

Wicked Problems in Water Governance: Paradigm Changes to Promote Water Sustainability and Address Planning Uncertainty

Brian Head

December 2010



Urban Water Security Research Alliance
Technical Report No. 38

Urban Water Security Research Alliance Technical Report ISSN 1836-5566 (Online)
Urban Water Security Research Alliance Technical Report ISSN 1836-5558 (Print)

The Urban Water Security Research Alliance (UWSRA) is a \$50 million partnership over five years between the Queensland Government, CSIRO's Water for a Healthy Country Flagship, Griffith University and The University of Queensland. The Alliance has been formed to address South-East Queensland's emerging urban water issues with a focus on water security and recycling. The program will bring new research capacity to South-East Queensland tailored to tackling existing and anticipated future issues to inform the implementation of the Water Strategy.

For more information about the:

UWSRA - visit <http://www.urbanwateralliance.org.au/>

Queensland Government - visit <http://www.qld.gov.au/>

Water for a Healthy Country Flagship - visit www.csiro.au/org/HealthyCountry.html

The University of Queensland - visit <http://www.uq.edu.au/>

Griffith University - visit <http://www.griffith.edu.au/>

Enquiries should be addressed to:

The Urban Water Security Research Alliance
PO Box 15087
CITY EAST QLD 4002

Ph: 07-3247 3005; Fax: 07-3405 3556

Email: Sharon.Wakem@qwc.qld.gov.au

Head, B. (2010). *Wicked Problems in Water Governance: Paradigm Changes to Promote Water Sustainability and Address Planning Uncertainty*. Urban Water Security Research Alliance Technical Report No. 38.

Copyright

© 2010 UQ. To the extent permitted by law, all rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of UQ.

Disclaimer

The partners in the UWSRA advise that the information contained in this publication comprises general statements based on scientific research and does not warrant or represent the accuracy, currency and completeness of any information or material in this publication. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No action shall be made in reliance on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, UWSRA (including its Partner's employees and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

Cover Photograph:

Description: iStock conceptual illustration © studiovision

ACKNOWLEDGEMENTS

This paper was developed for the Institutional Change project in the Urban Water Security Research Alliance program in 2008 and revised in 2010. The author thanks John Alford and several water sector informants who discussed their views on the prospects for expert-driven water planning under conditions of planning uncertainty.

FOREWORD

Water is fundamental to our quality of life, to economic growth and to the environment. With its booming economy and growing population, Australia's South-East Queensland (SEQ) region faces increasing pressure on its water resources. These pressures are compounded by the impact of climate variability and accelerating climate change.

The Urban Water Security Research Alliance, through targeted, multidisciplinary research initiatives, has been formed to address the region's emerging urban water issues.

As the largest regionally focused urban water research program in Australia, the Alliance is focused on water security and recycling, but will align research where appropriate with other water research programs such as those of other SEQ water agencies, CSIRO's Water for a Healthy Country National Research Flagship, Water Quality Research Australia, eWater CRC and the Water Services Association of Australia (WSAA).

The Alliance is a partnership between the Queensland Government, CSIRO's Water for a Healthy Country National Research Flagship, The University of Queensland and Griffith University. It brings new research capacity to SEQ, tailored to tackling existing and anticipated future risks, assumptions and uncertainties facing water supply strategy. It is a \$50 million partnership over five years.

Alliance research is examining fundamental issues necessary to deliver the region's water needs, including:

- ensuring the reliability and safety of recycled water systems.
- advising on infrastructure and technology for the recycling of wastewater and stormwater.
- building scientific knowledge into the management of health and safety risks in the water supply system.
- increasing community confidence in the future of water supply.

This report is part of a series summarising the output from the Urban Water Security Research Alliance. All reports and additional information about the Alliance can be found at <http://www.urbanwateralliance.org.au/about.html>.



Chris Davis

Chair, Urban Water Security Research Alliance

CONTENTS

Acknowledgements.....	i
Foreword.....	ii
Executive Summary.....	1
1. Introduction	2
2. Background: the Emergence of Wicked Problems.....	2
3. Processes for Resolving Wicked Problems	5
4. Political and Managerial Responses	7
5. Responding to Climate Change	9
6. Conclusions.....	10
References.....	12

LIST OF FIGURES

Figure 1: Wickedness as a combination of complexity, uncertainty and divergence	4
---	---

EXECUTIVE SUMMARY

Some of the most difficult policy problems of the modern era, including water and natural resources sustainability, have been described as complex, intractable, open-ended and ‘wicked’. What are the key features of such problems? And are they really very different in nature from more routine problems? To what extent can these problems be ‘solved’ by experts through technology and design innovation? Or should we seek more consultative and participatory approaches for addressing complex issues?

This discussion paper sketches some key aspects of wicked problems. It then considers the challenge of achieving water sustainability and responding to climate change, in the light of planning uncertainty and problem complexity. It asks whether, in relation to water policy, scientists, policymakers and water professionals are making significant progress in developing better ways to address these wicked problems. Lessons from the debate on climate change responses underline the need to encourage innovation across the boundaries of disciplinary knowledge and to encourage knowledge sharing with the community, in order to address contemporary issues of sustainable water management.

1. INTRODUCTION

There is a growing literature on ‘wicked problems’, which are generally seen as complex, open-ended, and intractable. Both the nature of the ‘problem’ and the preferred ‘solution’ are strongly contested (Head and Alford 2008; APSC 2007). This discussion paper outlines the main features of this debate and considers why these issues have been attracting considerable attention in recent times, both conceptual and practical. There has been surprisingly little attention in the research literature as to how ‘wicked problems’ are identified, understood and managed by practitioners concerned with policy and management. The paper suggests there are new challenges for policymakers, researchers and practitioners in coming to grips with these issues.

Standard public policy responses to complexity and uncertainty (e.g. greater use of markets, outsourcing, or regulatory prescription) seem to be insufficient. New processes spanning people and organisations (e.g. cross-sectoral collaboration, joined-up government, and conflict reduction or consensus processes) are increasingly being tested and endorsed. We appear to require some new approaches for addressing the multiple causes of inter-related problems in environmental and natural resource management, as a basis for opening up new insights about productive pathways for better solutions. The paradigm shifts associated with broad sustainability strategies in advanced western societies (Van der Brugge and Rotmans 2007; Pahl-Wostl 2007, 2008, 2009) are increasingly linked to processes for gaining broad stakeholder acceptance of shared strategies.

2. BACKGROUND: THE EMERGENCE OF WICKED PROBLEMS

The discourse around ‘wicked’ problems emerged forty years ago. A variety of critiques had been developed concerning the perceived dominance of rational-technical, or social ‘engineering’, approaches to complex issues of environmental policy, urban planning, and social policy. Firstly, public administration analysts became very critical of complex social policy programs (e.g. the US programs in the late 1960s designed to alleviate poverty, housing and unemployment problems in disadvantaged urban areas). These critics claimed that success was virtually impossible for complex social planning, because the required levels of information, goal-clarity, and coordination were too difficult to meet (Pressman and Wildavsky 1973; Lindblom 1979). The message was that decision-makers should be less ambitious, and should be content to tackle incrementally a few carefully defined (and thus manageable) elements of large problems, rather than become over-committed to a comprehensive or ‘blueprint’ approach.

A second group of critics, based in social policy analysis, argued that technical approaches are bound to overlook the values, perspectives and lived experience of the stakeholders and citizens who are directly or indirectly assisted or involved in these interventions. According to this critique, the growth of scientific and technical expertise alone cannot resolve difficult policy problems. The big and difficult issues should be seen as based on competing views and value frameworks. Addressing such problems requires deliberation and widespread debate concerning the very nature of the issues themselves, as a stage in exploring alternative ways forward. This deliberative process of solution-seeking, with its recognition of perspectives and values which ‘frame’ the definition of problems, is very different from top-down imposition of technical solutions, or from expertise-based solutions arising from the growth in empirical knowledge (Rein 1976; Schon and Rein 1994). It calls into question the effectiveness and the moral authority of expert-based decision-making – whether by planners, engineers or scientists – in isolation from the communities they serve.

The most challenging and wide-ranging critique of orthodox planning rationality emerged in Rittel and Webber's famous paper, 'Dilemmas in a General Theory of Planning' (Rittel and Webber 1973). Building on work in the 'decision' sciences, they declared that the days of solving major urban and environmental planning problems through an 'engineering' approach have ended. Modern society is too pluralistic to tolerate imposed and artificial solutions. Social groups have important differences in attitudes and values which undermine the possibility of clear and agreed solutions. There are two types of problems. The finite everyday problems tackled by science and engineering may be difficult but are relatively 'tame' or 'benign' – in the sense that the logical elements of a mathematics problem are definable and solutions are verifiable through agreed methods. By contrast, modern social and environmental problems are seen as 'ill-defined', inter-linked, and relying on political judgements rather than scientific certitudes. In this sense, most major public policy problems are 'wicked' (Rittel and Webber 1973: 160), i.e. they are inherently resistant to a clear statement of the problem and resistant to a clear and agreed solution.

Rittel and Weber identified ten primary characteristics of wicked problems:

1. There is no definitive formulation of a wicked problem, i.e. even the definition and scope of the problem is contested.
2. Wicked problems have no 'stopping rule', i.e. no definitive solution.
3. Solutions to wicked problems are not true-or-false, but good-or-bad in the eyes of stakeholders.
4. There is no immediate and no ultimate test of a solution to a wicked problem.
5. Every (attempted) solution to a wicked problem is a 'one-shot operation'; the results cannot be readily undone, and there is no opportunity to learn by trial-and-error.
6. Wicked problems do not have a clear set of potential solutions, nor is there a well-described set of permissible operations to be incorporated into the plan.
7. Every wicked problem is essentially unique.
8. Every wicked problem can be considered to be a symptom of another problem.
9. The existence of a discrepancy representing a wicked problem can be explained in numerous ways.
10. The planner has no 'right to be wrong' in an experimental sense, i.e. there is no public tolerance of initiatives or experiments that fail.

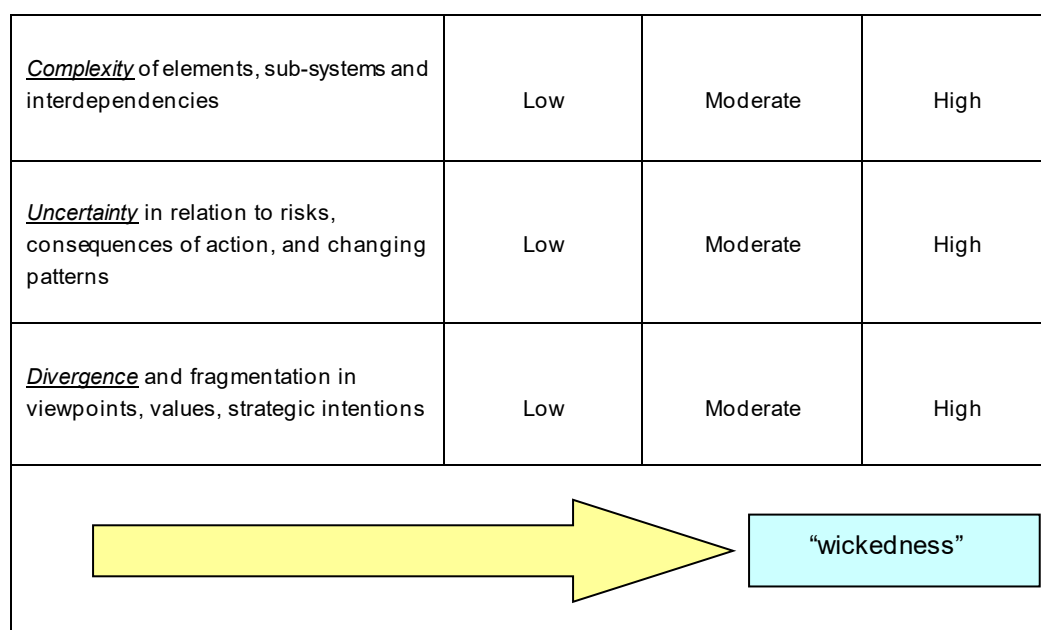
Thus, science and technology cannot resolve these dilemmas about 'knowledge-in-use' by simply aspiring to fill all the known gaps in empirical knowledge. The relevant knowledge base for sustainability policies is not uniform and cumulative, but is inherently uneven and fragmented. It is also a knowledge base shared between scientists, stakeholders and political decision-makers. Many scholars have found these features of complexity in knowledge and interests to be helpful in explaining the difficulties that have plagued some areas of urban planning, social policy, and environmental and natural resources policy (e.g. Allen and Gould 1986; Freeman 2000; Kepkay 2002; Campbell 2003; Van Bueren *et al.* 2003; Salwasser 2004; Conklin 2006).

The attraction of the 'wicked problem' concept is that it seems to provide additional insights concerning why many policies and programs generate controversy, fail to achieve their stated goals, cause unforeseen effects, or are impossibly difficult to coordinate and monitor. Even the business management literature is re-discovering 'wicked problems' as a way of understanding the changing role of business strategy in making sense of chaotic economic behaviour under conditions of risk and uncertainty (Camillus 2008). It is not clear, however, that labelling a problem as 'wicked' will readily assist in resolving it. However, this approach might help to generate wider understanding of strategies available for managing and coping with complex and chaotic issues.

According to Koppenjan and Klijn (2004), writing from a public sector management perspective, ‘uncertainty’ is the core feature embedded in both the institutional dimensions and the knowledge aspects of all our attempts to deal with ‘wicked’ problems. However, it is argued here, by contrast, that a degree of uncertainty is inherent in all areas of social and organisational life, so that high levels of uncertainty may not be enough to tip an issue into the category of ‘wicked’ problems. It is also necessary to explore the extent of problem complexity and the extent of value-based divergence among stakeholders.

In principle, it should be possible to ‘map’ issues in terms of low, moderate or high levels of complexity, uncertainty, and divergence. Wicked problems, on this view, would be those rating highly across these three dimensions. Complexity is clearly a constituent feature of wickedness, but complexity itself is not enough to trigger a wicked problem since there are many aspects of complexity that are amenable to scientific analysis and technical/engineering controls. There are many complex economic and social phenomena whose respective ‘maps’ (e.g. regional economic growth models; health service treatment models) contain many variables whose direction and interaction are difficult to estimate precisely, but which are not thereby ‘wicked’. Likewise, mere disagreement among stakeholders does not make a problem wicked, but when serious disagreements are combined with complexity and uncertainty we have crossed a threshold. These reinforcing relationships, representing an intensification of ‘wickedness’, are outlined in Figure 1.

Figure 1: Wickedness as a Combination of Complexity, Uncertainty and Divergence.



It is important to emphasise that these patterns could be very different across *various policy issues* or problem domains. Environment, natural resources, social welfare, public health and community safety are debated and managed in different political, institutional and scientific contexts. These patterns will also *change over time* as settled arrangements become undermined by circumstances; as new issues move into the political attention cycle; or as new policy instruments are freshly applied to a wider range of areas. *Responsibilities* for recognising and responding to particular problem-areas may also shift over time. Many issues have been re-defined as matters for *public sector* responsibility over the last century or so, but these allocations remain open to debate and are constantly adjusted. Thus, responsibilities for many issues are often perceived as lying largely with *non-government* actors: individuals, parents, families, neighbourhoods. Some issues may be seen as best handled through *market* mechanisms (exchange, trading, pricing) where business enterprises will play a larger role. In other policy areas, not-for-profit community organisations, public interest groups and charitable associations may be seen as having a greater role. It is also important to note that ‘wicked’ features are

not just about a clash of ideas and values; they are also implicated in structures, processes and institutional arrangements including power, authority, and procedural rules.

A few brief examples may illustrate some of these points about the important difference between complex-*technical* and complex-*wicked* challenges. Firstly, in some cases, a major project initiative may be widely recognised as deeply marked by complexities and uncertainties (e.g. building electronic information systems for an infrastructure network); but those challenges can be regarded as matters for technical experts to resolve following clarification of the scope, purpose and functionality as defined by key funders or stakeholders (e.g. the system owner and other key clients). Secondly, by contrast, the issues arising in other types of projects (e.g. building a dam in an agricultural and grazing catchment to improve urban water supplies; or building additional freeways through inner suburbs to reduce traffic ‘congestion’) involves not only significant technical expertise (e.g. engineering specifications, cost controls), but also other important dimensions. The overall project challenge is broader than technical experts can resolve alone, because (a) the goals themselves are inherently controversial and (b) the methods selected are likely to be heavily contested by a wide range of stakeholders directly or indirectly affected by the proposal. Thirdly, in some types of ‘wicked’ policy issues, uncertainty and value-disagreement both significantly intensify the conflict. Thus, there are likely to be strongly different value perspectives about interpretations of the precautionary principle, about the relative merits of ecological vs. economic values, and about whether to allow any trade-offs and offsets for polluting industries. Value positions underlie the strong differences of viewpoints concerning the rapid commercialisation of technical innovations (e.g. how to regulate the introduction of genetically-modified crops and foods). In the past, disagreements about problems and solutions have often led to a gridlock of fixed positions and in some cases protracted litigation.

3. PROCESSES FOR RESOLVING WICKED PROBLEMS

There are many policy areas where traditional approaches are seen as having failed to ‘deliver’ in solving the pressing demands of citizens for a healthy, fair, prosperous and green society. Traditional approaches have included both technical (expert-driven) processes, as well as the more routine administratively based programs. Where programs have failed to solve problems, it is often because traditional thinking has failed to recognise the key dimensions of the problem, the wide scope of possible response options, and the political and funding commitments required for effective implementation over time.

The effectiveness of traditional solutions may be weak in areas such as the sustainability challenges emerging from complex causal patterns. Where traditional approaches to management and problem-solving have failed to provide effective or successful long-term outcomes, one new response has been to broaden the dialogue with stakeholders about problems and solutions (APSC 2007). Most often this engagement occurs around specific major project proposals (e.g. community consultation about the social/environmental impacts of particular projects) or consultation around a proposed strategic plan (e.g. QWC 2008). But consultation can also occur around broader ideas for addressing big issues concerning regional sustainability. For example, governments sometimes promote open dialogue among stakeholders and experts to seek ‘new ideas’ (e.g. ideas summits), to ‘snowball’ some new feasible new pathways, or simply to seek greater consensus and bridge differences. When specific issues are intensely important to significant groups of stakeholders, as with the Reef Water Quality Protection Plan in 2003, negotiated accommodations among key participants may be seen as necessary and appropriate for the future success of the plan.

In some cases the key challenge is to unpack and discuss entrenched differences, and to move beyond current fixed positions. The path most commonly adopted in this instance is mediated dialogue, seeking to explore common ground about longer term goals and directions, and interim steps for moving forward together. The substantial research literature on conflict resolution (e.g. Susskind *et al.* 1999; Campbell 2003) has analysed many case-studies, developed scenarios for discussion, and provided advice on how to address intractable issues. This literature usefully draws attention to the role of values, issue-histories, the characteristics of the parties in dispute, and the organisational

context for mediation – these matters help assess the depth and breadth of problems and the prospects for well-informed and cooperative solutions.

This research on the potential contribution of carefully designed forums – for mediation, conflict reduction, dialogue and deliberation – is highly relevant for assessing the nature of major sustainability problems and strategic directions for addressing them. Understanding the perspectives of key stakeholders, the knowledge bases available, the extent of agreement on broad goals, and the prospects for developing shared expectations, can provide a sound basis for considering how further engagement should occur and how future decisions should be made. These processes can help address the insecurities arising from uncertainty, complexity and divergence. The role of facilitated dialogue, as an element of robust community consultation (Head 2007), is highly relevant for many elements in the ‘policy cycle’ including policy design and development, program evaluation and review, and in practical problem-solving to improve implementation.

It is important to consider why failures and under-performance are common in most areas of policy design and program delivery. Conventional explanations usually tend to focus on weaknesses and deficiencies in the public sector’s *implementation* or delivery mechanisms. These implementation weaknesses might include a lack of reliable information, lack of clarity about roles and tasks, lack of technical or managerial skills, inadequate funding, poor communication and/or consultation, lack of persistence and commitment over time, and lack of authority to achieve the right levels of coordination with partnering organisations. These are all very important capabilities, and their absence might explain many program failures. However, the concept of wicked problems potentially adds another layer of explanation and new research questions. Such questions focus mainly on the understandings that have shaped the identification and scoping of problems, and thus the ‘frames’ for generating problem solutions. Extending this line of explanation further, it can be seen that failures and unintended outcomes are likely to be endemic in many complex areas of policy and program delivery, for several reasons:

1. the ‘problems’ are poorly identified and scoped;
2. the problems themselves may be constantly changing;
3. solutions may be addressing the symptoms instead of underlying causes;
4. people may disagree so strongly that many solution-options are unworkable;
5. the knowledge base required for effective implementation may be weak, fragmented or contested;
6. some solutions may depend on achieving major shifts in attitudes and behaviours (i.e. the preferred solutions require changed conduct on the part of many citizens or stakeholders); but
7. there are insufficient incentives or points of leverage to ensure that such shifts are actualised.

Given that there is no single ‘root cause’ of complexity, uncertainty and disagreement (and therefore no root cause of ‘wickedness’ in policy problems), it follows that there is no single best approach to tackling such problems. If, for example, it is claimed that the fundamental *cause* of a wicked problem is *lack of scientific knowledge* (e.g. knowledge about future climate variability), this claim already implies a preferred solution – more scientific research will be needed to fill gaps, reduce uncertainty, and provide a basis for clear and agreed solutions. On the other hand, if the fundamental problem is seen to be *divergence of viewpoints*, and thus a lack of capacity for concerted action, the implied solution is to establish processes of participation, debate and mediation that lead to a workable consensus, as in the international talks on Climate Change sponsored by the United Nations. The above analysis is consistent with the important point, made by many scholars (e.g. Rittel and Webber 1973; Schon and Rein 1994), that problem-definition tends to imply a preferred solution. Hence, some caution is required in proposing solutions to address wicked problems, as every solution is likely to be insufficient, to some extent over time. Multiple approaches may need to be taken simultaneously to address different levels and different relationships.

The sustainable use of water and natural resources is a clear case of an inter-related set of ‘wicked’ problems. These are big and complex issues, which involve many natural, human and technical dimensions. Their significance is exacerbated by continuing population growth and climate change or variability. Dimension of complexity is the *spatial* scale of issues and proposed solutions, ranging from very small localities, through sub-regional areas and up to the national scale and beyond. The behavioural unit to be targeted by policies will likewise range from individuals, households, neighbourhoods and suburbs through to larger regional and nationwide scales. The inter-connections between these levels are also important to consider. At an international level, the related policy areas are marked by wicked problems, including international or global regimes for greenhouse gas reduction. These examples, domestic and international, show that problems are often ‘nested’ and interdependent. This feature raises great difficulties both for clear analysis and for devising practical interventions to tackle the problems.

4. POLITICAL AND MANAGERIAL RESPONSES

Effective interim actions are required in the absence of achieving a comprehensive understanding. Managers would probably prefer to have a solid information base before attempting to provide sound analytical commentary or to recommend well-grounded options for program improvements. Politicians, on the other hand, are often keen to pursue ‘solutions’ even when the evidence is uncertain or when the citizens disagree on key issues. Many politicians like to be seen as ‘decisive’, by taking conspicuous action to address issues and to contrast their position with that of opponents. Sometimes this preference is driven by ideological zeal and a preference for action. They will not wait for all uncertainty to subside before they choose to act. However, others take a more cautious and conservative approach, unwilling to over-commit their governments to finding solutions for obviously intractable issues. In practice, the majority of politicians tend to select for attention a few highly visible elements or tangible pieces of the puzzle, rather than requiring a comprehensive approach to issues. This preference is reinforced by administrative and budgeting processes which are predisposed towards tangible outputs and the measurement of incremental changes. Political and financial accountability systems encourage the specification of discrete project items rather than large and amorphous interlinked outputs.

Hence, an incremental approach often prevails (Lindblom 1979), even while governments sometimes acknowledge that many small steps are needed towards a larger end-goal. Politicians in many countries are often less interested in strategic directions than in the local benefit of distributing cheques, unveiling plaques, and cutting ribbons. Funding specific facilities (e.g. roads, buildings) or specific services (e.g. extra staff in remote locations) is more attractive for most Ministers than making onerous promises to improve environmental sustainability. A focus on providing a specific facility or service becomes associated with particular skill-sets within the public bureaucracy, highlighting skills in project management rather than strategic leadership and policy innovation. This incremental focus, sometimes known as ‘cherry-picking’ problems, may be a useful practical tactic for ‘coping’ with complex wicked problems – dealing with manageable elements today, while recognising that there will be other aspects to tackle tomorrow. However, these short-term tactics might contribute little in the longer term, unless other supporting actions are taken to increase evidence-based capability, including the collection of baseline data about the nature of the issues and solid evaluations of the impacts of current and previous interventions.

Public management research, taking some cues from public management practice, has begun to address not only the conceptual difficulties but also the practical challenges of tackling ‘wicked problems’ and complex uncertainties. Three relevant managerial trends attracting attention in recent decades have been new public management (NPM), cross-agency coordination, and more inclusive approaches to stakeholder engagement.

Firstly, NPM has sought systematic improvements in the efficiency of public sector agencies and hence in their capacity to improve services (McLaughlin *et al.* 2004). NPM has allowed some re-thinking of traditional ways to define program goals and instruments, with potential gains in resource efficiency and program effectiveness. Moreover, risk-management techniques have been used to assess and mitigate a range of risks to institutional capability and program implementation, for example, in relation to agencies' own resources, skills and capabilities, and also in relation to external threats to service delivery (Drennan and McConnell 2007). Secondly, cross-agency coordination has been highlighted as a higher priority for government, as more issues seem to require a connected approach across portfolios within each jurisdiction and across levels of government (Management Advisory Committee 2004). Coordination among public agencies (e.g. across portfolios for environment, natural resources, local and regional planning, infrastructure, emergency services, etc) is just as important as coordination between the government sector, the business sector and community organisations. Thirdly, a number of complex issues have required more inclusive approaches. Governments have selectively explored the benefits of closer consultation and engagement with non-government stakeholders, and have trialled a range of more collaborative and networked approaches (Roberts 2000; Mandell 2001; Goldsmith and Eggers 2004).

In the era of complex and intensively negotiated 'wicked' issues, the repertoire of strategies required for senior public managers is constantly being extended. A recent Australian government discussion paper on wicked or intractable problems (APSC 2007) suggests that the general aim of government when dealing with intractable problems should be to achieve 'sustained behavioural change' through 'collaboration' as a response to 'social complexity'. The report outlines several techniques that could be employed, emphasising that new processes and new thinking are required. For example (APSC 2007: 35-6):

- *The ability to work across agency boundaries* – as wicked problems do not conform to the constraints of organisations there is a need to work across agency boundaries.
- Increasing understanding and stimulating a debate on the appropriate *accountability framework* – existing frameworks may constrain attempts to resolve wicked problems.
- *Effectively engaging stakeholders and citizens in understanding the problem and in identifying possible solutions* – there is a need to understand the full dimensions of each situation through engaging with relevant stakeholders. Behavioural changes, the report suggests, are more likely if there is a full understanding of the issues by stakeholders.
- *Additional core skills* – develop skills in communication, big picture thinking, influencing skills and the ability to work cooperatively.
- *A better understanding of behavioural change by policy makers* – although the traditional ways by which governments change citizens' behaviour will still be important (e.g. legislation, regulation, penalties, taxes and subsidies), such practices may need to be supplemented with other behaviour-changing tools that better engage people in cooperative behavioural change.
- *A comprehensive focus and/or strategy* – as wicked problems have multiple causes they require sustained effort and resources.
- *Tolerating uncertainty and accepting the need for a long-term focus* – solutions to wicked problems are provisional and uncertain, and this fact needs to be accepted by public managers and Ministers. There are no quick fixes and solutions may need further policy change or adjustment.

These suggestions indirectly point to the enormity of the challenge for the public sector in an age of complex and intractable problems, typified by sustainability policies and practices. The APSC discussion paper points to the need for major cultural and operational changes in the way senior managers and political leaders undertake their work, and the ways in which agencies relate to stakeholders and the wider community. It is clear that management education would need to be adjusted accordingly. However it is not at all clear that governments have the political will or capacity to make the necessary changes, including a whole-hearted commitment to stakeholder inclusion at the heart of policy development.

To further illustrate the concept of wicked problems, some very brief comments are made below on policy responses to water sustainability as an aspect of climate change responses, understood as a linked series of 'sustainability' issues encompassing both national and state politics.

5. RESPONDING TO CLIMATE CHANGE

The debate in Australia on climate change has been strongly contested over many years. There was a long struggle before 'ecologically sustainable development' was recognised as a strategic framework by governments in Australia (adopted at the December 1992 meeting of COAG, together with a brief National Greenhouse Response Strategy). The 'greenhouse' (or climate change) challenge has always been the most difficult and contentious theme in the sustainability debate in Australia, exacerbated by the special standing of the coal industry in energy supply (Lowe 1994; Taplin 1994). While these early 1990s frameworks were developed through an extended process of bargained agreement among stakeholders, the agreed actions were not onerous (e.g. grants programs, research projects, education). Moreover, the implementation process allowed for many reinterpretations and revisions of policy priorities at both federal and state levels. The 1998 National Greenhouse Strategy remained a bland document which required little change in behaviour by corporations or citizens, and emphasised efficiency in resource use rather than structural change. The Howard government produced a framework of adaptation responses to climate change (Australian Government 2007), but failed to encourage large firms to anticipate the need for major changes in technologies and in carbon pricing. The Rudd government, following the Garnaut report (2008), promoted an Emissions Trading scheme to put a price on carbon. However, this legislative proposal was defeated in the Senate in late 2009, and the Gillard government has returned to further rounds of negotiation with key stakeholders in late 2010 to produce a more consensual model.

If the politics has been tortuous, the science concerning climate change has not been sufficiently precise to provide a unified view of policy objectives and instruments. The science has focused on understanding changes/variability in climatic conditions, at both a global and regional scales, as a basis for forecasting future patterns. The science has also focused on identifying and quantifying the specifically human-induced contributions to rapid changes in climate (e.g. the impacts of industrialisation on atmosphere, temperature and rainfall). Both the scientific inquiry process and the policy implications are massively complex and difficult to manage. Single regions and nations are concerned with their own likely futures, but the solutions are likely to require large-scale cooperative policy shifts. This has elevated the role of international bodies in brokering both the science and the politics – the expert reviews of scientific evidence (the Intergovernmental Panel on Climate Change (IPCC) was established in 1988) and the international treaty negotiation process (the Rio Framework Convention followed by the Kyoto Protocol). In Australia, the unwillingness of the Howard government to ratify the Kyoto Protocol during its term of office from 1996 to 2007 had become a political symbol of fundamental differences about the value of international dialogue to establish future regulatory arrangements. The key dimensions of debate have included clarifying the nature and urgency of the problem, determining the most cost-effective actions for emissions reduction, allocating responsibilities for effective action, and the distribution of cost burdens and possible compensation. Conflict and divergence thus run across multiple issues and geographical scales.

There are several reasons why climate change policy is a 'wicked problem'. Firstly, it is actually a series of linked problems, none of which can be resolved in isolation. Secondly, the short-term and long-term calculations of impacts, costs, and benefits of specific interventions are likely to be highly variable and may shift over time. Thirdly, the impacts are global, national, regional and local simultaneously. This makes the understanding of impacts, and the choice of useful adaptive behaviours, very complicated. Fourthly, in relation to the science or knowledge base, the extent of climate change, and especially the human contribution to the causal chain, has been hotly contested, with scepticism being fanned by some industry sectors. However, there has recently been a growing consensus (IPCC 2007; Stern 2006) that has finally convinced large sections of industry to accept the need for major changes. Fifthly, the allocation of responsibilities – to various levels of government, to private corporations, to citizens – for changing their behaviours and investment decisions is inherently

difficult. This is true both within each country (industries, localities) and across groups of countries (developed, developing, small, large, etc). Sixthly, equity issues around the pattern of burden-sharing and the rate of behavioural change are significant and difficult to resolve. Seventhly, the choice of instruments is contentious – which forms of regulatory mandate and which market-based mechanisms are most likely to be effective and at the same time be politically feasible? Finally, there is a serious debate about the distinctive or separate interests of regions within Australia vis-à-vis other regions and indeed other nations. Australia's global role is contested both within this country and internationally – should Australia play a 'leadership' role by requiring and encouraging large investment in best-practice technologies, or should Australia 'hide' behind other nations by agreeing only to incremental changes that minimise adjustment costs in the short term?

State and federal governments have all adopted sustainability policies, including encouragement for water and energy efficiency. But the politics of decision-making and community engagement on these issues in Australia, including the hard decisions on greenhouse gas reduction strategies and targets, will be part of the political and economic landscape for the foreseeable future. In this sense, the wicked problems are managed, debated and constantly renegotiated rather than solved.

6. CONCLUSIONS

Policy development occurs across a range of contexts, from the settled routines of 'business-as-usual' through to 'crisis management'. The international experience shows that under conditions of crisis, with strong pressure for immediate action, the need for conspicuous action sometimes stifles the opportunity for new thinking. Rather than a positive and thoughtful 'paradigm shift', there is a significant likelihood of reinforcing past practices, e.g. 'group-think' about tactical responses and use of top-down styles of emergency coordination (Boin *et al.* 2005: 47). Institutional learning, addressing the long-term causes of the problems, might occur – if at all – only when the immediate pressures have been alleviated. The paradigm shifts associated with broad sustainability strategies in European societies (Van der Brugge and Rotmans 2007; Pahl-Wostl 2007, 2008, 2009) have notably been linked to processes for gaining broad stakeholder acceptance of shared strategies.

Public managers are constantly obliged to consider a range of strategies to increase public sector capacity and effectiveness for dealing with complex and intractable problems. Both the traditional bureaucratic focus on authoritative processes to resolve issues, and the modern managerialist focus on greater efficiency in achieving outputs, have been widely used internationally. Each of these has important limitations (Head and Alford 2008) when dealing with problem complexity and when attempting to manage issues marked by divergent expectations. In some circumstances, leaders might wish to avoid taking action while waiting for others to take the initiative. Some will prefer calmer waters rather than tackle the more turbulent currents. Science cannot overcome two ongoing truths of public policy – the inherently political nature of decision-making, and the impossibility of resolving all problems through government activity.

The three most widely recommended approaches to wicked problems – better knowledge, better consultation, and better use of third-party partners – deserve closer attention in future research on water sustainability. These approaches are arguably more important on big issues where scientific expertise cannot drive consensus on key policies and cannot ensure community support. Firstly, investment in more research to address gaps in knowledge is necessary, especially in relation to understanding linkages, patterns and instruments for change. Better knowledge can contribute not only to 'evidence-informed' policy decisions (Head 2008) but also to good processes for developing greater understanding and consensus. Such knowledge should address institutional and social structures, processes and relationships as well as knowledge about civic attitudes, values and cultural expectations. Knowledge needs to be more than the documentation of the problems, but shift towards developing and disseminating knowledge about innovative approaches with strong prospects of success. Program evaluations and pilot schemes that assess the effectiveness of current and previous interventions could be very useful sources of applied knowledge, providing that key decision-makers are willing and able to learn from experience and that evaluation reports are publicly released (Head

and Stewart 2007). However, 'more' knowledge, even if well targeted, is never sufficient to manage the politics of complexity.

Secondly, the strategy of more effective consultation and closer 'collaboration' among stakeholders as a process solution is also important and widely recommended (Roberts 2000; Mandell 2001; Management Advisory Committee 2004; Goldsmith and Eggers 2004; APSC 2007). It is essential that consultation be regarded as an ongoing process rather than a one-off event. But rigorous consultation and dialogue might not be sufficient to achieve progress in tackling some intractable problems that require good social and technical analysis as well as improved exchange of information among stakeholders. Sometimes the 'best' policy strategies may require very detailed analyses of complex causality, both technical and social, in order to gain a clearer picture of how processes and proposed interventions are inter-linked. This understanding (the logic of change processes) could be a useful precursor to stakeholder dialogues.

Thirdly, there is increasing reliance on third parties (e.g. business firms and NGOs) and on market incentives to develop innovative programs and best-practice guidelines to address water sustainability and climate response issues. There is an assumption that market incentives and outsourcing service delivery (partnerships and contestability of supply) will tap into innovative and cost-effective ideas, and minimise the costs of transition. However, the responsibility for setting the framework for markets and business innovation to achieve public purposes will still remain with government.

In conclusion, the fundamental challenge for researchers is to develop new thinking about the multiple causes of problems, opening up new insights about the multiple pathways toward better solutions, and gaining broad stakeholder acceptance of shared strategies and processes. New strategic thinking and innovation needs to be championed within the public sector at state, national and international levels. This requires organisational learning and cultural change – perhaps a bridge too far for many government agencies which are obliged to expend almost all their energy on immediate tasks to ensure delivery of their budgeted outputs. The public agencies cannot be expected to move to a different paradigm without the insight, support and long-term commitment of political leaders, and encouragement from business and community stakeholders. It is too easy to blame the risk-averse organisational culture of public agencies for our lack of innovation. Public managers need to be encouraged by far-sighted political leaders who are capable of working effectively with the business and community sectors in developing new approaches to major issues of sustainability.

REFERENCES

- Allen, G.M., and Gould, E.M., 1986, Complexity, Wickedness and Public Forests, *Journal of Forestry* 84 (4), 20-24.
- Australian Government, 2007, *National Climate Change Adaptation Framework*. Canberra: Australian Greenhouse Office.
- Australian Public Service Commission [APSC], 2007, *Tackling Wicked Problems: A Public Policy Perspective*. Canberra: APSC. <http://www.apsc.gov.au/publications07/wickedproblems.pdf>.
- Boin, A., Hart, P., Stern, E. and Sundelius, B., 2005, *The Politics of Crisis Management*, Cambridge: Cambridge University Press.
- Camillus, J.C., 2008, Strategy as a Wicked Problem, *Harvard Business Review*, 86 (5), 99-106.
- Campbell, M.C., 2003, Intractability in Environmental Disputes: Exploring a Complex Construct, *Journal of Planning Literature*, 17(3), 360-371.
- Conklin, J., 2006, Wicked Problems and Social Complexity, in *Dialogue Mapping: Building Understanding of Wicked Problems*. Chichester: John Wiley.
- Drennan, L.T. and McConnell, A., 2007, *Risk and Crisis Management in the Public Sector*, London: Routledge.
- Freeman, D.M., 2000, Wicked Water Problems: Sociology and Local Water Organizations in Addressing Water Resources Policy, *Journal of the American Water Resources Association*, 36(3), 483-491.
- Garnaut, R., 2008, *Climate Change Review Draft Report*. Canberra: Australian Government. <http://www.garnautreview.org.au/CA25734E0016A131/pages/draft-report>
- Goldsmith, S. and Eggers, W.D., 2004, *Governing by Network: The New Shape of the Public Sector*, Washington DC: Brookings.
- Head, B.W., 2007, Community Engagement: participation on whose terms? *Australian Journal of Political Science*, 42 (3), 441-454.
- Head, B.W., 2008, Three Lenses of Evidence-based Policy, *Australian Journal of Public Administration*, 67 (1), 1-11.
- Head, B.W. and Alford, J., 2008, Wicked Problems: The Implications for Public Management, presentation to International Research Society for Public Management Conference, Brisbane, 26 March.
- Head, B.W. and Stewart, J., 2007, Evaluating Policy Processes: Reconsidering Policy Evaluation and Policy Learning, presentation to Conference on Governing by Looking Back, ANU, Canberra, 12 December.
- Intergovernmental Panel on Climate Change [IPCC], 2007, *Fourth Assessment Report: Climate Change 2007*, Geneva: WMO and New York: UNEP.
- Kepkey, M., 2002, Implementing Adaptive Forest Management: the challenge of a wicked human environment, Clayoquot Alliance Working Paper, Victoria BC. <http://www.clayoquotalliance.uvic.ca>
- Koppenjan, F.J.M. and Klijn, E.H., 2004, *Managing Uncertainties in Networks*. London: Routledge.
- Lindblom, C.E., 1979, Still Muddling, not yet Through, *Public Administration Review* 39 (6), 517-526.
- Lowe, I., 1994, The Greenhouse Effect and the Politics of Long-term Issues, in Bell, S. and Head, B.W. eds, *State, Economy and Public Policy in Australia*, Melbourne: Oxford University Press.
- Management Advisory Committee [MAC] (2004) *Connecting Government: Whole of Government Responses to Australia's Priority Challenges*, Canberra: Australian Government.
- Mandell, M.P. (ed) 2001, *Getting Results through Collaboration: Networks and Network Structures for Public Policy and Management*, Westport: Quorum Books.
- McLaughlin, K., Osborne, S.P. and Ferlie, E. eds., 2002, *New Public Management: Current Trends and Future Prospects*. London: Routledge.
- Pahl-Wostl, C., 2007, Transition towards adaptive management of water facing climate and global change. *Water Resources Management* 21 (1), 49-62.
- Pahl-Wostl, C., 2008, Requirements for Adaptive Water Management, in Pahl-Wostl, C., Kabat, P. and Moltgen, J. eds, *Adaptive and Integrated Water Management: Coping with Complexity and Uncertainty*, pp. 1-22. Berlin: Springer.
- Pahl-Wostl, C., 2009, A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change* 19 (3), 354-365.
- Pressman, J.L. and Wildavsky, A., 1973, *Implementation: How Great Expectations in Washington are Dashed in Oakland*. Berkeley: University of California.
- Putnam, L.L. and Wondolleck, J.M., 2003, Intractability: Definitions, Dimensions and Distinctions, in Lewicki, R.J., Gray, B. and Elliott, M. eds, *Making Sense of Intractable Environmental Conflicts*, Washington DC: Island Press.

- Queensland Water Commission [QWC] 2008, *Water for Today, Water for Tomorrow: Southeast Queensland Water Strategy Draft*, consultation paper, Brisbane.
- Rein, M., 1976, *Social Science and Public Policy*. New York: Penguin Books.
- Rittel, H.W.J. and Webber, M.M., 1973, Dilemmas in a General Theory of Planning, *Policy Sciences*, 4 (2), 155-169.
- Roberts, N.C., 2000, Wicked Problems and Network Approaches to Resolution, *International Public Management Review*. 1 (1), 1-19.
- Salwasser, H., 2004, Confronting the Implications of Wicked Problems: Changes Needed in Sierra Nevada National Forest Planning and Problem Solving.
http://www.fs.fed.us/psw/publications/documents/psw_gtr193/psw_gtr193_1_05_Salwasser.pdf
- Schon, D.A. and Rein, M., 1994, *Frame Reflection: Toward the Resolution of Intractable Policy Controversies*. New York: Basic Books.
- Stern, N., 2006, *The Economic Impact of Climate Change: The Stern Review*, London: HM Treasury and UK Office for Climate Change.
- Susskind, L., McKernan S. and Thomas-Larmer, J. eds, 1999, *The Consensus Building Handbook: A comprehensive guide to reaching agreement*, Thousand Oaks, CA: Sage.
- Taplin, R., 1994, Greenhouse: An overview of Australian Policy and Practice, *Australian Journal of Environmental Management*, 1 (3), 142-155.
- Troy, P.N., ed., 2008, *Troubled Waters: Confronting the water crisis in Australia's Cities*. Canberra: ANU e-Press.
- UNESCO, 2009, *Water in a Changing World: The Third United Nations World Water Development Report*. Paris: UNESCO.
- Van Bueren, E.M., Klijn, E.H. and Koppenjan, J.F.M., 2003, Dealing with Wicked Problems in Networks: Analyzing an Environmental Debate from a Network Perspective, *Journal of Public Administration Research and Theory*, 13 (2), 193-212.
- Van der Brugge, R. and Rotmans, J., 2007, Towards Transition Management of European Water Resources, *Water Resources Management*. 21 (1), 249-267.

Urban Water Security Research Alliance

