria), viewed 11 May 2010, [http://www.waterregister.vic.gov.au/Public/ApplicationFees.aspx]

Department of the Environment, Water, Heritage and the Arts, viewed December 14 2009, [http://www.environment.gov.au/water/locations/murray-darling-basin/index.html]

Department of Water, Land Biodiversity Conservation (South Australia), viewed 11 May 2010, [http://www.dwlbc.sa.gov.au/assets/files/ra_rma1_v1.pdf]

Department of Water, Land Biodiversity Conservation (South Australia), viewed 11 May 2010, [http://www.dwlbc.sa.gov.au/assets/files/ra_rml3_v1.pdf]

Goulburn-Murray Water, viewed 11 May 2010, [http://www.g-water.com.au/browse.asp?ContainerID=unbundledtradingfees]

Melbourne Water, viewed 1 June 2008, [http://www.melbournewater.com.au/content/water_storages/water_supply/history_of_melbournes_water_supply.asp]

Murray-Darling Basin Authority, viewed 25 April 2010, [http://www.mdba.gov.au/water/about_basin]

Murray-Darling Basin Authority, viewed June 3, 2011, [http://www.mdba.gov.au/communities/having-your-say/feedback-received]

NSW Government, viewed December 1 2009, http://www.waterforlife.nsw.gov.au/

NSW Office of Water, 2010, NSW Department of Environment, Climate Change and Water, viewed 11 May 2010, [http://www.water.nsw.gov.au/Water-licensing/About-licences/Water-Act-912/act1912_fees/default.aspx]

Pacific Institute, viewed 12 December 2009, [http://www.worldwater.org/conflict/list/]