

Chapter 6

Sustainability in urban water futures

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There is now a substantial literature defining and encouraging sustainable urban water management. Nevertheless, the responses of urban water utilities to changed demand and supply options have tended to focus on technological solutions, new sources and well-worn approaches to demand management. While there is increasing interest in water-sensitive urban design, whole-of-lifecycle economic consideration and the incorporation of externalities into pricing and cost-benefit analyses, there are significant areas of sustainability that have received scant attention. These neglected areas tend to relate to the difficulty in creating, as opposed to promoting, the concept of sustainability that includes social and cultural assessment, integrated response and key institutional issues in achieving adaptive learning.

From the community's perspective there are those who will be happy with modest modifications to the status quo. Recently, however, there have been attitude changes towards supporting stronger approaches to sustainable water-resources management. There is also a greater appreciation that holistic approaches will have to be taken as the issues associated with metropolitan growth and climate change have become more evident.

Thus it is realised by many in the community that there are important value judgments that will have to be addressed to establish whether the status quo should be maintained. Alternatively, if strategic social and cultural goals are to be achieved the community are willing to engage in examining what novel institutional structures should be seriously considered to attain them. Community engagement will need to be structured around the drivers of their decision-making and consequent water-supply preferences if procedurally just change is to be achieved.

Research has shown that these drivers include judgments on issues of fairness in allocation, acceptable risk and uncertainty, trust in both government and its agencies, and perceived wellbeing from alternative levels of service. Emotion is also a significant driver of community decision-making. These judgments are underpinned by perceptions of professional roles and knowledge and how they are incorporated in public discussion.

The above issues and the overall prospects and justification for change in decision-making in urban water management are discussed in terms of examples of community water culture in relation to alternative delivery systems and inter-regional transfer of water resources.

The important role that water plays in the urban environment is well documented. The amenity provided by traditional centralised water supplies overcame early water-borne diseases early in our history. Large sewerage systems led, with some isolated exceptions, to a comfortable 'out of sight and out of mind' mentality in regards to the inconvenient truths associated with waste disposal. Stormwater management was only an issue during heavy rainfall and if drains became blocked. Local wetlands and parks have been regarded as a metropolitan 'staple'. Economically, the amenity associated with proximity and access to water bodies in the landscape has been reflected in land and housing prices.

Thus, through its ready availability and largely unseen management, water, as with oil and electricity, has been largely taken for granted by city-dwellers. Recent challenges through drought and climate change, however, have left water planners, politicians and the public with difficult trade-off choices with regard to the costs associated with maintaining current levels of service, how to create acceptable demand management and the ongoing socio-political problems associated with a lesser level of security of supply and imposition of ongoing restrictions of differing degrees of severity.

The debate about levels of service and their ongoing contribution to community wellbeing and environmental sustainability is now on in earnest (for example, Larsen and Gujer 1997). Much of the sustainability-related argument in Australia is discussed in the context of the concept of integrated urban water management (Mitchell 2006). The resolution of this debate is urgent (for example, see Vlachos and Braga 2001). If historical expectations of the community in this regard are to be met, alternative sources of supply need to be identified with some alacrity. While decisions need to be made in a timely fashion, knee-jerk responses which are potentially unsustainable need to be avoided. The merits of 'quick fixes' such as the current penchant for desalination plants need careful analysis against alternatives. Some would say that technological 'fixes' such as desalination plants are unsustainable (Hurlimann 2007).

This situation reinforces the need for better long-term planning, as the limitations of our past efforts have been exposed. But to improve in this domain we also need to carefully examine the current assumptions upon which long-term demand predictions are made and our expectations of socially acceptable demand-management programs. This examination should, perhaps, occur at a very fundamental level. Currently, our explicit debates around acceptability of levels of service tend to focus around the relatively uninterrupted quantity of

potable water provided and the aesthetics and risk associated with the system-level quality of that water. Furthermore, while holistic thinking is being promoted in the sustainability debate, levels of service seem to be discussed and investigated in a component context. That is, for example, required reliability is considered as one dimension, pressure as another, and health concerns and water aesthetics as two others. Regardless of our role in urban water management, the processing of each of these dimensions into an overall level of service is problematic for us all.

There is, of course, no reason to assume that the public expect that traditional levels of service or large-scale central delivery systems should be retained. The water-reform process and the increasingly evident community-based support for water conservation and sustainable development (Syme and Hatfield-Dodds 2007) indicate that the community may be highly supportive of responsible change in this area. Opponents of this view may tend to point to such issues as the rejection of potable supply from recycled water as an example of community conservatism in this regard. An equally plausible explanation may relate to the quality of the decision-making process and the crisis atmosphere in terms of lack of water and therefore confidence in the planning system.

Changes in water-supply delivery are often couched in terms of the need for urgent action to get more giga-litres in the dam. It is the contention of this paper that long-term planning may be better driven by examining the benefits to the urban community and how they can be delivered, rather than from the point of view of the amount of water in the dams. The question should be: Given the degree and range of benefits, how much water needs to be delivered and how can that best be achieved?

In short, the issues associated with the long-term planning of sustainable urban water supply should be addressed by starting with the holistic concept of wellbeing or the related concept of quality of life (Cummins *et al.* 2003; Pacione 2003) or the benefits to householders provided by active and passive use of water (Moran *et al.* 2004). Hoekstra *et al.* (2001) and Syme *et al.* (2008) point out that potentially the same volume of water can provide for multiple benefits. Potentially, therefore, demand management and setting levels of service is about using water most efficiently to retain these benefits. These will not only include the benefits at personal household levels but those which manifest themselves in the context of sustainability. These include the costs to the environment of augmenting current supply or re-allocating water from other users. As Syme and Nancarrow (2007) discuss, there appears to be a significant and strengthening aspiration in the urban community for sustainable urban-water supply and this goes beyond the water supplied to individual households. As has been foreshadowed (Syme and Hatfield-Dodds 2007) and will be elaborated in the

following discussion, these wider sustainability concerns extend to institutional and decision-making process, trust and justice concerns.

Moving towards more sustainable urban water resource decision-making.

ARCWIS (1999) in their review of the social issues propose that the concept of levels of service be expanded from the traditional elemental approach to a broader perspective that includes issues related to the externalities of water supply as well as wider symbolic, ethical and aesthetic issues (see Table 6.1).

Table 6.1: Scoping Levels of Service (from ARCWIS, 1999)

	DIMENSION 1 What Comes in the Household's Door	DIMENSION 2 Costs of What Comes in the Household's Door	DIMENSION 3 Symbolic, Aesthetic, Moral or Ethical Issues
Quality of Service Delivery	1. time taken to answer phones 2. response time to complaints 3. design of bill 4. etc.	5. loss of environment 6. risk of dam failure 7. water treatment 8. recreation	9. equity 10. who pays 11. definition of Community Service Obligations 12. regional differences in levels of service
Quality of Product	13. Pricing 14. Drinking water quality 15. Water pressure 16. Reliability of supply 17. Etc.	18. Waterways quality 19. Risks in implementation 20. Confidence in institutional arrangements	21. Appropriate degree of recycling 22. Support of urban amenity

While this is a significant broadening of issues for consideration by urban utilities there is no guidance given within the report as to how these dimensions should be integrated to arrive at an overall judgment. Perhaps more importantly, key process issues associated with implementing change without equity issues becoming a significant barrier is not specifically addressed. Some questions that may arise in regard to equity issues are outlined in what follows.

Given that new technology may make it possible for individual households to treat and recycle their own wastewater, how should we manage if a large proportion of households decide to opt out of a central system? Should that system be retained and, if so, who should pay for the upkeep of it? These equity issues in relation to change are likely to be much easier to resolve or accommodate in new suburbs where a uniform approach can be taken in a locality and, on purchasing the house, the householder can voluntarily opt in to an alternative system. This is probably why most reform is currently occurring in new suburbs rather than in established areas. The question is, given the traditional behaviour of the urban water industry is it competent or appropriately constructed to manage significant change in the delivery of urban water from the viewpoint of equity and related social constructs?

The discussion around change is much more than the macro issues such as whether the water industry should be privatised. It includes more subtle judgments in regard to who should manage the urban water cycle, why and at

what level. Theoretically, if home treatment were to become the preferred option much of the water cycle could be managed by small-to-medium enterprises on a regular inspection basis. In many ways, we could be returning to the days of the 'night cart'. This is a return to social organisation and practice current more than a century ago — a long way from centralised management, which currently enjoys the confidence of the public.

The problems associated with defining sustainability in urban water management are challenging enough, but achieving it with integrated macro-, meso- and micro-systems may prove to be a very high hurdle. Cities change incrementally and water-management reform occurs gradually, driven by pressures for more urban development. Even when integrated urban water-resource management is mooted by state government, such as in New South Wales, progress is in the form of pilot studies (Anderson and Iyaduri 2003). In this situation there may be no formula that that can provide a silver bullet for reasonably uniform change across entire cities. This add-on approach will need a diversity of tactics and strategies for water management across differing areas of cities.

Perhaps the best contemporary exemplar of the problems facing reform in the urban water industry can be seen in the challenges occurring in managing urban stormwater and urban lakes and streams. In Western Australia, despite several workshops and studies over 30 years (including the preparation of a multi-stakeholder based White Paper for government after two years' discussion and a universal agreement on a set of sustainability principles) reform remains elusive. Funding and implementation issues still cannot be agreed between state and local government. In slightly different forms this problem occurs throughout Australia. Perhaps this is understandable given the complex nature of stormwater, but if the other components of the water-management cycle become more fragmented similar difficulties in governance and management may arise.

So how can we create change from the relatively simple centralised 'catchment to the sea' systems to manage water in a whole-of-water-cycle sense that which may require smaller infrastructure and more-localised management? Do we want to and do we have to? Our response will probably be governed largely by the wider socio-political system in which urban water is currently managed, in particular state government politics and demands. Issues such as the need to provide financial returns to the government, the sensitivity of voting intention and the poor definition of the public-good components of urban water supply will all tend to hinder reform beyond tariff structures and the introduction of technological 'fixes' such as desalination plants. Neither of these will lead to cultural change in regard to urban water and its provision. In many respects it is the urban development industry that is leading reform on a locality-by-locality level and the market is beginning to reward innovation, although it is far from

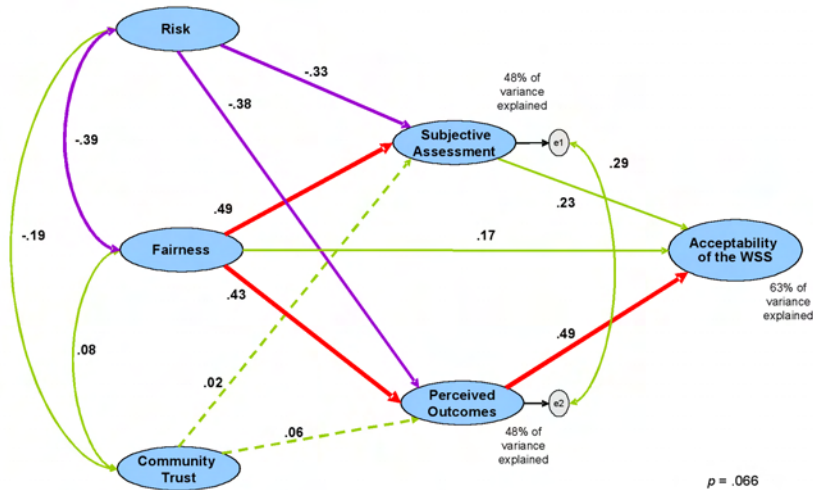
certain as to whether it is the water innovation that governs purchasing behaviour. Mitchell (2006), for example, reviews a significant number of infrastructure developments that are occurring in the Integrated Urban Water Management paradigm using total-water-cycle management concepts. Despite their equal importance, examples of the enabling of water reform in this regard from the viewpoint of social and decision-making processes are remarkably fewer.

Can social research help reform?

Given this slow-moving system that largely operates on political hunch and market research it would seem that detailed knowledge of what futures the community sees as sustainable and what trade offs the community is prepared to consider would be of great value. Thirty years of experience with community-based research have led to an observation that, given a facilitative environment, the community is often prepared to make choices which are decidedly more innovative than those currently being made on their behalf. For example, in the 1980s a carefully constructed longitudinal field-based study of the latitudes of tolerance (and intolerance) of a variety of possible restrictions policies in Perth was conducted (Nancarrow, Kaercher and Po 2002). The findings were very definitive. By far the preferred policy was for the then Level 1 restrictions to become permanent. On presentation of the results to the then Minister for Water Resources, these findings were dismissed. We were later told that it had been surmised at a political level that a state government had lost an election in the 1960s because of water restrictions. Of course it is hard to define whether and how such a 'political urban myth' affected the decidedly limp response to the social research. Nevertheless, it would seem that, when in doubt, the political environment will tend to prevail over service. The traditional engineering decision-making culture (Spearritt 2007) would tend to underscore this tendency.

One area where reform can be assisted by social science is that of ex-ante evaluation of innovative technologies. This has been the purpose of a long-term 'water cultures' program (Leviston, Porter and Nancarrow 2006) in which a generalised community decision-making model has been derived from examination of a number of innovations in several Australian cities (for example, high-rise water-recycling schemes, managed aquifer recharge, suburban recycling schemes and so on). A number of replicable elements to community-based decision-making have been found (see Figure 6.1). The models have gradually been refined and now can explain a very high proportion of the variability in acceptance (upwards of 80 per cent).

Figure 6.1: A structural equation model of the acceptability of novel water-supply systems (Leviston, Porter and Nancarrow, 2006)



While it is not the purpose of this chapter to comment on the variables in detail, three important determinants can be related to the institutional context for achieving change. Institutions in this context relate not only to the formal governmental organisations or utilities but also the more informal groupings and cultural values embedded in the community. People tend to see acceptable sustainable reform in terms of institutional behaviour as well as the familiar triple bottom line. These institutionally related considerations are perceptions of acceptable risk, perceived fairness of the new system to all consumers and trust in the water utility and its decision-making processes. To achieve reform it is important, therefore, to spend some time on these variables to foster a process that can incorporate ongoing innovation. While there is obviously a need to understand the dynamics of risk, trust and fairness and how to create them, particular attention should be given to the concept of fairness as this has a strong shorter- as well as a longer-term component.

The overall judgment of fairness consists of three components (Tyler and Blader 2000; van den Bos and Lind 2002): distributive justice, relating to the proportion of benefits and costs that differing groups in society; procedural justice — whether the community feels that it has had an adequate opportunity within the decision-making process to make comment (for example, did it have a ‘voice’ or an opportunity to have an influence?); and ‘interactive’ justice, which is sometimes considered as a component of procedural justice. Simply stated, interactive justice reflects whether people feel as though they have been treated with respect and valued as individuals during the decision-making process.

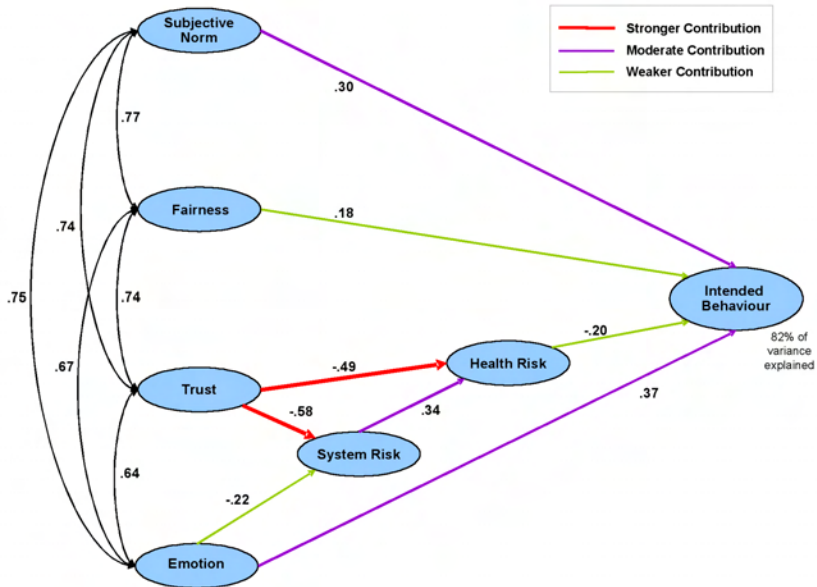
Overall judgments of justice have two components, cognitive and affective. That is, fairness judgments involve logical thinking in relation to the issue at hand. These judgments also have a strong and significant emotive part. Emotion is important, as it is exhibited as a consequence of reactions to the perceived justice of treatment that has been given to the individual or his community (de Cremer and van den Bos 2007). For example, one can easily imagine that a perceived lack of procedural or interactive justice could be important in engaging the emotional side of fairness judgments. These feelings may also lead to an enduring sense of outrage and protest, particularly in the areas where risk is involved.

Thus, those who hope that the decision-making processes will remain rational and that emotion will be avoided would seem to be doomed to disappointment. Emotion is a basic part of human nature and an important component of democracy. The important point for this discussion is that getting our public processes 'right' will be a powerful driver of reform, especially as it is so hard to achieve within our current socio-political environment. The community can only participate and lead in reform if effective decision-making processes are put in place.

The cogency of this argument is also highly evident in a behavioural model developed by Leviston *et al.* (2006) for predicting actual individual consumption of recycled wastewater for potable purposes. This model (see Figure 6.2), the variables for which were derived from a community-based experimental study, like the 'water culture' model underlined the significance of the above discussion. As for the acceptance of new water-delivery systems, generally key variables for willingness to drink such water were trust in the agency, emotion (disgust or the 'yuck' factor) and perceptions of risk. The two other variables of significance were also of interest in predicting actual consumption of the water and, potentially, for conducting the public decision-making process. These were subjective norm, or the opinions of other significant others about the issue, and perceived control over the necessity to drink recycled water. Subjective norm tends to indicate that there will be conferring between individuals about the subject that is likely to lead to the desire for public debate.

Perceived control would seem to indicate that if people feel that they have been forced to drink recycled water by poor planning or lack of procedurally just decision-making processes, they will try to avoid it. Both the subjective norm and perceived control variables underscore the need for good participative processes.

Figure 6.2: A structural equation model of intended behaviour to drink recycled water (Leviston *et al.* 2006)



In short, detailed, in-depth and preferably longitudinal social science research can provide a map of good process which can deliver on the fairness issues. Because the models show significant interrelationships between the achievement of fairness, the development of trust and more positive views of perceived risk, this fairness-based decision-making map becomes a central tool for planning and implementing productive reform.

Relating social science to adaptive learning and sustainability

Initially, sustainability was often considered in the context of evaluating plans and practice through the triple bottom line of environmental, economic and social analyses. Apart from the community, there is an increasing professional acknowledgement that a key element of sustainability is institutional (for example, Hedelin 2007). That is, it is recognised that the quality of the decision-making process is a highly significant precursor to implementing sustainable practice. Institutions are not simply construed as formal government organisations but more as the interfaces of various sectors of the community and government to obtain outcomes which reflect the long-term aspirations of the community for the benefits it wishes to attain from its water resources (Syme *et al.* 2008). As described earlier, one of the key elements of high-quality decision-making in this context is the achievement of procedural justice in the involvement the community has with the water utility.

Procedural justice has a number of elements (Lawrence *et al.* 1997) and these support acceptance of the decision-making process and its outcomes (Tyler and Blader 2000). While most of this social-justice research has been conducted in traditional social service areas, it is relevant to urban water management and other natural-resource management issues. For example, in a long-term planning exercise for creating strategic plans for the use of wastewater with the West Australian Water Corporation, perceptions that the public-involvement process was procedurally just led to greater commitment for involvement in future decision-making activities (Syme and Nancarrow 2002).

In procedurally just processes because there is voice (or an open expression of views), which enables information exchange, and decision-making can include local knowledge that can enhance the possibilities for adaptive learning. Adaptive learning is an important underpinning of sustainability in that increasing knowledge can contribute to the wisdom of decision-making and the avoidance of 'surprises'. While the concept of adaptive learning is appealing, it has not really occurred in many places. But if adaptation is to evolve in an atmosphere of continuous improvement, it is vital that urban utilities grasp the opportunities provided by procedural-justice research and practice in the sustainability context.

The recent debate on whether to pipe water to Perth from the large South West Yarragadee aquifer, some 300 kilometres from the metropolitan area, provides a good example of the widening context within which urban utilities will be evaluated. This transfer would assist in lessening the probability of the imposition of severe restrictions. The early social research on this issue indicated concern by both South West and Perth residents that there was too little knowledge of the aquifer; fairness issues relating to the concept of 'reasonable regional needs' (that is, was it fair to take the water from that community?); and finally the doubt that the Water Corporation would reverse its decision if data showed that it was not sustainable for the aquifer. These issues continued to drive the community debate as the hydrological modelling became more detailed and the social and economic analysis increased. Finally, it became evident that the limits to the usefulness of modelling had been reached and that only monitoring the effects of the abstraction of water would validate the decision. The Independent Sustainability Panel established by the State Government, therefore, in its acceptance of the proposal put in place a series of public-accountability and involvement processes designed to ensure that adaptive learning through procedurally just processes could occur (Sustainability Panel 2007).

The issue for the community then became whether they could trust the utility or the regulators to implement the recommendations effectively. Comparisons were made between the recommended adaptive-learning approach and the widely publicised deterioration in the Gnangara mound aquifer (a groundwater mound

also supplying Perth), where breaches in extraction rules had been publicised. Thus the issue of trust was paramount for the Water Corporation and for the community when assessing new developments.

Given the growing discussion of reallocation of water from rural to urban communities, this example is likely to recur. Thus, the water industry has been moved by circumstance and the community to become a much more visible player in the overall movement towards adaptive learning and sustainability. It is no longer sufficient for urban utilities to think on a project-by-project basis and to deliver levels of service that satisfy only the utilitarian aspects of water supply. Increasingly, issues of urban and environmental amenity and the integrity and quality of decision-making are becoming central concerns for the community. Longitudinal social research evaluating the maintenance of procedural justice and providing a basis of understanding the generation of trust while incorporating the concept of acceptable risk can provide a major contribution to the achievement of sustainability and improved decision-making. This contribution is currently patently lacking.

Can we usefully study institutions to help achieve sustainability?

Saleth and Dinar (2000) have identified a series of endogenous and exogenous factors that will tend to promote water institutional changes. Exogenous variables of particular relevance to Australia are water scarcity, performance deterioration, financial non-viability and the emergence of technological progress. These conditions, the authors suggest, will create a need for more adaptive institutions with lower transaction costs and a pro-reform environment. All these conditions for institutional reform are highly evident in Australia. Establishing efficient and effective formal and informal institutions would therefore seem to be logical if sustainability is to be achieved to a greater extent than it currently is in the Australian context. Institutional research within an integrated water-management framework should therefore have a high priority. Nevertheless, holistic research in this area has been scarce.

While specific alternative institutional or management structures were part of the scenarios included in the ARCWIS analysis of the community's willingness to accept water-supply innovation, this was not detailed enough to determine any generic findings. Are there any general rules in relation to institutional structure and functions that can assist in the implementation of procedurally just decision processes? This type of question can be answered in the community context in urban water-resources management. Ostrom (1990) has provided extensive work on understanding the principles and criteria for successful institutional arrangements for management of common property resources for small and largely rural communities. The same level of analysis will be required for alternative forms of governance for urban water. There is a need for social

and organisational research that focuses on the generics of institutional structure, decision-making processes and implementation responsibilities.

This research should be conducted with water-resource decision-makers who can provide ideas for alternative institutional arrangements and functions that could support alternative but coherent arrays of local, meso and whole-of-system management. These could be considered in the light of each element of the water cycle. It should deal directly with issues such as the appropriate communication and responsibility networks, the role of legislation, public versus private water-supply responsibilities, transaction costs, and so on. For sustainability purposes these should be interpreted in the light of social, economic and environmental analysis. As the previous discussion in this chapter indicates, the social analysis and preferred network identification and the overall sustainability goals of whole-of-water-cycle management will also need to incorporate public perspectives to create a management framework that will create ongoing flexibility for change.

The investigations need to be inclusive of differing breadth of decision-making from macro-allocation decisions (for example, inter-regional transfers from rural to urban regions) to more micro decisions (alternative localised stormwater management). The need for social and institutional bottom lines has been shown to be imperative at both levels. Both levels also incorporate much more than the current rational decision-making paradigm. There is a need for the incorporation of structures and processes that can cope with emotions and ethics of fairness and organising frameworks such as trust and accountability. Perceived and acceptable risk is also particularly important when water quality-related issues are discussed. These variables can be measured in an *ex-ante* and formative manner (Kasemir *et al.* 2003) to derive an adaptive-learning approach to urban water reform.

Conclusions

The traditional approach to sustainability in urban water provision has been to provide a series of indicators. Social, institutional and decision-making issues have been discussed in general terms (Kenway, Howe and Maheepala 2007) but are generally included as a vague backdrop unless quantitative demographic information is obtainable. Thus they are there but are not seen as principal drivers of change. But if change is to occur, it is these dynamic social things that can drive it: ethics, values, attitudes and behaviour at individual, organisational, community and political levels.

If we are to advance towards sustainable water futures it is important to free up those things which are currently holding it back. The social, institutional and cultural variables thus become of paramount importance. These must be underpinned by processes that are seen to be procedurally and interactively

just. Once these processes are in place, economic and environmental investigations come into play, as do the more conventional social-sustainability indicators. It is analysis of alternative scenarios from these perspectives that provides important criteria against which alternative futures can be described.

Finally, it is worth observing that this chapter does not provide the right answer to which way the urban water industry should go forward. Centralised systems have provided reliable and healthy water supply in the past, albeit by providing three largely separate systems. But such infrastructure has been facing large challenges in Australia in recent years because of drought and increasing problems with water quality. On the other hand, micro-systems may provide for sustainability and whole-of-cycle management at a micro-level but face management and regulation problems. Meso-scale developments, while being easier to manage than micro-systems, could face issues of social acceptance, especially if they are in the form of neighbourhood wastewater treatment plants.

In reality, if there is to be a change from large centralised systems and there is a consistent introduction of meso- and micro-systems, for whatever reason, there will be major challenges for the urban water industry, both socially and institutionally. Most particularly, widening the scope from rational engineering and economic decision-making to incorporating community values and emotions into procedurally just and iterative decision-making processes will be the greatest challenge of all. Without integration of these components, sustainable urban water systems are unlikely to be achieved.

References

- Anderson, J. and Iyaduri, R. 2003, 'Integrated urban water planning: big picture planning is good for the wallet and the environment', *Water Science and Technology* 47(7–8):19–23.
- ARCWIS 1999, *The Social Basis for Urban Water Provision in the 21st Century*, CSIRO Urban Water Program, CSIRO Land and Water, Perth.
- Cummins, R. A., Eckersley, R., Pallant, J., Van Vugt, J. and Misajon, R. 2003, 'Developing a national index of subjective wellbeing: The Australian Unity Wellbeing Index', *Social Indicators Research* 64: 159–90.
- De Cremer, D. and van den Bos, K. 2007, 'Justice and feelings: Towards a new era in social justice research', *Social Justice Research*, 20 (1): 1–9.
- Hedelin, B. 2007, 'Criteria for the assessment of sustainable water management', *Environmental Management* 39: 151–63.
- Hoekstra, A. Y., Savenije, H. H. G. and Chapagain, A. K. 2001, 'An integrated approach towards assessing the value of water: A case study on the Zambesi basin', *Integrated Assessment* 2: 199–208.

- Hurlimann, A. 2007, 'Time for a Water Re-"Vision"', *Australasian Journal of Environmental Management* 14: 14–21.
- Jenerette, G. D. and Larsen, L. 2006, 'A global perspective on changing sustainable urban water supplies', *Global and Planetary Change* 50: 202–11.
- Kasemir, B., Jaeger, J., Jaeger, C. and Gardner, M. (eds), *Public Participation in Sustainability Science*, Cambridge University Press, Cambridge.
- Kenway, S., Howe, C. and Maheepala, S. 2007, *Triple Bottom Line Reporting of Sustainable Water Utility Performance*, AwwaRF, in press.
- Larsen, T. A. and Gujer, W. 1997, 'The concept of sustainable water management', *Water Science and Technology* 35 (9): 3–10.
- Lawrence, R. L., Daniels, S. E. and Stankey, G. H. 1997, 'Procedural justice and public involvement in natural resource decision making', *Society and Natural Resources* 10: 577–89.
- Leviston, Z., Nancarrow, B. E., Tucker, D. I. and Porter, N. B. 2006, 'Predicting community behaviour: Indirect potable reuse of wastewater through Managed Aquifer Recharge', CSIRO Land and Water Science Report 29/06: Perth.
- Leviston, Z., Porter, N. B. and Nancarrow, B. E. 2006, *Interpreting householder preferences to evaluate water supply systems*, Stage 3, Water for a Healthy Country National Research Flagship, CSIRO Land and Water: Perth.
- Mitchell, V. G. 2006, 'Applying integrated urban water management concepts: A review of Australian experience', *Environmental Management* 37(5): 589–605.
- Moran, C. J., Syme, G., Hatfield-Dodds, S., Porter, N., Kington, E. and Bates, L. 2004, 'On Defining and Measuring the Benefits from Water', paper presented at 2nd IWA Leading Edge Conference on Sustainability—Sustainability in Water Limited Environment, November 2004, Sydney.
- Nancarrow, B. E., Kaercher, J. and Po, M. 2002, 'Community Attitudes to Water Restrictions Policies and Alternative Sources. A Longitudinal Analysis, 1988–2002', CSIRO Land and Water Consultancy Report: Perth.
- Ostrom, E. 1990, *Governing the Commons: the evolution of institutions for collective action*, Cambridge University Press: Cambridge.
- Pacione, M. 2003, 'Urban environmental quality and human wellbeing — a social geographic perspective', *Landscape and Urban Planning* 65:19–30.
- Saleth, R. M. and Dinar, A. 2000, 'Institutional changes in global water sector: trends, patterns and implications', *Water Policy* 2: 175–99.
- Spearritt, P. 2007, URBAN WATER: Crisis and response. This symposium.

- Sustainability Panel 2007, *Sustainability Assessment of the South West Yarragadee Water Supply Development*, Department of Premier and Cabinet, Government of Western Australia: Perth.
- Syme, G. J. and Hatfield-Dodds, S. 2007, 'Values attached to Water and the potential for Communication and Institutions that Encourage Community and Government Partnerships to Achieve Implementation of Water Reform' in *Implementing Water Reform in Australia*, CSIRO Press: Collingwood.
- Syme, G. J. and Nancarrow, B. E. 2002, 'Evaluation of public involvement programs: Measuring justice and process criteria', *Water* 29: pp.18–24.
- Syme, G. J. and Nancarrow, B. E. 2005, 'Sharing the Pain of Water Reallocation: Creating Consent by Taking Fairness and Justice Seriously' in D. Cryle and J. Hillier (eds), *Consent and Consensus, Politics, Media and Governance in Twentieth Century Australia*, API Network, Curtin University of Technology, Perth, Australia: 371–87.
- Syme, G. J. and Nancarrow, B. E. 2008, 'Changing Attitudes to Urban Water Use and Consumption' in P. W. Newton (ed.), *Transitions: Pathways Towards Sustainable Urban Development in Australia*, CSIRO Publishing, Collingwood. In press.
- Syme, G. J., Porter, N. B., Goeft, U. and Kington, E. A. 2008, 'Integrating social wellbeing into assessments of water policy: Meeting the challenge for decision makers', *Water Policy*. In press.
- Tyler, T. R. and Blader, S. L. 2000, *Cooperation in Groups: Procedural Justice, Social Identity and Behavioral Engagement*, Psychology Press: Philadelphia.
- Van den Bos, K. and Lind, E. A. 2002, 'Uncertainty management by means of fairness judgments' in M. P. Zanna (ed.), *Advances in Experimental Social Psychology* 34, Academic Press: San Diego.
- Vlachos, P. E. and Braga, P. B. 2001, 'The challenge of urban water management' in C. Maksimovic and J. A. Tejada-Guibert (eds), *Frontiers in Urban Water Management, Deadlock or Hope?*, IWA Publishing, London: 1–34.