

Graduate School of Business

**Critical issues for the future of the Australian urban
water supply industry**

Victor William Fazakerley

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of
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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

Signed:

Date:

Acknowledgements

'There is...nothing greater than touching the shore after crossing some great body of water knowing that I've done it with my own two arms and legs.' Diana Nyad,
(Moncur 2004).

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Operational definitions

Bulk water means large volumes of water supplied either treated or untreated to drinking water standard to water retail organisations (water utilities).

Drinking water means water that meets the Australian Drinking Water Guidelines 1996.

Drivers are used in the context of the business environment being a driver that is influencing the direction of an industry sector.

Driving forces and key driving forces are used in the context of scenario planning as defined by van der Heijden (1996), refer to chapter five.

Scenario planning is used in the context of scenario planning as defined by some prominent writers on the process such as van der Heijden (1996), van der Heijden et al. (2002), Schoemaker (1995) and Schwartz (1991). In developing scenarios for this study the researcher has deviated from the process as defined by the writers noted above. These differences are acknowledged and relate to the scenarios being developed as a desk top study rather than as a group format involving a selection of people from the industry and key experts.

Scenarios in this study are used in the context of scenario planning as defined by van der Heijden (1996).

Strategic planning/plans is used in the context of developing strategies for the future by what ever method. The various schools of strategic planning are discussed in chapter two.

Urban water supply industry and water industry in the context of this study refers to public drinking water supply, water services for domestic and commercial customers and sewerage services. It includes organisations that supply bulk water to water retail organisations.

Water services mean the supply of drinking water and the removal of wastewater (grey and black water, sewage) from domestic and commercial customers.

Abstract

This study makes a contribution to the Australian urban water supply industry because it highlights some of the critical issues the industry faces in the future. Through the scenarios it illuminates an alternative method to develop strategies for the future. Ultimately the end result of scenario planning is not a more accurate picture of the future, but better decision making for the future.

This is a significant piece of research because it demonstrates the advantages of the scenario planning process as a method to illuminate the potential future dangers and opportunities in the water industry's business environment. The scenarios can be used as a launching pad for strategic planning and to prepare the water industry for the uncertainties it faces.

Water is precious and essential to life. Water supply is arguably the ultimate essential service. Australia uses about 22,000 gigalitres of water [1 gigalitre (GL) = 1,000,000,000 litres, approximately 444 Olympic swimming pools (ABS 2004)] per annum across all sectors, irrigation, industry and domestic. The aim of this study was to determine the ***critical issues for the future of the Australian urban water supply industry***. The study achieved this with the aid of scenarios that tell stories about urban water supply to the year 2025.

A key to this study is the concept of organisations as living organisms, which are capable of learning and adapting to changes in their business environment. Today's business environment is constantly changing through globalisation, technological innovation and society's values. To survive, organisations must be able to anticipate and adapt to this often uncertain environment. Traditional methods, from a mechanistic perspective, of developing strategic plans for the future have a poor track record because they invariably rely on forecasting and predicting the future from historical information that, in an increasingly uncertain and fast changing world, may no longer be appropriate.

Scenarios are stories about the future. They combine uncertainty and trends with creativity, insight and intuition to enable an organisation to learn and develop strategies for the future from an organic perspective. Scenarios are not predictions, but they are plausible stories about the future. The stories do allow an organisation to re-perceive a different world by questioning prevailing paradigms and assumptions.

The underlying philosophical basis for scenario planning is constructivist which is consistent with the ontological position taken for this study.

This study was undertaken under a qualitative research paradigm. The ontological position taken to answer the research question was constructivist with a critical

perspective where realities are intangible mental constructs based on the culture and experience of individuals or groups. Constructs are more or less informed and changeable. From an epistemological perspective the constructivist position assumes that the enquirer and subject of the research are interactively linked so that findings are created. Research under a constructivist paradigm requires a hermeneutical and dialectical methodology leading to interpretation. The methodology adopted for this study was grounded research, being a modification of grounded theory and applicable to the business environment.

Data were initially gathered by semi-structured interview, the objective being two fold.

1. The data were used to elicit critical issues for the future of the Australian urban water supply industry.
2. The data were used to develop 'plausible' futures for the urban water supply industry in the form of scenarios.

The data were analysed using grounded research principles and organised using NVivo (Richards 1999; NVivo 2002). After two stages of analysis, 16 major categories, focusing on the future emerged from the data. In order to write the scenarios two key uncertainties critical to the future of the urban water supply industry were required for the scenario matrix. The two selected were '*Water availability*' and '*Technological change*' from the water industry's contextual environment. These two key uncertainties were considered to be the most uncertain and have the greatest impact on the future of the water industry.

These two key uncertainties formed the context for the scenarios into which over 200 other issues were de-dimensionalised, as in the scenario planning method, and crafted into four scenarios. A time horizon of 2025 was selected for the scenarios to reflect the water industry's long term planning horizon. The scenarios were called '*Decadent water use*', which depicts a future where there is plenty of water and technology addresses the cost of service delivery; '*Smart water world*', which depicts a future where water is scarce but is addressed by technology providing alternative sources of water; '*Muddy waters*', which depicts a future where there is plenty of water but technology does not address the cost of delivery and issues of infrastructure deterioration and '*Mad Max water world*', which depicts a future where water is scarce and technology does not address the scarcity, the situation becomes a crisis.

From the scenarios and using concepts from complex adaptive systems theory a number of critical issues emerged from the data. Some were at a philosophical level such as whether water, as a common good, fits with society's philosophy about

water. Others were at a practical level for example expressing the criticality for the water industry to build community trust and support.

The research notes the potential for further qualitative research in the fields of community attitudes and behaviours towards water, water services, recycling wastewater and the preparedness to pay for water services. In addition there is potential to further develop scenarios presented in this study; *'Decadent water use'*, *'Smart water world'*, *'Muddy waters'* and *'Mad Max water world'*; for the Australian urban water supply industry using the data from this research as a basis for group consultation.

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CHAPTER 1 – INTRODUCTION, BACKGROUND AND OVERVIEW

'When you drink the water remember the spring.' Chinese Proverb, (Moncur 2004).

1.1. Introduction

1.1.1. The research question

The research question for this study was ***'What are the critical issues for the future of the Australian Urban water supply industry?'***

1.1.2. Aims, objectives and significance

To answer the research question the aim of this study was to determine ***the critical issues for the future of the Australian urban water supply industry.*** Water is essential to life. It is precious. Good quality water must be made available to all for the basic requirements of drinking, cooking and hygiene. The provision of water services must be managed to achieve these goals. It is important, therefore, that the water industry is aware of critical issues that could impact on the provision of water services in the future. This study aims to highlight the critical issues using interviews and scenario planning techniques to depict a number of plausible futures for the water industry. This study has significance because it is undertaken at a time when issues concerning water supply and water services in Australia are taking an increasingly higher profile in the public arena.

The study has been undertaken using qualitative research methods in order to surface these critical issues from interviews with Chief Executive Officers, Managing Directors and senior managers of water supply utilities across Australia. Of importance for this study is that major water utilities from every state and territory have participated in this study as well as smaller water utilities, key industry organisations and research institutions, therefore, this is considered to be a nation wide study.

An underlying objective of this study was to stimulate debate about how water services in the future should be delivered by questioning the appropriateness of the traditional and domineering engineering paradigm of urban water supply, basically pipes and pumps technology. The debate must involve both the community and water industry and is needed in order to develop strategies for the provision of water services in the future that meet community expectations. The scenarios presented in this study are important as a catalyst for that debate.

In addition this study demonstrates the use of scenario planning as a method for strategy formation and preparing an organisation for a future that contains

uncertain elements. In this study the significant driving forces for the water industry, *Technological change and Water availability*, emerge from analysis of the data to form the basis of four scenarios, *Decadent water use, Smart water world, Muddy waters and Mad Max water world*.

1.1.3. Inspiration and motivation

It is said that if you want to experience life then run a marathon. The undertaking of this research has been a marathon journey but has enabled the researcher to experience the life of the Australian urban water supply industry along the way.

Inspiration and motivation for this research came from several areas. Firstly inspiration came from the writers and practitioners of scenario planning and in particular de Geus, (1988; 1997a); Schoemaker, (1992; 1995); Schwartz, (1991); van der Heijden, (1996); van der Heijden et al., (2002) and Wack, (1985a; 1985b). In the researcher's view, scenario planning makes sense as a better way to develop business strategy because it involves and harnesses the intellectual capital and genetic material of organisations. This is consistent with other strategy theorist views. In addition scenario planning is a way for organisations to learn and envisage plausible future business environments. This inspiration motivated the researcher to apply the scenario planning tool to the urban water supply industry.

Motivation for this study arose after the researcher began working in the urban water supply industry. A passion surfaced about water and how this scarce resource is used and cared for. Perhaps this was a latent realisation that water should be valued after the researcher's years of working in the Australian outback and African bush where there was no tap, time and effort had to be spent collecting water and the quality was sometimes questionable.

This study is as much about the water industry as it is about demonstrating a better way to develop strategy for the future. Water is important and in the future it will be a liquid gold just as oil has been in the past.

1.1.4. Key concepts

The key concepts used in this study are: -

- scenario planning as a useful and well established way to elicit organisational learning from respondents;
- the biological metaphor to illustrate how, like nature, organisations have a life cycle, they can adapt and evolve into new species; and
- complex adaptive systems theory (Pascale, Millermann & Gioja 2000) in recognition that visualising and planning for the future is a non-linear and adaptive process.

This study brings these concepts together to answer the research question, ***‘What are the critical issues for the future of the Australian urban water supply industry?’*** The thinking behind the use of scenarios was to illustrate possible and plausible futures for the water industry that highlight dangers and present challenges and opportunities. The position, going into the study was that if insights are produced, these may, in turn, influence behaviours. If behaviours are changed they can alter the future for a favourable outcome.

1.2. Background to urban water supply

The history of drinking water has been documented since the Egyptians who used primitive methods to treat water by sedimentation and filtration. In the 5th century B.C. Hippocrates used cloth to filter water. The Romans were the masters of their time in constructing water distribution systems (AWWA 2004). In 313 B.C. the thirteen kilometre long Appian aqueduct was constructed. Between 343 BC and 225 A.D. Roman engineers constructed aqueducts to transport and supply water and by the time of the collapse of the Roman Empire, over 500 kilometres of aqueduct had been constructed (Cotruvo & Cotruvo 2003). Public water supply systems were developed during the 3rd century B.C. in Rome, Greece and Egypt for public baths, fountains and domestic use (Cotruvo & Cotruvo 2003; AWWA 2004). The first closed sewerage system dates from 500 B.C., the Cloaca Maxima, which discharged raw sewage into the Tiber (Cotruvo & Cotruvo 2003).

Aqueducts delivered water from higher locations with the following advantages (Cotruvo & Cotruvo 2003): -

- gravity distributed water, meaning water did not have to be carried from the river;
- the source was more reliable in terms of volume;
- human waste discharged downstream did not contaminate water sources;
- there was water for fire fighting; and
- the water was of better aesthetic quality.

In the 17th and 18th centuries the development of the microscope by Anton van Leeuwenhoek and the Porizio filter by Lu Antonio Porizio were instrumental in water treatment technology, but not until 200 years later was the connection made between microscopic organisms in water and public health. By 1750 Joseph Amy had patented and was selling water filters for domestic use consisting of sponge, charcoal and wool (AWWA 2004).

In the US, from 1652, private water supply companies began to deliver water from wells to reservoirs. By 1796 water was being pumped to every house in Bethlehem

Pennsylvania. The first large scale water distribution system was built in Philadelphia in 1799. By 1860 there were approximately 400 water systems; however all were providing unfiltered water with the capacity to carry waterborne disease (Cotruvo & Cotruvo 2003).

In 1804 Paisley in Scotland was the first town to have a water treatment facility. Water was delivered to the whole town and similarly in Paris by 1806 (Cotruvo & Cotruvo 2003; AWWA 2004).

In London in 1858 the stench of sewage brought a halt to Parliament sittings and led to the construction by Joseph Bazalgette of 82 miles of sewers to carry sewage into the Thames and unknowingly spreading cholera to thousands of people. The cholera epidemics in London during the mid 1850's killed over 30,000 people. John Snow was the first to make the connection between the epidemics and drinking water contaminated, by sewerage, with the discovery of a leaking sewer next to a well. He linked this to the 1854 cholera epidemic. Prior to Snow's discovery it was thought that bad air and smell was the cause of cholera spreading (Cotruvo & Cotruvo 2003; ABC Television 2004a).

In 1883 Dr. Robert Kock showed that micro-organisms in drinking water caused cholera and typhoid outbreaks and in 1893, by filtering contaminated water, the disease could be prevented (Cotruvo & Cotruvo 2003). Various other water treatment methods were developed by the turn of the century including filtration, ozonation and the use of sodium hyperchlorite to disinfect water. A combination of filtration and chlorine disinfection all but eliminated the epidemics from waterborne bacteria (Cotruvo & Cotruvo 2003; AWWA 2004). Perhaps the next major development in water treatment came during the Second World War with the development of desalination technology to supply water for forces in arid areas (AWWA 2004).

In cities around the world water was, historically, only supplied to households that could afford the convenience of having water delivered by private organisations. Those less well off had to fetch water from public taps, wells or a river. The typhoid epidemics of the 19th century and the inability of private organisations to continue the service meant that governments took over the industry. Throughout most of the 20th century this model of public utilities prevailed to provide universal access to water services and thereby protect public health. The monopolistic nature and cost of augmenting services was justification for government's continuing ownership of water utilities. Utilities were characterised as being not for profit organisations managed by experts in engineering (Bakker 2003).

The cost of providing water services is linked to the availability and quality of source water. In areas of low population wells and septic tank systems adequately

provided water services, but as populations grew the demand for water services increased leaving wells and septic systems inadequate to meet the demand. In addition if there is plenty of source water and it is of high quality, the price is low. Until the connection between water quality and disease was made, water treatment focused on improving the aesthetic quality of water. Treatment methods added costs to the production of water which became a function of the volume of water supplied. Rising cost meant that smaller water consumers would tolerate poorer water quality which was adequate until urbanisation and industrialisation increased the risk of contaminated source water. Water quality is now a significant proportion of the cost of delivering water (Cotruvo & Cotruvo 2003).

Traditionally all water supplied is treated to drinking water standard. This is the most convenient strategy, one quality of water, the highest, delivered by one supply system to all customers. Less than 1% of this high quality water is drunk or used for cooking the rest is for washing, toilets and exterior use such as gardens and swimming pools. There are cost efficiencies through economies of scale in providing one quality of water (Cotruvo & Cotruvo 2003).

In Australia a typical water service is provided by one monopolistic organisation in each state for a community. These water utilities supply clean water and take away wastewater for treatment before disposal into the environment (Bowers & Young 2000).

The paradigm of delivering water via big pipes was adopted to satisfy the needs of large industrial users (Fox 2003). The traditional water supply system has brought benefits to millions of people and in terms of food production 40% of the world's food is produced by irrigated agriculture. However, throughout the world many communities are still without adequate safe water supply (Gleick & et al 2002).

The community expects that safe and aesthetically pleasing water will be available from a tap, even during droughts and that wastewater will be removed conveniently without being hazardous. Water systems have been built to satisfy these community expectations. A typical urban water system begins at the catchment by sourcing water either from surface resources such as lakes, rivers or reservoirs and or groundwater. Water is pumped from the source to a treatment plant where sediment and contaminants are removed and chlorine disinfection kills microbiological organisms. Water is distributed via localised storage tanks and pipes to the community. Wastewater from domestic kitchens, bathrooms and toilets discharges to the sewer through pipes and is pumped to a wastewater treatment plant where after microbiological treatment, it is discharged to the environment. A small percentage is recycled for agricultural and irrigation purposes (CRCWQT

2002). Figure 1.1 presents a generalised and schematic outline of a water supply system.

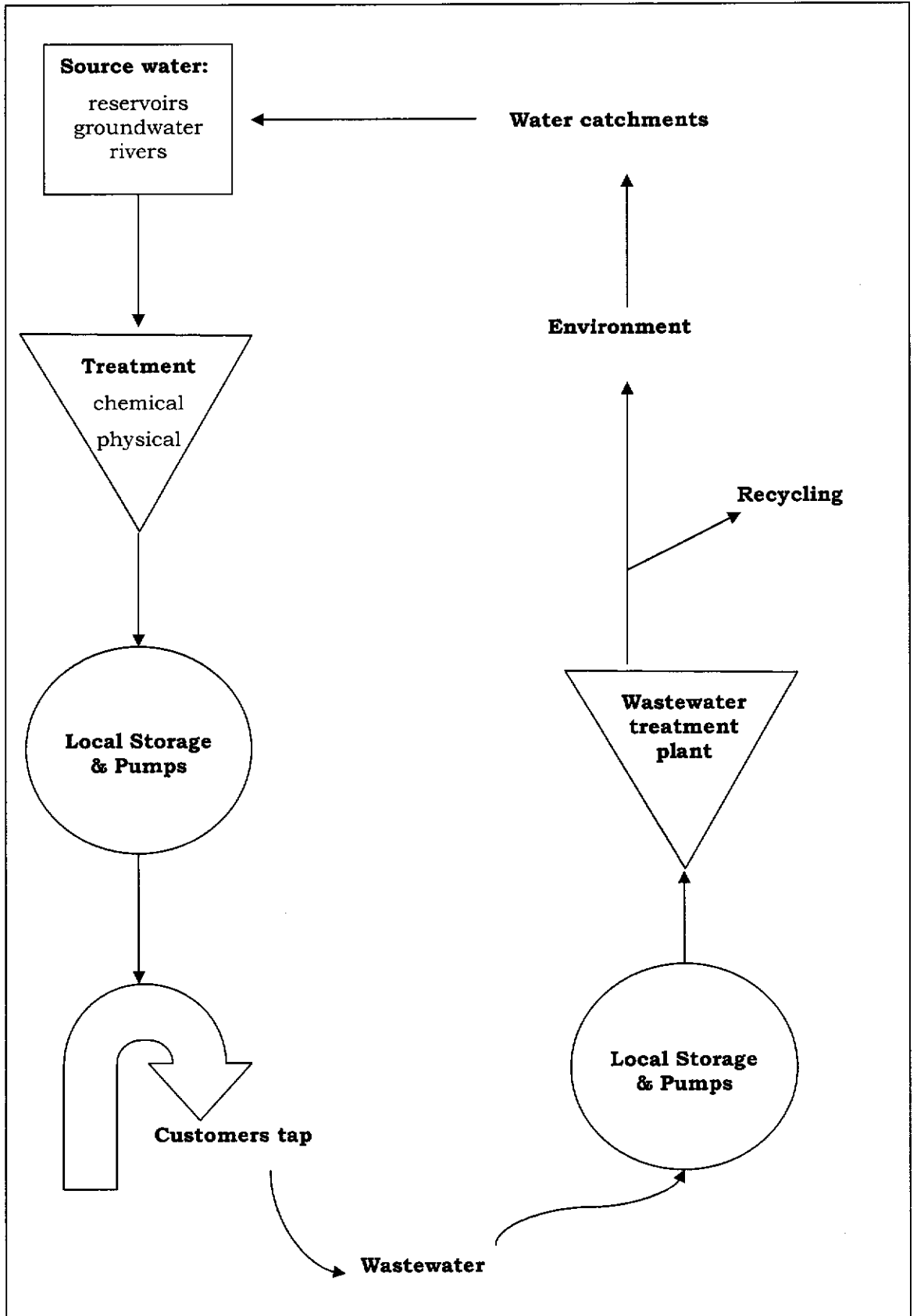


Figure 1.1. Generalised water supply system

1.3. Overview of the study

1.3.1. Chapter two literature review – strategic planning

This study begins with a literature review about strategic planning, focusing on the organisation as a living organism and questioning the appropriateness of traditional methods of developing strategy in a complex and ever changing business environment. In chapter two the work by de Geus (1988; 1997a; 1997b) is used to illustrate the concept of a living learning organisation and question the speed of organisational learning. De Geus (1997a) writes about corporate longevity and the ability of organisations to adapt to their environment in the same way as organisms adapt. Hamel and Prahalad (1993) write about the speed of organisational learning in order to keep in front of competitors. Two other perspectives of organisations are briefly reviewed, corporate culture through the work of Hampden-Turner (1992) and soft systems methodology through the writings of Checkland (2000). Both are relevant to this context of this study in terms of organisational learning and scenario planning.

The literature review then looks at what is strategy and strategic planning, drawing on answers provided by Godet (1987), Hamel and Prahalad (1993), The New Shorter Oxford English Dictionary (1993), Hay and Williamson (1998), Mintzberg et al. (1998) and Farjoun (2002).

The literature review continues with a brief outline of the various stages of corporate planning since the mid 1960's (Taylor 1986) and their different cultural origins. The work of McKiernan (1997) and Mintzberg et al. (1998) is reviewed in terms of the classification of modern planning into various schools of thought.

Having described strategic planning, the literature review then focuses on the problems with traditional strategic planning and why it has failed to deliver on expectations (Pennington 1972; McKiernan 1997; Glaister & Falshaw 1999).

The chapter two then turns to strategic planning and strategic thinking and writings by Heracleous (1998) who suggests they are inseparable and should both be part of the dialectical process. The review considers Hamel and Prahalad (1989) and Hamel (1996) for an alternative philosophy about strategy and the biological metaphors of Ahmed (1998) and Matheson and Matheson (1998). There are issues about how strategy is formed, whether it is emergent or deliberate depending on the type of organisation (Mintzberg & Waters 1985). Moncrieff (1999) suggests that changing paradigms requires learning from others and challenges assumptions. In terms of complexity theory Hamel (1998) asks what catalyst is needed for new strategies and suggests having order at the junction of chaos. Hamel (1998) cites

the internet as an example. Chapter two continues by examining writings of Voyer (1996) and Liedtka (1998) and combines strategic thinking and learning.

The concept of the organisation as a living learning organism outlined in chapter two is consistent with the constructivist paradigm taken for this study; a key is to have the right environment for the organisation to learn.

Sections 2.14 to 2.19 of chapter two focus on the issue of forecasting and uncertainty and commences by asking why we need to plan for the future. Responses to the question were found in Loasby (1967), Kock (1976) and Langley (1988) and concerned the need for forecasting and foresight in order to make provision and being prepared for the future (Fayol 1949; Ackoff 1983). However a problem arises when the past is used to predict the future, which can lead to what Mintzberg (1994) calls the fallacy of prediction. Forecasting is notorious for being inaccurate because it does not address uncertainty (Allaire & Firsirotu 1989). As Beinhocker (1999) says the past should not be a predictor for the future because it gives a false sense of security (van der Heijden 1996).

The literature review explores uncertainty and change with early work by Emery and Trist (1965), the role of change in the business environment and the increasing uncertainty, meaning that survival for organisations is concerned with what it knows about its environment. Ackoff (1983) suggests that to deal with uncertainty depends on what an organisation does by learning, adapting and controlling responses. Allaire and Firsirotu (1989) suggested flexibility to deal with uncertainty. Taylor (1997) suggests three steps including surfacing the critical issues.

Chapter two then looks to the literature for better ways to develop strategy drawing on the writings of Ansoff (1980) and Simpson (1998a; 1998b) and focusing on top management support and involving people at all levels of the organisation so that the strategy is owned, has clear vision and strategic goals (Onsman 2000). Gaddis (1997) highlights the threats to planning in an unpredictable world and introduces the concept of chaos and complex systems and the influence people can have on the future. Eisenhardt (1999) discusses effective strategy making concluding that it is a key capability in a changing environment.

Chapter two concludes with a discussion on environmental scanning to detect weak signals in the environment so that the organisation can learn, adapt and take advantage of unpredictable events (Ackoff 1983) and strategy formation from an organic perspective Farjoun (2002).

A method to address some of the problems associated with traditional strategic planning, to change mind sets and involve people in the organisation is scenario planning, which is used later in this study to answer the research question. The

study continues with a discussion of the theory of scenario planning in chapter three and an overview of the scenario planning process in chapter four.

1.3.2. Chapters three, four and five scenario planning and driving forces

Chapter three presents an overview of the origins of scenario planning by Herman Kahn (Godet 1987; Kleiner 1989; Tibbs 1998; van der Heijden 1996; Fahey & Randall 1998). Van der Heijden (1996) and van der Heijden et al. (2002) outline the objectives of scenario planning. Chapter three continues by answering what is scenario planning and what are its purposes with information principally from van der Heijden (1996), van der Heijden et al. (2002), Schwartz (1991), Schoemaker and van der Heijden (1992), and Schoemaker (1991; 1992; 1993; 1995).

The philosophical basis of scenario planning is constructivist as discussed by Schoemaker (1993) which is consistent with the paradigm basis of this study, as opposed to a positivist paradigm for traditional forecast planning. Writings by Godet (1987) conclude this section with three elements organisations need for a strategic culture.

Chapter three continues by showing that scenario planning can be considered as a type of organisational learning because it deals with and addresses uncertainty through collective learning (Wack 1984; Senge et al. 1994; Senge 1994; van der Heijden 1996). In terms of strategic planning paradigms, scenario planning integrates three schools of thought as discussed by van der Heijden (1996). The overview of scenario planning then looks at mental models and the role scenario planning plays in changing them, (Wack 1984; 1985a; 1985b; Senge et al. 1994; Senge 1994), by tapping the creative resources of the organisation through conversation and the processural paradigm of scenario planning (Wack 1984; van der Heijden 1996). Writings by Wack (1984; 1985a; 1985b) and Schwartz (1991) are then used to demonstrate that scenario planning deals with uncertainty by accepting and understanding it.

Chapter three ends by presenting Godet's (1987) comparison of forecasting and 'La perspective', a way of thinking about the future. It represents the key differences between scenario planning and traditional forecasting as outlined by Schoemaker (1993).

Chapter four describes and discusses the practicalities of developing scenarios. Much of this is drawn from writings by van der Heijden (1996) and van der Heijden et al. (2002). It begins with a brief description of the various methods and the elements that scenarios must have to be successful. Schoemaker (1991; 1992; 1993) and Schoemaker and van der Heijden (1992) outline of ten steps to scenario formation is presented.

One of the first tasks in scenario planning is to develop the critical question or key issue, in this study about the future of the urban water supply industry, that most concerns the organisation (Schoemaker 1992; 1995; Schoemaker and van der Heijden 1992; Spies 1994; van der Heijden 1996; Mathews 1997; van der Heijden et al. 2002) followed by environmental scanning and interviews across a section of people in the organisation and key people outside the organisation. This is followed by a workshop to surface the driving forces. Finally all the information is condensed into a few key issues and placed in a grid or matrix. Chapter five discusses driving forces in more detail.

The description of scenario planning continues with a discussion on the number of scenarios, naming them, the writing process and incorporating scenarios into the organisation. Chapter four concludes with a description of the benefits of scenario planning and briefly the urban water supply industry's strategy formation process.

Within the scenario planning literature, especially when applied to strategic activities, are various theoretical models. One such model (van der Heijden 1996; van der Heijden et al. 2002) considers organisational drivers or driving forces as pivotal issues. Because this study is concerned with the critical issues for the future of the Australian urban water supply industry and key uncertainties, chapter five presents a more detailed investigation into driving forces. Driving forces in the scenario planning context are the key uncertainties in the organisation's contextual environment (Wack 1985a; 1985b; van der Heijden 1996; van der Heijden et al. 2002) an organisation must understand these forces and the impact they might have on the business environment (Schwartz 1991).

Van der Heijden's (1996) and van der Heijden et al. (2002) 'iceberg' model is described as a way to understand the structure of an industry, trends and events all of which are derived from the information gathered during the scenario planning process. The driving forces are the key elements for the development of scenarios.

Chapter five concludes with descriptions of some drivers in the business environment (Ansoff 1980; Schwartz 1991; Schoemaker 1993; Tucker 1997; Mante-Meijer, Duin & Abeln 1998; Schwartz et al. 2000). It is interesting to consider a range of strategy theorists who all, within their own perspectives, recognise the importance of the broader business drivers.

1.3.3. Chapter six research paradigms

Having reviewed the literature and made an argument for scenario planning as a strategic planning method the study then turns, in chapter six, to arguing for a research paradigm and methodology to answer the research question; ***what are the critical issues for the future of the Australian urban water supply industry?***

There are different approaches to research based on the enquirer's values, assumptions and beliefs about the world (Smith & Dainty 1991). Chapter six begins by discussing the qualitative, quantitative debate for conducting research and the writings by Guba and Lincoln (1994) and Lincoln and Guba (2000). Smith (1983) and Neuman (2003) are referred to for the philosophical background in terms of the constructivist and positivist perspective. Other terms and perspectives are reviewed such as idealism and realism, inquiry from inside and inquiry from outside (Smith & Dainty 1991) and the ontological, epistemological and methodological questions that must be answered (Smith 1983; Neuman 2003). This first section ends with a comparison of qualitative and quantitative position.

There is then a short section on the relevance of the qualitative quantitative question to this study and an explanation of the position taken by the researcher.

The next section discusses inquiry paradigms and mental models about the world (Covey 1989; Senge 1990; Zohar 1990; Guba & Lincoln 1994) as an introduction to the ontological question. The ontological question is discussed with reference to Guba and Lincoln (1994), Lincoln and Guba (2000), Burrell and Morgan (1979) and Morgan and Smircich (1980) with constructivism being the position taken for this research.

The next section of chapter six discusses the epistemological question and the relationship of the enquirer and knowledge to the research subject, drawing on the writings of Guba and Lincoln (1994), Lincoln and Guba (2000) and Schwandt (1994; 2000).

Chapter six concludes by discussing the methodological question and how the research can be undertaken. The constructivist position requires a dialectical methodology to gain an understanding of the research subject (Guba & Lincoln 1994).

1.3.4. Chapter seven research method and analysis

Chapter seven begins with an explanation of the research design, taking scenario planning (de Geus 1988; 1997a; 1997b; Schwartz 1991; Schoemaker 1992; 1995; Schoemaker and van der Heijden 1992; van der Heijden 1996; van der Heijden et al. 2002) as the theoretical framework with the underlying philosophy of organisations as living organisms that learn and adapt.

The discussion continues by relating ontology, epistemology and methodology to the research question and the adoption of grounded research (Whiteley 2002) as the research method. Grounded research is a modification of grounded theory (Glaser & Strauss 1967; Strauss & Corbin 1990) for application to business

research, an explanation of the modification, as applicable to this study concludes this section.

Chapter seven then moves on to discuss the research process beginning with the rationale for selecting the target organisations. There is a brief review of the theory of interviewing in reference to scenario planning (Senge 1992; Senge et al. 1994; van der Heijden 1996; Barker, Jenkins & Bonavita 1999; van der Heijden et al. 2002) before discussing the development of the questionnaire. Work by Tibbs (1995), Voyer (1996), van der Heijden (1996), van der Heijden et al. (2002) and Barker et al. (1999) is drawn on to develop the questionnaire for this study.

The data collection and transcription process is described. The computer software package NVivo (Richards 1999; NVivo 2002) was used to organise the data. A four level analysis was done. The unit of analysis was a personal construct. Constructs were categorised, compared and concepts developed.

This research concerns the future of the urban water supply industry. Seven of the ten questions asked during the interviews focused on the future. In order to undertake further analysis a second phase of coding was undertaken to bring together all the future issues. This resulted in 16 major categories of data. Chapter seven concludes with a model depicting these categories.

1.3.5. Chapters eight, nine and ten findings, discussion and conclusions

Chapter eight presents the findings from the data analysis. Each of the 16 major categories is initially presented with a model showing three of the four levels of coding. The data is then presented in terms of the concepts for each category with quotes from respondents to illustrate the issue in more detail.

Chapter nine discusses the findings in detail. The data were further analysed to uncover the key uncertainties, concerns and issues as discussed by respondents. Eighteen topics emerged from the data. One of the objectives of this research was to write scenarios for the future of the Australian urban water supply industry. The discussion uses van der Heijden's (1996), and van der Heijden et al. (2002) model of the organisation's business environment to assess each key uncertainty and uncertainty as a selection criterion for the scenario matrix. The discussion concluded that 'Water availability' and 'Technological change' in the urban water industry's contextual environment were the two key uncertainties with the most uncertainty and greatest impact for the future.

The second part of chapter nine discusses scenario writing (van der Heijden 1996; van der Heijden et al. 2002; Lindgren & Bandhold 2003) and presents the four scenarios, 'Decadent water use', 'Smart water world', 'Muddy waters' and 'Mad Max water world'.

Chapter nine concludes with a brief overview of some other scenarios that have been written for urban water supply both in Australia and overseas using different key uncertainties (ASTECC 1995; Pinkham & Chaplin 1996; Pinkham 1999; Alcamo, Henrichs & Rosch 2000; Means III et al. 2000a; 2000b; 2002; Means III 2001).

Finally the study concludes with chapter ten. As stated previously the aim of the research was to uncover the critical issues for the future of the Australian urban water supply industry. The critical issues have emerged from both the data and the scenarios, however, they are not necessarily all critical issues discussed by respondents. Additionally there are some critical issues of a philosophical nature in regard to urban water supply, and there are critical issues of a practical nature. These are discussed and presented in chapter ten.

Chapter ten brings together concepts discussed in the literature review, the biological metaphor, organisational learning and how scenario planning can increase the speed of organisational learning. The conclusion uses the concept of complex adaptive systems theory (Boulding 1987; Beinhocker 1997; Pascale 1999; Pascale, Millermann & Gioja 2000) to explain the nature of the urban water supply industry in Australia.

Chapter ten concludes with the presentation of the biological metaphor, theory and model for the Australian urban water supply industry followed by suggestions for further research.

CHAPTER 2 - LITERATURE REVIEW: STRATEGIC PLANNING

'Perception is strong and sight weak. In strategy it is important to see distant things as if they were close and to take a distant view of close things.' Miyamoto Musashi,
(Moncur 1994-2004).

2.1. Introduction

In order to develop strategies it is important to consider what is driving an industry and the forces that will be important in the future. This research will focus on the urban water supply industry in Australia and will identify the forces driving this industry and the issues that will be critical in the future. Armed with this knowledge an organisation can plan and position itself to adapt to and take advantage of opportunities presented by these driving forces.

To understand these driving forces this chapter will focus on strategic planning in general in order to set the context and explain the origins and meaning of strategy in the business environment.

There is an enormous volume of literature on strategic planning and strategy formation. Therefore in this chapter a few key writers have been used to illustrate specific points of view. This is well summarised by Mintzberg et al. (1998) in placing the various writers into one of a number of schools of thought on strategy formation.

One of the key concepts in this research is the notion that the organisation is a living organism. Early practices in strategic planning failed to appreciate this concept. Organisations consist of people each with their paradigm about the organisation and its purpose. This concept aligns with the theoretical basis of this research in that reality is a construction of each individual, which is open to change as new information comes to light to change an individual's paradigm. Collectively individuals make up the genetic material of organisations to arrive at the notion that organisations are living organisms.

The concept of the living organisation questions how can organisations learn and accelerate the learning process in order to gain an advantage over competitors and survive in a turbulent and chaotic world? If organisations are living creatures, then strategy can be perceived as a product of a living organism, which is required to survive in the business world and each organisation's perception of that reality can be different. Should then strategy be deliberate, or, emergent and adaptable to compensate for the ever changing environment and uncertainty? People also revolt and change the rules of the business game by developing new strategies that go

beyond the traditional fit of the organisation to its environment. In addition organisational capability can be stretched by resource leverage.

Whilst the concept of strategy can be traced to early Chinese military strategy (Sun Tzu c500BC) business theorists have identified it within theory from around the 1960's (Ansoff, 1980; Ackoff, 1983).

Since the 1960's strategic planning, according to Mintzberg (1994), has had a cyclical popularity with organisations as it gained and lost popularity, much as a result of its limited success in failing to deliver expectations and results; namely creating wealth for organisations and shareholders. Allaire and Firsirotu (1989) suggest that this limited success is attributable not only to earlier poor practices but is also a function of the ever rapidly increasing change of the business environment. This rapidly changing business environment causes uncertainty and brings into question the appropriateness of strategic planning and how to deal with uncertainty.

The question arises why do organisations need to plan? The literature suggests it is to reduce future uncertainty but when the business environment is changing at an increasing rate, uncertainty has to be dealt with differently from traditional methods, often related to the past.

2.2. The living learning organisation

In order for an organisation to live harmoniously with its environment and survive, people in the organisation must be able to absorb information from the external environment, act on it and learn. In order to change, organisations depend on learning. This is the basis of strategic planning for the future and the mental model or paradigm of the business. De Geus (1988) describes planning as learning and organisational planning as institutional learning. De Geus (1988) asks the question how does an organisation learn and adapt and what is planning's role in institutional learning?

Using the biological metaphor, sociologists and psychologists say that pain makes living organisms' change, similarly in an organisation when times are hard everyone in the organisation feels the 'pain'. In a crisis, decisions become reactionary and are often poor. The result is that the organisation may not survive. Early recognition of environmental change, before a crisis occurs is, therefore, important for organisational survival (de Geus 1988).

All living organisms learn, and we are aware that people learn and constantly modify their mental models about the world. The process is, however, slow. In the business environment the process can be too slow. Competitive advantage depends on learning faster than the competition. De Geus's (1988) critical question is how

can institutional learning be accelerated? Effective learning in an organisation is done by people who have the delegation to make decisions. An objective of planning is to change the mental model of those decision makers (de Geus 1988).

Aris de Geus (1997a) in his paper titled 'The Living Company' writes that whilst businesses over the last 500 years have been immensely successful in creating material wealth they have in fact been underachievers utilising only a small part of their potential. The corporate mortality rate is unnaturally high compared to other living species. De Geus (1997a) suggests that this is because policies and practices are too heavily slanted towards economics; management forgets that organisations are composed of groups of human beings who are in business to live. Living companies, de Geus (1997a) says, have a personality; they evolve harmoniously, value new ideas and people.

De Geus (1997a) discusses research undertaken for Shell to find organisations that had survived over a long period of time. The research found that corporate life span was much shorter than it should have been, on average less than 50 years and less than 20 years in the northern hemisphere. De Geus (1997a) compares this corporate life span to Neanderthal Man with a life expectancy of 30 years but biological capability of 100 years. It is, therefore, worth pondering what has contributed to human increase in longevity and whether these concepts can be applied to organisations and the business environment.

De Geus (1997a) found that living organisations were good at change management and adapting to a changing environment. De Geus (1997a) uses Stora, a Swedish pulp and chemical manufacturer, as an example of an organisation that has survived since the Middle Ages, when it began as a copper mine, and adapted to changes in the social, technological, environmental, economic and political environment. De Geus (1997a) notes four personality traits of long surviving organisations.

1. They show conservation in financing. This contrasts to the alternative view of leveraging resources (Hamel & Prahalad 1993).
2. They are sensitive to the business environment, adapting and learning.
3. They are aware of their identity having a holistic internal environment.
4. They are open to new ideas to stretch the organisation.

As a key element in urban water supply, water utilities were the focus of this study. They are organisations with longevity, having begun life as government agencies and have not operated in a competitive environment. This has probably contributed to their longevity as well as their characteristic as being the ultimate essential service.

In order for organisations to survive for a long period of time they must exist in an environment that they cannot control and be prepared to change as the environment changes. Long surviving organisations must require a change of leadership from time to time. In changing leadership organisations need to be handed over in a healthy condition which means people in the organisation must be allowed to grow and be valued above material assets. Assets and profits are like oxygen, needed to sustain life but not the reason to live for (de Geus 1997a).

Organisations learn when they adapt; the question is how organisations learn, compared to an individual within it. De Geus (1997a) uses birds to illustrate the answer. Three conditions are necessary, according to de Geus (1997a).

1. Members of the species must be able to move, flock and herd rather than being solitary beings.
2. Some individuals must be able to learn new skills.
3. There must be direct communication with others to transfer the new skills.

Under these conditions learning is accelerated, the species adapts quicker to the changing environment. Birds that flock learn faster, similarly, in organisations where people interact, learning is faster.

De Geus (1997a) uses water (appropriate for this study) in its different manifestations as a metaphor for the organisation. Organisations that create wealth for a few individuals are likened to a puddle of water, a collection of a few raindrops. When rain is added the puddle's sphere of influence increases, the original drops stay in the middle. With inaction there is stagnation; heat evaporates the puddle including the original drops. A surviving organisation is like a river; a permanent feature, which rises and falls, only a sustained drought will cause the river to dry up. A river is turbulent; constantly in motion the drops always moving. In organisational terms this means the people must be constantly moving and like a river somewhere it becomes a living organisation.

Hamel and Prahalad (1993) say that being a learning organisation is not enough; learning must be more efficient than that of competitors. One of management's tasks, therefore, is to assist in accelerating knowledge about the business environment to reduce risk and enable the organisation to advance (Hamel & Prahalad 1993).

Living learning organisations have a better chance of survival in a changing environment because intelligence is mobilised, the organisation is tolerant resulting in an atmosphere for innovation and learning (de Geus 1997a).

Effective strategic planning in all its forms is therefore, the basis of a learning organisation. It enables the organisation to adapt to its changing environment.

Organisations that learn effectively, efficiently and fast will have a better chance of survival in the competitive environment.

2.3. Organisational perspectives

Two additional perspectives of the organisation as a phenomenon are important in the context of organisational learning and scenario planning.

Hampden-Turner (1992) looks at corporate culture saying that it dictates the way an organisation processes information, its relationships and values. Culture defines behaviour and motivates individuals. Corporate culture is a response to the problems the organisation faces. Hampden-Turner (1992) calls an organisational culture cybernetic, because it is the self steering mechanism of the organisation, preserving the direction despite obstacles; it is an auto-pilot. Such systems have feedback loops that process information and make appropriate changes when the external environment changes. In a business environment that is constantly changing an organisation must have a culture of learning if it is to survive.

He (Hampden-Turner's 1992) goes on to discuss corporate culture functions to resolve dilemmas. Hampden-Turner (1992) sees dilemmas as two horns of a bull; the organisation needs to avoid both horns for example adapting externally and integrating internally and the need for continuity whilst there is change. The most successful corporate cultures are ones that find synergy between the two dilemmas rather than being lopsided towards one or the other, compromising or being in conflict, situations that threaten the cultures survival.

In his view (Hampden-Turner 1992) it is possible to change corporate culture by researching the organisation's values, myths and rituals. This can be done by interviews in order for the researcher to gain an understanding of the organisation's cultural paradigm and how the organisation learns.

Morgan (1997) in his book "Images of Organisation" uses metaphors to depict the pattern of corporate cultures such as a mechanism, a brain or flux and transformation. Hampden-Turner (1992) continues by saying that corporate cultures learn but how they learn depends on the organisation's paradigm. For example a mechanistic paradigm of corporate culture learns in a Newtonian manner by predicting and control. In the newer fluid paradigm of synergy with its external environment and internal harmony an organisation's culture learns by experience and synthesis of information transformed into knowledge for self correction. The organisation deals with complexity and adapts to the external environment as it changes.

Hampden-Turner (1992) argues that because corporate culture is unique to a particular organisation the products of culture are unique such as business

strategy and therefore the process of developing business strategy should begin with corporate culture.

Another perspective on the phenomenon of the organisation has been developed by Checkland (2000) and work on soft systems methodology. Checkland (2000) writes that soft systems methodology is an approach to organisational research that explores how people in a particular situation make sense of their world and in doing so act.

Checkland (2000) describes hard and soft systems thinking. In hard systems thinking the organisation is viewed as a production system. The organisation's goal is to produce a number of products in a certain time at a certain quality with certain resources, constrained by costs. This is classic systems engineering where the concept of management is concerned with decision making to achieve the set outcomes. This is the mechanistic view of the organisation and arguably only a small step from Taylor's principles of scientific management (Morgan 1997).

Checkland (2000) writes that soft systems methodology was developed because systems engineering failed to address complex human situations. Soft systems methodology views the organisation as a cycle of inquiry and experiences leading to a learning system to improve a situation of concern. The world in this paradigm is assumed to be complex and problematical and that the process to deal with this can be organised into a learning system. In this paradigm the term system refers to the process of dealing with the world. Checkland (2000) says that this is the critical difference between hard and soft systems thinking. In hard systems thinking the world is assumed to be a system to achieve objectives, a positivist's ontology. In soft systems thinking the world is assumed to be problematic and that the process of inquiry can be organised as a system.

Checkland (2000) says that models developed in soft systems methodology can be used to make sense of complex situations. Models are descriptions of concepts based on world views and can be used as a point of debate about a potential situation and what is desirable to change. This is analogous to the object of scenarios in the context of scenario planning and discussed in chapters four and five.

2.4. What is strategic planning?

The word strategy has been around for a long time. The New Shorter Oxford English Dictionary (1993) describes strategy as: -

'The art or skill of careful planning toward an advantage or a desired end...'

and in business theory: -

'...a plan for successful action based on the rationality and interdependence of the moves of opposing or competing participants.' (The New Shorter Oxford English Dictionary 1993, p3085).

Mintzberg et al. (1998) offers five answers to the question, what does strategy really mean?

1. A plan, direction or course of action for the future.
2. The course of action an organisation has followed over the past.
3. Strategy can also be positioning of a product in a market; the product meets the customer's needs.
4. Strategy is a perspective in terms of the way an organisation does business, the vision of the organisation.
5. Strategy is ploy, a specific tactic in response to competition.

Ackoff (Godet 1987, p102) defines planning as:-

'...conceiving a desired future and in parallel the means of implementing it.'

Strategy establishes objectives whilst tactics outlines the means of achieving the objectives (Godet 1987).

Mintzberg et al (1998) describe positive and negative aspects to strategy: -

- it can set direction, charting a course of action for an organisation, but it can render the organisation blinkered to external change;
- it gives focus to coordinate effort, but limits peripheral vision and changes of mind set;
- it defines the organisation for its employees giving vision, but the definition may be too simple to differentiate the organisation from others; and
- strategy is needed for order and consistency, this can stifle creativity. Strategy is not reality it is only represented in the minds of people; therefore each strategy has a level of distortion.

This last point is consistent with the constructivist position taken by the researcher for this study. Under constructivism realities are intangible mental constructs based on the culture and experience of individuals or groups. Constructs are more or less informed and changeable (Guba & Lincoln 1994; Lincoln & Guba 2000). This is discussed in more detail in chapter six Research Paradigms: The Qualitative – Quantitative Choice.

Strategies can be useful to an organisation as much by their presence as absence in minimising tunnel vision and allowing flexibility and creativity (Mintzberg, Ahlstrand & Lampel 1998).

Research by Hay and Williamson (1998) concluded that strategic planning is perceived as being concerned about the future and trying to forecast the future. It rarely relates to next year's activities and looking beyond five years is a waste of time. According to Hay and Williamson (1998) strategic planning is characterised by: -

- confusion about the nature of strategy and how it operates at various levels;
- periodic strategic planning doesn't fit every day management; and
- various sections of the organisation often oppose each other rather than working to common objectives.

The comment by Hay and Williamson (1998) about looking beyond five years is interesting in terms of this research because the urban water supply industry considered five years to be a short term planning horizon. This was noted by respondents and is a function of the planning required to augment water supply. It contrasts markedly with say the telecommunications industry where one year might be considered a long term planning horizon.

Hay and Williamson (1998) asked various people in organisations what they thought should go into a successful strategy; responses were grouped into five features.

1. Inspirational goals for people to aim for.
2. Linkage of tasks between groups so they work together.
3. Guidelines for individual decisions and prioritising.
4. Freeing individuals by reviewing critical and non-critical constraints.
5. Establishing a common language that everyone can understand.

Hamel and Prahalad (1993) ask the question what is strategy? In the context of organisational competitiveness, it depends on managers challenging their paradigm and focusing on three things.

1. The concept of fit.
2. Allocation of resources.
3. Taking a long term perspective particularly in reference to money and risk.

This suggests that strategic planning is about taking a long term view with a substantial commitment of resources (Hamel & Prahalad 1993). Hamel and

Prahalad (1993) believe this framework is unbalanced. They suggest there is an alternative view where: -

- stretch enhances fit;
- leveraging resources is important; and
- the long term is about consistency of effort.

Hamel and Prahalad's (1993) view of long term planning contrasts with Hay and Williamson's (1998) position that planning beyond five years is a waste of time.

Hamel and Prahalad (1993) say that the misfit between resources and goals is creating stretch, which is an important task for management.

Farjoun (2002, p570-1), from an organic perspective and based on other researchers, defines an organisation's strategy as: -

'the planned or actual coordination of the firm's major goals and action, in time and space that continuously co-align the firm with its environment'.

2.5. The history of traditional corporate planning

In order to present a history of traditional corporate planning selected writers on the subject have been referenced that are appropriate for this study. Taylor (1986) is reviewed for the different periods of strategic planning. McKiernan (1997) presents four schools of strategic planning that are further developed by Mintzberg et al. (1998) into ten schools of strategic planning. More recently Farjoun (2002) discussed strategy formation from a mechanistic and organic perspective. These reviews whilst not representing all writers give a flavour of the history as it developed during the last forty years.

The review of the history of corporate planning begins with Taylor (1986) who in 1986, after reviewing earlier articles published in the business journal 'Long Range Planning', viewed corporate planning as evolving in three principal stages from the mid 1960's to the mid 1980's.

2.5.1. 1965 – 1973

Taylor (1986) writes that during this period a stable business environment was assumed, government expenditure increased and organisations focused on managing the bureaucracy. Strategy making focused on long range planning and forecasting with little consideration for the unpredictable; outcomes were highly inflexible. According to Godet (1987) factors seen to contribute to the development of effective corporate planning were technological and economic.

2.5.2. 1974 – 1979

Taylor (1986) notes that the oil crisis of 1973 was a watershed event that changed the business environment, the concept of everlasting growth disappeared. Organisations had to defend themselves against environmentalists, a raft of other interest groups, new legislation and growing global competition from emerging nations. In this period strategic planning set the overall strategy before the detailed planning was undertaken. This caused a problem because the process was too elaborate and centralised and had no implementation strategy.

2.5.3. 1980 – 1986

Taylor (1986) writes that in order to be competitive, organisational restructuring resulted in some businesses growing whilst others declined; the polarisation of rich and poor grew. This period saw the growth of strategic planning to manage change processes and involve employees in decision making. The problem was how to manage the organisational change process, which required an investment in new technology and was dominated by restructuring, mergers, acquisitions, efficiency gains, higher performance, reducing costs and improving service.

Taylor (1986) concludes with six emerging strategies of the 1980's that focused on improving competitive performance.

1. Strategy and technology, requiring investment.
2. Production and operational strategy.
3. Strategies for human resources by harnessing the energy and knowledge of people.
4. Strategic marketing to be customer focused.
5. Financial strategy.
6. Information strategy as a corporate resource. In the 1980's this was seen as a future focus.

McKiernan (1997) says that strategists do not really know where the current thoughts on strategy have come from. To find out where organisational strategy's future lies it is interesting first to look at the past and there seems to be two sources of strategy.

1. The Biological Metaphor and recognition of natural selection, a la Darwinism, to build on competition. This concept is discussed further in section 2.12 of this chapter.
2. The Military analogy a more traditional source modelled on 'The Art of War' by Sun Tzu (c500BC), the objective being to overcome the enemy by strategy.

Both of these stances have different cultural origins.

McKiernan (1997) classifies schools of thought broadly into four categories with interplay between them.

1. **Planning and practice.** McKiernan (1997) writes that the Industrial Revolution was the birthplace of the mechanistic approach to organisational management. The military model of strategy is concerned with long term decisions and the need to position the organisation to fit the business environment. This forms the basis of the analytical approach to strategy. From this the notion of competitive advantage grew and was taken up by Michael Porter (McKiernan 1997). McKiernan (1997) notes that Ansoff's model supports this school with strategic planners' playing a key role in the organisation.
2. **Learning.** McKiernan (1997) says that observation of strategy's success shows that some planned strategies failed whilst some successful ones emerged informally. The learning school, analogous to natural selection, assumed a complex, unpredictable environment. As stated previously organisations have to adapt to survive. Lindblom (1959) uses the phrase 'muddling through', the planner was not required, and adaptation was pervasive without a central location.
3. **Positioning.** McKiernan (1997) writes that the positioning school was developed by Porter and is the crux of competitive advantage and fitting the organisation to the business environment by analysing the industry structure according to Porter's 'Five forces'. Porter's (1980) five competitive forces are rivalry amongst existing organisations, bargaining power of buyers, threat of new entrants, bargaining power of suppliers and threat of substitute products or services.
4. **Resource based.** McKiernan (1997) notes that in the resource based school attention is focused on analysing the organisation's resources to develop a unique composition for competitive advantage. The emphasis is on acquiring scarce resources and learning.

What ever the school of thought used in planning, an organisation has to accept that the business environment is constantly changing and as such the corporate strategy must be flexible enough to accommodate change.

2.6. Schools of strategic planning

Many writers on strategy formation have looked at particular aspects of strategy without coming to terms with the whole process. Mintzberg et al. (1998) propose ten schools of thought on strategy formation each of which focuses on a particular aspect of strategy formation. The ten schools are further grouped into three.

1. The first three are perspective in nature being concerned with how to formulate strategy rather than how strategies are formed.
2. The next six are descriptive, focusing on different aspects of the strategy formation process.
3. Lastly, the configuration school tries to combine the other schools into episodes (Mintzberg, Ahlstrand & Lampel 1998).

2.6.1. The design school

According to Mintzberg et al. (1998), this is the most influential of the schools being the basis of teaching and practitioners of strategy. The SWOT (strengths, weaknesses, opportunities and threats) analysis is one of its key tools. Simplistically the design school tries to match the organisation's capabilities, both strengths and weaknesses, with the business environment, by examining opportunities and threats. Once a strategy has been agreed upon, from this analysis, it is implemented. The origin of this school dates from the late 1950's and early 1960's and the Harvard Business School. The design school provides the basis from which other schools have developed.

Mintzberg et al. (1998) suggest that one of the shortcomings of this school is that it can position the organisation in a narrow niche not allowing enough flexibility in strategy.

2.6.2. The planning school

Mintzberg et al. (1998) say that the origin of the planning school lies in the 1960s to 1970s. There is a huge amount of literature associated with this method; however, minimal research into strategic planning has meant that the quality of writing remained constant resulting in the school's decline. Whilst there are many strategy planning models most can be distilled down to the SWOT model. The model is divided into a checklist of techniques; objectives are set and backed up with budgets and operating plans and all are shown in elaborate flow diagrams.

The difference between this school and the design school, according to Mintzberg et al. (1998), is that the planning school is highly formalised and elaborate requiring a multitude of planners. In reference to the planning school Mintzberg et al. (1998) believe that strategic planning is an oxymoron and it should be called strategic programming.

2.6.3. The positioning school

The positioning school, according to Mintzberg et al. (1998), added context to the design and planning school. The importance of strategy was emphasised in addition to the process of strategy formation. The school also added substance by focusing

on the content of strategies. Porter's (1980) work in the 1980's crystallized the positioning school. Mintzberg et al. (1998) note that the main difference from the design and planning school is the premise that a few rather than a single strategy is desirable as a defence against competition.

2.6.4. The entrepreneurial school

Mintzberg et al. (1998) say that the entrepreneurial school focuses on a single leader and stresses intuition, judgement, wisdom, experience and insight. This puts forward the notion of strategy being visionary and being the construct of the leader. The leader controls the organisation and manoeuvres it through the terrain of the changing business environment. The vision is inspirational and tends not to be formalised leaving it flexible and adaptable. Strategy in this school is both deliberate and emergent.

2.6.5. The cognitive school

The cognitive school, according to Mintzberg et al. (1998), is concerned with understanding the mind of the strategist and understanding what the process means. Strategists are generally self-taught through experience, which moulds knowledge and influences actions and thus modifies experience. This duality is central in the cognitive school.

Mintzberg et al. (1998) argue that positivist members might see strategy development as an attempt to produce an objective picture of the world through the eyes of the strategist. The subjective posture adopted by cognitive thinkers view strategy as an interpretation of the world; the focus is on how the strategist interprets the events, symbols and behaviours around them. Realist members try to understand cognition as a re-creation of the world. Cognitivist members believe that the world is created in the mind of the member.

Mintzberg et al. (1998) suggest that the cognitive school is the bridge between the objectivist schools of design, planning, positioning and entrepreneurial and the subjectivist schools of learning, culture, power environment and configuration.

2.6.6. The learning school

Mintzberg et al. (1998) write that the learning school proposed that strategists progress by learning. Strategies emerge as groups learn over time about a situation and the organisation's capability to adapt to a different environment. The school came into being with 'The Science of Muddling Through' by Lindblom (1959). Lindblom (1959) suggested that decision making is not neat and controlled but messy as decision makers' deal with a complex environment.

Strategy emerges, according to Mintzberg et al. (1998), because the business environment is unpredictable and knowledge is diffuse, the process is one of

learning over time. Learning becomes behavioural and stimulated by retrospective thinking. The role of the leader is therefore to manage the process of learning so that novel strategies can emerge.

2.6.7. The power school

In the power school, according to Mintzberg et al. (1998), power and politics are used to negotiate strategies favourable to particular interests. Strategies are emergent as positions and ploys change. Mintzberg et al. (1998) describe two branches.

1. The play of power within the organisation is both legitimate and illegitimate, focusing on internal actors and self interest.
2. The use of power by organisations focusing on external factors in the organisation's own interest.

Mintzberg et al. (1998) write that power and politics are particularly present during major changes, in large organisations, decentralised organisations, when change is stopped and when organisations cannot find clear direction.

2.6.8. The cultural school

Mintzberg et al. (1998) suggest that culture knits individuals into an organisation focusing on a common interest. Mintzberg et al. (1998) literature review focuses on using culture for stability. The central concept in culture is anthropology. Culture is all around us; it makes people what they are and it makes organisations different. Culture came to the forefront in management in the 1980's focusing on successful Japanese organisations and how they did things differently. Culture can be studied from outside or inside the organisation; the first is objective in trying to explain why people behave as they do, the second is subjective in looking at culture as an interpretative process. According to Mintzberg et al. (1998) the danger with the cultural school is that it can discourage change because it prefers consistency

2.6.9. The environmental school

Mintzberg et al. (1998) write that the environmental school sees the organisation's external environment as the controlling force and the organisation reacting to that force. Strategy therefore is a mirrored response to the environment. The environment together with leadership and organisation is one of the three core forces in strategy formation. According to Mintzberg et al. (1998), this school has helped to define the different types of environment that the strategists face. The environment is considered to be a set of abstract forces that can drive the organisation into a competitive niche. The organisation must respond to those forces or be selected out. Leadership therefore, becomes passive to ensure the organisation adapts to the environment.

2.6.10. The configuration school

Mintzberg et al. (1998) say that there are two sides to the configuration school, one is the configuration of the organisation and its environmental context, and the other describes the strategy making process as transformation. Most of the time the organisation is in a stable configuration, to match the environmental context in which it operates, this produces a set of strategies. Occasionally there is transformation to another stable state when the environment dictates the need for change. This is reflected in organisational lifecycles. Strategic management is therefore necessary to maintain stability and when transformation is required to manage it as painlessly as possible.

Mintzberg et al (1998) say that the configuration school brings together the diverse world of strategy formation. Each of the ten schools is a configuration perspective of a single world.

Mintzberg et al. (1998) describe a model, figure 2.1, for strategy formation that incorporates these ten schools. Strategy creation is central to the model, which is where the cognitive school tries to be. The learning and power schools focus at the centre but include detail rather than look at the big picture. The positioning school uses historical data to formulate strategy. The planning, design and entrepreneurial schools each, in turn, look a little further ahead. The cultural and environmental schools look down from above. Whilst the cognitive school tries to look inside the process and finally the configuration school tries to look all around.

Whilst Mintzberg et al. (1998) have categorised strategy formation into ten schools there are new hybrids forming which help to connect the various schools. What ever method of strategy formation is followed strategy formation is complex and requires elements of all schools to be successful. Whilst it is important to study the detail of each school it is also important to know how the various schools work together.

The researcher acknowledges varying and more recent perspectives on the categorising of strategic management approaches. Hoskisson et al. (1999) review the development of strategic management from the decade of Ansoff's 'Corporate Strategy' in 1965. This parallels the early part of Taylor's (1986) stages of corporate planning. Hoskisson et al (1999) say that the initial focus of strategic management research and theory was on the resource based view of the organisation and the fit between an organisation's strategy and structure. The focus, according to Hoskisson et al. (1999), then swung to industrial organisation economics with the work of Porter (1980; 1985).

Hoskisson et al. (1999) suggest that recent theorising on strategic management has now moved back to the resource based view of the organisation focusing on why

organisations are different and how they achieve competitive advantage and an extension to this with the knowledge based view of the organisation.

Hoskisson et al. (1999) write that the resource based view of the organisation has refocused attention on the organisation's internal resources for competitive advantage. Competitive advantage has become central to organisation sustainability as the external business landscape continues to change particularly as technological discontinuities become the norm and globalisation increases.

Perhaps more tuned to this research is Farjoun's (2002) paper that discusses the difference between the mechanistic perspective of strategic management based on Newtonian epistemological assumptions adopting the design model of strategic management and the organic perspective with influences from the natural and social sciences. According to Farjoun (2002), the organic perspective of strategic management is iterative and integrated and better suited to an uncertain and changing business environment. This organic perspective is in harmony with the constructivist underpinnings of scenario planning and ontological position adopted for this study, concepts that are discussed further in chapters three and six.

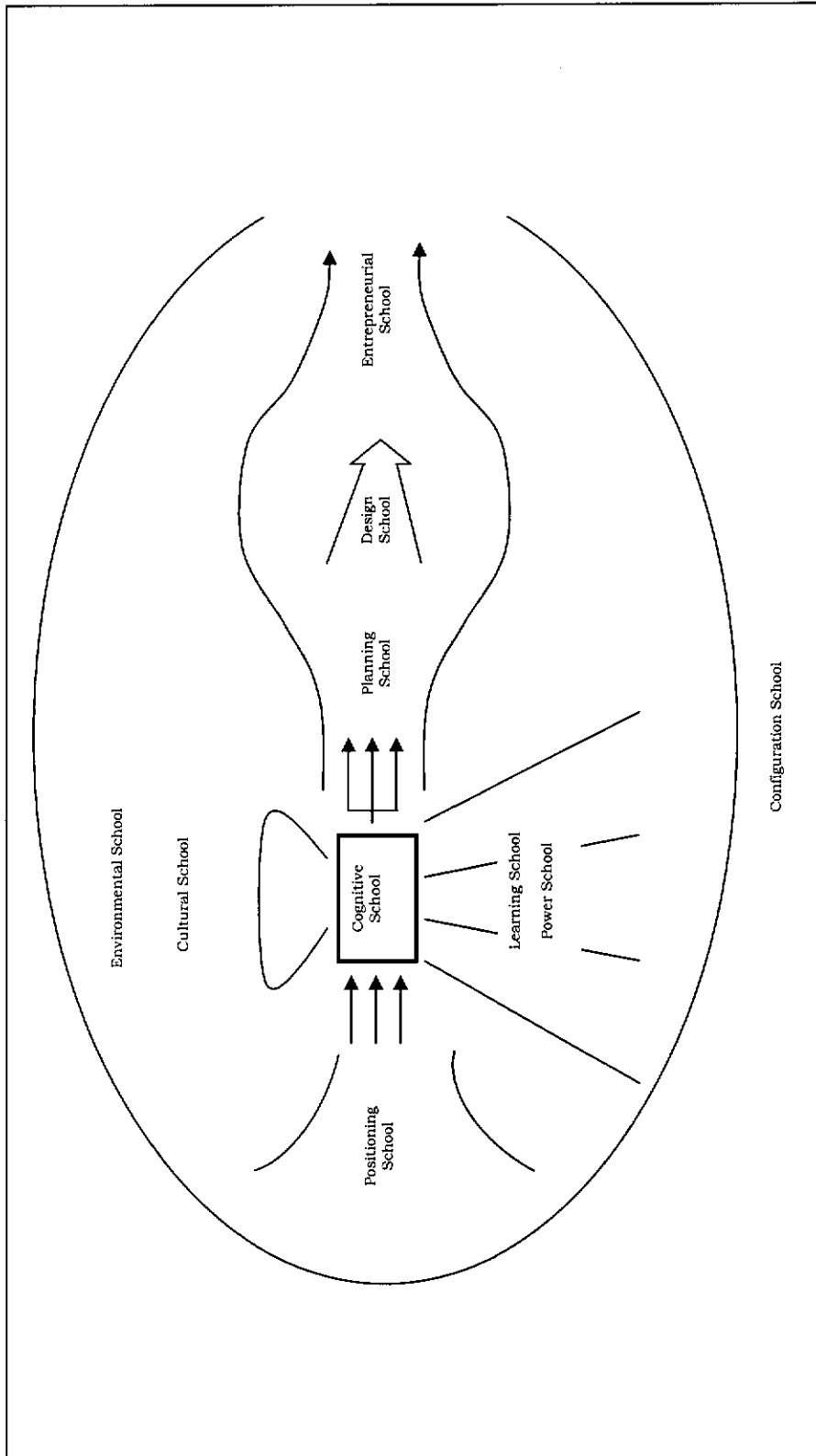


Figure 2.1. Strategy formation model
Source: (Mintzberg, Ahlstrand & Lampel 1998, p371)

2.7. The problem with strategic planning

Over 50 years ago Henri Fayol (1949) wrote that one of the prime functions of management is planning for the future direction of the organisation. Planning should be an important function for the success of any organisation (Pennington 1972). For many organisations, as noted earlier in this chapter, the memory and history of corporate planning or strategic planning has been less than successful (Pennington 1972). In fact it has been a resounding and expensive failure in meeting the objectives of growing a successful organisation (Pennington 1972). There has been a lot of soul searching amongst strategic planners to analyse failure and make suggestions to rectify the problem (Pennington 1972; Mintzberg 1994; Mintzberg et al 1998; Taylor 1997). Some have rejected the notion of strategic planning in favour of a more fluid and dynamic approach to managing the direction of an organisation (Semler 2003).

McKiernan (1997) suggests that over the last 30 years organisations have had an intermittent engagement with strategic planning, the cost has been lost momentum, poor planning, confusion, wasted capital and demoralisation all contributing to poor organisational performance.

Pennington (1972) documented two reasons for the failure of planning to deliver on expectations.

1. It has changed the way business is conducted in only a few organisations because planning has failed to prepare the organisation for an uncertain future. Where it has prepared organisations they have been very successful because they have been able to control their future.
2. It has not satisfied top management because planning has tried to change the way organisations do things.

Another reason why, in the past, strategic planning has failed to meet expectations is because it has grown out of the quantitative approaches to business of the 1960's (The new breed of strategic planner 1984). In the 1960's the emphasis was on the growth of market share. However, not enough emphasis was placed on turning sick companies into healthy ones and making sure they were strong (The new breed of strategic planner 1984).

Glaister and Falshaw (1999) note that by the end of the 1970's strategic planning had lost its popularity because it wasn't delivering results. Evidence suggests that formalised planning can be dysfunctional if it is too rigid (Loasby 1967). Simpson (1998a) says that strategy does not respond well to routine processes, such as an annual strategy development process, because it produces routine results. Similarly it has been noted that the strategy process is too mechanised for a

complex world and can become too far removed from the realities of the organisation (The new breed of strategic planner 1984).

Sarrazin's (1978) research into the effectiveness of strategic planning concluded that the cause of strategic planning's failure in large French organisations was: -

- because of the complex business environment, organisations gave priority to local strategic studies rather than the overall organisational strategic plan;
- this resulted in a number of decision centres rather than the classical single decision centre;
- the classic strategic planning model did not take into account the existing organisational interactions; and
- the classic strategic planning model was not readily integrated into the management system of the organisation (Sarrazin 1978).

Simpson (1998a) says the model of senior people in the organisation developing a strategy and the rest of the organisation executing it has three fatal flaws.

1. People at the top are too far removed from the business to develop strategy.
2. It assumes the brains at the top are superior.
3. It assumes the rest of the organisation is ready and waiting to implement the strategy when it's handed down (Simpson 1998a).

Taylor (1997) documents five reasons for strategic planning's decline.

1. Costly and ineffective central planning teams.
2. Annual planning is too cumbersome and inflexible to deal with rapid change.
3. Central planning inhibits line managers by relying on a control strategy too far removed from everyday operations.
4. Business units did not own the finished plan.
5. The bureaucratic process did not produce innovative thinking (Taylor 1997).

Mintzberg (1994) in his book 'The Rise and Fall of Strategic Planning' extensively reviews the problems with strategic planning.

According to Mintzberg (1994) a basic assumption of strategic planning seems to be that senior management sets the objectives for the organisation. The formulated strategy is then passed down the hierarchical chain. The objective is to give incentive, motivate, control and assess employee performance. However, according to Mintzberg (1994) behavioural scientists espouse that people have to be involved

in setting objectives in order to motivate them therefore; this model of strategic planning is unlikely to be effective.

Research cited by Mintzberg (1994), including that of Sarrazin, says organisations cannot afford to wait for the planning cycle to come around each year in order to address a problem. Few critical decisions are taken as a result of planning because it cannot handle the complexity of the modern business environment (Mintzberg 1994).

In other research cited by Mintzberg (1994), Gomer concluded that planning did not provide early warning or sensitise the organisation to environmental change. Planning was more concerned with output from the process rather than input into the process. Gomer (Mintzberg 1994) also concluded that planning's contribution to problem solving was insignificant.

Quinn's (Mintzberg 1994) research concluded that formal planning rarely determined an organisation's key strategy; it was not the source of a new direction.

Studies at McGill University found that planning was only used to satisfy external needs in the financial markets and to program an existing strategy (Mintzberg 1994).

Studies at Air Canada showed that formal planning not only did not contribute to strategy but it discouraged it, impeding strategic thinking and change (Mintzberg 1994).

Research into the Canadian armed forces after World War II found that the organisation either planned or acted, both were unrelated. With nothing to do the armed forces planned and in times of war it acted; planning seemed to have no place in war time (Mintzberg 1994).

Planners themselves attribute the failure of strategic planning to a number of pitfalls in the system; these are managers and people in general. 200 years ago Kant (1724-1804) said this about planning: -

'The making of plans is mostly an uppish, presumptuous mental exercise in so far as the planner claims some creative genius when he demands of others what he cannot himself deliver, or blames others for what he could not do himself...' (Mintzberg 1994, p153).

Mintzberg (1994) quotes Steiner's survey of the pitfalls of planners and, together with evidence from other research, groups ten pitfalls of planning into two categories.

1. Lack of senior management commitment.
2. The lack of a climate congenial to planning in the organisation.

Mintzberg (1994) explores these two pitfalls by asking why is commitment not forthcoming and why doesn't the climate exist? Mintzberg (1994) suggests that objective detachment undermines commitment and conservatism together with control results in an environment of conformity and inflexibility.

Mintzberg (1994) argues that lack of commitment, in particular, is the main pitfall of planning. The assumption behind this is that planning is the best way to develop and implement a strategy. It also assumes that commitment means that planning is accepted and engendered throughout the organisation.

Mintzberg (1994) concludes that planners' explanation for the failure of strategic planning is superficial. It does however show that planning can be dysfunctional.

Mintzberg (1994) notes three assumptions of strategic planning.

1. Assumption of formalisation.
2. Assumption of detachment.
3. Assumption of quantification.

Nowhere in the literature on strategic planning has there been an effort to understand how the strategy making process works, this is the first assumption, that of formalisation (Mintzberg 1994).

Some of the past problems with strategic planning, according to Wilson (1998), are attributed to the fact that management has not taken a holistic approach to strategy formation and the need to use strategic planning in times of uncertainty for corporate direction.

The underlying theme from the literature appears to be that in the past, strategic planning, as it has been both theorised and practiced, has not prepared the organisation for a turbulent and uncertain future. It has not been able to combine the complexities of the organisation with the complexities of the business environment. The solution may be to look at the strategy formation process from a different perspective. The next part of this chapter explores some of the different perspectives on strategy formation.

2.8. Strategic planning or strategic thinking

According to Heracleous (1998) the relationship between strategic thinking and strategic planning is not clear from the literature. Strategic planning is considered to be an analytical process whereas strategic thinking is considered to be a creative process (Heracleous 1998). Heracleous (1998) believes the confusion arises from authors interchanging the usage of the terms and that the authors are unclear about the relationship. Heracleous (1998) groups the different relationships into four categories.

1. Strategic planning and strategic thinking are distinctly different mental activities. They are used at different stages in the strategic management process. Strategic thinking should be the precursor to strategic planning. Strategic planning is analytical and doesn't produce strategy. It is the process after the strategy has emerged. According to Heracleous (1998), Mintzberg (1994) believes that planning is based on the fallacy of prediction, detachment and formalisation. Strategic planning is one convergent trajectory whilst strategic thinking is on a one divergent. Strategic planning sets the strategy in operation whereas strategic thinking produces new strategies.
2. Strategic thinking is a cognitive analytical tool, as in the Porter (1991) frameworks. It involves asking what the structure of the industry is and what the organisation's relationship to the industry is.

Heracleous (1998) writes that Mintzberg and Porter represent the two principle positions on strategic planning and thinking. Mintzberg believes strategy is a stream of decisions that can be deliberate or emergent, based on creativity. Porter believes strategy is the product of the value chain, unique, sustainable and not easily copied.

3. Strategic planning's purpose is to facilitate strategic thinking through one of the planning tools and aid creative thinking using such tools as scenario planning (Heracleous 1998). According to Wack (1985a; 1985b) the purpose of scenario planning is to understand risks, anticipate them and discover new options. De Geus (1988) says planning's purpose is aimed at values and changing mental models.
4. Strategic planning, according to Heracleous (1998), has evolved into strategic thinking and become less elitist through changes in organisational practices because planning has moved to line managers and become decentralised. Strategic planning, says Heracleous (1998) should, therefore, be scrapped and the focus placed on strategic thinking.

Heracleous (1998) clarifies the differences between strategic thinking and planning by suggesting they reflect double and single loop learning. Argyris (1977) argues that single loop learning occurs when there is a match between the organisation's plans and its outcomes, when mismatches occur they are corrected without analysis. In double loop learning, Argyris (1977) suggests, there is analysis and questioning of assumptions when mismatches occur.

According to Heracleous (1998), this parallels Fiol and Lyle's lower and higher levels of learning and Senge's generative and adaptive learning. High learning occurs when norms are challenged and altered and there is an understanding of causal relationships; generative learning occurs when the world is seen in a new way.

Lower learning does not question norms and adaptive learning copes with environmental change. In summary, thinking and action are governed by assumptions, challenging the assumptions leads to better actions (Heracleous 1998).

Heracleous (1998) writes that in single loop learning the organisation responds to environmental change as it has in the past by reacting and reengineering, (much as the urban water supply industry appears to do), whereas, in double loop learning an organisation thinks of new ways to do things. In this framework strategic planning is single loop learning because it doesn't question the parameters of achieving goals, it extrapolates the past without focusing on the future. Strategic thinking on the other hand reinvents the future and challenges assumptions and is therefore double loop learning. It leads to new strategies by altering the competitive field, focusing on the future and challenging assumptions. Organisations that succeed in today's changing environment are ones that change the rules of competition (Heracleous 1998). This is consistent with Pascale et al. (2000) concept of how complex adaptive systems operate and is discussed in the conclusions, chapter ten.

Heracleous (1998) believes that strategic planning and strategic thinking are inseparable, ground breaking strategy comes from strategic thinking that needs to be put into operation by strategic planning. Strategic planning and strategic thinking, in Heracleous's (1998) view, are linked in a dialectical process there is a need to see the big picture and the operational implications.

2.9. Strategic thinking and strategic learning

Voyer (1996) says learning occurs when people change their thinking after comprehending the consequences of actions. If people don't review the results of their actions they will not change their thinking and learn. Without learning, strategic change does not occur.

Voyer (1996) cites Isaacs in saying that dialogue increases enquiry and challenges mental models. Dialogue leads to deeper understanding and appreciation of mental models and their influence on strategy. Voyer (1996) also notes that trying to predict the future is foolish.

Liedtka (1998) notes that the term strategic thinking is widely used without being defined to the extent that it becomes almost meaningless. It is often used in the context of thinking about strategy and interchangeably with strategic planning and strategic management.

Strategic thinking is a particular way of thinking. Liedtka (1998) cites Mintzberg, as the founder of strategic thinking. It is a synthesising process, using intuition and creativity to produce an integrated perception of the organisation.

Liedtka (1998) notes that Hamel and Prahalad use the term crafting strategic architecture encompassing the concepts of creativity, exploration and understanding discontinuities. Stacey (Liedtka 1998) looks at strategy through quantum physics and complexity theory and believes strategy making is successful when based on new learning. Strategic thinking is using analogies and qualitative similarities to developing new ideas.

Liedtka (1998) notes a number of challenges arising from the literature to translate the concept of strategic thinking into practice: -

- the literature says what strategic thinking is not but gives no guidance to facilitate its implementation;
- creativity and analytical aspects are polarised when both are needed to develop strategy; and
- strategic thinking and strategic planning seem to be incompatible when in fact strategic thinking is needed in formulating strategy.

Liedtka (1998) suggests that strategic thinking can be defined as a way of thinking and modelled related to five elements.

1. **Systems perspective.** This is the foundation; a strategic thinker has a mental model of value creation, how the world works and the internal and external business environment. The strategic thinker sees the linkages within the organisation and of the elements outside the organisation (Liedtka 1998).
2. **Intent focused.** This is Hamel and Prahalad's (1994) concept in having a vision of where the organisation is going and of the future. It gives direction with discovery and destiny. Liedtka (1998) cites Csikszentmihalyi in that the investment in psychic energy is how we create ourselves; this may be the scarcest resource the organisation has. Strategic thinking is therefore about shaping and reshaping intent (Liedtka 1998).
3. **Intelligent opportunism.** This is the ability of the organisation to adapt, without top management foresight, at the lower levels in the organisation (Liedtka 1998).
4. **Thinking in time.** Strategic thinking, says Liedtka (1998), joins past, present and future, all of which needs to be considered in formulating strategy. For control there needs to be continuity with the past and direction for the future.

The question is what from the past should be kept and what discarded to get to the future.

5. **Hypothesis driven.** Strategic thinking, writes Liedtka (1998), is hypothesis generating and testing. The ability to do this well and efficiently is critical and becomes a core competence of the organisation. Being hypothesis driven strategic thinking bypasses the analytical intuitive division. Strategic thinking is both creative and critical; the hard part is to suspending critical judgement to think creatively.

Liedtka (1998) says that the strategic thinker therefore takes a holistic view and sees all components, it includes a sense of future, and how the organisation moves to that future, is experimental, requiring the best creative and critical thinking to test options.

Liedtka (1998) argues that successful capability in strategic thinking is a competitive advantage for an organisation. The above five elements are advantageous to the organisation because they: -

- create superior value for customers;
- are hard to imitate; and
- enable the organisation to be more adaptable (Liedtka 1998).

Liedtka's (1998) view describes the strategic thinker as a learner, it is the process that is important rather than the end product and plans. The role of planning is to act as a catalyst for strategic thinking. Planning can be the catalyst by creating dialogue about issues. This is invaluable for better strategy and thinking. Planning, that focuses on long term issues, creates the opportunity for strategic conversations leading to choices being made, tested and relationships being built. Dialogue results in shared meaning and understanding of mental models (Liedtka 1998).

The dialogue planning process has three activities, according to Liedtka (1998).

1. Repertoire building. The five elements of strategic thinking have a number of techniques to inform them; e.g. thinking time used in scenario planning, it isn't the scenario that is important but the communal thinking process to create them. Individuals must also have the skills to translate thinking into dialogue within a group; this requires listening, inquiry and an appreciation of group dynamics.
2. Managing the strategic issues agenda is what the planning process is all about and not controlling or overseeing others.

3. Planning is a democratic process which whilst time consuming during the strategy formation process can save time during implementation because there is a shared understanding and commitment

An objective of this study is to stimulate dialogue about how urban water supply services in Australia are delivered. The scenarios developed and presented in chapter nine are a starting point for dialogue by presenting four plausible futures for Australia's urban water supply.

2.10. Strategy as revolution

Technological change, globalisation, deregulation and social change all contribute to a business environment that is in a constant state of flux (Hamel 1996). Organisations, according to Hamel (1996) that can harness these forces of change are causing a revolution in the business world.

Organisations grow old because habits based on successful strategies are too hard to change when the environment changes (Russel 1938). Therefore, organisations require a new philosophy towards strategy creation, strategy that is revolutionary (Hamel 1996).

Hamel (1996) proposes the following set of ten principles for thinking about the way strategy is created to realise revolutionary strategy.

1. In order for strategic planning to be strategic it must be creative. Strategy based on the future being the same as the past is unrealistic. Strategy must challenge what the future looks like and the boundaries of the business.
2. Strategy making must be subversive; iconoclasts reinvent the industry by challenging established convention.
3. The bottleneck is at the top of the bottle in that, historically, senior management has developed the strategy and probably has least interest in changing what has given them success. Strategy making, therefore, must be freed from past experience because the business environment changes and the future, in all likelihood, will not be like the past.
4. There are revolutionaries in every organisation but often there are no mechanisms for them to be heard, they are isolated. Revolutionaries must be given their say, otherwise the danger is that they will leave and challenge from outside the organisation. (The increasing use of email has given revolutionaries the mechanism whereby they can have their say and reduce isolation).
5. Change is not the problem it is implementing it. Employees must be given control over the change process in order for it to gain support.

6. Strategy making must be democratic. A hierarchy of imagination is required as well as a hierarchy of experience giving everyone in the organisation an opportunity to participate in a neutral environment.
7. Anybody can be a strategy creator but it is unlikely that senior management will be the revolutionary. Revolutionaries are thinking about ways to better the organisation and are not intent on destroying it. They should, therefore, be listened to.
8. Perspective is invaluable, to see the world in a new way. Innovations arise in the creation of strategy.
9. Top down and bottom up approaches are not the only alternatives. A slice of decision making through the organisation is required to give a diverse perspective. Often the thinkers are scattered throughout the organisation, however the resource allocation process rests with senior management therefore they must believe and be involved in the revolution. This requires a learning process.
10. The end is not obvious and often in engaging in open strategy making if senior management do not like the outcome it may be ignored. This will kill the source of creativity.

These ten principles of Hamel (1996), capture what other authors have suggested has been wrong with strategic planning in the past and suggestions to improve the process.

2.11. Strategic intent

According to Hamel and Prahalad (1989) global competitors have a fundamental new approach to strategy with organisations having ambitions beyond their resources, high goals and an obsession for winning e.g. Komatsu, Canon and Honda. This is what Hamel and Prahalad (1989) call strategic intent. Management in these organisations motivates people with the value of winning, intent then guides the allocation of resources. Strategic intent, according to Hamel and Prahalad (1989), is the core to winning, it is: -

- consistent over time; and
- sets targets for effort and commitment.

Strategy based on imitation is transparent and whilst flattering for those it is copied from, it will not lead to revitalising an organisation. The fundamental approach to strategy must be different as Sun Tzu (c500BC) said: -

"All... ...can see the tactics whereby I conquer but what none can see is the strategy out of which great victory is evolved." (Hamel & Prahalad 1989, p64)

Hamel and Prahalad's (1989) research showed that Western and Eastern organisations have different strategies. Two basic models emerged.

1. The Western model strategy is focused on maintaining strategic fit by constraining ambition to match resources and looking for sustainable advantage and niches. There is a focus on reducing financial risk with consistency in action by conforming to financial objectives. Human resources are allocated to business units.
2. The Eastern model, the focus is on leveraging resources to achieve seemingly unattainable goals. The emphasis is on organisational learning and developing new rules of engagement to reduce the competitive risk. Human resources are allocated to core competencies. This is strategic intent.

Hamel and Prahalad (1989) say that strategic planning uncovers problems whereas intent reveals opportunities. With the pace of change in today's business environment it is important for organisations to focus on what they need to do differently in the future. Strategic intent is flexible and open to innovation in the way goals are achieved.

The challenge in strategic intent, according to Hamel and Prahalad (1989), is to achieve goals with limited resources. Hamel and Prahalad (1989) write that in setting challenges organisations must engage all staff including management to: -

- create a sense of urgency by using weak signals in the business environment;
- develop competitive awareness using information;
- give employees the skills required to compete, improved skills are the most defensible competitive advantage;
- allow the organisation to come to terms with a challenge before commencing others; and
- set goals and review outcomes.

For the purposes of this research the planning focus will be on issues in the business environment that may impact on the urban water supply industry in the future. By scanning the business environment for weak signals organisations can prepare for change and perhaps be ahead of others less vigilant.

2.12. The biological metaphor

For organisations to meet the complexity of the business environment they need to be flexible and adaptable to relentless change, they need to be in a state of fluidity, complexity and chaos (Ahmed 1998). Ahmed (1998) uses the biological metaphor to describe an organisation that can re-constitute itself to match the environment, an ephemeral organisation.

Ahmed (1998) believes that linear thinking and logic are deficient in the new business environment and that knowledge and power need to be distributed throughout the organisation. Ahmed (1998) suggests an organisational structure should be like the brain for efficient, rapid response to external environmental change so that the organisation can survive. In a complex business environment central systems of control are too slow for survival. The centralised system is only needed to allow the individual parts to make their own decisions. The human body works in this way and so should complex organisations, which are large social systems.

Matheson and Matheson (1998) note that whilst strategic risk does not often occur it comes out of left field, representing a fundamental change in the business environment. These changes can be from social, technological, environmental, economic or political sources. The change rearranges the business environment, upsets the rules of engagement and can lead to the demise of organisations. Data analysis does not prepare the organisation for such events because they are unknown. However, by monitoring the environment weak signals of fundamental change may be detected. The way to deal with these events is for management to think strategically rather than tactically.

Matheson and Matheson (1998) use the analogy of the body, if the brain is confused and weak and out of touch with the environment then other parts of the body cannot function. As with an organisation if management is out of touch with the business environment and possible change then the organisation is at risk. It is, therefore, vital that the organisation scans its business environment for signals that may be the harbinger of change.

Matheson and Matheson (1998) say that uncertainty must not be ignored but confronted and taken into consideration in decisions in order that the organisation does not miss a strategic change of direction in an industry. Matheson and Matheson (1998) use the example of Motorola, an industry leader that was left behind because it failed to direct attention to digital phones as opposed to analogue.

Beinhocker (1999) suggests using nature as a guide rather than predicting the future. The power of evolution should be used to develop and manage a series of strategies that may evolve over time. This is more robust than focusing on a single strategy.

Byrne (1996), like other authors, notes that strategic planning is again in favour in an attempt to increase profits but with a different focus. He states, it should be done by line managers, and be seen as an opportunity to change the rules for competitive advantage. Again biological terminology is used, such as co-evolution and ecosystem. Byrne (1996) also talks about white space opportunity where there is growth potential in areas that don't necessarily fit existing business units.

2.13. The emergent strategy

Mintzberg and Waters (1985) ask the question, 'How is a strategy formed?'

Mintzberg and Waters (1985) researched this critical question, using the definition of strategy as 'a stream of decisions' and being either intended or realised. This resulted in the identification of strategies as either deliberate or emergent. Deliberate strategies arise from a group of people possessing a mission whereas emergent strategies are not guided by intention. According to Mintzberg and Waters (1985) deliberate strategies require: -

- precise intentions;
- actions consistent across all employees; and
- actions must be realised as intended in a perfectly predictable environment.

Mintzberg and Waters (1985) say that this situation although closely existing is rare, as is a perfectly emergent strategy where there would be no intention in action other than responding to a change in the external environment requiring action. These two situations form the end members of a continuum along which most strategies fall.

Mintzberg and Waters (1985) conclude from their research that strategy formation is more deliberate in tightly knit organisations and emergent in loose, decentralised organisations. The underlying implications of these different strategies is that emergent strategies surface the notion of strategic learning, whereas traditional deliberate strategies suppresses this concept to the extent that signals from the environment are not recognised by the organisation. Emergent strategies and learning on the other hand suggests that changes in the external business environment are noticed by the organisation and that it learns from these signals.

Mintzberg and Waters (1985) meaning of emergent strategy is that the organisation is flexible and responsive to its external environment but not out of control, this is important in an uncertain environment.

Moncrieff (1999) cites Mintzberg in saying that realised strategy is often emergent and suggests three criteria behind a dynamic strategy process.

1. Implementation of strategic intent.
2. Responding to emerging issues.
3. Learning.

Moncrieff (1999) also cites Johnson in saying that intended and realised strategy are formulated within the organisation's paradigm of its business environment and that paradigms can desensitise the organisation to environmental change. To change the paradigm requires learning from others and challenging assumptions. Successful innovative strategies require analysis, vision, assumptions and beliefs in an atmosphere of social and political interaction. Moncrieff (Moncrieff 1999) suggests strategy is: -

- a learning process;
- an action process;
- a behavioural process; and
- a holistic continuous process.

Hamel (1998) says that in a discontinuous world strategy innovation is the key to success. Successful organisations such as Nike, Compaq and Intel developed non-linear strategies. In the present turbulent world, deep strategic thinking is vital for success. Hamel (1998) espouses that strategy must be reinvented such that it is important for organisational survival in the new economy.

Hamel (1998) cites Stuart Kauffman's work on complexity theory, whereby life began as an autocatalytic system; Hamel (1998) asks what would be needed to catalyse new strategies in a similar way?

Hamel (1998) goes on to say that strategists don't know where new strategies come from and that a theory of strategy formation is required. Hamel (1998) agrees with Mintzberg (1994) in the notion of emergent strategy and adds that this does not stop organisations assisting the process of strategy innovation. By creating a conducive environment, emergence can be stimulated. In the past senior management has focused on the strategy making rather than developing the climate to produce the strategy innovation.

Hamel (1998) suggests that the goal of making strategy is to have order, without careful crafting, with preconditions and a broad outline rather than at the detailed level. Hamel (1998) uses the internet as an example of how what started as a simply designed concept is now richly interwoven and complex.

Hamel (1998) suggests that strategy is at the junction of perfect order and total chaos. If this is true then there are implications for developing strategy innovations. Hamel (1998) says that we could do something to make the accident of strategy making easier, to improve the odds of insight occurring, this is the process school of strategy.

Hamel (1998) asks whether great strategy is luck or foresight, suggesting it is both and questions how can serendipity in strategy formation be made to happen and how can emergence be promoted? Hamel (1998) suggest five preconditions for emergent strategy.

1. New voices, through participation.
2. New conversation to juxtapose isolated knowledge.
3. New passion from individuals given the opportunity to participate.
4. New perspectives from all stakeholders.
5. New experiments from which to learn.

Hamel (1998) concludes by saying that more time should be spent in understanding strategy than making it; to invent 'a strategy oven' through emergence, self organisation, cognition and organisational learning.

2.14. Why do we need to plan for the future?

A critical question that was not been addressed is why do organisations' need to plan for the future? From the literature it appears part of the answer is to assist organisations make better strategies through a systematic logical approach (Langley 1988).

Loasby (1967) answers the question with three responses.

1. To understand the future implications of present decisions in order for the organisation to get the full benefit from its present decisions.
2. To understand the implications of future events in order to make decisions to prepare for the future. This is an attempt to forecast the future.
3. To provide motivation and a mechanism for dealing with the above and reviewing assumptions about the future.

In 1976 Koch (1976) wrote that planning is necessary because of the increasing complexity of the economy and society. Economic decisions affect a wide range of issues; therefore, planning is needed if these decisions are to have the desired affect. Planning is also important because, increasingly, people want to have control over their own destiny and eliminate the Darwinian outcomes of competition. Kock (1976) was writing about democratic planning in France and whilst she questions whether the goals of planning could be achieved it highlighted people's desire to have control over their future.

Rahardjo and Dowling (1998) say that organisations face a myriad of threats and opportunities to their financial viability and survival. In this complex business environment organisations need to ask what their objectives are in risk management and subsequent decision making. The answer is not only to enhance the value of the organisation but also to protect it from unforeseen events in the future.

According to Wilson (1998) in today's fast changing business environment strategic thinking and strategy formation are essential tools for all types of organisations in order to deal with future uncertainty. Slow change can be dealt with systematically; however, radical change requires rethinking of strategy. Strategy gives direction for the organisation to negotiate through the environmental mine field of the business world.

2.15. Forecasting and foresight

Some of the earlier literature focuses on strategic planning as a tool for forecasting the future in order for the organisation to be prepared for what might happen. Forecasting that was based on historical information and past events.

In 1949 Henri Fayol (1949) wrote that managing means looking ahead and that if foresight is not the whole of management it is at least a major part of it. According to Fayol (1949) to foresee was to assess the future and make provision for it and that any plan needs to have unity, continuity, flexibility and precision. It meant that organisations should be run as if the future was foreseen. The plan of action was considered indispensable and that experience, from the past, was what determined the value of the plan. An organisation needed a single plan; to have two would mean confusion and disorder. Fayol (1949) did, however, recognise that there would be unexpected events but the plan would protect the organisation against such events and any resulting enforced changes of course.

Predicting and preparing is, according to Ackoff (1983), the paradigm of management with predicting and forecasting being the more important. Decision makers, however, regard their errors as being derived from poor prediction, all they

wanted to know from their planning departments was what was going to happen. The decision makers would take care of the preparation, hence the past growth and investment in forecasting the future.

Ackoff (1983) goes on to say that forecasts are based on descriptions of the past and that data is fitted to a line and projected into the future. The assumption is that what has happened in the past will happen in the future. It is people's obsession with prediction and preparation that is the major obstacle in being able to achieve a desired future (Ackoff 1983).

In discussing the fallacy of predetermination, Mintzberg (1994) says that forecasting is planning's method to predict the future but if the future does not exist how can there be knowledge about it. Mintzberg (1994) makes the point that the literature on planning stresses the issue of making accurate forecasts, which is fine, so long as the business environment does not change. The problem with forecasts is that they are only an extrapolation of the past into the future, with any change in the environment all or any extrapolations may be inappropriate.

Mintzberg (1994) cites Makridakis in reference to peoples' ability to forecast. People predict by observing regularities, providing a pattern exists, however if a one-off event occurs predicting becomes impossible. The paradox is that no matter how inaccurate forecasts are, no planning is possible without forecasting and estimating uncertainty (Mintzberg 1994).

This raises the question if forecasting is so notoriously inaccurate why has so much time and resources been spent on it? Gimpl and Dakin (1984; Mintzberg 1994) suggest the reason for the obsession with forecasting is to relieve anxiety; it is nothing more than a superstitious behaviour to lend confidence to deal with the future.

The following writers have commented on forecasting and predicting: -

- Linneman and Kennell (1977) say that forecasting is important but it has limitations in that many key variables are unpredictable. This, in 1977, was Linneman and Kennell's (1977) apprehension about planning for the future.
- Allaire and Firsirotu (1989) argued that strategic planning is focussed on predicting in order to prepare for the future. The strategic plan gives a fixed target and a method to get there.
- Williamson (1999) says that single line forecasting leads an organisation into one future, an organisation should have a portfolio of strategic options.
- Simpson (1998a) wrote that strategic planning is not about forecasting and predicting but about ideas.

- Hecht (1997) says that traditional forecasting worked well in the 1950's and 1960's since then forecasting errors have been more frequent and with more dramatic consequences. Today's business environment is too uncertain, and it's this uncertainty that's a basic feature of the business environment.
- Beinhocker (1999) wrote that developing strategies based on prediction about the future is wrong in an uncertain world. The business environment is highly unpredictable and people are generally poor at forecasting. The past should not be used as a predictor for the future.
- According to van der Heijden (1996) forecasting can lead to over planning and false security because of the difference between real and perceived uncertainty.

This particular point is consistent with a constructivist ontological position adopted for this study. Therefore perceptions of uncertainty may be 'real' for one organisation but not for another.

From the literature it seems that the fundamental problem with forecasting is that today's business environment is too unpredictable to accurately forecast the future. Unpredictability arises from the increasing rate of change meaning that what has happened in the past may be inappropriate for future strategy development. The literature review continues with an investigation of uncertainty and change in the business environment.

2.16. Uncertainty and change

Emery and Trist (1965) recognised that one of the main problems for organisations is that the environmental context in which organisations exist is constantly changing. This change is becoming faster and more complex and is often not recognised until it is too late. Organisations can fail to appreciate that a number of outside, connected events, can lead to irreversible change in the business environment. Emery and Trist (1965) called the business environment 'turbulent fields'. The business environment is dynamic; the ground is consistently in motion. According to Emery and Trist (1965) three forces contribute to the turbulent field.

1. Decisions and actions by large organisations initiate ripple effects throughout the environment. This notion is one of the tenets of chaos theory and the butterfly effect (Gleick 1987).
2. The interlinking between organisations and the economy to the extent those organisations have to be regulated by legislation.
3. The need for research and development for organisations to meet competitive challenges. This ensures there is continuous change.

Emery and Trist (1965) postulated that these forces increase the level of uncertainty in the business environment because they are generally outside the control of individual organisations.

Emery and Trist (1965) say that survival for an organisation can be precarious if it attempts to deal tactically with each environmental variance as it occurs. Survival becomes critically linked with what an organisation knows about its environment. Organisational objectives need to be defined in terms of the capacity of the organisation to make and meet the competitive challenge.

Loasby (1967) says that uncertainty about the future should not be considered ignorance, it is in fact knowledge. An exact forecast can hide uncertainty and give less information about the future than a forecast with a range of values. Over confidence can result in commitment to future plans with a reluctance to change them when new information is received or the business environment changes. It also means new information can be ignored or not sought. Timely new information means the organisation can change direction if necessary. What is critical is to have an organisation that can deal with uncertainty.

2.17. How to deal with uncertainty

If uncertainty and change results in forecasts being too unpredictable how can organisations deal with uncertainty in order to survive the turbulent fields of the business environment?

According to Ackoff (1983) predictions are based on the use of causal laws of change to the present or past situation, choice is therefore eliminated. Rather than forecasting Ackoff (1983) suggests that the future can be subjected to creation and can be postponed if it depends on what the organisation does between now and the future, this is a matter of choice. Therefore the solution for dealing with uncertainty is to control cause and effects in order to control the future. Ackoff (1983) illustrates this in a business environment that consists of uncontrollable variables that impact on a decision, but if these variables can be changed then the impacts are changed or removed.

Ackoff (1983) suggests that organisations should engage in contingency planning to prepare for unforeseen events. These possibilities do not need to be predicted but are based on human perceptions about the nature of reality; *weltanschauung*; and what may happen in the future. Through learning and adaptation organisations can increase their control and responsiveness to their business environment. Precise prediction and preparation is not required.

Other writers and researchers have proposed similar and different ways to deal with uncertainty in an ever, faster, changing business environment.

Pennington (1972) noted that change is part of the world in which we live and accordingly plans must change. Plans need to be regularly reviewed, resisting change usually leads to failure. In fact an uncertain future can be valuable because the organisation has to adapt quickly as the future unfolds. Successful organisations prepare for this environment with appropriate plans and actions.

Malmlow (1972) writes that the business environment changes too quickly for anything other than a comprehensive approach to planning. All available information, from both internal and external sources needs to be assembled in order to develop different 'what if' scenarios to meet a range of challenges.

Linneman and Kennell (1977) proposed that organisations should adopt a systematic method of monitoring the environment and they should consider long-range planning as a continuous process. They suggested that multiple-scenario analysis could be a valuable tool to make today's decisions flexible enough for an uncertain future.

In a more detailed analysis Allaire and Firsirotu (1989) called uncertainty the 'Achilles Heel' of strategic planning particularly in a predict and prepare mode to cope with the future. Allaire and Firsirotu (1989) outlined three ways to deal with uncertainty.

1. **Predict and prepare.** This Allaire & Firsirotu (1989) considered to be a wise strategy, despite its shortcomings, as some trends will remain the same, however, it assumes that the future can be simulated, converting unpredictability into predictability. This leads to contingency plans based on assumptions that can be used as present and pre-set responses to a situation that might not quite fit the plan.
2. **Dominate or eliminate uncertainty.** Actions organisations can undertake to eliminate uncertainty include political lobbying, negotiation, compromise, acquisition and mergers, divesting, passing the risk to others, disciplined rather than uncontrolled competition. These actions can eliminate some uncertainty; the disadvantage is that they can result in long term stagnation with severe consequences when new products and competitors emerge (Allaire & Firsirotu 1989).
3. **Build a capacity for flexible responses and adaptation.** This aims at reducing the organisation's vulnerability to unpredictability. It can be achieved through a broad product base, strategic alliances or an organisational structure that absorbs uncertainties that are outside the organisation's control (Allaire & Firsirotu 1989).

In summary Allaire and Firsirotu (1989) suggest that fundamentally the organisation must be able to adapt to changes in its external environment arising from social, technological, economic, environmental and political sources. Allaire and Firsirotu (1989) say this can be achieved by operating the larger organisations as small entrepreneurial entities by: -

- being loosely coupled, vertically integrated and having the benefits of large organisations without the penalties; and
- being able to move in many directions to take advantage of new windows of opportunity when they arise.

The cost of this type of organisational structure is less control, the trade-off for flexibility and being able to adapt when unpredictable events occur (Allaire & Firsirotu 1989).

Uncertainty, from the literature review, appears to be the essential reason to engage in strategic planning; however the organisational structure and politics can hamper the process resulting in strategic planning becoming an oxymoron. The first step is to consider uncertainty and in doing so surface the critical strategic issues. This awakens the organisation to different world views of the future business context (Allaire & Firsirotu 1989).

Surfacing the critical issues for the Australian urban water supply industry is the focus of this study and has been achieved by asking senior managers from water utilities their perceptions about the uncertainties facing the future of urban water supply.

Taylor (1997) commented that a rapidly changing business environment has left the old methods of strategic planning obsolete. He suggests the way to deal with this environment is to have a continuous dialogue about the future rather than a single detailed planning event.

Taylor (1997) suggests three directions for strategic planning.

1. Strategy formulation involving, inter alia, determining the driving forces of the business environment in order to formulate a strategic vision.
2. The strategic vision which management wants to sell to stakeholders.
3. Strategic implementation, through internal changes to the organisation and or changing the rules of play.

Taylor (1997) suggests that to deal with unpredictability organisations have in recent years engaged in downsizing restructuring and reengineering. They need now, more than ever, strategic thinking and strategic planning in the form of: -

- continuous dialogue;
- decisions focused on key strategic issues;
- small teams focused on corporate projects;
- organisations working to internal targets;
- consultants considering the future to develop a corporate vision, key issues emerge as gaps are identified;
- the organisation aligned to the strategy; and
- focusing on strategic implementation.

Research by the Strategic Decision Group (Matheson & Matheson 1998) outlined nine principles in decision making the most important is embracing uncertainty. If organisations do not face uncertainty then risk might be avoided, however, the organisation will achieve little. An alternative is to proceed blindly into the future; both of these strategies are likely to lead to the demise of the organisation in an unpredictable business environment (Taylor 1986).

2.18. Strategy formation for uncertainty

The major focus of writers such as Porter (1980; 1985) has been on the organisation's business environment and the assumption that this determines the organisation's freedom to develop strategies. Competitive advantage arises by positioning the organisation in its environment. The question is how does the organisation develop a defensible competitive strategy in a changing business environment (Marsden 1998)?

Igor Ansoff (1980) noted that during the 20th century organisations had developed many different responses to environmental change. Environmental changes are, according to Ansoff (1980), defined as strategic issues and an analysis of environmental trends identifies these issues. The speed of change means that annual planning cycles are often inappropriate. Timely response requires anticipation of change and, given enough advanced warning; the time can be used wisely for a response (Ansoff 1980).

As stated previously to adapt quickly to a changing environment, organisations need to be flexible and all parts of the organisation need to work together (Lester, Piore & Malek 1998).

According to Simpson (1998a) the key to an organisation's success is to have a good sense of direction (Onsman 2000). Strategic planning is about ideas not forecasting and predicting. Ideas are a scarce resource in strategic planning.

Strategy should take place at all levels in the organisation in order to surface a wide range of ideas. Simpson (1998a) agrees with Hamel and Prahalad in that ideas should be canvassed from:-

- young people;
- those on the edge of the organisation; and
- those with experience outside the organisation.

Van der Heijden et al. (2002) suggest that another key element is to include 'remarkable' people not associated with the organisation or industry who bring an alternative perspective to the issue under consideration.

According to Simpson (1998a) strategy formulation is a creative process that should be undertaken routinely and to be successful, strategy needs to be owned by the people in the organisation. Whilst data is useful for strategy development it is historical and over reliance on it can be dangerous.

In planning for the future, in an unpredictable world, four philosophical and pragmatic forces, according to Gaddis (1997), threaten these two essential skills.

1. The concept of chaos in complex systems and small random events with potentially significant impacts on the future.
2. The effects of cultural heritage and religion. The notion of the world being linear, evolutionary and progressive was ideal for future planning and for long term improvement through the development of strategic planning. These notions are now challenged resulting in doubts about meeting the challenges of the future.
3. Incrementalism and the idea that corporate change should be by degrees, some strategic planners challenge this in that change should be allowed to emerge.
4. Short term profits from takeovers rather than building long term competitive advantage.

Gaddis (1997) says that at the centre of this challenge is the concept of what influence people can have on the future, whether they are purposeful or powerless. In the past management has believed it was purposeful in shaping the organisation's strategic future. The dilemma is that management must be accountable for the organisation's future and understand these four forces in order to respond.

Eisenhardt (1999) suggests that a critical question for organisations is how to maintain competitive advantage. Advantages are never permanent the winners are those that create shifting competitive advantage. This requires strategic decision

making at all levels in the organisation. According to Eisenhardt (1999) this is created by: -

- having collective intuition (paradigms, mental models), to see and act on opportunities and threats. This requires real time information about the business environment. The information must be shared through intensive interaction to develop the collective intuition that allows rapid response to opportunities when they emerge;
- stimulate strategic thinking by creating alternative points of view by using, for example, scenario planning. Considering multiple alternatives helps to prevent stale thinking and adds confidence to decision making. Diverse teams of people help to provide varied points of view. Differing alternatives diffuse interpersonal tension by giving people room to move and save face;
- a disciplined time frame in which to make decisions so that they are timely and maintain momentum. Decisions should be prototyped and then analysed to gain consensus; and
- eliminate political behaviour by emphasising a shared vision and a balanced power structure. Politicking leads to competition and distortion of the facts resulting in a poor decision and time wasting. This reduces the internal pecking order and fosters information sharing.

Eisenhardt (1999) says that in a fast moving environment strategic decision making results in superior performance and becomes a key capability.

Ginsberg (1997) writes that the revitalised model of strategic planning lacks one of the main criticisms of past practices, the top down approach. Current processes are open and involve more people throughout the organisation and from outside the organisation. Strategic planning, therefore, has a more holistic approach than it used to, being based on a wider range of stakeholders. Strategic thinking is emphasised and the ability to balance comprehension, creativity and consensus results in superior strategic performance.

2.19. Scanning the environment

According to McKiernan (1997) and Marsden (1998) as the business environment in which organisations operate becomes more complex the limitations of linear forecasting in planning have become obvious. Organisations have had to shift from forecasting to developing scenarios for the future in order to improve the organisation's fit to its environment. This requires the organisation to sieve through environmental signals and decode information, all of which requires additional

resources. The key for the strategist is to find a position that is defensible against competition.

Ghoshal and Westney (1991) say that the challenge for people scanning the environment is to produce information that is perceived to be useful. Most managers agree that environmental information is important but they often don't use the information. Those that do, use it because past experience has shown that new developments are constantly occurring that might impact on the organisation either positively or negatively. Environmental scanning, according to Heene (1997), assists the organisation to align with its business environment by imagining the patterns between elements that impact on the organisation and which dictate strategies for future action.

Environmental scanning is not a new concept. In 1980 Ansoff (1980) documented the changing business environment and introduced strategic issue management. However, increased computer technology and the development of the World Wide Web have made this process more readily accessible and reliable for organisations.

Ansoff (1980) writes that a strategic issue is a future event, from any source whether social, economic, environmental, technological or political, that will impact on the organisation either positively or negatively. The issue can be from internal or external sources. Strategic issue management is a system for early identification and response to events impacting on the organisation. Early identification of issues requires continuous monitoring of the business environment and for early response decision responsibility must be delegated. Early detection of critical issues leaves more time for a response, hence the importance of detecting weak signals in the organisation's business environment.

According to Ansoff (1980) strategic issue management, like strategic planning, requires senior management commitment to the process particularly for delegation of responsibility. It is also critical that when an issue arises senior management accepts new issues that may be outside previous experience, and which may impact on the organisation.

Ackoff (1983) introduced a decision making model for organisational rapid response, learning and adaptation. It included an environmental surveillance function in order to detect unusual events that had happened or were likely to happen in the environment. Surveillance should be as wide as possible. It is critical in order for the organisation to adapt to a changed environment and for rapid response to change.

Ackoff (1983) says that the rationale for organisational learning and adaptation is to increase control and responsiveness to uncontrollable events in the business environment. Often, because of rapid change, the solutions to problems are

outdated before the organisation can respond to the problem; the life expectancy of solutions is rapidly reducing.

In introducing the concept of environmental scanning this study will focus on scenario planning as a tool to surface critical issues in the business environment of the Australian urban water supply industry. These issues may be predictable or unpredictable and have positive or negative impact on the industry.

2.20. Summary

Just as the business environment is turbulent so too strategic planning has had a turbulent past. The literature is full of the reasons why strategic planning has failed in so many cases to deliver the desired outcomes of the proponents. There are a number of schools of thought on strategy formation and none should be considered in isolation as a method to develop strategy but are part of the complex world of strategy formation that has and continues to evolve over time. Indeed some schools overlap and have evolved from one another. They are based on two philosophical backgrounds one Newtonian with a mechanistic perspective and the other from the social sciences with an organic perspective (Farjoun 2002). The extremes represent the philosophical perspectives of a continuum about the world and the nature of reality. Those end members are the positivist and constructivist points of view and represented by, for example, the design, planning and positioning schools and at the other end the environmental, cultural and learning schools.

Following the constructivist paradigm and the concept of the organisation as a living learning organism, strategy should follow an organic perspective and be adaptable to the external environment in order for the organisation to survive. The key is creating the right environment so that the organisation can learn and learn faster than its competitors.

Following the organic perspective the general theme from the literature is that organisations need to be flexible and responsive to their business environment, they need to adapt to change rather than trying to forecast and predict the future. Being flexible and adaptable is important in an unpredictable world. Fast moving organisations that are aware of their environment and look for weak signals from the environment are able to take advantage of unpredicted events when they occur. The concept of the living organisation is ideally suited to this type of business environment.

The documented failure of traditional strategic planning techniques to deliver desired outcomes prompted the researcher to focus on scenario planning as a method for strategy formation and to use the method for this study. The following

chapter will focus on the theory of scenario planning as a method to create the right environment for organisational learning, as a tool for strategy formation from an organic perspective and as a process for perceiving a number of different futures for an organisation.

CHAPTER 3 – THEORETICAL BASIS OF SCENARIO PLANNING

'Never let the future disturb you. You will meet it, if you have to, with the same weapons of reason which today arm you against the present.' Marcus Aurelius Antoninus (121AD-180AD), (Moncur 2004).

3.1. Introduction

As has been discussed in the previous chapter, strategic planning has had a mixed record of success with organisations (Mintzberg 1994). Some of the problems seem to arise from the ever, and increasingly faster, changing business environment (Allaire & Firsirotu 1989). Another problem has been that the organisation's strategic plan has been developed by senior management without much involvement from employees (Simpson 1998a). In many instances organisations have not been prepared for major events that changed their competitive advantage and indeed the whole business environment (Mintzberg 1994). Organisations have tried to forecast the future but invariably this has been based on the extrapolation of existing data (Ackoff 1983).

A concept that has emerged in recent years is the notion of the organisation being a living entity, a learning organisation that learns, grows and most importantly can adapt to a changing business environment (de Geus 1997a; 1997b).

All of the above has lead to the evolvement of a number of strategic planning models and processes or tools to assist organisations to formulate strategy. In order to prepare organisations for a future that is uncertain it is important for organisations to think outside the traditional mental model of their business and to involve the intellectual power from a number of backgrounds both within and from outside the organisation (Simpson 1998a). What is also important is to have the right conditions under which creative thinking can take place (Hamel 1998). A process that brings these elements together and has resulted in significant success is scenario planning. Scenarios, in the context of scenario planning, are stories about the future, developed by a group of people within an organisation (van der Heijden 1996). Phelps et al. (2001) write that scenario planning is a tool that provides a starting point for an organisation to consider the future and from which to formulate strategy based on a number of scenarios as to how the future business environment might look. Scenario planning addresses some of the concerns of traditional strategic planning and forecasting by providing alternative outlooks to the future.

In order to develop an overview of scenario planning, the process and philosophical background a number of key authors have been referred to Schwartz (1991), Schoemaker and van der Heijden (1992), Schoemaker (1995), van der Heijden (1996), Ringland (1997), Fahey and Randall (1998), van der Heijden et al. (2002) and Lindgren and Bandhold (2003).

3.2. Origins

Scenario planning originated as a military tool during the Second World War for war games and contingency planning (Schoemaker 1993; Hecht 1997). Following the War, Herman Kahn developed scenario planning as a business process through the Rand Corporation and Hudson Institute (Godet 1987; Kleiner 1989; Tibbs 1998; van der Heijden 1996; Ringland 1997; Fahey & Randall, 1998; van der Heijden et al. 2002; Lindgren & Bandhold 2003). According to van der Heijden (1996) the importance that Khan saw in the process, because it is value free, was that it allowed managers to see the world in a different way and therefore develop a different mental model of the business environment. The phrase 'thinking the unthinkable' is associated with Kahn's work (Fahey and Randall 1998).

Van der Heijden (1996) and van der Heijden et al. (2002) write that since the 1960's scenario planning has gained prominence in the business world. Initially the process was one of forecasting a number of different futures, rather than a single line forecast, and assessing the most likely outcome. The problems with this approach soon became evident and the process now relies on qualitative causal thinking to enhance the understanding of a changing society.

In the 1970's Shell, through the work of Pierre Wack and SRI International, developed a process that linked scenario planning to strategic planning (Fahey & Randall 1998). Shell is generally considered to be one of the first organisations to use the technique consistently and successfully and in particular to judge the effects of the crude oil price on investment decision making (Wack 1984; 1985a; 1985b; van der Heijden 1996; Hecht 1997; van der Heijden et al. 2002). According to van der Heijden (1996) and van der Heijden et al. (2002) early use of the technique was based on the assumption that planning was based on predictability. If there were total uncertainty then planning would be a waste of time. The key therefore is to determine what is predictable, predetermined, and what is uncertain.

Schwartz (1991), van der Heijden (1996) and Lindgren and Bandhold (2003) write that this early work with scenario planning lead to the establishment of five objectives from the technique.

1. The formation of decisions that are robust under alternative futures.
2. Better thinking about the future.

3. Better appreciation of events, as part of a pattern, and perception of their implication.
4. Setting the context through which decisions are made.
5. Using scenarios to provide leadership.

In recent years many organisations have used scenario planning successfully in order to escape the traditional forecasting methods of strategic planning (Fahey & Randall 1998).

Wilson (1973) recognised that because the business environment was changing faster, planning had to be more far seeing, complex and adaptive rather than based on trends from a stable past. Global changes impact on local organisations from the perspective of social, technological, economic, environmental and political issues. Constant monitoring of the business environment is required to detect early warning signals, without filtering data, and understand the significance of change and discontinuities in trends. Schwartz (1991) uses the metaphor of a radar signal, when a return signal is received with something unusual the phenomena should be investigated. The organisation must determine the implications of change, which may challenge core business values. Pierre Masse (Godet 1987) uses the concept of a germ as a harbinger for the future, a signal that is small in size but huge in terms of consequences.

Wilson (1974) in discussing the dangers of relying on a single model of the business environment noted that scenario planning was a useful technique for exploring different futures and integrating the facts of technology, economics and the environment with the subjective notions in sociology and politics. Scenarios accept uncertainty and discontinuities in order to take multiple views of the future (Wilson 1973).

3.3. What is scenario planning?

Organisational planning is important and necessary, however, in many instances it has deficiencies in that it is a distorted representation of what is happening in the business environment and does not consider variables (Schoemaker 1995). Schoemaker and van der Heijden (1992) describe scenarios as tools to improve decision making against different future business environments. It is a disciplined method for considering possible futures (Schoemaker 1995); a way of discovering the future (Tenaglia & Noonan 1992). Scenarios are not predictions or science fiction (Schwartz 1991). They help organisations and creative minds to think systematically about and envision the future and to see and embrace change (Tenaglia & Noonan 1992). Scenario planning combines inside and outside the box thinking (de Geus 1988). Scenario planning is a precursor to strategic planning

(Barker 1996). The purpose of scenario planning is not to identify a particular future but to explore and highlight the major forces that will push the future in a particular direction (Wilkinson 1995). Scenarios are a tool to identify the forces driving a system through systematic analysis of trends and uncertainties. Scenarios highlight dynamics and reflect a broad range of issues and view points (Schoemaker 1991).

Van der Heijden (1996) and van der Heijden et al. (2002) write that scenario planning is about organisational learning by giving organisations the ability to perceive potential futures, consider what they mean for the organisation and take appropriate action.

Scenario planning simplifies data into a few alternatives by decomposing complex phenomena into analysable sub-units (Schoemaker 1993) in order to tell a story of how the variables might interact. Schoemaker (1993; 1995) says that scenario planning is also a tool to: -

- examine the cumulative impact of a number of uncertainties;
- identify patterns and clusters of information from a number of possibilities; and
- challenge mental models of the business environment, expand and stimulate new thinking.

Schoemaker (1993, p195) describes scenarios as: -

“Focused descriptions of fundamentally different futures presented in coherent script like or narrative fashion.”

Scenarios work because the future told in the narrative is recognised, it rings true (Schwartz 1991).

Wack (1984) describes scenarios as a way to surface the entrepreneurial power of foresight in an environment of rapid change, complexity and uncertainty.

According to Wack (1984) scenarios deal with two worlds, fact and perception. They explore for facts and aim at perceptions, in the minds of managers. They gather information of strategic importance and transform it into new perceptions (Wack 1984; Kleiner 1989; Hecht 1997). Chapman (1976) says that other forms of simulation models aim at determining the future from current trends whereas scenario planning looks at the future from the perspective of choice and how decisions made now can influence the future. This is a philosophical different way of looking at the future. Therefore, scenarios describe a number of mental images of the future as they might unfold. Scenarios give decision makers the freedom to act with confidence because they have knowledge about the uncertainties (Schwartz 1991).

Scenarios make decision makers more aware of uncertainty by stimulating thinking in a systematic way (Schoemaker 1991). According to Schoemaker (1993) scenarios are not forecasts with probability distributions. They are a sounding board for better understanding future uncertainties. Scenarios force people to think about the future based on sound analysis of 'reality' (Wack 1984; Simpson 1992)

Schoemaker (1993) says that to gain the full benefit of scenarios they must be integrated into the organisations strategic planning system through: -

- focused scenarios;
- competitive positioning;
- strategic vision; and
- options management.

Schoemaker and van der Heijden (1992) and Schoemaker (1993) say that scenarios focus on: -

- issues of concern to the organisation;
- predictable elements in the business environment;
- trend breaks, unpredictable elements with known consequences;
- surprises with major implications for the; and
- explaining the interrelationship among trends and uncertainties.

Scenarios are developed from a key issue in order to answer a critical question such as: -

'What might give the organisation continued competitive advantage?' (Schoemaker 1992, p67)

Schoemaker (1992) argues that scenario planning can be used by an organisation facing major uncertainties, and trend breaks when the rules of the 'game' change. It helps the organisation think outside the box by challenging and stretching conventional thinking in order to map out a future. It gives the organisation an appreciation of long term threats and opportunities and helps it discover the boundaries of future outcomes.

Tenaglia and Noonan (1992) and Schoemaker (1995) say that scenario planning is visionary, it can be used in developing the organisation's strategic plan particularly:-

- in a business environment of high uncertainty;

- for generating new opportunities;
- when the level of strategic thinking is low;
- for developing a common language in the organisation; and
- when there are strong differences of opinion.

Good scenarios say Schwartz (1991) and Simpson (1992): -

- must be plausible, internally consistent and surprising;
- have the power to break stereotypes;
- are used to rehearse the future; and
- help to recognise warning signals that a particular future is unfolding thus avoiding surprises and enable the organisation to act quickly (Using scenarios to navigate the future 1986).

Wack (1985b) describes the purpose of scenarios as: -

- a way to challenge the assumptions of the business environment;
- anticipating and understanding risk;
- a way to discover strategic options that the organisation was previously unaware of;
- an internally consistent pathway to the future; and
- highlighting the driving forces, relationships and uncertainties in the business environment.

A way to think about the future is to imagine what a possible future might look like and then determine if the tools and resources are available to get to that future. Thomas (1994) and Mathews (1997) describe scenario planning as one such tool that communicates the future and is a learning mechanism from the insights offered by the scenarios.

3.4. Scenario planning the theoretical background

The philosophical basis for scenario planning is that the organisation is a living organism that learns and whose goal is to survive and flourish. Survival is the ultimate driving force for any organisation (van der Heijden 1996).

3.4.1. The context

In introducing scenario planning and answering the critical question; why do we need to plan; van der Heijden (1996) imagines an organisation gaining competitive

advantage by being able to adapt faster to environmental change than its competitors. By preparing the organisation for the risks that might befall it, and by being aware of changes in the business environment earlier than its competitors, an organisation can gain an enormous competitive advantage. This is one of the outcomes of scenario planning (Simpson 1992).

Van der Heijden (1996), in introducing scenario planning, writes that a basic assumption in strategic planning is that organisations should understand the benefit of thinking strategically about the future in order to consider where they want to go and how to get there efficiently. However, many managers are unable to find the time and resources in this fast changing world to think strategically. Scenario planning is about efficient strategic planning in an uncertain business environment when, in times of rapid change the reaction time of an organisation can mean the difference between survival and extinction.

According to Emery and Trist (1965) and van der Heijden (1996) there are two parts to the organisation's external business environment.

1. The contextual environment over which the organisation has little influence but which sets the boundaries under which the organisation operates.
2. The transactional environment over which the organisation has significant influence and can change the environment to its own advantage.

In discussing scenarios van der Heijden (1996) is talking about the external environmental context of the organisations. Scenarios are used to test the organisations strategy against what might happen and in doing so fine tune the strategy; this is called 'windtunneling'. The success of the organisation depends on how well it positions itself for this future contextual environment. In chapter nine, Discussion, van der Heijden's (1996) model is used to evaluate each of the key uncertainties for the urban water supply industry for inclusion in the scenario matrix.

3.4.2. Psychological basis

Simpson (1992) suggests that people generally prefer certainty. The psychology of decision making is based on past experiences and the decision maker's mental model, or constructed 'reality' (Simpson 1992), of the business environment (Wack 1984). Schoemaker (1993) says that scenarios focus specifically on uncertainty across all possible futures. Each scenario bounds the uncertainty without specifying a probability of it occurring. This is consistent with the learning and understanding premise of scenario planning rather than problem solving and choice.

Kleiner (1989), Tenaglia and Noonan (1992) and Schoemaker (1993) have all written on the subject of the psychological basis for scenarios and whilst not all in agreement psychologically scenarios appear to have the effect of:-

- promoting wider thinking by providing many insights into a complex phenomena and challenging people's mindsets;
- overcoming availability bias where people undervalue what is difficult to remember or imagine; and
- shifting the anchor from which people view the future, this may be in the past and can be very misleading for the future.

To improve the psychological impact of scenarios it is important to understand what makes them accepted. This, according to Schoemaker (1993), is influenced by:-

- who develops them; source credibility;
- what they say; context credibility; and
- who presents them and how they are presented; channel credibility.

Schoemaker (1993) writes that what is also important is whether they are labelled as findings, hypothesis or conjectures. A scenario that is presented as certain will leave it difficult for people to return to a previous mindset. However, if they are presented as a possibility they will be less threatening.

Causal reasoning, according to Schoemaker (1993) is important in scenarios because causality is what psychologically binds the universe. More detailed scenarios are often seen as being more believable. People become victims of the conjunction fallacy, which assists people to take seriously unlikely scenarios. This counterbalances overconfidence in one scenario, one bias is exploited to overcome another.

Schoemaker (1993) says that a number of psychological issues impact on scenarios.

1. The effects on people's beliefs, confidence and problem perception.
2. Factors that determine causal strength, coherence and plausibility need to be understood.
3. Cognitive areas of comprehension, metaphors and scripts explain why scenarios work well.
4. Understanding how scenarios have emotional impact so that people 'feel' the future.

3.4.3. Philosophical basis

Schoemaker (1993) writes that the underlying philosophical premise of scenario planning is Hegelian because scenarios court contradiction and paradox. In considering a number of scenarios of the future and 'reality' its philosophical paradigm is constructivist. Traditional approaches to planning, on the other hand, through decision analysis and forecasting are Leibnizian, which seeks a single truth of 'reality', a positivist paradigm.

Russell (1961) suggests that part of Hegelian philosophy is that all the characteristics of the subject must be known before the interrelationships can be understood; enough must be known to recognise something. A holistic view is taken in order to understand 'reality'; the whole is 'reality' whereas a part is not the whole 'reality'. Hegelian philosophy seeks the truth of 'reality', there being more value in the whole than the parts. Any portion of the universe is profoundly affected by its relationship to the whole. A part isolated from the whole is changed in character. Maintaining the biological metaphor in reference to Hegelian philosophy:-

'The eye is worthless when separated from the body' (Russell 1961, p713).

Russell (1961) writes that Leibniz believed in an infinite number of substances, which he called monads, each monad was a soul. He believed in the doctrine that substances cannot interact; therefore no two monads can have any causal relationship to each other even if they seem to have. The resemblance of harmony comes from the pre-established harmony between the changes in one monad and another in the same way as two clocks strike the hour at the same time because they keep perfect time together. And in the same way two plus two equals four, there is no synergy to the extent that the whole is greater than the parts.

These two philosophies demonstrates the difference between the constructivist, subject-subject relationship and understanding the causal relationships of events in the business environment, an objective of scenario planning and the positivist, subject-object relationship of analysing individual events in order to forecast the future.

Wack (1985a) says that scenario planning's philosophy is based on perception and judgement. Scenarios explore facts and aim at perceptions by gathering new information of strategic importance to create new perceptions. An organisation's decisions are made on its internally constructed 'reality' of the business environment (Simpson 1992).

Godet (1987) writes that organisations have a high level of competitiveness when they have a strategic culture. This has three elements: -

1. Future awareness.
2. Strategic resolve.
3. Joint commitment.

Godet (1987) says that if any one element is missing the organisation loses direction. Godet (1987) likens this to a Greek Triangle, Anticipation, Action and Incarnation in which three interrelated worlds describe humanity's relationship to nature: -

- Sophon, the spirit, mind;
- Techne, materialism, body; and
- Poiesis, emotion, soul.

This relationship is depicted in figure 3.1 (Godet 1987).

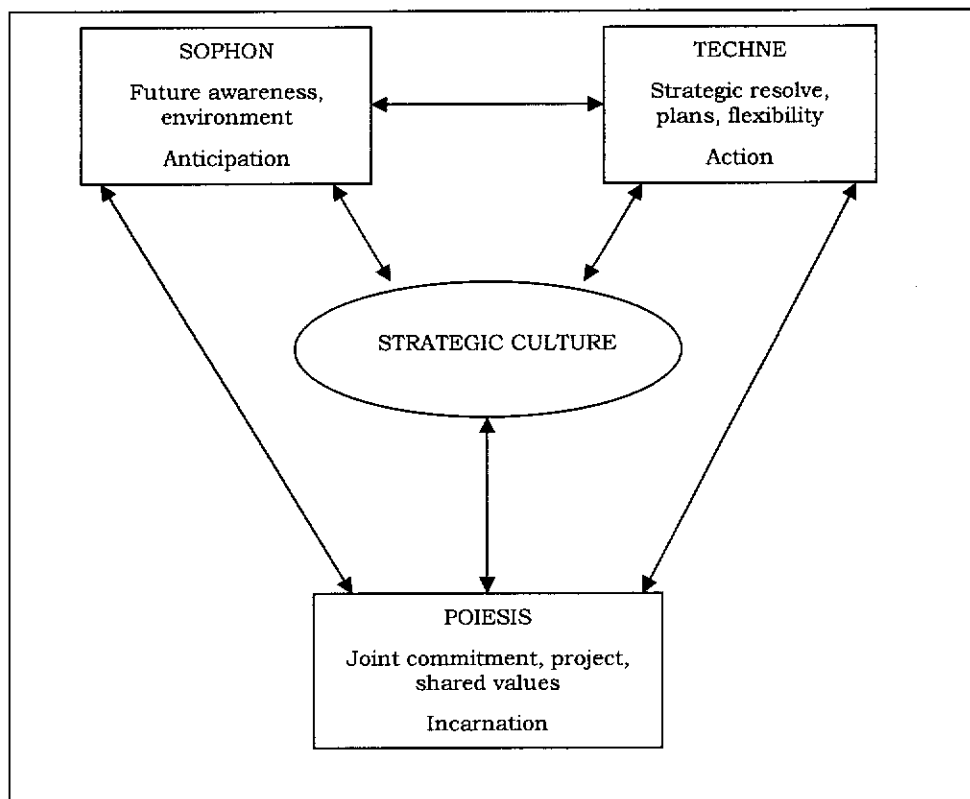


Figure 3.1. The Greek triangle

Source: (Godet 1987)

Chermack and van der Merwe (2003) review the literature for the implicit connection between scenario planning and constructivist thinking in the context of learning in order to make the connection explicit and provide a theoretical basis for

scenario planning. In addition Chermack and van der Merwe (2003) write that traditional strategic planning has a positivist assumption in its attempts to define the future.

3.4.4. Organisational learning

Senge (1994) and van der Heijden et al. (2002) say that large hierarchical and bureaucratic organisations are slow to adapt to environmental change, unless there is a crisis. Adaptation is, however an essential part of learning. Humans not only learn through trial and error but they learn because they want to learn.

In order to survive and flourish, according to van der Heijden (1996), an organisation must have a good fit with its environment. In order to achieve this, a good business strategy should: -

- aim for survival and development of the organisation;
- determine the organisation's strengths and weaknesses;
- develop an understanding of the organisation's business environment, opportunities and threats;
- assess the fit between the organisation's capabilities and the business environment; and
- propose a strategy of actions to improve the fit.

Van der Heijden (1996) writes that scenario planning aims to address all these criteria but what distinguishes scenario planning from other forms of planning is that it addresses uncertainty. In dealing with uncertainty planning becomes an ongoing learning exercise as opposed to a once off planning exercise. There must be a continuous effort to quantify the uncertainty, therefore planning never stops until the uncertainty dissolves, however; scenario planning assumes there is constant uncertainty.

Van der Heijden (1996) argues that scenario planning is, therefore, organisational learning and involves the whole organisation. Individual members in the organisation learn creating a synergy of greater value than the sum of individuals. What emerges is a unique organisational behaviour.

Van der Heijden (1996) and van der Heijden et al. (2002) write that organisational learning only occurs when people share their experiences; develop a theory, plan and act together to establish a learning loop. In an organisation this requires a critical mass of opinion and planning, a shared mental model; otherwise there is uncoordinated individual action. Effective conversation assists people to appreciate others' world view and develop a shared understanding of a situation.

If consensus in the organisation falls below a critical mass, according to van der Heijden (1996), it is management's role to increase consensus so that a critical mass of shared view allows whole of organisation action to be achieved. At the other extreme over consensus leads to unanimous thought and reduced sensitivity to environmental changes. Van der Heijden et al. (2002) say that scenarios provide the environment for different views to be considered and strategic thinking to develop a shared view and organisational learning.

Not only is learning important in an organisation but the speed of learning is also important (de Geus 1988), as was discussed in chapter two of this study. It is achieved by having short learning loops. Accelerated change in the business environment requires shorter feedback loops for information on the internal and external environment to produce quicker response times to new learning (Taylor 1997). This means decision making is delegated to the point of experience, decentralisation.

Van der Heijden (1996) says that the scenario planning process contributes to learning in individuals and organisations by: -

- being an efficient way to organise data through stories;
- increasing what individuals see in the business environment and expanding their mental model;
- enabling people to think through ideas from conversations;
- assisting the conversation process across a wide range of views;
- facilitating communication of business issues at an organisational level; and
- aligning mental models for cohesive action.

Scenarios also act as a cautionary vehicle when there is a single view of the business environment; they enable other possibilities to be considered. Scenarios help to create order out of many confusing issues (van der Heijden 1996).

Van der Heijden (1996) writes that the three basic steps in learning; perception, theory and action, benefit from scenario planning through stories about the future; they make the organisation more perceptive of the business environment and change its mental model to produce actions.

In his work at Shell with scenarios, de Geus (1988) asked managers to consider what they would do if a particular situation arose in the future. They were asked to consider what they would do if oil prices fell to \$15 a barrel when the price was presently at \$27 a barrel. Approximately six months later oil fell to \$10 a barrel but because Shell had considered this environment they were able to make strategic

decisions in what was a rapidly changing business environment whilst other organisations were still considering their options. By considering a future business environment before it happened institutional learning had been considerably increased (de Geus 1988).

3.4.5. Paradigms

In order to put scenario planning into the context of strategic planning van der Heijden (1996), based on work by other authors Lindblom (1959), Mintzberg and Waters (1985) and Mintzberg (1994), describes three broad paradigms for strategic management. These are the rationalistic, evolutionary and processual schools of thought. These schools of thought have been discussed previously in chapter two. Scenario planning attempts to integrate thought from these three schools.

The rationalistic school, according to van der Heijden (1996), tries to find the one right answer for the future and with enough resources it can be discovered. The process starts with a mission; strategies are designed to meet objectives to realise the mission through a number of options. Van der Heijden (1996) says that there are limitations in this approach, these are: -

- have all the options been identified? and
- has the organisation enough resources to identify the best option?

Scenarios assist in identifying a wide range of options (van der Heijden 1996; van der Heijden et al. 2002).

Van der Heijden (1996) and van der Heijden et al. (2002) write that the rationalistic strategy requires a prediction about the future, in a world that is highly unpredictable. This prediction is, invariably, done by one person with the assumption that they have superior knowledge about the future. The pit-falls of forecasting and prediction in an uncertain business environment were discussed in the previous chapter. Van der Heijden (1996) writes that sensitivity analysis can be used to consider a range of outcomes to which probability analysis can be applied. This is basically the same as forecasting a number of futures. Scenarios on the other hand describe a number of futures, all of which are plausible but structurally different from each other, they are all considered to be equally likely of eventuating.

The evolutionary school, according to van der Heijden (1996), produces the pure emergent strategy, as previously discussed in chapter two. It is strategy that is retrospective and satisfies the psychological needs of people. However, as in nature there are mutations and only the fittest survive in the changing business environment. In times of rapid change, organisations tend to react to events as they arrive, rather than having a holistic business strategy. Organisations hope that whatever decision is taken, it is the right one to enable them to survive. Because of

the randomness of events, managers feel more comfortable with a flexible system than with a fluid strategy, this leaves enough room to change direction if necessary.

The processual school, writes van der Heijden (1996), is based on the idea that organisational success requires original thought from people. This requires the intellectual power of the organisation to be mobilised. An environment needs to be created to allow ideas that will improve the organisation's fit to its environment, to be surfaced (Hamel 1998). Van der Heijden (1996) continues by saying that it is the internal organisational processes that are important to establish a loop linking action, perception and thinking so that the organisation continually learns from experiences. The learning loop is the key difference between the rationalist and processual paradigm. Under the processual paradigm there is continuous development as uncertainty is faced.

Senge (1994) says that one of the purposes of planning and scenario planning in particular is, as stated previously, to alter the mental models of managers. The problem with a fixed mindset is that information that doesn't fit the paradigm, or mental model, is blocked out. It is important that different mental models are recognised.

3.4.6. Mental models

Organisational perceptions of the business environment are as important as investment decisions because business strategy comes from these perceptions (Wack 1985a).

Wack (1984) writes that a person's mental model of the business environment is based on experience and knowledge; it is a construct that never mirrors 'reality'. Decisions are behaviour alternatives within a mental model and a good decision matches the fundamentals of the 'real' world, the decision maker's mental model or as Wack (1985a) calls it, microcosm. However, it can be difficult for decision makers to break out of their mental model whilst working in it as illustrated by a Chinese proverb (Wack 1984, p102): -

"The fish is the last to know it swims in water."

In order for the scenario planning process to work effectively the decision maker's perception of 'reality', their mental model and assumptions about how the world works must be altered (Wack 1985a).

Wack (1984) and Senge (1994) say that scenario planning requires the existing mental model of the business environment to be placed on the table and restructured. A bridge must be created between the new unfolding business environment and the decision maker's microcosm; scenarios are that bridge. The new microcosm is created from elements perceived relevant to the business

environment. Scenarios convey and communicate the world view throughout the organisation (Wack 1985a). Strategy is a product of a worldview. When the world changes a new common worldview is required (Wack 1984; Schwartz 1991).

Schoemaker (1993) writes that scenarios aim at consensus building of strategic issues by bounding the future, and in this way consensus building can work. This results in a conceptual framework of the future, which can be updated with new information. By having a mental model of the future it helps to distinguish signals in the environment from noise information. Consensus building of the mental model is a key to identifying the assumptions about the business environment and the critical uncertainties (Tenaglia & Noonan 1992). The end result is better decisions about the future (Schwartz 1991).

3.4.7. The living organisation

Organisations are organisms and strategic planning is a way for the organisation to learn. In order to survive the organisation must adapt when it acquires new knowledge (Ackoff 1983; Kleiner 1989). Under the processual paradigm, writes van der Heijden (1996), the organisation is complex and adaptable. It adapts to external forces and becomes more internally complex to deal with external forces. Higher levels in the organisation guide and constrain lower levels. The constraints are assumptions imposed by the organisation. These constraints mean individuals in the organisation are no longer free to act independently. This, according to van der Heijden (1996), results in the organisation: -

- behaving to address external conditions;
- moving to favourable environments to improve survival; and
- reorganising to achieve the above.

The organisation, therefore, needs to become a living organisation in order to survive and prosper.

Van der Heijden (1993) and van der Heijden et al. (2002) say that if the organisation is viewed as a self organising brain then strategic vision becomes an emerging property of the organisation. A characteristic of the living organism metaphor is the harmonious cooperation between semi autonomous operations with the purpose of self development and survival. The organism must be aware of its environment to take advantage of opportunities and counter threats. Being more adaptable to the environment is a competitive advantage for the organisation.

Scenario planning, according to van der Heijden (1996) and van der Heijden et al. (2002) is a process to tap the creative resources of an organisation. It acknowledges that competitive advantage comes from original innovations. This leads to a fitter

organisation because the organisation is more robust to deal with external shocks by increasing adaptability through environmental awareness.

3.4.8. Conversation

Van der Heijden (1996) writes that conversation is the key to the processual paradigm. If organisational action is based on a shared mental model then only through conversation within the organisation can all the players have a shared mental model of the organisation's business. New experiences from the business environment can only be shared by conversation. A continued strategic conversation is required for scenarios to be successful for an organisation.

3.4.9. Competitive advantage

Wack (1984) says that a sustained competitive advantage comes from, amongst other things, finding barriers to entry so that a strategy can emerge and not be copied. The strategy then becomes the innovative, unique property of an organisation giving the organisation a competitive advantage. The one right answer of the rationalist paradigm would be available to everyone and therefore holds no competitive advantage. Scenario planning enhances the capability of the organisation to develop innovative strategic capability (van der Heijden 1996). Sustainable competitive advantage comes from learning faster than other organisations and competitors (Kleiner 1989; Schwartz 1991; van der Heijden 1993; van der Heijden et al. 2002).

3.4.10. Uncertainty

In chapter two of this study the concept of uncertainty was discussed and the impact uncertainty has on the organisation's strategic planning for the future outlined.

Van der Heijden (1996) discusses three types of uncertainty.

1. Risks, where historical events enable a probability to be placed on an outcome.
2. Structural, a unique, cause and effect, event with no indication of likelihood.
3. Unknowables, an unimaginable event.

Van der Heijden (1996) says that scenario planning assists in surfacing what might happen in the business environment by looking at different, future business environments and 'wind-tunnelling' the robustness of the business strategy for these events. In terms of unknowables scenario planning helps the organisation by sharpening its perception skills and reaction to unknowables.

Uncertainty is a basic feature of the business environment (Wack 1985a). Wack (1985a) says that scenarios help to deal with uncertainty by: -

- accepting uncertainty and trying to understand it by making it part of our reasoning;
- helping the organisation to understand the business environment by seeing events as a pattern, this avoids conservatism and allows some risk taking;
- putting structural uncertainty on the agenda, which avoids undue risk; and
- helping the organisation to be adaptable, enhancing mental models and perceptions to recognise the unexpected.

Van der Heijden (1996) and van der Heijden et al. (2002) say that whilst there is uncertainty some elements of the business environment are predictable or inevitable. These are known as predetermined elements. Some examples of the predetermined elements in business are people's culture, beliefs and values; however, how people will react can be uncertain. Economic development and structure is usually confined to a predictable or inevitable range but predicting the detailed outcomes is uncertain. Whilst an event may be predictable or inevitable the timing of its occurrence may be unpredictable such as weather conditions. Other examples are slow changing phenomena such as population growth, constrained situations, elements in the 'pipeline' such as aging population and irreversible collision (Schwartz 1991). Scenario planning considers both predetermined/inevitable events and unpredictable/uncertain events (van der Heijden 1996; van der Heijden et al. 2002).

A full outline of forecasting was discussed previously in chapter two. Forecasting can work when all elements are predetermined (Wack 1984). Wack (1985a) writes that a degree of forecasting is necessary in planning while recognising that there are inherent problems with forecasting. The main problem being that there are trend breaks in the business environment that mean forecasts, based on the past, are no longer valid. Forecasts tend to miss the critical turning points in the business environment (Wack 1985b).

Godet (1987) writes that frequent errors from forecasting and the inability to predict crisis attest to its inadequacy. It is impossible to see into the future using past data alone without the input from qualitative information. Godet (1987) says the future must be studied in order to understand the past. Godet (1987) calls this '*La prospective*'. This is a way of thinking about the future using fatalism. In uncertain times it is important to invest in the intellectual process of forecasting using scenarios (Godet 1987). Godet (1987) summarises the difference between forecasting and the prospective approach in table 3.1.

Table 3.1. Comparison of forecasting and 'La prospective'

| | Forecasting | 'La Prospective' |
|------------------------|--------------------------|---------------------------------------|
| Viewpoint | Piecemeal | Holistic approach |
| Variables | Quantitative | Qualitative |
| Relationships | Static | Dynamic |
| Explanation | Past explains the future | Future is the purpose for the present |
| Future | One and certain | Many and uncertain |
| Method | Economic, mathematical | Structural analysis, multiple impacts |
| Attitude to the future | Passive / adaptive | Active / creative |

Source: (Godet 1987)

The future is not the same for everyone because there are several futures, the one that transpires results from the interaction of unequal human forces; therefore the future becomes one of a balance of power (Godet 1987). Godet (1987) suggests that present action should be based in light of the future and that uncertainty should be explored.

Schoemaker (1993) suggests that the degree to which an organisation incorporates uncertainty into its strategy depends on its ability to adapt to a changing business environment and its acceptance to follow one future. Commitment to one future is a major risk for an organisation (Godet 1987).

3.4.11. Time horizon

Chapman (1976) and Schoemaker (1992) write that because of the increasing rate of change in the business environment the planning time horizon for many organisations is becoming shorter. The time horizon, however, depends on the type of business and industry. In fast moving industries such as computers and communications the planning horizon is short whereas for industries such as water supply utilities the planning horizon is much longer due to the length of time to augment water sources. The urban water supply industry, the focus industry for this study, considered five years was a short term time horizon. In shorter planning horizons strategies must be flexible to adapt to changing environments.

Determining the time horizon for the scenario is one of the first critical decisions to be made.

Van der Heijden (1996) says that the relationship between momentum and volatility in the business environment determines the planning horizon. There is predictability in the short term but long term there is only uncertainty.

The time frame, according to Schoemaker (1995) can depend on:-

- the rate of change;
- product life cycles;
- political elections; and
- competitor planning horizons.

3.4.12. Difference to traditional planning

Scenario planning has three key differences to traditional planning, according to Schoemaker (1993).

1. Intent; scenario planning is problem defining rather than problem solving.
2. Implementation in organisations as a result of scenario planning is fluid whereas from traditional planning implementation is structured.
3. Philosophical premise Hegelian as opposed to Leibnizian.

The advantages of scenario planning, according to Schoemaker (1993), have been found to outweigh the disadvantages required of a steep learning curve, broad organisational ramifications and the changes necessary as an organisation moves from scenario planning into strategy development.

3.5. Summary

This chapter has reviewed the theoretical, constructivist, basis for scenario planning. Scenario planning is a process of changing an organisation's paradigm about the business idea in an environment that is changing and uncertain (van der Heijden 1996). Scenario planning aims to understand the cause and effect relationships in the business environment and present a number of plausible futures (van der Heijden 1996). Scenario planning is not about forecasting the future (Schoemaker 1993).

Scenario planning requires the organisation to learn from weak signals in the business environment that herald change, in order for the organisation to adapt to that new environment (van der Heijden 1996). Perhaps the most powerful aspect of scenarios is the stories they tell about the future that aim at changing the mind sets within organisations about what the future might look like (Mathews 1997).

The following chapter of this study will outline the scenario planning methods that although, in the view of some, is regarded as an art form, is increasingly using scientific methods supported by computer software to ensure that the organisation strategic conversation is adequately represented.

CHAPTER 4 - AN OVERVIEW OF THE SCENARIO PLANNING PROCESS

'The trouble with our times is that the future is not what it used to be.' Paul Valery
(1871-1945), (Moncur 2004).

4.1. Introduction

In the previous chapter the theory of scenario planning, its origins and philosophical background was reviewed. This chapter presents the practice and methods of developing scenarios.

4.2. Scenario development

4.2.1. Basic approaches

In different writings Schwartz (1991), van der Heijden (1996) and Fahey and Randall (1998) each describe three ways of doing effective scenario planning.

1. **The inductive method**, van der Heijden (1996) writes, builds step by step on the data presented, the story, or framework, emerges out of the incremental addition of data. Each piece of information is depicted on a card illustrating an event or through a specially designed computer program. In this method predetermined events are in each scenario and uncertain events are in only one. The scenarios are built around the events with some events naturally clustering around each other in three or four scenarios. In each cluster the events should flow to maintain internal consistency. On completion the scenarios are named (van der Heijden 1996) (Fahey & Randall 1998). Another way to undertake the inductive method of scenario planning is to start with a few cause and event relationships and build up a short story. Each short story is then grouped into three or four logical piles. This way logic generates the events. The pit fall of this method is that favourable and unfavourable scenarios eventuate. One of the basic tenets of scenario planning is that all scenarios should be plausible (van der Heijden 1996).
2. **The deductive method**, as described by van der Heijden (1996) and Fahey and Randall (1998), starts with a framework to which the data are added where it appropriately fits. Three or four outcomes from a present position are identified and named to depict the story. Data from the research are described in a few words on a card or through the use of a computer program. These are then clustered in natural groups. The groups can be based on a limited number of key events, key trends or two or three key driving forces. In using key driving forces the end members of each driving force are used to create a matrix such that two key driving forces produce four scenarios. This depends on identifying

only two or three key driving forces. Whichever grouping method is used the final stage is to construct the scenarios from the data available to reach the initially identified outcome through a series of events. Different and creative scenarios enable the scenario team to visualise new mental models of the business environment from the data presented (van der Heijden 1996; Fahey & Randall 1998).

This study is a desk top scenario planning exercise, as discussed in chapter nine, and has therefore deviated from traditional methods of conducting scenario planning; however, the process has followed the deductive method of developing the scenarios.

3. **The incremental method**, according to Schwartz (1991) and van der Heijden (1996), is suitable for organisations that have not fully adopted the scenario planning way of thinking. In this case the official future is used as the starting point either by identifying flaws in the official future, from which alternatives are proposed, or by exploration into new mental models of the future business environment. The key is to make sure the alternatives have underlying differences in the driving forces. If the official future is internally inconsistent, then a new scenario addressing the inconsistency is developed.

Van der Heijden (1996), Fahey and Randall (1998) and Lindgren and Bandhold (2003) say that whatever method is used it must suit the organisation and the stories attached to each scenario must be memorable, interesting and rich in information whilst being creative and like all good stories should have a beginning, middle and end. Each scenario, according to Simpson (1992), van der Heijden (1996), Fahey and Randall (1998) and Lindgren and Bandhold (2003): -

- is a narrative linking hypothetical events of the future, but in order to be plausible they must be anchored in the past and emerge logically;
- must be understood as a whole and be identifiably different from other scenarios;
- must be internally consistent with an underlying model;
- must be fundamentally different;
- must contain the predetermined elements identified;
- must identify and describe the key driving forces; and
- must attempt to answer the critical question within the time frame established.

Schoemaker (1991; 1992; 1993) outlines ten steps in constructing scenarios.

1. Define the issue in terms of time frame, scope and decision variables. Review the degree of past uncertainty.
2. Identify stakeholders and their roles, interests and level of power.
3. List trends and predetermined elements affecting the subject of interest.
4. Identify key uncertainties.
5. Construct two scenarios, one with positive outcomes of uncertainties and one with negative outcomes.
6. Check for internal consistency and plausibility.
7. Create new scenarios, more than two that are internally consistent and have eliminated the impossible. These should cover a wide range of futures.
8. Revise the scenarios after assessing how the stakeholders might behave. These are the learning scenarios that can be revised with new information.
9. Formalise interactions in scenarios with a qualitative model and simulation.
10. Reassess the uncertainties and dependant variables to produce decision scenarios.

4.2.2. Establishing the critical question or key issues

In undertaking scenario planning it is important to first set the agenda target or critical question to be addressed, the 'key issue' (Schoemaker and van der Heijden 1992) and define the parameters of the problem so that a picture of the future is established (Mathews 1997). Schoemaker (1995) and van der Heijden et al. (2002) note that major stakeholders need to be identified.

Van der Heijden (1996) and van der Heijden et al. (2002) say that it is possible to use scenario planning as a general strategy formulation tool, however, this may limit the organisation's perception of trend breaking events that might occur in its business environment, a sort of 'blinkering' of the organisation. This can be overcome by involving people from outside the organisation, who have different perspectives of the business environment, in the scenario planning process.

The first step, according to Schoemaker (1995), is to determine what is of strategic importance and of concern to the organisation and to explain them in terms of the impact they have on the organisation. Spies (1994) notes that outlining and conceptualising the critical question or key issue is one of the first steps in scenario planning. The key issue must be outside the control of the Chief Executive Officer and or the business unit. Scenario team members should consider the values of the organisation and focus on outcomes that are not predetermined. In addition the key issue should reflect an aspect of organisational life where decisions are not easily

reversed or undone after changes occur (Ringland 1997; van der Heijden et al. 2002; Lindgren & Bandhold 2003).

4.2.3. Environmental scanning

Analysis of historical data is required to interpret what is currently happening in the business environment and from which the scenarios for the future are based.

Computer based and library searches help gain this information and evaluate the business environment in which an organisation operates. Environmental scanning is now frequently carried out through the use of search engines and specialist information support personnel.

Environmental scanning, as a preliminary activity in scenario planning, assists in clarifying the critical question which, in turn, assists to focus the environmental scanning.

Environmental scanning can also be assisted through discussions with people in the organisation to determine what they feel is critical to the future success of the organisation (Mante-Meijer, Duin & Abeln 1998). The forces that drive the success of the organisation can be surfaced through interview or group brainstorming using the SWOT, strengths, weaknesses opportunities and threats, analysis technique (Wack 1984).

If individual interviews are conducted then a group session for feedback to all participants should be held (Schoemaker and van der Heijden 1992; van der Heijden 1996).

Van der Heijden (1996), Fahey and Randall (1998), van der Heijden et al. (2002) and Lindgren and Bandhold (2003) say that in holding a group feedback session it is usual for a diverse range of strategic issues to be presented on the nature of the business and its environment. Often the ideas presented are found to be surprising and show the diverse range of views or mental models of the business, within the organisation. This can generate further ideas and the process should continue until no new data is generated, this is the saturation point. The SWOT analysis can then provide the basic data for scenario planning.

4.2.4. Pre workshop interviewing

According to Barker et al. (1999), prior to commencing scenario planning and in order to gain maximum information about the organisation, interviews are held with a minimum of twenty carefully chosen people from within the organisation. These people will later attend the scenario planning workshop. In addition about twenty people external to the organisation are also interviewed who have expertise in the area being workshopped. The objective is to gather as wide a range of information as possible.

People from the organisation to be interviewed should include the CEO in order to include people with the power to act and learn from the process (de Geus 1988). The scenario planning team should also consist of people who are specialists, generalists and team players covering a spectrum of demographics (Barker et al. 1999). Van der Heijden (1996) and van der Heijden et al. (2002) discuss the inclusion of a remarkable person who is capable of adding a different perspective to those from the organisation and adding insight to the scenario planning process.

Schoemaker (1995) poses four questions that need to be asked in defining the scope for the scenario planning process.

1. What knowledge would be of greatest use for the next, say 10 years?
2. In retrospect what from the past would have been useful to know in advance?
3. What have been past sources of uncertainty?
4. Will there be the same rate of change in the future?

Another set of seven valid and reliable questions, designed by de Geus (1998), are also often used. These look at concerns and uncertainties, future directions, pivotal events, decisions either long term or short term, constraints and what people would like to be remembered for (de Geus 1988). Interviews are used to explain what issues deeply concern people in the organisation (Wack 1984). Chapter seven Research Method discusses the development of the questionnaire for this study, which was similar to the de Geus (1988) outline.

This information is analysed and key trends and themes are extracted for use in a workshop setting. This is the point at which this study deviates from the traditional scenario planning method. This research was designed to develop scenarios as a desk top exercise in order to identify the critical issues for the future of the Australian urban water supply industry. Whilst the method adopted for this study has limitations in terms of scenario planning, it does present an opportunity to further this research and presents the critical issues for the industry. These are discussed in chapter ten, Conclusions.

4.2.5. Workshop

Schwartz (1991) says that a workshop of usually two days duration is held, with twenty of the above participants from the organisation, where the key trends are discussed and prioritised. The scenario team selection is important; members must be multi-disciplinary, they must be able to suspend disbelief and think outside their world view of the business environment. Fahey and Randall (1998) write that team members must be open-minded and be decision makers but not all chosen from line management. A gender balance is important as is age differential and the

selection of generalists as well as specialists from within the organisation, as stated previously, is important to provide for a variety of input.

The objective of scenario planning is to balance relevance and novelty (van der Heijden 1996). Novelty comes from the interaction of people who know the scenario agenda and from people outside the organisation, referred to as remarkable people, who have original insights (van der Heijden 1996). Adding one or two carefully chosen external people into the organisation's scenario planning process provides this additional insight (van der Heijden et al. 2002).

Van der Heijden (1996) writes that a wide range of issues will be discussed that are internal and external to the organisation. Because scenario planning is concerned with the contextual environment of the business and its possible future environment the external issues are dealt with separately to the internal issues. These, according to van der Heijden (1996), are known as the driving forces.

4.2.6. Driving forces

Schoemaker and van der Heijden (1992), van der Heijden et al. (2002) write that the various strategic issues or driving forces in the external environment can be grouped into one of five categories, social, technological, economic, environmental and political. The acronym 'STEEP' is used to depict these categories. This analysis forces the organisation and its business units to understand the competitive situation and find ways to improve it.

Van der Heijden (1996) says that the workshop group examines the driving forces of the system to determine which forces can be predicted and which are the major uncertainties about the future. This results in an understanding of how the business environment works.

In addition van der Heijden (1996) notes that in scenario planning it is important to understand the broader picture of the industry structure in which the organisation operates. The industry structure is the result of competitive forces; these are Porter's (1980) five competing forces as discussed in chapter two of the literature review and chapter nine, Discussion.

This study assesses a number of key uncertainties from the interview data to determine two key driving forces for the scenario matrix. The assessment process and outcomes are presented in chapter nine, Discussion. In addition because the driving forces are an important part of this study they are discussed in more detail in chapter five.

4.2.7. Scenario formation

The data gathering process accumulates a vast amount of information about the future business environment of the organisation. This has to be distilled into a

number of categories. To undertake this process clear group communication and decision making is required of the workshop participants. The data is categorised into the strategic issues that are the most uncertain and most important to the 'key issue' in the time frame, as determined by the workshop group, that the scenarios will extend to.

Schoemaker (1995), van der Heijden (1996) and van der Heijden et al. (2002) say that these issues are clustered and up to six areas of major uncertainty to the organisation are selected. These form the scenario agenda. Five to six major issues are a comfortable number to deal with in a scenario planning session, more and the exercise becomes cognitively difficult. This is related to Miller's (1956) the magical number seven, plus or minus two, and the limits to human cognitive powers. Each of the major areas of uncertainty should be exclusive of others. If there are numerous strategic issues then each needs to be ranked in order to select the top ranking issues to be addressed by the scenario planning exercise (van der Heijden 1996).

Lindgren and Bandhold (2003) write that the scenario planning process, having identified the key uncertainties expresses them on an X and Y grid, tree or matrix from which four plausible futures are described. The method chosen enables uncertainties to be clustered.

Schoemaker and van der Heijden (1992) and Schoemaker (1995) describe this step as constructing the scenario themes around a key concept or extremes of key uncertainties. For this study a similar process of clustering was undertaken during data analysis and is discussed in chapters seven, eight and nine.

4.2.8. Number of scenarios

Scenarios are constructed in the workshop environment. The exact method of scenario construction is flexible. However, each of the major five to six uncertainties identified must be included in each scenario. Also included is as much of the data from the interviews and discussions at the workshop that is relevant to the story line. Scenarios, van der Heijden (1996) writes, are given names to identify the major issues within each story. These names then provide one of the communication links when the final scenarios are taken back through the organisation. The scenarios developed and presented in chapter nine include as many issues from the data as were relevant to each particular scenario.

Wack (1984), Simpson (1992), Mintzberg (1994) and Mathews (1997) and van der Heijden et al. (2002) all discuss the number of scenarios that should be developed. Two scenarios does not give enough insight, they offer an either or future; three scenarios can lead to the extremes being rejected in favour of the middle ground,

and, numerous scenarios over complicates the decision making process. Four scenarios are generally taken to be ideal.

Van der Heijden (1996) and van der Heijden et al. (2002) proposes a number of guiding principles for developing scenarios.

1. Each scenario must be plausible and logical.
2. The scenarios must be internally consistent through cause and effect relationships
3. The scenarios must be relevant to the organisation, useful and challenging for future business strategies.
4. The scenarios must provide a new perspective.

Scenarios at this stage are called skeletal scenarios or first generation scenarios and they need to be tested for internal consistency (van der Heijden 1996; van der Heijden et al. 2002). According to van der Heijden (1996) and van der Heijden et al. (2002) the skeletal scenarios still require further research to build up the skeleton stories to fully fledged scenarios and: -

- must be understood as a whole and be identifiably different from other scenarios;
- must be internally consistent with an underlying model;
- must contain the predetermined elements identified;
- must identify and describe the key driving forces;
- quantify the scenario particularly for wind-tunnelling strategies and projects; and
- involve stakeholder analysis to see if the logic in the scenario fits with human intuition about the subject.

Schoemaker (1995) describes the process of checking for internal consistency and plausibility as follows: -

- are the trends compatible with the time frame?
- do the combined uncertainties fit together? and
- are outcomes for major stakeholders unfavourable to the extent they will alter the scenario outcome?

These skeletal scenarios are learning tools and form the basis for further research. The second generation scenarios become the decision making tools (Wack 1984).

4.2.9. Naming scenarios

Schoemaker (1995), van der Heijden (1996), Ringland (1997) and Flowers (2003) say that naming of the scenarios is an important part of the process. The scenario names are decided by the workshop group from the story lines or from data within each scenario. The scenario names provide an instant picture of the future, they become the story seeds, convey information and become tools for further research and importantly become part of the shared language within the organisation; people in an organisation talk of the '*so and so*' scenario.

4.2.10. The scenario writing process

Scenarios are constructed in the workshop environment and take time to complete. The exact method of scenario construction is flexible. Initially data is unstructured, van der Heijden (1996) suggests that each idea be written on a sticker and that the stickers should then be clustered into related issues (van der Heijden et al. 2002).

Hodgson (1998) and van der Heijden et al. (2002) suggest that grasping the issues can be one of the hardest parts of modelling because of the restrictions on human cognitive capability. A technique that can assist in handling information and which is more flexible than a flip chart is the use of magnetic hexagons. Each idea is written, in a few words, on a hexagon and placed on a magnetic whiteboard. This enables ideas to be clustered and moved around as thinking deepens. Once the clusters are developed they can then be connected to each other to produce an issues map showing the relationships between clusters. Alternatively computer software has been designed to assist this process.

Van der Heijden (1996) writes that the choice of scenario building method depends much on the facilitator and the organisation undertaking the process. Time, diversity of thinking and appreciation of uncertainty are all factors to be considered. However, each scenario must be written to clearly identify a different future (van der Heijden et al. 2002; Lindgren & Bandhold 2003).

4.3. Incorporating scenarios

Schoemaker (1995) describes steps to incorporate the scenarios into the organisation's strategic plan. The scenarios become learning scenarios because they are the basis for further research and improve knowledge blind spots. The scenarios are tested by the workshop group for the opportunities and threats that each scenario poses to the organisation. From these action plans, notional strategies or a number of options for the future are developed. The scenarios can be used to test strategies and to address the strategic issue facing the organisation (Schoemaker and van der Heijden 1992; Schoemaker 1995).

Having generated three or four scenarios Schoemaker (1995) says that the organisation must decide how to use them. For example: -

- focus on one scenario, which is not regarded as sensible as it can lead the organisation into some dead ends;
- be flexible and exploit all scenarios;
- develop exit strategies in case the situation becomes unfavourable; or
- hedge risk through alliances and diversification.

4.4. Scenarios for strategy formation

Scenarios are a learning mechanism for organisations (Fahey & Randall 1998; van der Heijden et al. 2002), however, there needs to be action for the learning loop to be closed. Two basic questions arise that need to be answered (van der Heijden 1996).

1. Internally; does the organisation have the capability for survival and growth in the scenarios of the future?
2. Externally; is the organisation developing in the appropriate direction to meet the future business environment?

Van der Heijden (1996) says that there are four steps to address these questions with the focus on organisational survival and growth in light of an uncertain future.

1. **Portfolio review.** If, according to van der Heijden (1996), the organisation is well positioned to face the uncertain futures in the scenarios the organisation then needs to consider how best to exploit the future business environments as presented in the scenarios. This is done by reviewing the existing business portfolio and considering new options that are needed to expand the organisation, either through brainstorming or interviewing key people in the organisation.
2. **Capability review.** Van der Heijden (1996) writes that an organisation's competitive advantage deteriorates over time to the extent that the organisation may not be in a robust position to face future uncertainties; therefore, changes to the organisation's business strategy are required. Future competitive advantage has to be invented or developed from existing advantages. Again new options to develop the organisation need to be considered. These new options then need to be tested against the scenarios.
3. **Options generation.** Van der Heijden (1996) says that scenarios are a useful starting point to generate new options for the organisation particularly if the scenarios are part of the general conversation in the organisation. The question

to be asked is what the organisation would do if a particular scenario eventuated?

4. **Option evaluation.** Wack (1985b), van der Heijden (1996), and van der Heijden et al. (2002) all say that having generated a number of options these can now be tested against the scenarios. Option evaluation usually takes the form of financial, risk, strategic and organisational evaluation. Scenario planning, however, aims at improving the various options rather than making choices and is therefore, philosophically different from traditional rationalistic decision making. In scenario planning the assumption is that all proposals have good and bad points, the future is fundamentally uncertain and all futures need to be considered. Thus an option may have better outcomes in one future than another. The final goal is to produce a holistic strategic direction for the organisation irrespective of future uncertainties.

According to Hay and Williamson (1998) a successful business strategy requires a clear understanding of the external world. The organisation needs to know: -

- what drives the market it operates in;
- what drives customers;
- who are the important competitors; and
- what impact changes in the macro economy will have on the market.

Vision and strategy give a set of values and general sense of direction to the organisation so that strategies can be adapted to deal with change and uncertainty (Taylor 1997). Vision is a bet on the future, scenarios help to hedge that bet against a broader range of possible futures (Schoemaker 1992).

Schoemaker (1992) suggests that strategic vision combines scenarios, industry structure and the organisation's core capabilities. To determine the core capabilities, as future drivers of the organisation, can be achieved in a matrix consisting of scenarios and market segments. By allocating a core capability to a scenario and market segment the most important capabilities to address the future business environment emerge. An organisation must have a clear picture of what it will look like in the future (Wack 1985b).

Whatever method used, to take scenarios into strategy, the importance of setting up an environmental scanning system within an organisation, in order to keep a watching brief on the changing business environment and therefore change strategies cannot be reinforced enough (Lindgren & Bandhold 2003).

Wack (1985a p84) quotes Cicero in the context of watching for signs of change in the business environment: -

“It was ordained at the beginning of the world that certain signs should prefigure certain events.”

Wack (1985a, p86) uses a metaphor saying;

“...a canoeist who hears white water around the bend and must prepare to negotiate the rapist.”

4.5. Why use this method?

Mathews (1997) says that through a workshop communication process scenarios force organisations to think about their model and assumption of the business. Scenario planning gives a balanced approach to change by combining the unknown and the known elements of the business environment.

In 1974 Wilson (1974) suggested organisations should speculate about the future ten years hence in order not to make decisions now that might be disadvantageous later. In today’s business environment ten years may be too far in the future to speculate about. The focus industry for this study was urban water utilities that have a long planning horizon and consider five to ten years as being short term. Godet (1987) says that it is not possible to know what the ‘real’ future will be because of the complex interplay of dynamic factors and individual freedom but it does help organisations to think about possible futures and develop strategies to meet those futures.

James (1998) says that scenarios are not used to predict the future but to highlight options by identifying what is known and what is unknown. They are, however, plausible accounts of what the future might look like. They can be used to raise difficult issues in an organisation. Scenarios should fit the mental model of the user whilst describing structurally different and stable futures (Schoemaker 1995).

Wack (1985a) writes that in today’s technological world it is important to transfer information of strategic importance into initiatives. There is a danger in times of rapid change of being tuned into an old mind set which is difficult to break out of whilst working within it. A manager’s mind set is critical to the success of the organisation.

Linneman and Kennell (1977), Schoemaker (1993; 1995) van der Heijden (1996), Fahey and Randall (1998), Ringland (1997), Mante-Meijer et al. (1998), van der Heijden et al. (2002) and Lindgren and Bandhold (2003) all say that scenarios are important for: -

- stretching and focusing thinking both collectively and individually;
- developing early warning signals that a particular future is unfolding;

- assessing the organisation's competencies;
- generating better strategic options;
- evaluating risk and return options;
- making decisions flexible enough for an uncertain future;
- communication within the organisation; and
- as a change tool.

Godet (1987) says that considering the future is important because of: -

- changes in the business environment and the faster the changes are the more important it is to see further into the future;
- factors relating to organisational structure and the length of time it takes to see the results of change; and
- uncertainty.

The organisation therefore needs strategic thinking and needs to be flexible (Godet 1987).

Mathews (1997) says that a number of major questions arise from a scenario planning exercise.

1. Is the organisation aligned to the future presented by the scenarios?
2. How does the organisation know that a future scenario is unfolding?
3. What is the organisation doing to be prepared for the future outlined by the scenarios?

Wack (1985a) suggests that to test the value of a scenario the following questions should be asked.

1. What do the scenarios leave out that may be important for the future?
2. Do the scenarios lead to action other than that gained from past experience?

4.6. Outcomes of scenario planning

Van der Heijden (1996) and van der Heijden et al. (2002) write that the full benefit of scenario planning comes when an organisation adopts scenario planning as a way of thinking, and it becomes part of the organisational culture. As with cultural processes scenario thinking takes time to become part of the organisation. However, when scenario planning does become part of the organisational culture, and planning cycle, it becomes a core capability that opens the organisation's mind

to a number of different futures where uncertainty is managed for opportunities and growth.

Schoemaker (1995), van der Heijden (1996) and van der Heijden et al. (2002) continue by saying that scenario planning evolves with strategic thinking in the organisation and becomes a competitive advantage within the organisation which is difficult for competitors to mimic. It expands the imagination in order to see a wider range of possible futures so that unexpected opportunities can be taken advantage of. Barker et al. (1999) outline the scenario planning process as provided in figure 4.1.

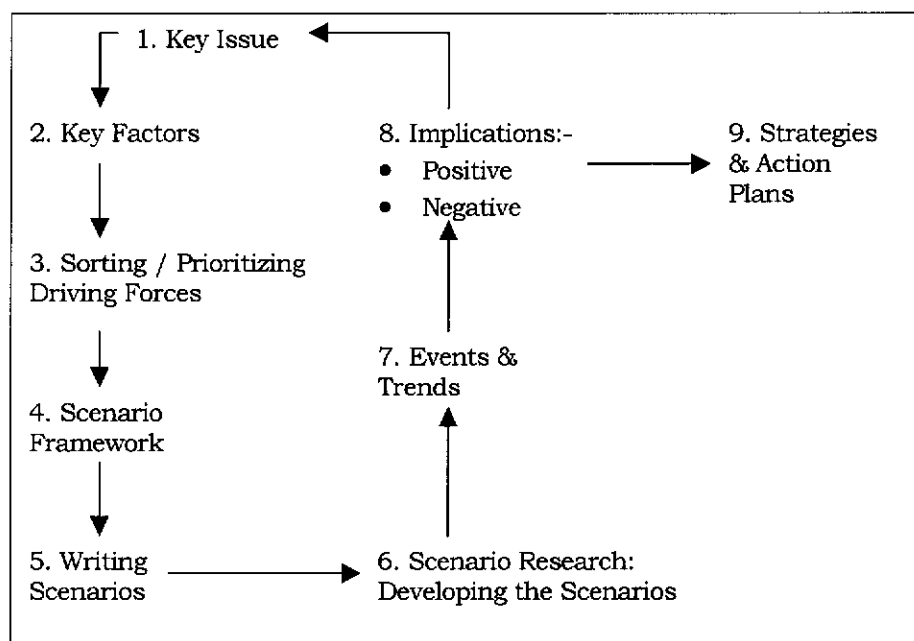


Figure 4.1. Scenario planning summary

Source: (Barker et al. 1999, p4)

Chermack (2003) proposes that performance is the focus for organisation's to undertake scenario planning and that learning is an outcome. Chermack (2003) discusses scenario planning and performance improvement at three practical levels, the organisational level, the process level and the individual level.

Organisation's that have faced challenges and used scenario planning, such as Shell, British Airways and Nokia are testament to the value of scenario planning at the organisational level (Chermack 2003).

Chermack (2003) says that at the process level scenario planning has rarely been used. There has been little research to determine if scenario planning has improve

performance, however, Chermack (2003) suggests that scenario planning could be used for process management and knowledge transfer.

At the individual level there is well documented evidence of improved performance of individuals through learning and the development of mental models, however, no studies have been undertaken to evaluate the improvement (Chermack 2003).

At an organisational level research by Phelps et al. (2001) suggests that scenario planning improves the organisation's financial performance, however, in the case of United Kingdom water utilities this was at the expense of customer service.

Issues of customer service and the focus of Australian water utilities on financial performance will be discussed later in this study in chapters eight and nine.

4.7. Water industry strategy formation

Australia, from a jurisdictional perspective, consists of six states and two territories. A review of selected water utility annual reports (Melbourne Water 2002; Power and water 2002; Sydney Water 2002; Water Corporation 2002; SAWater 2003; ActewAGL 2004; Brisbane City Council 2004 and Hobart water 2004) from each state and territory reveals that most water utilities have vision and mission statements that direct the organisation's strategic direction. Strategies are presented as Statements of Corporate Intent and Strategic Plans that set the organisation's performances; these are then measured against the stated objectives. Some reports list aims and or set the objectives for the following year. Throughout Australia there are some common strategic objectives such as providing customer service and fulfilling needs through service delivery and a focus on growth by increasing business opportunities and improving commercial outcomes. Other strategic objectives are a focus on environmental outcomes, asset management and the work force. There is no nationally recognised strategy on water usage.

4.8. Summary

This chapter has reviewed the literature on the scenario planning process and whilst there are some differences between practitioners all focus on involving people in the organisation in order to have a strategic conversation. The differences perhaps point to scenario development being an art and adapting the process to fit individual practitioners and organisational cultures. Clearly computer software packages can assist with the assimilation and analysis of the large amount of information that is gathered during the process.

This chapter put forward reasons to use scenario planning and a tenet for this study is that scenario planning is a better way for organisation's to develop

strategies for the future, particularly when the future is uncertain and will be different from the past.

In the next chapter a detailed review of driving forces and their importance to scenario development is presented.

CHAPTER 5 – DRIVING FORCES IN SCENARIO PLANNING

'The future belongs to those who prepare for it today.' Malcolm, X (1928-1965),
(Moncur 2004).

5.1. Introduction

Driving forces were briefly introduced in the previous chapter on the overview of the scenario planning process. It is appropriate for this study to discuss driving forces in more detail because the aim of this research is to surface the critical issues for the future of the Australian urban water supply industry through, in part, the development of scenarios. The development of those scenarios is dependant on selecting two key driving forces.

5.2. The nature of driving forces

Wack (1985a) and van der Heijden (1996) say that in developing scenarios the driving forces of the business environment need to be considered in detail and there is a need to distinguish between those elements that are predetermined or inevitable and those that are uncertain as all scenarios are built on uncertainties. When the fundamental driving forces and level of uncertainty the organisation faces are determined then responses to the contextual environment can be considered. The power in scenario planning comes from understanding the forces behind an outcome and to make the forces work for the organisation so that two plus two makes five (Wack 1985b). Schwartz (1991) says that generally organisations can exert little control over driving forces. The competitive advantage comes from recognising and understanding their impact on the business environment.

Determining the driving forces is an integral part of scenario planning after establishing the critical question and time horizon (Mathews 1997). The driving forces shape a particular scenario story, they are the forces that influence the outcome of events (Schwartz 1991), and they are fundamental forces that change the pattern of events seen in the world (van der Heijden et al. 2002). Fahey and Randall (1998) group them into two types, environmental forces and actions of organisations.

Wack (1985a) talks of first generation or skeletal scenarios as described in the previous chapter. These are designed to provide an understanding of the business environment rather than for developing action. They highlight the connections in the system and identify the major driving forces. Second generation scenarios begin to consider the behaviour of stakeholders in the business environment. Schwartz (1991) says that scenarios aim to understand the forces that will define an

outcome. Identifying the driving forces helps to hone judgement and decide what is important to the organisation. It often reveals deeper more fundamental forces. These can be obvious to some people and less so to others.

Godet (Godet 1987) discusses construction of the base or image of the present on which to build the future. It must be: -

- detailed;
- comprehensive;
- broad in terms of social, technological, environmental, economic and political ('STEEP') issues;
- identify past trends and signals for the future; and
- explain the drivers of the system.

Barker (1996) and Smith (1997) write that while many people in the organisation may have an intimate knowledge of how their business operates from the inside, a major area of concern to the organisation is the identification of the driving forces, or those elements outside the organisation in the contextual environment that impact on the organisation. These forces frequently appear out of left field. This is the analysis of past and present social, technological, economic, environmental and political issues (STEEP) that impact on the organisation.

Wilkinson (1995) says that identifying the driving forces, in the 'STEEP' model, helps decision makers to look past the crisis occurring in their minds and to identify the long term forces outside the mind. These driving forces characterise the scenario stories, often the realised future is not in a single scenario but elements of several scenarios.

5.3. The 'iceberg'

Van der Heijden (1996) suggests that the 'iceberg' metaphor is a way of thinking about and categorising data for scenario planning, figure 5.1. According to van der Heijden (1996), van der Heijden et al. (2002) and Lindgren and Bandhold (2003) there are three categories.

1. **Events.** This is the visible part of the iceberg, events in the business environment that are observable.
2. **Trends and patterns.** To understand the events we try to find a structure to the situation through causal analysis, these are the trends and patterns.
3. **Structure.** Scenario planning is built on the premise that there is a hidden structure to an event; this is the unseen part of the 'iceberg'. Events are not

random; they are related through a structure that drives them. This structure becomes clearer over time. To understand the structure it is necessary to look for the relationship between trends. Once the structure and the causal relationship to events are understood a mental model of the business environment develops.

Having understood the structure and surfaced a number of key variables, it is then possible to project future behaviour and recognise some of the predetermined elements that will happen in the future (van der Heijden 1996).

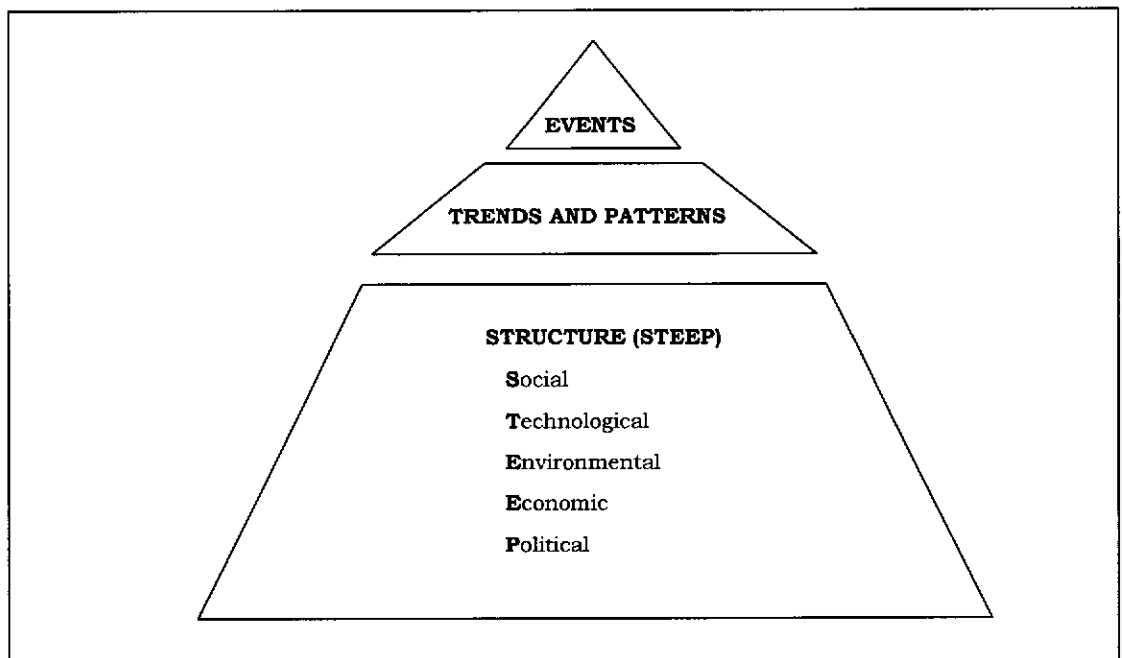


Figure 5.1. The 'iceberg'

Source: (van der Heijden 1996, p98)

Van der Heijden (1996) writes that documentation of the trends and patterns of events helps to understand the underlying structure and how the business environment works. Initially the key variables in the environment need to be determined and how they change, or cycle, over time. These changes in the variables explain the events taking place in the business environment and which events might be related to a particular changing variable. Trends emerge from this analysis that can be shown graphically by using an influence diagram to show which variables impact on others and in what direction.

Van der Heijden (1996) and van der Heijden et al. (2002) say that the influence diagram helps to develop an insight into the complexity and interrelated causal events taking place in the business environment. This moving down the 'iceberg'

from events to trends and underlying structure is called surfacing the driving forces of the system. These forces are the fundamental drivers that affect the business environment.

According to van der Heijden (1996), the data collected through interviews with key industry stakeholders contains elements of the 'iceberg'. One of the first tasks is to determine the structure that explains the events and trends in the data so that the driving forces can be understood.

5.4. Selecting the key driving forces

As discussed in chapter four, in an overview of the scenario planning process, one way to develop scenarios is by using a matrix. The axis of the matrix are based on key structural variables or key driving forces (Schwartz 1991), as shown, for example, in figure 5.2.

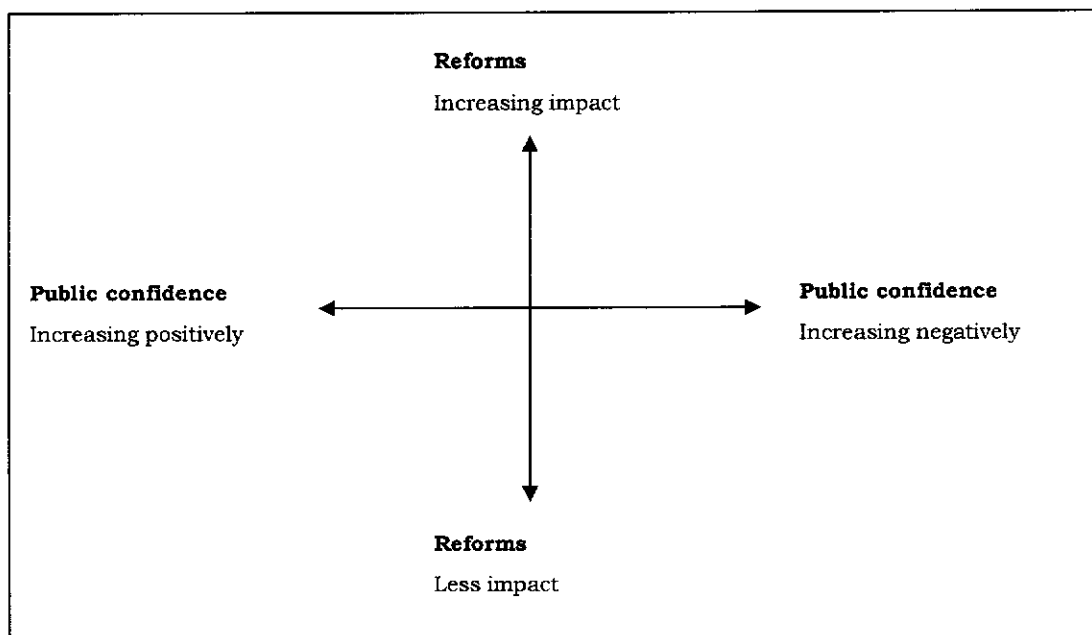


Figure 5.2. Scenario matrix

Source: (Barker et al. 1999, p42)

Van der Heijden (1996) says that these are forces that are of critical importance to the organisation. In order to identify a few key driving forces members of the scenario team must have an in depth understanding of the structural 'iceberg' to find two or three driving forces that are critically important for the future of the organisation. In selecting these key driving forces consideration must be given to the level of impact they will have on the organisation and the level of uncertainty as

a predetermined or inevitable driving force is not a unique characteristic of a scenario.

Barker et al. (1999) present another format that can be used is a table to develop the scenarios as shown in figure 5.3. In this case more than two critical uncertainties can be selected.

| Top drivers | Scenario A | Scenario B | Scenario C | Scenario D |
|-------------|------------|------------|------------|------------|
| Driver | | | | |
| Driver | | | | |
| Driver | | | | |
| Driver | | | | |
| Driver | | | | |
| Inevitable | | | | |

Figure 5.3. Table framework

Source: (Barker et al. 1999, p41)

Van der Heijden (1996) and Fahey and Randall (1998) write that future uncertainty is governed by a few key driving forces. The key driving forces from the full list of driving forces obtained from the data gathering exercise are selected by the workshop group who rank them in terms of their impact and unpredictability on the organisation. Ranking the driving forces can be done on the degree of importance to the organisation and the degree of uncertainty. This enables two or three key driving forces to be identified and forms the axis along which the scenarios differ. Schwartz (1991) says that scenario drivers must be few in number if the scenarios are to be successful as a learning tool. It is important to avoid a proliferation of driving forces and therefore scenarios.

Van der Heijden et al. (2002) say that often during the data gathering process numerous driving forces are identified. The driving forces need to be clustered into a manageable number, for this study ten uncertainties or driving forces were identified. Each of these must be separate from each other and summarised by a short title.

Mathews (1997) says that the driving forces should be clustered into a few groups of critical uncertainties that are the most important and uncertain to the organisation. Mathews (1997) describes three ways this can be done.

1. **Intuitively**, by grouping driving forces that seem to be related.
2. **Heuristically**, by taking a vote on the most important driving forces.
3. **Statistically**, by combining outcomes of uncertainties into internally consistent groups.

5.5. Vision and driving forces

According to van der Heijden (1993) strategy is influenced by the driving force of vision in a changing business environment. The vision needs to be adapted, in time of change, for survival. The vision is associated with concepts such as world view and mental models. Individual vision is related to the mind to rehearse the route to the future; this mental model can act as a filter to new information. A shared vision becomes an underlying driving force in an organisation. It is a result of information and understanding of the business environment and the driving forces, as perceived by management, in that environment. Decisions are based on the shared vision (van der Heijden 1993).

Van der Heijden (1993) suggests that vision can be resistant to change because information is filtered and signals from the environment remain outside the field of view. 'Pain' is often the only way a vision can be overridden. With faster change a more effective communication channel is required to make changes to the vision.

5.6. Examples of drivers and trends

In 1980 Igor Ansoff (1980) listed a number of trends important to industrial organisations: -

- The global market
- Government as a consumer
- European Union
- Business with socialist countries
- Developing countries
- Global economics
- Multinational organisations and organisational size
- Technology

- Service sector growth
- Affluence
- Demographics
- Government controls
- Increasing customer orientation
- Unions
- Environmental issues
- Product life cycles
- Nationalism
- Conflict between globalisation and national interests
- Public perceptions of business
- Shorter time horizons
- Competition
- Strategic surprises
- Redistribution of power in the organisation
- Changing work attitudes
- Job security

Twenty years later it is interesting to reflect how many of these are still drivers and trends in the business environment and how some are now beginning to take on a new perspective such as globalisation.

Schwartz (1991), Schoemaker (1993), Taylor (1997) and Mante-Meijer et al. (1998) note that in the last decade whole industries have been restructured because of the following key drivers of change: -

- Deregulation and privatisation;
- Converging technology such as telecommunications and computers;
- Globalisation;
- Changing political alignments;
- Rapid technological change;

- Changing demographics;
- Energy consumption;
- Environmental issues; and
- The information economy.

These drivers and trends have the potential to deliver impacts of the magnitude the Industrial Revolution delivered (Mante-Meijer, Duin & Abeln 1998).

Tucker (1997) describes ten driving forces of change in the retail and service industries that need to be considered if an organisation is to survive. It is not sufficient for an organisation to notice the change, it must have continuous improvement. To gain the competitive advantage, according to Tucker (1997), organisations must consider the following: -

- speed – reduce and extinguish customer waiting;
- convenience – services and products must be delivered to busy customers for their convenience;
- age waves – baby boomers will create a labour shortage, therefore reducing the labour content for products and services will be an advantage;
- choice – customers are requiring more choice of product and services;
- lifestyle – this affects the way customers use products and services;
- discounting – particularly in non traditional products and services;
- value adding – to products and services;
- customer service – a key is to motivate employees to give extra service;
- techno-edge – for speed, convenience and raising productivity; and
- quality – added to products and services.

As can be seen by the above examples each industry and organisation has driving forces that are specific to it. It is only through a group workshop and consensus that the driving forces, which are most important and most uncertain to the key issue under discussion and in the time line established, that the organisation can determine which their major drivers of change are.

Schwartz and Leyden (1997) and Schwartz et al. (2000) write about a global future in 'The Long Boom between 1980 and 2020'. They suggest two global mega trends, technological change and global openness that will transform the world. Five waves

of technology over this forty year period will expand global economies whilst preserving the environment. These are: -

1. Personal computers
2. Telecommunications
3. Biotechnology
4. Nanotechnology
5. Alternative energy

Some of these technological changes have occurred and some still to make their impact felt, an impact that may not be felt until a generation after their introduction. In the context of this study it is interesting to reflect on 'The Long Boom' scenario in light of some recent world events such as increasing terrorism. As in all scenarios aspects have eventuated and others have not.

5.7. Summary

Identifying the driving forces in the organisation's contextual environment is a key to developing scenarios and in particular determining which driving forces are predetermined and which are uncertain because two or three key driving forces determine the basis for the scenarios (van der Heijden 1996).

Chapter nine of this study discusses the key uncertainties for the Australian urban water supply industry and the selection of two from a list of ten for the scenario matrix. It is interesting to compare the above lists of drivers from selected industries to the ones identified for the water industry in chapter nine, many are the same.

CHAPTER 6 – RESEARCH PARADIGMS – THE QUALITATIVE QUANTITATIVE CHOICE

‘There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy.’ William Shakespeare (1564-1616), Hamlet, Act I, Scene 5, (Moncur 2004).

6.1. Introduction

Research, according to the Oxford Dictionary: -

‘...is an investigation to discover new facts and reach new conclusions by the critical study of a subject’

It is a process of inquiry that adds knowledge of a phenomenon (Smith & Dainty 1991). Bennett (Smith & Dainty 1991, p68) describes research as: -

“...a systematic, careful inquiry or examination to discover new information or relationships and to expand/verify existing knowledge for some specified purpose.”

Research, according to Bennett (Smith & Dainty 1991), is concerned with problem solving; investigating relationships and building on the body of knowledge. Business and management research is aimed at improving how business is carried out and management practiced.

Smith and Dainty (1991) write that in undertaking a particular piece of research the researcher must understand the assumptions surrounding the research framework. The research perspective is the assumptions, values and paradigm underlying the research. It is important the researcher understands the strengths and weaknesses of a perspective in order to achieve a successful outcome to the research.

Evered and Louis (Smith & Dainty 1991) write that there are different approaches to research each based on the enquirer’s values, assumptions and beliefs about the world, this is the researcher’s worldview. An understanding of alternative perspectives is essential to develop a research approach appropriate for a research question.

For organisational research there are two basic perspectives, qualitative and quantitative. The path the researcher follows is determined by their constructed paradigm about the nature of the world. Determining this paradigm is achieved by asking the ontological and epistemological questions.

6.2. The qualitative - quantitative debate

Guba and Lincoln (1994) say that research and in particular scientific research in the field of mathematics, physics and chemistry has been dominated by a need to quantify hypotheses using mathematical formulas in order to predict and control natural phenomena. This quantification is widely believed necessary for the validity and legitimacy of findings. Guba and Lincoln (1994) continue by saying that in the field of social science the need to quantify has been questioned. Qualitative techniques based on the interpretation of non-numerical data can provide meaning to human behaviour missing in quantitative data. It provides a perspective to the research giving findings relevance. Since the mid 1990's the literature of postmodern research paradigms has been well established (Lincoln and Guba 2000).

Smith (1983) writes that the qualitative - quantitative debate has its origins in the 19th century when researchers pondered the validity of using physical scientific research methods to study the social world. At this time there was concern that the social world was not attracting and achieving the same level of attention as the physical world. Two schools of thought with different philosophical backgrounds argued their position. These were the positivists with an empirical background, established by Newton and Locke, and the idealists based on Kantian tradition (Neuman 2003).

According to Smith (1983) the positivists believe that: -

- knowledge is based on science; and
- there is a hierarchy of science with mathematics at the top and sociology at the bottom.

Even today there is still debate arguing that 'science' is the superior method to achieve knowledge and that basically all science adopts the same methods (Smith 1983; Schwandt 2000; Neuman 2003).

Smith (1983) and Neuman (2003) say that the positivist school of thought put forward a number of issues they consider important in relation to quantitative research: -

- if the objects of physical scientific research are independent then the objects of social studies should be treated likewise, with no inherent meaning. The observer therefore has an independent reality, the relationship between the researcher and knowledge is one of subject-object;
- social science research should be emotionally neutral towards the object of investigation to eliminate bias; and

- research should benefit society as physical research does, to produce laws to enable causes to be discovered and predictions made.

Idealists of the 19th century, writes Smith (1983), argued that in social science research the object being studied is not an inanimate object but the outcome of human minds, therefore, separating the researcher from the object of the research was not possible, a subject-subject relationship existed. Social science research is the product of knowledge about us, people. The focus is interpretive understanding (*Verstehen*) rather than making laws (Neuman 2003).

Smith (1983) continues by saying that idealists believed that understanding was a hermeneutic process with constant movement and no end points. Human meaning must be context bound for which there is no 'scientific' way to express phenomena in the social world. In addition idealists believe that the selection of research objects must be based on the values of all involved (Neuman 2003).

A number of writers, say Evered and Louis (Smith & Dainty 1991), have debated, under different terms, the qualitative quantitative issue. Geertz used the thick and thin analogy; Hall the high and low context; Chomsky the deep and surface structure; Pike's emic and etic positions; in addition James, Dewey, Schutz and Merton have written extensively on different philosophical perspectives.

Silverman (1993) in the context of social science describes the desire for knowledge in two ways.

1. The enlightenment urges to find and categorise previously unknown tribes.
2. The drive to understand unaltered experiences by interviewing.

Smith (1983) says that the contemporary discussions concerning qualitative - quantitative research are between realism and idealism. Realism exists independent of people, this is the basis for the subject-object research stance where knowledge corresponds to truth and is 'reality'. Research does not affect the object of the research. Whereas idealists believe that 'reality' is constructed in the mind and therefore research is a subject-subject relationship because what is being researched is not independent of the researcher, 'reality' is agreed in a social context (Neuman 2003).

In order to determine the researcher's paradigm and the relationship between the researcher and object of the research Smith, (1983) poses three questions that must be answered.

1. What is the relationship of the investigator to what is being investigated?

'Reality' can be thought of as existing independently of people's minds, a subject-object, realists relationship, or as part of our minds, a subject-subject, idealist relationship (Smith 1983).

Smith (1983) writes that the position taken by the researcher determines the research methodology. The separation of the researcher from the object of research is only possible in the realist paradigm. Idealists believe, because 'reality' is constructed, that research will impact on the subject of the research. Research instruments for realists are used to accurately measure the research object whilst idealists view instruments as part of the researcher, the difference between a telescope and a questionnaire.

2. What is the relationship between facts and values in the process of investigation?

According to Smith (1983), the focus here is on objectivity. From the realist's approach objectivity is the separation of the researcher's values from the object of the research. Knowledge is considered public and all researchers who use the same methods should get the same answer. Facts are independent of the researcher's values and worldview.

Idealists, writes Smith (1983), believe that their view of the world is based on values that guide how research is conducted; objectivity is a social agreement of values and similar interests. Similar results are based on common perspectives, facts and values are intertwined.

3. What is the goal of investigation?

The quantitative researcher's goal, according to Smith (1983), is to explain, predict and develop laws that can be universally applied. Qualitative researcher's goal is the interpretation and understanding (*Verstehen*) of what people give to their situation. This requires a hermeneutical approach; the researcher must understand the context of the situation and particular actions (Neuman 2003).

These are ontological, epistemological and methodological questions that must be addressed in order to determine whether the research should follow a qualitative or quantitative methodology.

Evered and Louis (Smith & Dainty 1991) use the analogy of inquiry from the inside (subject-subject) and inquiry from the outside (subject-object). Evered and Louis (Smith & Dainty 1991) address the qualitative - quantitative debate by discussing a number of key issues that differentiate the two perspectives.

1. The researcher's role and relationship to the object of study; this is basically the same as the first question posed by Smith (1983) above.

Inquiry from the inside, say Evered and Louis (Smith & Dainty 1991), is achieved by the researcher becoming part of the organisation. A research method might use an unstructured interview. The researcher is trying to get inside the minds of people in an organisation, to understand and interpret their points of view. The critical epistemological assumption is that the researcher believes that to experience is the way to gain knowledge, and the best way to understand an organisation is to become part of the phenomena being studied, knowledge is validated experientially. According to Evered and Louis (Smith & Dainty 1991) the disadvantage, some believe, with this methodology is that findings may become distorted with the values of the researcher; this is the fallacy of the subjectivists.

Evered and Louis (Smith & Dainty 1991) continue by saying that inquiry from the outside is research at arms length from data produced by the organisation such as annual financial reports. The researcher is detached from and has no impact on the organisation. The researcher's role is to observe. His/her epistemological position is the belief in an external reality of facts governed by laws, the objectivists' illusion.

2. Source of categories.

Evered and Louis (Smith & Dainty 1991) write that inquiry from inside has no predetermined categories; categories emerge through the research and experience of the situation. The process is an exploration to find issues through the interpretation of situations. This exploration is useful for research into new areas and generating theories that are grounded in a particular phenomenon.

Inquiry from outside is guided by a set of predetermined categories to the extent that some categories may be ignored (Smith & Dainty 1991).

3. Aim of inquiry.

Inquiry from inside is aimed at understanding a particular phenomena and understanding reality as it is now (Smith & Dainty 1991).

Inquiry from the outside makes generalisations and universally applicable laws (Smith & Dainty 1991).

4. Different types of knowledge.

Inquiry from the inside produces knowledge about a particular situation being studied whilst inquiry from outside produces theory (Smith & Dainty 1991).

5. Data and meaning.

Inquiry from inside, according to Evered and Louis (Smith & Dainty 1991), requires the researcher to make contact with the organisation being studied. The researcher must understand the organisational context of culture, people, resources and its

purpose. Knowledge is related to the employees' worldview in the organisational context, the phenomenal field.

Evered and Louis (Smith & Dainty 1991) say that inquiry from the outside removes idiosyncrasies to find generalisations applicable to all organisations, a common truth. Data is considered real in all situations and settings, it is context free.

Quantitative research, argue Evered and Louis (Smith & Dainty 1991), overlooks issues such as human behaviour in a particular situation, people's worldview, motives, motivation and the situational context. Qualitative research can be accused of being too fuzzy, lacking rigor and precision. Each research methodology can overcome the shortcomings of the other. Evered and Louis (Smith & Dainty 1991) suggest researchers should try to combine the two principles to take strength from both and eliminate weaknesses by: -

- doing both qualitative and quantitative research and combining the results;
- alternating between the two methodologies; or
- develop a new science by combining the rigors of positivist science and the context based grounding of idealism.

Qualitative and quantitative research therefore requires different epistemological assumptions and research methodologies. Table 6.1 summarises the main differences between qualitative and quantitative research noted by Evered and Louis (Smith & Dainty 1991).

Table 6.1. Differences between qualitative and quantitative research

| QUALITATIVE | QUANTITATIVE |
|------------------------------|---------------------------|
| Subject-subject | Subject-object |
| Intertwined values and facts | Separate values and facts |
| Search for understanding | Search for laws |

Source: (Smith & Dainty 1991)

Does all this make a difference to research? The answer is yes, because, say Evered and Louis (Smith & Dainty 1991): -

- what is valid as knowledge must be debated to give it authority;

- objectivity is defined differently by qualitative and quantitative researchers with different assumptions; and
- if qualitative and quantitative research is different then each requires different standards to judge them by.

After an in depth review of the literature on qualitative and quantitative methodologies of research this research will adopt a qualitative research methodology. The reason for taking this approach is that the research will deal with people's perceptions in reference to the future uncertainties in the business environment. These perceptions are intangible and therefore cannot be measured. They are a 'reality' constructed in the minds of those people being interviewed and this 'reality' may be different to another person's 'reality'. In order for the researcher to appreciate a person's 'reality' they will be engage in a dialect through a semi structured interview.

6.3. Research question and relevance to the research

The aim of this study is to determine the: -

“Critical issues for the future of the Australian urban water supply industry”

These are critical issues in the minds of chief executive officers, managing directors and senior managers in water utilities. In addition critical issues will emerge from data analysis and scenarios by analysing the key uncertainties for the future of the urban water supply industry. Developing scenarios of possible future business environments encapsulates a number of uncertainties that a business may face in the future; these are the key driving forces. The critical issues are possible future issues, they have not already occurred, they are not tangible, but are perceptions in the minds of people working in organisations. Having no tangible or concrete existence there is nothing to conduct empirical research on, nothing to quantify. A way to surface and interpret perceptions about an uncertain future is to engage people through a dialectical and hermeneutical methodology to gain a shared understanding, *Verstehen*, of their perceptions. This requires the researcher, albeit for a short period of time, to become part of the organisation, to make inquiries from inside, to promote a subject-subject relationship, in order to gain an understanding of perceptions at a particular point in time. This research must therefore follow a qualitative methodology of research.

6.4. Paradigms

The word paradigm comes from the Greek language '*paradeigma*' meaning model, pattern or example (Barker 1992). In the philosophical meaning,

'...it is a way of viewing the world that underlies the theories and methodology of science in a particular period of history...' (The New Shorter Oxford English Dictionary 1993).

Adam Smith in his book 'Powers of the mind' describes paradigms as (Barker 1992, p31): -

'A shared set of assumptions. The paradigm is the way we perceive the world; water to the fish. The paradigm explains the world to us and helps us to predict its behaviour.'

Covey (1989) explains paradigms as the way we see the world in terms of perceiving, understanding and interpreting, a theory, explanation, model or map. Covey (1989) says that humans interpret everything they experience through their individual, personal mental maps. Mental maps are rarely questioned. Humans assume that what they see is 'reality'. Our basic attitudes and behaviours are derived from our paradigms which affect the way people interact with each other. People see the world as they are conditioned to see it through their perceptions, paradigms or mental maps.

Covey (1989) write that when a person sees the world from a different viewpoint they experience a paradigm shift, nearly every breakthrough in research has been derived from a paradigm shift. Zohar (1990) describes a worldview as a living truth, which is taken for granted. It is only when there is change do people try to understand and articulate their worldview.

Senge (1990, p8) calls paradigms mental models and describes them as: -

'...deeply ingrained assumptions and generalisations that influence how people see the world and behave.'

People are not always aware of their mental model. Senge et al. (1994) say that people cannot steer through the environment of life without a mental model and that all mental models are, in some way, flawed.

Pascale (1990) prefers the term paradigm to mind set because it encompasses the sharing of a belief system by a community, whereas a mind set or world view refers to an individual.

Guba and Lincoln (1994) describe a paradigm as a set of basic beliefs dealing with first principles. It is a worldview describing the nature of the world, a person's place in it and their relationship to the world. A paradigm, according to Guba and Lincoln (1994), is a person's best perspective about the world based on the answer to metaphysical questions. These basic beliefs must be accepted their realism cannot be established.

6.5. Inquiry paradigms

Guba and Lincoln (1994) write that inquiry paradigms define for the researcher the legitimate limits of inquiry. The researcher's basic beliefs and assumptions determine the inquiry paradigm and are derived from the answers to three metaphysical questions. These are the ontological, epistemological and methodological questions. The questions are interconnected such that the answer to one question constrains the response to the others. A paradigm is the researchers most informed worldview based on the answers to these three metaphysical questions. An inquiry paradigm is a human construct of the mind which is open to error and question and cannot be proved correct, the proponent of a paradigm must use persuasion to argue their worldview (Neuman 2003).

Smith & Dainty (1991) argue that to add rigor to research it is important for the researcher to investigate the assumptions, values and paradigms that under-pin the research. This is the research perspective. Not understanding the research perspective and its limitations has the potential to deliver an unsuccessful result from the research.

Morgan and Smircich (1980) and Smith and Dainty (1991) say that in order to develop a research methodology the researcher must examine his/her own beliefs and assumptions about the nature of knowledge and the phenomena being researched. The research methodology needs to be appropriate for the research question. These are questions of ontology and epistemology. Evered and Louis, (Smith & Dainty 1991) say that a greater awareness of epistemology is necessary to develop an appropriate research methodology for the phenomena being researched.

According to Hassard (Smith & Dainty 1991) Burrell and Morgan's four paradigms of social theory and organisational analysis have probably attracted the most attention. These are: -

1. Burrell and Morgan's **functionalist paradigm**, according to Hassard (Smith & Dainty 1991), is based on the belief that society is real and concrete, it is focused on order and regulation; social science is objective and value free. The research scientist is separated from the object of research. The objective of research is to understand society so that the knowledge gained can be applied.
2. In the **interpretive paradigm**, of Burrell and Morgan, writes Hassard (Smith & Dainty 1991), society although orderly and regulated does not realise a concrete form, but rather is the result of intersubjective experience. The researcher's goal is to understand the process whereby shared 'reality' is made, maintained and changed.

3. In the **radical humanist paradigm**, Hassard (Smith & Dainty 1991) says that 'reality' is constructed and socially maintained, people are said to be prisoners of the social world they create. Research is focused on the thought processes that express life in a modern world.
4. In Burrell and Morgan's **radical structuralist paradigm**, Hassard (Smith & Dainty 1991) writes that social reality is independent of the way it is constructed, having its own external existence. Tension and contradictions in the social world are the driving forces that change the social system.

Other researchers have proposed paradigms for social research Guba and Lincoln (1994), Lincoln and Guba (2000) and Neuman (2003) based on fundamental philosophical differences and assumptions towards social science research.

6.5.1. The ontological question

Guba and Lincoln (1994) and Neuman (2003) propose that to develop an inquiry paradigm the first question to be addressed is the ontological question. This asks what 'reality' is and what can be known about 'reality'. If, for example, it is assumed the world is 'real' then what is known about the world and how does the world work? This position would lead to research of 'real' phenomena; issues of human perception, with no physical 'reality' would not be legitimate to study.

Guba and Lincoln (1994) originally discussed possible answers to this question under four different paradigms, each with their own assumptions: -

1. **Positivism**; according to Guba and Lincoln (1994), is where a simple reality is assumed governed by natural laws; knowledge is context free and controlled by cause and effect laws. The goal of research is to discover the 'truth'.
2. **Postpositivism**; say Guba and Lincoln (1994), is where imperfect 'reality' is assumed because of imperfect human intelligence and the complex nature of phenomena.
3. **Critical theory**; write Guba and Lincoln (1994), is where 'reality' is shaped by social, political, cultural, economic, ethnic and gender values. Over time this 'reality' is assumed to be 'real'.
4. **Constructivism**; 'reality' is intangible, a construction of the human mind shaped by experiences of the world, it is dependant on the individual and can be changed with new information (Guba & Lincoln 1994).

More recently Lincoln and Guba (2000) have drawn on the work of Heron and Reason (1997) and included a fifth paradigm, participatory, to their list of alternative inquiry paradigms. Heron and Reason (1997) argue that under the

participatory paradigm mind and the given cosmos interact so that reality is a product of the way the mind engages with the cosmos.

Burrell and Morgan (1979) and Morgan and Smircich (1980) present a continuum of approaches to social science based on the assumptions made about the world. This continuum, where the transition from one position to another is gradual, is from an objectivist to subjectivist approach to social science. In this model proponents of one paradigm may assimilate intellect from adjoining paradigms. As one moves along the continuum presented by Burrell and Morgan (1979) and Morgan and Smircich (1980) the different paradigms convey their own basis for knowledge depending on the assumptions made. This is in contrast to Guba and Lincoln's (1994) original model which proffers isolated paradigms. However, Lincoln and Guba (2000) now acknowledge that the boundaries between the various research paradigms are less rigid than initially suggested. Lincoln and Guba (2000) suggest that it is more useful to consider where paradigms differ and where they converge.

Morgan and Smircich (1980) suggest that science can be viewed as a metaphor so that knowledge about the world can be discovered. For the different positions along their continuum various metaphors can be used. At one extreme of the objective/subjective continuum positivism views the world as a closed structure, a machine consisting of parts. 'Reality' is the concrete relationship between the parts of the machine, an objective phenomenon. Moving along the continuum the world, although concrete, is modified by new information. Still further from objectivism 'reality' is modified to fit the environmental context. Eventually 'reality' becomes a social construct changed by culture. At the other extreme end of the continuum solipsism views the world as an open system, a living organism. 'Reality' is in the minds of individuals.

The position taken by the researcher for this study is constructivism from a critical perspective.

Schwandt (2000) and Neuman (2003) write that interpretive social science takes its origins from the neo-Kantian sociologist Weber and philosopher Dilthey. Dilthey argued for two forms of science, *Naturwissenschaft* based on abstract or scientific explanation and *Geisteswissenschaft* based on empathetic understanding or *Verstehen* of peoples lived experiences and the meaning of social phenomena. Weber believed it important to learn about the personal reasons that shaped peoples feelings and guided decision making.

Interpretive social science, says Neuman (2003), is related to hermeneutics, a theory of meaning. It is concerned with examining text to discover meaning. The researcher's goal is to understand the parts of text holistically to achieve a deep

understanding. Neuman (2003) notes that constructivism is a variety of interpretive social science. Schwandt (1994) says that constructivist thinking is more recent than interpretivist thinking and cites Goodman for defining the constructivist theory of reality. Schwandt (1994) writes that constructivist believe that knowledge and truth are a perception, they are created. The constructivist view is that people construct knowledge by inventing concepts, models and schemes of the world and testing them. Through new experiences knowledge is modified.

Guba and Lincoln's (1994) and Lincoln and Guba's (2000) constructivist paradigm argues that 'realities' are mental constructs, socially and experientially based. Constructs and 'reality' is more or less informed and can be modified.

Critical theory was developed in Germany by the Frankfurt school over 70 years ago. It follows the tradition of Marx, Kant and Hegel (Kincheloe & McLaren 1994; 2000). Kincheloe and McLaren (1994; 2000) define a criticalist as a researcher who uses research as a social or cultural criticism. Qualitative research in the critical theoretical context produces, in Kincheloe and McLaren's (1994; 2000) opinion, controversial knowledge that can threaten organisations. A critical researcher aims to produce a social or cultural criticism within certain assumptions. The assumptions of critical theory, write Kincheloe and McLaren's (1994; 2000), are: -

- thought is modified by power relations;
- facts are value mediated;
- the relationship between concept and object is mobile;
- language is central to developing subjectivity;
- society has a social status hierarchy;
- there are many faces of oppression; and
- research often, unwittingly, reproduces the class system.

Kincheloe & McLaren (1994; 2000) say that modern critical analysis is a hybrid and not confined to a specific school of analysis. Critical researchers try to understand the ideologies that inform their research so that assumptions can be transparent. Information for critical theorists is an act of human judgement or interpretation, knowledge that must be interpreted by people. This interpretation and development of theory requires an understanding of the relationship between the parts of the whole (Wack 1985a).

Creswell (1998) notes that there are a number of themes for the critical researcher; one of the core themes is to critique and imagine a different society. Critical research aims to confront issues in a society or part of it and to change the wrongs

that emerge from the research as perceived by the researcher, to just increase knowledge is not enough for critical researchers (Kincheloe & McLaren 1994; 2000). In contrast to empirical research critical research depends on meaning being derived from interpretation of data (Kincheloe & McLaren 1994, p144): -

'...what we see is not what we see but what we perceive...'

According to Kincheloe & McLaren (1994; 2000), knowledge comes from interpreting data by people who are part of the world and understanding the relationships between parts of the world. Critical research is a process of offering hope where there is contempt.

In the context of this study the key uncertainties for the urban water supply industry will be discussed from a critical perspective. The key uncertainties will then be used to construct scenarios about the future of the water industry; a process of describing a non-real but possible future (Heilman 2003).

6.5.2. The epistemological question

The second question is the epistemological question. This asks what is the relationship between the enquirer and knowledge? Guba and Lincoln (1994) postulate that no one answer can be given to this question, the answer is dependent on the answer to the ontological question. For example if the world is considered 'real' then the researcher's position is one of objective separation from the object of research.

Under Guba and Lincoln's (1994) and Lincoln and Guba's (2000) positivist paradigm of 'reality' the researcher can research the object of inquiry without impact. However, there are implications for validity if either the researcher or object of the research is influenced. Set research procedures are followed to eliminate bias; repetition produces the same results.

Under postpositivism, according to Guba and Lincoln (1994), the dualism of positivism is discarded, however, there is still objectivity guarded by questions such as do the results fit existing knowledge; the research is also reviewed by peers.

Guba and Lincoln (1994) write that under the critical theory position the researcher and the subject of the research interact to the point where the values of the researcher influence the research. This is taken further under constructivism where the researcher and the subject of the research are actually linked to the extent that research findings are created during the research (Lincoln & Guba 2000).

The epistemology of the participatory worldview, write Heron and Reason (1997), involves the researcher participating in the known and expressing this through experience, presentation, proposing and practice.

At the objectivist end of the continuum, presented in the Morgan and Smircich (1980) paper, because the world and its relationships are concrete research is at arms length independent of the object of the research, phenomena that cannot be observed are disregarded, 'reality' is external. Human behaviour is a result of external stimuli in the environment; responses to external stimuli follow set rules. Moving along the continuum (Morgan and Smircich 1980) towards a subjectivist world, the world is less concrete there is more change and it becomes more difficult to find causal relationships. Morgan and Smircich (1980) write that the fluid nature of the world enables relationships to be exploited and the environment used to achieve desired ends and survival. Still further along the continuum relationships change and adapt as new information is received and interpreted, the context in which humans operate changes. Humans react to the environment through interpretation. Groups of humans may develop a shared reality for a given situation that can be fickle and disappear, as the group no longer shares the 'reality'. At the extreme end of the Morgan and Smircich (1980) continuum subjectivism proposes 'reality' as a construct of the human mind and the nature of this 'reality' can only be gained by phenomenological interpretation. Humans shape the world through their own experience).

Schwandt (2000) says that human beings do not construct their knowledge in a vacuum but with understanding, practices and language. Schwandt (2000) calls this perspectivism where the world is explained and critiqued in a conceptual framework.

Guba and Lincoln (1994) write that interpretative research requires the researcher to watch, listen, ask, record and examine. How this is done depends on the purpose of the research, which in turn is shaped by the researcher's paradigm. Under the ontology of constructivism the epistemology of research is transactional and subjectivist, producing findings that are created, meaning the researcher is linked too the subject of the research by the researcher's values.

6.5.3. The methodological question

The third question is the methodological question. Guba and Lincoln (1994) write that this asks how the researcher will go about the research. The answer to this question is also constrained by the answers to the previous metaphysical questions. If, for example reality is 'real' the objectivist or positivist researcher controls the factors being researched.

The research methodology for Guba and Lincoln's (1994) positivist paradigm involves empirical analysis to test stated hypotheses. The conditions of the experiment are controlled to prevent bias.

Postpositivism, say Guba and Lincoln (1994), emphasises falsifying hypothesis. Data that is collected about a situation allows for the discovery of knowledge, viewpoints are solicited, without interaction, to interpret people's actions.

Critical theory requires a dialectical methodology so that misconceptions are transformed into an informed understanding of the research subject (Guba & Lincoln 1994).

Constructivism requires interaction between the researcher and the subject of the research to form an agreed, informed construction through dialectical exchange (Guba & Lincoln 1994).

Heron and Reason (1997) write that a participative paradigm requires a collaborative form of inquiry through democratic dialogue as co-researchers and co-subjects. People determine the questions to be answered and the methodology to explore them. This is applied in their world of practice, which leads to new experiences and new ways of representing their understanding.

Guba and Lincoln (1994) write that from the constructivist position the methodology must be hermeneutical and dialectical. Individual constructs are gained and modified through interaction between the researcher and respondents. The objective is to have an informed consensus construct.

If a quantitative research methodology were to be applied to the research question, how would the question be answered? Quantitative methods try to prove a hypothesis, what hypothesis is posed by the research question? What in the research question can be numerically quantified? How do we quantitatively measure meaning? Quantitative research involves collecting factual data and statistically analysing the data. How can statistical methods be applied to the human meaning asked by the research question? Clearly a quantitative research methodology is not appropriate to answer the research question posed in this study.

An objectivist or positivist ontological position requires an objective form of knowledge, to measure relationships precisely using a quantitative methodology of research. The subjectivist position is one of individual imagination or constructs. The research approach is to understand the constructs of a person's 'reality'; to understand their worldview. The research question offers no objectivist knowledge to specify and prove. The research approach for this study must therefore be qualitative rather than quantitative.

6.6. Summary

This chapter has argued for the qualitative position taken by the researcher in order to address the research question '*Critical issues for the future of the Australian*

urban water supply industry'. Because the critical issues are in the future they are perceptions of the mind therefore to investigate the critical issues requires a qualitative research methodology of *Verstehen* requiring a hermeneutic process. In addition the qualitative position is consistent with the constructivist basis of scenario planning which will be used to assist in the emergence of critical issues.

The following chapter presents the research method based on a qualitative methodology.

CHAPTER 7 – RESEARCH METHOD AND DATA ANALYSIS

'If we knew what it was we were doing, it would not be called research, would it?'

Albert Einstein (1879 - 1955), (Moncur 2004).

7.1. Introduction

The aim of this research was to determine the critical issues for the future of the Australian urban water supply industry. From the interview data with senior water industry stakeholders the key uncertainties or driving forces as described by scenario planners such as Schwartz, (1991) and van de Heijden (1996) and van der Heijden et al. (2002), were used to develop scenarios for the future of Australia's urban water supply industry. From these scenarios and interview data the critical issues were determined. This chapter will describe the research method and initial phases of coding from which 16 major categories of data emerged.

7.2. Research design

The theoretical framework for this research was based on scenario planning as presented and researched by well recognised scenario planners; de Geus, (1988; 1997a); Schoemaker, (1992; 1995); Schwartz, (1991); van de Heijden, (1996); van der Heijden et al. (2002); and Wack, (1985a; 1985b). Numerous other writers have written on the subject of scenario planning, however, these writers and practitioners are considered by the researcher to be the key proponents of the technique. Their underlying philosophy, as discussed previously, is that an organisation is a living organism capable of learning and adapting through the members of the organisation. An objective of this research was to use the scenario planning framework to develop scenarios for the future of Australia's urban water supply industry thereby uncovering the critical issues for urban water supply.

7.2.1. Ontology

In relation to the research question posed, critical issues for the future of the Australian urban water supply industry, the ontological position taken to answer this question is constructivist from a critical perspective. Guba and Lincoln (1994) and Lincoln and Guba (2000) say that 'reality' for constructivists are multiple intangible mental constructs, socially and experientially based, more or less informed and can be changed.

This research focused on discovering mental constructs, critical issues and future uncertainties that are intangible in the minds of senior executives from the Australian urban water supply industry. The key driving forces are major issues of uncertainty that are shaped by social, technological, economic, environmental and

political (abbreviated to the acronym STEEP) issues that are considered important and will impact on the urban water supply industry in the future.

7.2.2. Epistemology

The ontological position of constructivism assumes, according to Guba and Lincoln (1994) and Lincoln and Guba (2000) that the enquirer and the research object are interactively linked and that the enquirer's values can influence the research. What can be known is intertwined with the interaction of researcher and subject of the research. Analysis will enable the critical issues and uncertainties for the Australian urban water supply industry to emerge from the data. It is acknowledged that the researcher's involvement and values as an employee in the industry could influence the conclusions of this study and the crafting of the scenarios for the future. However, to understand what the critical issues are there must be some interpretation to produce a more informed worldview.

7.2.3. Methodology

In order to answer the research question, the methodology required a qualitative approach to the inquiry. The research method proposed interviews with key industry stakeholders, ideally Chief Executive Officers (CEOs) or Managing Directors (MDs) and senior operations managers from major water utilities throughout Australia, in order to develop an understanding of the critical issues for the future of the urban water supply in Australia.

The methodology determined for this study consisted of a qualitative framework, requiring interviews and the collection of dialectic data, transcription and analysis of the text by meaningful coding using the NVivo software package to organise the data. The software package can help in the understanding of the data by organising the information and assist in finding similarities and differences between the various stakeholders' concepts of the critical issues and uncertainties. Therefore, from a constructivist position, a qualitative research methodology was legitimate to answer the research question posed for this study.

7.2.4. Grounded Research

The research method adopted for this research was modified grounded theory (Glaser & Strauss 1967; Strauss & Corbin 1990). The study has been conducted in the spirit of grounded theory in that theory has been allowed to emerge from social research by data collection, coding and analysis. Data were collected by interviewing and engaging with representatives from the water industry. In the business environment theories can have time limits because the external environment changes and therefore theories need to be modified (Strauss & Corbin 1994).

The theories developed from this research are, in part, via four scenarios about the future of Australian urban water supply from which the critical issues for the future of the industry emerged. However, the research process, coding and analysis differed from true grounded theory as espoused by Glaser & Strauss (1967) and Strauss & Corbin (1990) in a number of ways.

The first possible deviation from grounded theory was the use of a standardised set of questions. The research focused predominantly (seven out of ten questions) on the future of the urban water supply industry in the context of scenario planning. Whilst the questions, as discussed later in this chapter, were broad, which was commented on by several respondents, they could be construed as forcing the data in a certain direction to meet the researcher's goals rather than investigating a social behaviour (Glaser 1992).

Secondly, theoretical sampling as described by Glaser and Strauss (1967) and Strauss and Corbin (1990) is a process of collecting data, coding, analysing and theorising before collecting more data. The focus of subsequent rounds of data collection is directed by the emerging theory. In this study all data were collected prior to any coding or in depth theorising. Whilst an emerging theory may have been present consciously or subconsciously in the researcher's mind, there was no modification of the standardised questions or data collection techniques during the interview program.

Thirdly, the coding procedure varied from grounded theory in that four main levels of theoretical coding were developed; category, concept, construct and characteristic; as discussed later in this chapter, to which data were coded. However, within each of these four main levels, the labels given to nodes originated directly from the data.

Whiteley (2002) proposes that if the principles and procedures of grounded theory, as espoused by Glaser and Strauss (1967) and Strauss and Corbin (1990), can only be partially met then the term grounded research may be a more appropriate term to use. With the variations from grounded theory discussed above the researcher has opted to use the term grounded research to describe the research method for this study.

7.3. Research process

7.3.1. Target organisations

The prime target group for this research was the urban water supply organisations who are full members of the Water Services Association of Australia (WSAA). Their main area of activity is the supply of drinking water either in bulk or as a reticulated supply and the collection of wastewater from urban centres in Australia.

WSAA (2001) is the peak organisation representing the interests of the Australian water supply industry. WSAA was incorporated in 1995. The organisation collates information about member activities, conducts research and interfaces with the industry's external environment, both nationally and internationally. In 2001 there were twenty two full members of WSAA. A full member is defined as an organisation that supplies water services to over 50,000 customers either as direct retailers or as wholesalers of bulk water. These twenty two members collectively supply water to approximately 13 million Australians representing the bulk of the urban water supply to Australia's population (WSAA 2001).

In addition to the prime target group of organisations key people from other organisations such as industry bodies and research organisations, closely related to the urban water supply industry were also targeted.

During the course of interviewing it was suggested to the researcher that data should be gathered from smaller regional water supply organisations to balance and compare data from larger organisations. This suggestion was implemented.

7.3.2. Interviewing

As discussed in chapter six and earlier in this chapter, a qualitative research methodology using a grounded research method was argued as the framework to answer the research question. The critical issues, in the context of this research, are the perceptions or the mental models that people construct in their minds about how the world works. Senge (1992) and Senge et al. (1994) write that short term mental models change over time to become deep seated tacit models reflecting a person's beliefs, which are below the level of awareness. To discover the critical issues, data were collected by interviewing. Van der Heijden (1996) discusses interviewing, in the context of scenario planning, in some detail. One of the main purposes of interviewing is to surface the critical issues of concern (van der Heijden et al. 2002). Van der Heijden (1996) writes that the results from interviews are the foundation stones for scenarios. It is therefore important to make the interviewee feel important and that they are making a valuable contribution. The critical challenge for the interviewer is to be accepted as a listener. The interviewer must be attentive and ask questions. There must be interaction for a successful interview. In addition it is important to assure the interviewee that all information will be kept confidential and that there will be no linkages to recordings or information. The interview is van der Heijden's (1996) strategic conversation in the context of scenario planning (van der Heijden 1996; Barker, Jenkins & Bonavita 1999; van der Heijden et al. 2002).

The interviewing method used for this research was a semi structured interview. A broad set of standardised questions was used to guide the interview. Barker et al.

(1999) say that this is the most effective method for scenario planning. If interviews are too rigid they can lead to short responses that lack the depth of information to flush out the critical issues. Interviews enable respondents to frankly express their perceptions about the present and future business environment (van der Heijden et al. 2002). Van der Heijden et al. (2002) suggest that interviews should last for at least an hour in order to surface the major issues.

7.3.3. The questionnaire

Van der Heijden (1996) and van der Heijden et al. (2002) say that a strategic dialogue is about listening for deeper understanding and insight into the mental model of participants. This is important because mental models are the underlying basis for decisions. The mental model is also the basis for the perceived critical issues for a business and its environment. The interview questions used and dialogue must be designed to surface these issues. A number of practitioners have suggested questions to surface critical issues. These were reviewed prior to developing the questionnaire for this study.

Voyer (1996) suggests asking: -

'If there was one core question that underlies all the strategic challenges you face what would it be?'

Hardin Tibbs (1998) suggests the following questions when gathering data for scenarios: -

- What concerns you most about the future?
- What would you ask an 'Oracle'?
- What would be a good/bad scenario?
- What would lead to a good/bad scenario?
- What critical decisions have to be made soon?
- How does the organisation's culture constrain decisions?
- What was learned from past surprises? and
- What lasting contribution do you hope to make?

Van der Heijden (1996, p145) suggests starting the interview to gain the trust and a sense of caring about the interviewee by asking the question: -

How did you come to be in your present position?

This question is designed to involve the interviewee in the exercise by allowing them to express an opinion (van der Heijden 1996). Van der Heijden (1996) proposes a

set of seven questions which are trigger questions to solicit the interviewee's perceptions about the uncertainties facing their organisation and business environment in the future. The first question is (van der Heijden 1996, p146): -

If you could ask a clairvoyant about three critical uncertainties what would they be?

This first question introduces priority into the uncertainties, so that uncertainties, with potential significant impact, are discussed. The next two questions turn the situation around so that the interviewee is the clairvoyant (van der Heijden 1996, p146): -

What would be a favourable future?

What would be an unfavourable future?

Interviews are generally designed to last an hour. If more time is available after asking the first three questions then further open ended questions, such as those below, can be asked in a format alternating with a focus on the past and the future (van der Heijden 1996, p146).

What pivotal events in the history of the organisation should be remembered as important issues for the future?

This question acknowledges that mental models are perceptions from the past. The question surfaces organisational stories from the past (van der Heijden 1996, p148).

What major decisions with long term implications does the organisation now face?

This should focus on a short time frame of a few months in order to surface the current uncertainties (van der Heijden 1996, p148).

What major constraints both internal and external does the organisation currently face?

Constraints are usually strongly felt and should include internal cultural constraints (van der Heijden 1996, p148). A concluding question could be: -

What would you like to be remembered for?

This question is aimed at the interviewee's value system (van der Heijden 1996).

In contrast van der Heijden et al. (2002) in "The Sixth Sense" suggest starting the interview with questions about the future business environment to solicit positive and negative perceptions. Questions then move to the present and how the organisation might address the future critical issues and uncertainties. The final questions discuss the recent past of the organisation to determine how this has contributed to the present situation.

Following a review of the literature on developing questionnaires for scenario planning the following ten questions were used for this study. The questions were adopted from van der Heijden (1996) and the John Curtin International Institute (Barker, Jenkins & Bonavita 1999) and made applicable to an industry rather than focusing on an individual organisation: -

1. What watershed events have occurred in the past either positive or negative that should be remembered in the future?
2. What major changes with long term implications are facing the Australian urban water industry at the moment?
3. How do you see the future of the industry developing?
4. What major constraints are limiting the industry's development?
5. What in your view are the concerns and uncertainties regarding the future of the urban water industry?
6. Consider the future and imagine that things are going well for the industry, what do you hope to achieve over the next 5 years?
7. And if things do not go well for the industry?
8. If you left the industry tomorrow what would you like to be remembered for?
9. Are there any other issues or uncertainties that we have not covered that you think are important?
10. Out of the issues we have discussed could you pick two or three that you consider are the key uncertainties facing the Australian water industry?

The final question was designed to highlight the key uncertainties facing the future of the Australian urban water supply industry. Two key uncertainties, that are argued to be the most important by the researcher, were subsequently used in a matrix as a basis for the scenario writing. The selection of the key uncertainties will be discussed in chapter nine.

7.3.4. Pilot study

Prior to commencing data collection the questionnaire was piloted on work colleagues in the water industry. No major changes to the questionnaire or interview procedure arose from the pilot study.

7.3.5. Data collection in practice

The research was conducted nationally to gain an Australia wide perspective of the urban water supply industry and its future. Public water supply organisations are scattered throughout Australia in areas of major population. To visit all of these

centres in a short period of time would have been costly and time consuming. The researcher therefore adopted the strategy of conducting interviews in major centres when the need and opportunity to visit them arose. For centres outside the mainland capital cities interviews were conducted by telephone. This strategy resulted in the core of interviews being conducted over a period of some eighteen months. The disadvantage of this is that the emphasis on some issues may have changed. The events of September 11 2001 in New York and Bali in November 2002 fall into this category. However, only two out of thirty interviews were conducted prior to September 11 2001. On a positive note the urban water industry is a slow moving industry with a long term focus as such the critical issues remain much the same. This was substantiated by the data gathered.

The initial approach to the organisations involved was by letter explaining the nature of the research and a request for interview within a time frame when the researcher was travelling to the location. The letter was accompanied by a short summary of scenario planning. In most instances a follow up telephone call was required to make an appointment for the interview. For organisations that were well outside capital cities the interview was conducted over the telephone. In these instances the interview could not be recorded, the data was gathered by taking notes.

A total of thirty interviews were conducted in twenty four organisations. Twenty three interviews were face to face and in most cases on a one to one basis, but in four instances with two or three respondents. This had the advantage of being more akin to a brainstorming session; however, the disadvantage was that respondents may not have been as candid as they would have been on a one to one basis. At the beginning of the interview respondents were asked if the interview could be recorded, one face to face interview was not recorded at the request of the respondent. Notes were taken during the face to face interviews as a safeguard against failure of the recording. As soon as practical after each interview the tapes were transcribed and notes typed up from telephone interviews. The recorded interviews resulted in richer data than the non-recorded interviews. Interviews were completed from all Australian states and territories. The target time for an interview was an hour with introduction and final discussion. The actual interview resulted in a recording of about thirty to forty minutes.

The interview data were transcribed by the researcher. A standard format was used for each write up with no links made to organisations or people. Eisenhardt and Bourgeois (1988) suggest three rules for writing up interviews.

1. Write up interviews within 24 hours. This was less critical for interviews that were recorded; however, for telephone interviews it was critical to transcribe the notes whilst the interview was still fresh in the researcher's mind.
2. Use all the data even if some seems irrelevant. This was adhered to for this research and indeed during the coding phase it became clear that some material was irrelevant.
3. At the end of the interview the researcher should record their own perception. Any memorable thoughts about the interview were recorded.

Once written up the taped interviews were checked against the recording for accuracy. An interview of approximately forty minutes took about ten hours to complete a final transcript.

7.3.6. Ethical issues

All names of organisations and people that took part in this study have been kept confidential. All interviews were voluntary and conducted under the guidelines of Curtin University's Human Research Ethics Committee. Prior to all interviews participants were asked to give their consent for the conversation to be recorded, when declined no recordings were made. All data gathered for this research will be retained for five years with no links between transcripts and participants' identity.

7.4. Data analysis

The initial data analysis was divided into four stages. Coding adopted a theoretical framework of hierarchical nodes with the following headings, category, concept, construct to characteristic (Glaser 1992; Anderson 1999). As noted in subsection 7.2.4 Grounded Research all interviews were completed and transcribed before any data coding and analysis. This avoided any preconceived theories to emerge during the interview process. The coding began with a transcript, selected by the researcher; that encompassed a wide range of the issues to emerge from the data.

7.4.1. Coding – phase one

Before analysis could begin each of the interview transcripts was converted from a word document into rich text files so that they could be imported into the software package NVivo for data management.

7.4.1.1. Stage 1 – category nodes

Each question in the transcript was formatted as a heading and interviewee responses formatted as normal text. This enabled each file to be section coded by question giving ten category nodes as below: -

1~ What watershed events have occurred...

- 2~ What major changes with long term...
- 3~ How do you see the future of the...
- 4~ What major constraints are limiting...
- 5~ What in your view are the concerns...
- 6~ Consider the future and imagine that...
- 7~ And if things do not go well for...
- 8~ If you left the industry tomorrow...
- 9~ Are there any additional issues...
- 10~ Out of the issues we have discussed...

The node titles, which were the interview questions, have been truncated because of the limitation by NVivo on the number of characters and spaces to thirty eight (Richards 1999). Each of these nodes was described as a category and represented a fundamental class or division of data. A coding report was made of each of the ten category nodes and printed out.

7.4.1.2. Stage 2 – concept nodes

The data at each category was then reviewed and coded to the next level. These nodes were described as concepts and defined, by The New Shorter Oxford Dictionary (1993), as an idea or general notion. For example taking the first category node called, '(1) 1~ What watershed events have occurred'; a concept under this node was called '(1 1) Sydney Water incident'. The numbers in parenthesis representing the node address. Each node below a higher node is called a child. Node (1), or category, has 27 children or concepts. A total of 180 concepts were coded to the ten category nodes.

7.4.1.3. Stage 3 – construct nodes

Each concept node was then reviewed and coded to the next level down termed constructs. These nodes were described, by The New Shorter Oxford Dictionary (1993), as constructs and defined as a perception or construct of the mind, a theory, such as the theory of learning. For the concept node called '(1 1) Sydney Water incident', there were nine child nodes or constructs, one of them was called '(1 1 5) Learning. Node (1) has a total of 134 children at the construct level. Under the 180 concept nodes, for the ten categories, a total of 418 construct nodes emerged.

7.4.1.4. Stage 4 – characteristic nodes

Each of the 418 constructs were then reviewed and coded to the next level down termed characteristics. These nodes were described as characteristics and defined, by The New Shorter Oxford Dictionary (1993), as a phrase which is indicative of or describes a construct. For the concept called 'Learning' at node (1.1.5) a characteristic is '(1 1 5 1) Realised water quality core business'. Node (1.1.5) has four characteristics which describe the learning construct for the concept '(1 1) Sydney Water incident'. A total of 1938 nodes are at the characteristic level.

Coding of the whole thirty documents produced a total of 2546 nodes. The description of the above coding procedure is shown graphically in Figure 7.1.

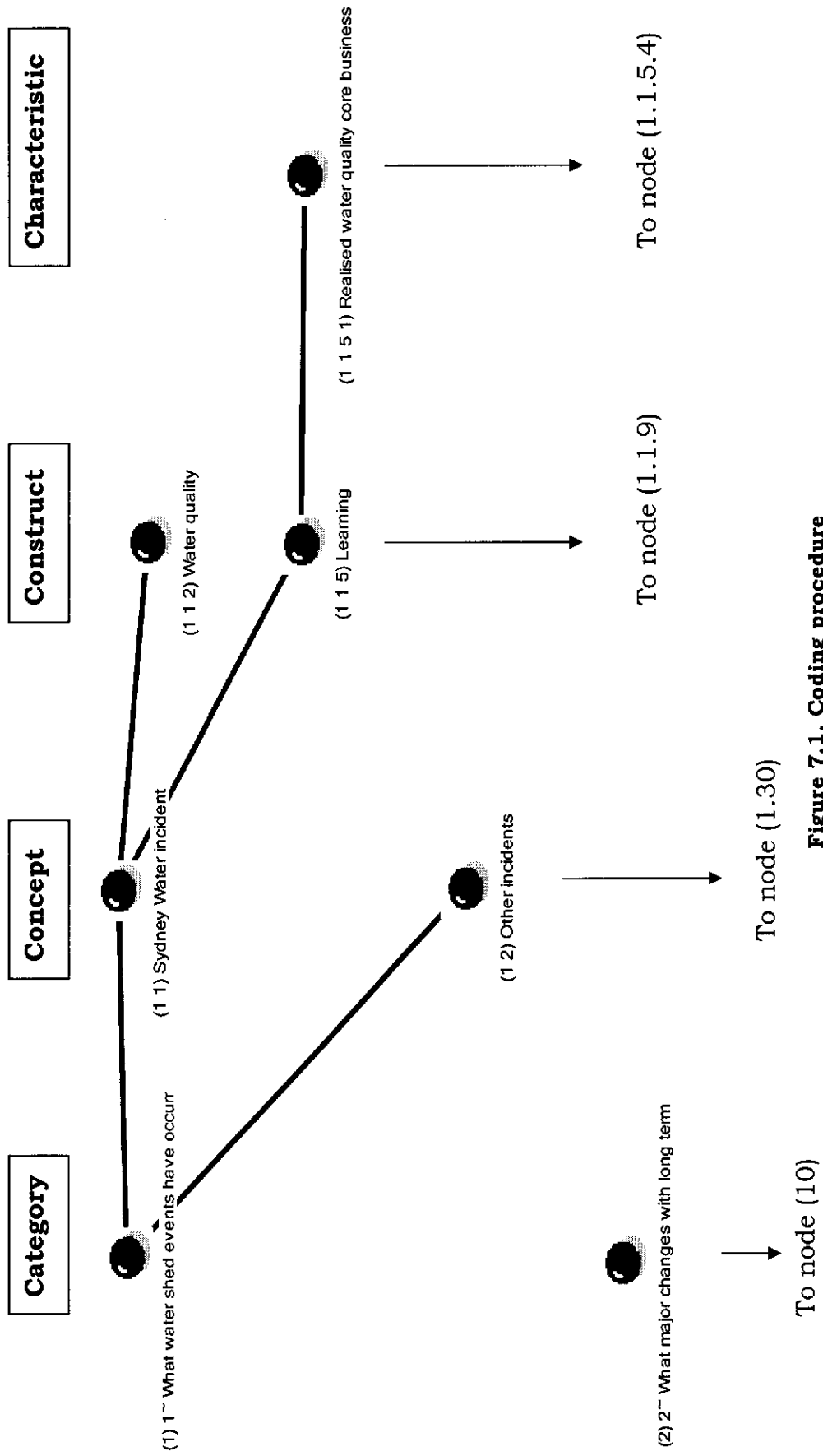


Figure 7.1. Coding procedure

A critical question for the researcher emerged at this point; how to maximise the data gathered?

To resolve this, the researcher focused on the research aim and the nature of scenario planning. The research aim was to determine what the critical issues are for the future of the Australian urban water supply industry. The nature, in part, of scenario planning is concerned with uncertainties for the future. From this position the researcher focused on responses to questions three, four, five, six, seven, nine, and ten, which led to a second phase of coding and reorganising the data as described below.

7.4.2. Coding – phase two

The purpose of questions three, four, five, six, seven, nine, and ten focused on the future. The responses to these seven questions, or category nodes, contained a total of 122 concept nodes. The second phase of coding involved reorganising the data in four stages.

7.4.2.1. Stage 1 – reorganising the category nodes

A list with node addresses of all the concepts was produced in a Microsoft (MS) word document. The list showed that some concepts occurred in each category as a response to different questions either with the same title or with a different title with a similar meaning. Since the aim of the research was to determine the critical issues for the future of the Australian urban water supply industry the 122 concepts were assigned by the researcher to 16 major categories that reflected the critical issues. One such category was called 'The community'. Data belonging to these 16 major categories are presented in the following chapter, Findings.

7.4.2.2. Stage 2 – reorganising the concept nodes

The second stage was to review the concept nodes coded to each category. This was achieved by producing a node set. As an example, the data coded to the category node called 'The Community' initially had nine concepts after the first phase of coding. A node set of the original nine concepts was made in NVivo and the text copied to a MS word document. The researcher found it easier to edit and format using MS word. This was then printed together with a list of child nodes and addresses. The data was reviewed, recoded or nodes moved into three new concept nodes, for example the concept called 'Behaviours'.

As the researcher went through each of the 16 major category nodes some concept node names were changed. From the original list of 122 concepts 61 remained under the 16 major categories.

7.4.2.3. Stage 3 – reorganising the construct nodes

Continuing with the example from the node called 'The Community', the data coded to the node called 'Behaviours' was reviewed, recoded, or nodes moved to five constructs for example the construct called 'Expectations'.

7.4.2.4. Stage 4 – reorganising the characteristic nodes

The data at each of the construct nodes was reviewed and nodes moved or renamed by the researcher into the final level of coding, characteristics. Following the example through the construct node called 'Expectations' five characteristics were coded as children to this node, for example the characteristic called 'realise things are changing'. Figure 7.2 presents the node diagram for the category called 'The Community' to the construct level.

7.5. Models

Each of the models for the 16 major categories was put into an over all model called 'Future' depicting the super category 'Future ~Qs 3, 4, 5, 6, 7, 9, 10~' and shown in Figure 7.3.

In summary this second level of data analysis reduced the data to a manageable set of 16 major categories relevant to the aim of the study to determining the critical issues for the future of the Australian urban water supply industry.

7.6. Summary

Following the qualitative methodology, argued for this study in the previous chapter, the researcher has used a grounded research method in order to answer the research question. The method required interviewing senior people in urban water supply utilities across Australia. A questionnaire was developed, for a semi structured interview, with a focus to collect data under the framework of scenario planning. Data analysis was undertaken using NVivo to organise the information into 16 major categories.

The following chapter, Findings, will discuss these 16 major categories in more detail illustrating them with data from the interview transcripts. Chapter nine, Discussion, will show how the data were used to develop the four scenarios for the future of Australia's urban water supply.

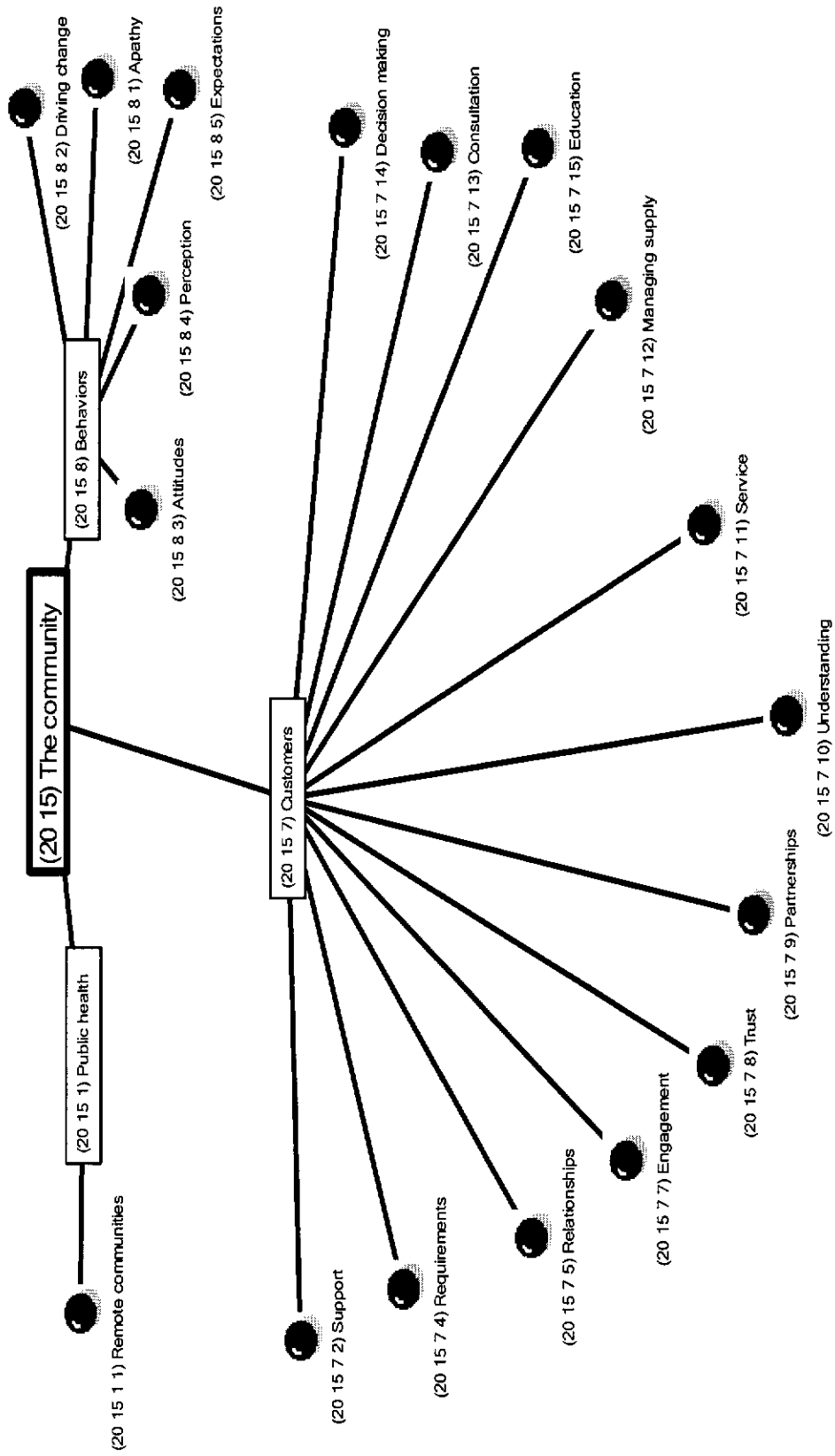


Figure 7.2. Category Node (20.15) 'The Community'

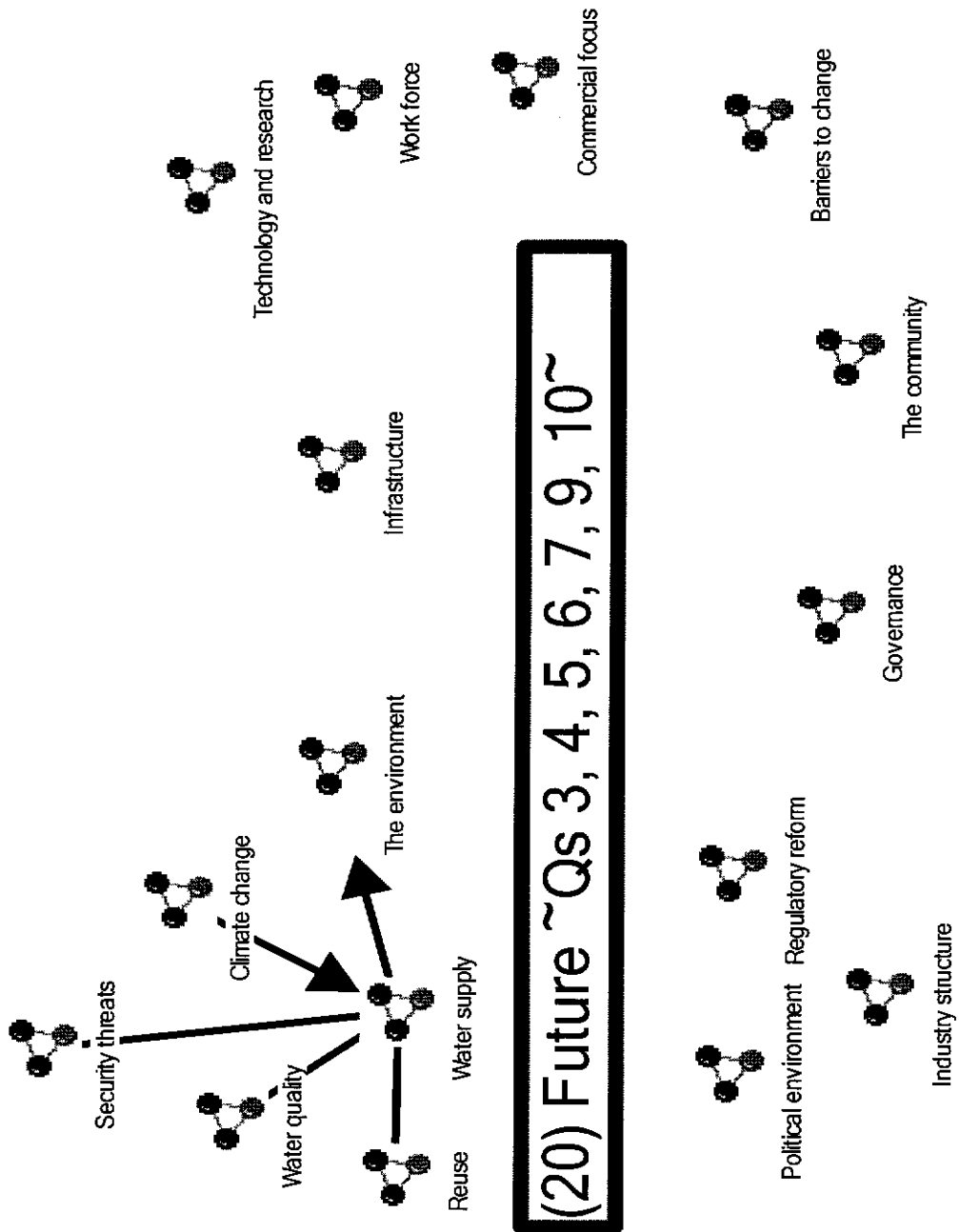


Figure 7.3 Model Future

CHAPTER 8 - FINDINGS

'The world has changed.

I see it in the water.

I feel it in the Earth.

I smell it in the air.

Much that once was is lost,

For none now live who remember it.'

J. R. R. Tolkien (1892-1973), (Moncur 2004).

8.1. Introduction

In the previous chapter, Research Method, two phases of data coding were described, the outcome of which gave 16 major categories containing data relevant to the future of Australian's urban water supply industry, refer to section 7.4.2. This chapter will present these categories in detail and illustrate them with data from the interview transcripts.

When using NVivo (Richards 1999; NVivo 2002) to organise data, as discussed in chapter seven, each node in the model was linked to the documents and passages coded to that node. This enabled the researcher to browse the data coded at any particular node. During the second phase of coding it was important when reorganising nodes that data were copied from one node to another rather than just moved to ensure the data were retained at higher node levels. This was critical for this study to ensure all data were available at a particular node. Hard copies of all data were retained as a safeguard against digital data failure.

Glaser and Strauss (1967), Strauss and Corbin (1990), Creswell (1998), Locke (2001) and Goulding (2002) describe the first stage of analysis, using the grounded theory method, as open coding allowing categories to emerge from the data. The second stage of coding, as defined by Strauss and Corbin (1990), is termed axial coding in which data are reassembled in different ways by making connections between categories. Axial coding utilises a theoretical coding framework. This study used a theoretical coding framework, as previously discussed, to code data from the outset and whilst the second phase of coding resembles axial coding it could be argued that only axial coding has been undertaken. This again highlights a deviation, in this study, from the true grounded theory method.

The main objective of this chapter is to present the research findings, what respondents said about the industry, the challenges, issues and uncertainties that Australia's urban water supply industry faces in the future. The findings are presented firstly as a diagram showing the category, concepts and constructs followed by the researcher's comments. Quotes, in italics, from the interview

transcripts allow respondents to speak for themselves in illustrating the issues (Whiteley 2002).

For the purposes of clarification where quotes from respondents are used they have been slightly modified to remove duplicated words, this in no way has altered the meaning of the response. Quotes from respondents are identified by being within the symbols //...// and in italics. Where pauses in transcripts or sections have been deleted, these are represented by three dots.

Whilst the objective of this research was to uncover the critical issues for the future of the Australian urban water supply industry there are important events that have occurred in the past that have shaped the industry and continue to provide uncertainty. Question one of the interviews asked about these events and is referred to later in this chapter.

8.2. The 16 categories

The categories are defined as a fundamental class or division of data. In the context of this study they represent a fundamental issue or topic concerning the future of urban water supply. The structure of the 16 major categories is subdivided into concepts as shown in table 8.1. Each category is depicted graphically by a model imported from NVivo (Richards 1999; NVivo 2002).

Table 8.1. Categories and concepts

| | Category | Concepts |
|---|-------------------|--|
| 1 | Commercial focus | Financial The organisation Efficiency Benchmarking |
| 2 | The environment | Water resources Development Being greener |
| 3 | Regulatory reform | Competition Economic Environment Change Impact |
| 4 | The community | Public health Customers Behaviours |
| 5 | Water supply | Sustainability Demand management Irrigation Planning Resource administration Resource availability Integrated water services Safety |

Table 8.1. Continued

| | | |
|----|-------------------------|---|
| 6 | Industry structure | Ownership Outsourcing Globalisation Partnerships Rationalisation |
| 7 | Reuse | Pressure Safety Community Distribution Trade waste Cost |
| 8 | Technology and research | Knowledge Research Technological change |
| 9 | Work force | Employees Skills base |
| 10 | Political environment | Government intervention Controlling the future Government structure Will to make change Political climate |
| 11 | Infrastructure | Asset management Generational problems |
| 12 | Climate change | Attitudes Impacts Actions |
| 13 | Water quality standards | Public health Emerging issues Managing expectations Standards |
| 14 | Governance | The legal environment Management schemes Accountability Liability |
| 15 | Barriers to change | Attitudes Tradition Conservative industry Mind set |
| 16 | Security threats | Open minds Managing risk |

8.2.1. Commercial focus

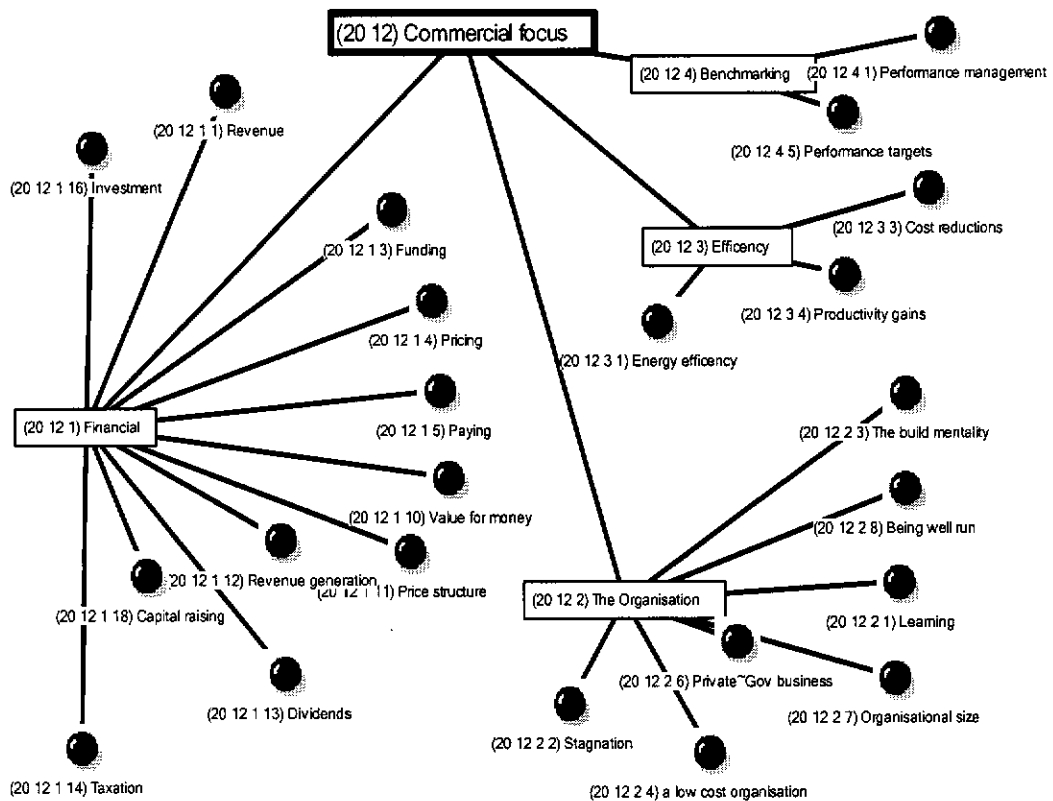


Figure 8.1. Category 'Commercial focus'

The category of Commercial focus is concerned mainly with funding and generating revenue so that water utilities can move forward and invest in new projects and infrastructure. This is done through the price of water, efficiency gains and cost reductions whilst at the same time utilities try to achieve a commercial rate of return on assets and pay dividends to their state or territory governments, the owners. Longer term commercialisation is expected to put upward pressure on the price of water as efficiency gains expire.

8.2.1.1. Financial

Respondents said that a prime consideration for water utilities is revenue so that they can invest in their business. Financial resources have, for most water utilities, always been in short supply and are likely to continue to be constrained in an environment of price control and the community not wanting to pay more for water services. Some utilities have developed and sold services beyond their traditional customers. Comments made by respondents suggested:-

//sufficient revenue to keep ourselves clever and our solution to that has been trying to sell some of our services//we've got some additional revenue coming in from selling our services to other agencies mainly in the east coast of Australia//

//financial constraints and the extent to which people are able, organisations are able to invest in things they need to invest in//

//going to be a difficult balancing act to achieve that...given the expectations of the community of...paying less for water and sewerage in the future//

In contrast one respondent said there was no shortage of money. However, the biggest concern for many water utilities was having enough funds to finance infrastructure and meet community expectations in reference to water services.

//there will be massive replacement cost//spikes in expenditure covering two to three generations//

//its ability to fund infrastructure//

//the issues are community expectations and ability to fund it//

Central to the issue of revenue is the price of water. This is further noted in the findings under the Regulatory reform category in subsection 8.2.3.

//well one is certainly the price of water,...which I think, relates to the amount of...capital available to the industry...in that you cannot really spend or invest more than you can afford out of your revenues//

The difference between urban and agricultural irrigator water users is noted in several contexts. One of these is in terms of water pricing in Australia. Irrigators pay far less and use far more water than the urban users. A lot of this is to do with water quality and providing services. Taking the comparison further the price of bottled water is even higher with implications for the preparedness of the community to pay for water.

//in Australia where 70% of the water goes to irrigation, 20% to urban and industrial uses...and another 10% to...stock and domestic//you're looking at a cost differential about fifty times between what irrigation water costs and what rural [urban] water costs...now it's not apples and apples you've got a...clean high quality treated monitored supply delivered to your door step//and...if you then go and pick up a bottle of water of the shelf and buy it...I think the order of magnitude is along the lines of that bottle of water costing 400,000 times the price of the irrigation water...so, on the one hand you've got a demonstrated willingness to pay, on the part of the consumer, a much, much higher price than they pay right now for the water that they drink//

Respondents said that the price structures for water were generally set by a political rather than an economic agenda, this, some respondents believed impacts on long term planning.

//it's very difficult...for...long term planning to be done in a frame work where...the pricing structures are often politically set rather than...economically set//

Others respondents believe that pricing structures have improved, it depends on the jurisdiction. Most water utilities would like to see price deregulation.

//I think...pricing'll sort itself out alright, pricings improved//I don't know what it's like around the rest of Australia but I think it's pretty well sorted out now under National COAG//

Most water utilities have a user pays pricing scheme for water. Respondents believe that there is reluctance on the part of the community to pay more for water and that the increasing price of water is a concern from the customer's point of view. This has political and demand management implications. These issues are discussed further under the categories of Regulatory reform, Water supply and Political environment.

//I suppose you've got 'a look at this also from the customer's point of view, the people that turn the taps on every day of the week. What would be the concerns and uncertainties of them? I think [it] would be increasing price of water//

//general reluctance to pay more for water//people don't want to pay more for water//

In terms of pricing structure respondents said that there is an increasing proportion of the population, 'Baby Boomers', retiring with implications for water pricing and the economic well being of the country.

//there is going to be a very big in-balance between those who are retired and those who are actually working and that will affect this industry in terms of...structures prices, but also affect the economic well being of the whole...country//

Respondents said that another area of increasing pressure for water utilities was providing returns to government as a way of offsetting the cost of an aging population. Respondents believed that water utilities should not be tax collectors for government because it may impact on efficiency. Respondents raised the questions as to why water utilities needed to make a commercial return and whether it was the reason for the industry coming into existence.

//but I also think it's going to come under increasing pressure to...provide returns to government//

//it could be seen as a way of offsetting the social costs of an older population is to actually increase the revenue contributed to Government via water. I think that would be an unfortunate step because I don't actually ever believe water should be seen as a tax collector//

//if you look at the history of the water industry it was, developed because of public health concerns and it was never there to sort of...to be a profit making business//I mean I think it can; I think it can be paying those dividends//

In the area of investment respondents again said that the price of water is a major issue in order for some utilities to be able to invest in new infrastructure and get a good rate of return on the infrastructure in an environment of scarce and competing demands for capital.

//the ability to fund infrastructure and get a reasonable return on that funding is a real issue//the pricing setters...are really not giving owners a reasonable return on capital invested and that's a real constraint//you could argue that this infrastructure is fundamentally vital...to the community and...getting a reasonable return on water infrastructure...is not necessarily sensible but remember capital's a scarce resource and there are many competing demands for capital and our ability to fund infrastructure given very, very low returns ultimately will be a problem//

Current rates of return for the water industry are low at 2-4%. Respondents believed that this will have to rise in order for the industry to be sustainable. This will impact on the future price of water, demand for water and operational costs.

//corporatisation is...really going to drive a lot of change in the industry focused on...its...return on...investment...fairly low rates of return on investment, currently...bobbing around the 2 to 4% for the industry nationally...I think that's unsustainable for the industry and it will certainly be looking at...moving to...a higher level of return...certainly in the 3 to 5%...and longer term, I think, some utilities will...push between...the 7 to 10%... that'll have implications for...the price of water and, therefore...effecting its...the per property and per capita demand, I think, it'll also have implications...in driving down...operational...and recurrent costs as well as...focusing...very heavily...on the return of new capital investment//

Respondents speculated that once the water industry was recognised as making a good return it would become attractive to outside investors with the associated risks.

//investors could see that it's, it's a great business//buy it up and then run down the assets//make the quick profit and then just say are OK well that's it we're out of this business//

On a positive note whilst returns may be low the water industry has a lower financial risk than many other businesses.

8.2.1.2. The organisation

In order for the water industry to move forward respondents believed that water utilities must learn and not accept the status quo or they will stagnate and not be able to attract people to the industry. This is connected with changing people's mind set discussed later in this chapter under the category Barriers to change.

//if we don't learn from the current water shortage problems, if we continue to be engineering driven, if we continue to ignore the realities that capital is a scarce resource//then I think we'll find ourselves a few years down the track with the same sorts of issues water constraints from time to time...poorly performing plant, water quality supply problems, inability to attract good people to the industry//we've got to get ourselves away from being seen as...engineers wearing our cardigans and Hush Puppies//

Respondents said that the water industry had to become faster moving in a changing business environment in order to gain access to resources both natural and financial.

//water industry is not a fast moving industry but has to become, because of resource allocation and funding//

//the industry's ability to react quickly enough to the changing...environment within which we work//my concern is that we will be driven back to ever be a cost, a low cost organisation, which doesn't allow us, as I say, to invest in our future//

In some states, mainly Queensland and New South Wales, many water supplies, outside the major cities, are run by local councils. Respondents said that there was a need for rationalisation and that the size of some organisations is not optimal in commercial terms. However, not all respondents believed that bigger was better. So what is the optimal size for a water utility?

//the size of some of the organisations are not, certainly not optimal and therefore it's more difficult for them to actually drive their businesses forward//

//have some concerns about it's fragmented structure, in terms of whether or not the organisations are big enough; in a lot of cases, to be effective//

//one of the constraints is to actually define what is a viable size for a water industry to provide the optimum price//

//in electricity it's about one, two million customers is seen to be the optimum, well in water it's around...700,000 or something//

//personally I don't think bigger is better and in fact if you listen, there's enough evidence around that if, that some of the smaller operations can in fact// deliver quite a...healthy dividend to the owners and run quite a profitable business//

In the future respondents would like to see the water businesses being well run on a commercial and sustainable basis.

//what you'd like to see in five years, I think, is water utilities sort of, pretty much focused on being well run well governed bodies that really managing their supply responsibilities well but within a commercial framework//

8.2.1.3. Efficiency

Most water utilities are now run as commercial organisations they are focused on efficiencies and reducing costs, particularly in terms of energy consumption, which is a major input for the water industry. Respondents said that becoming energy efficient is a major challenge for the water industry.

//we would want to have made a significant...step forward in reducing our own energy demands//obviously as a public authority with an environmental focus there's a need to set a good example//reducing energy consumption is important//that's a challenge for the whole industry//

//greater emphasis on the energy requirements of the water industry. I don't think people realise the energy demands of the industry//

//we're looking really closely at our electricity bill//

Respondents said that other areas of focus to reduce costs have been labour efficiencies. The focus now is on the optimisation of asset.

//just trying to get cost efficiencies//it was mainly driven by labour cost efficiencies before, now we're trying to make cost efficiencies in asset management decisions//least cost, ownership of all the assets//

//the economic drivers...particularly in the productivity gain area and optimisation of assets//

8.2.1.4. Benchmarking

In terms of performance, respondents commented that whilst there may not be much direct competition between utilities there is comparative competition through benchmarking. Respondents said that they thought competition would increase as commercialisation increases and that there would also be an increased focus on risk management as a result of terrorist threats and water quality incidents.

//the benchmarking that can be done we're going to do much more of that too here as well, we will benchmark ourselves against other organisations and the whole area

of performance management the organisation work at individual levels is becoming more pronounced//and there is much more emphasis now on the risk process in terms of water quality or catchment management or floods or water supply//

The introduction of performance standards and key performance indicators (KPIs) are set to increase.

//setting performance targets so you can see how you're fairing with other...similar water authorities so I think, in the next five years we're going to see those refined even more//we've got our own, what we call KPIs//

8.2.2. The environment

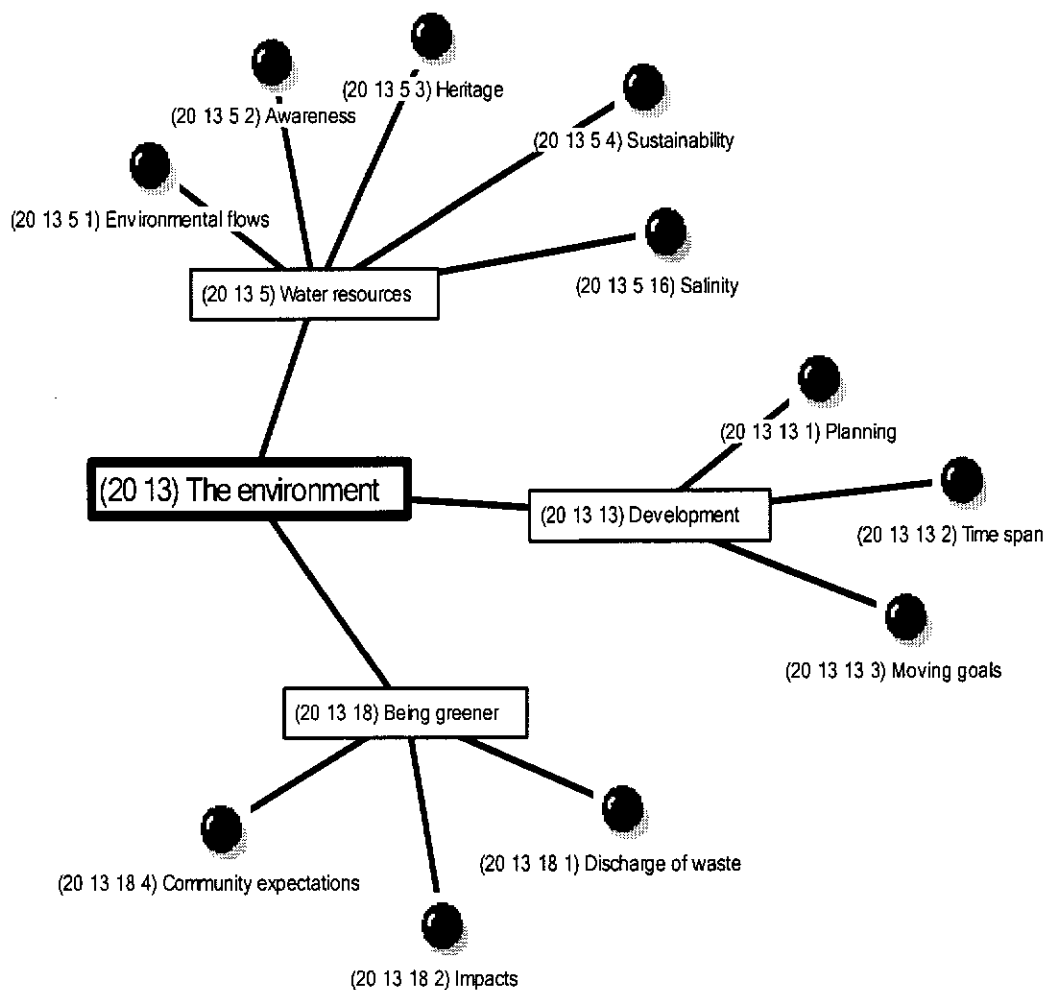


Figure 8.2. Category 'The environment'

8.2.2.1. Water resources

Findings show that the water industry is under pressure to be environmentally conscious in terms of maintaining environmental river flows. This is particularly an

issue for the eastern states and the Murray Darling Basin where one state's actions impact another and political forces come into play between urban water users and irrigators. This is one area where the holistic Federal management of water would be beneficial.

//the Queenslanders who've got the upper part of the Darling system, say well we're goin' to keep puttin' dams there we want to have more rice or what ever it is they're growing, so...but the down stream states in New South and in South Australia, in particular, feel that's not taking into account their interests so the environmental flows...and maintenance of environmental flows in rivers, I think, is sort of...it's probably one of the emerging issues//restoring environmental flows into the river, unleashed other political force that opposed it because it meant less water to go perhaps west for irrigation//

From an environmental awareness perspective respondents said that the days of being able to build another Snowy Mountain scheme are gone and the construction of large dams has become very difficult because of the environment, heritage and Aboriginal cultural issues. However, respondents believe that these issues are now taking their rightful place in the debate about water use and development.

//some people wouldn't say environment is a constraint though, they'd say it's its right and proper place an' so, I think it depends on which side of the spectrum in water that, if you were a water industry person who is really just about getting the water out and selling it and using it you might see that as a constraint whereas the environmental people would say...or its right and proper outcome we should have water and use it properly and wisely and not wreck the environment//

Respondents considered that environmental and sustainability issues will continue to rise and that the challenge for the industry is to continue to deliver water and wastewater services with ever increasing environmental constraints.

//how does the industry continue to...have the financial capital...and the intellectual capital...to continue meeting the challenge and delivering the...product...and faced by the broadening impact of...environmental constraints...and I think the environmental aspect will continue to drive in all the time//

8.2.2.2. Development

Developing new infrastructure takes time particularly major projects because of the impact these projects have on the environment. Respondents saw this as a constraint particularly when the regulations change.

//anybody wanting to build a new reservoir, a major reservoir was looking at a 20 year time span...from the idea to completion because of all the steps and all the

arguments they'd have to go through...so I think that does restrain us to some extent//

8.2.2.3. Being greener

One of the key issues for the water industry is waste disposal, effluent quality and the discharge of bio-solids. The pressure for improved environmental outcomes is increasing. As more water is used the volumes of wastewater increase, at the moment the most environmentally friendly way of disposal is discharge, after treatment, via ocean outfalls. Some wastewater is recycled to ovals and golf courses. One of the issues, according to respondents, is how the water industry funds improved environmental outcomes.

//we're going to have to be...extremely green...we're going to have to look...at how we minimise our impact on the environment whether that's electricity, methane generation, discharges, waste products, what ever. We're going to become more of an environmental service//

//that pressure to improve the environmental outcomes is only going to increase on us//and it gets very complicated because it's who funds it//

8.2.3. Regulatory reform

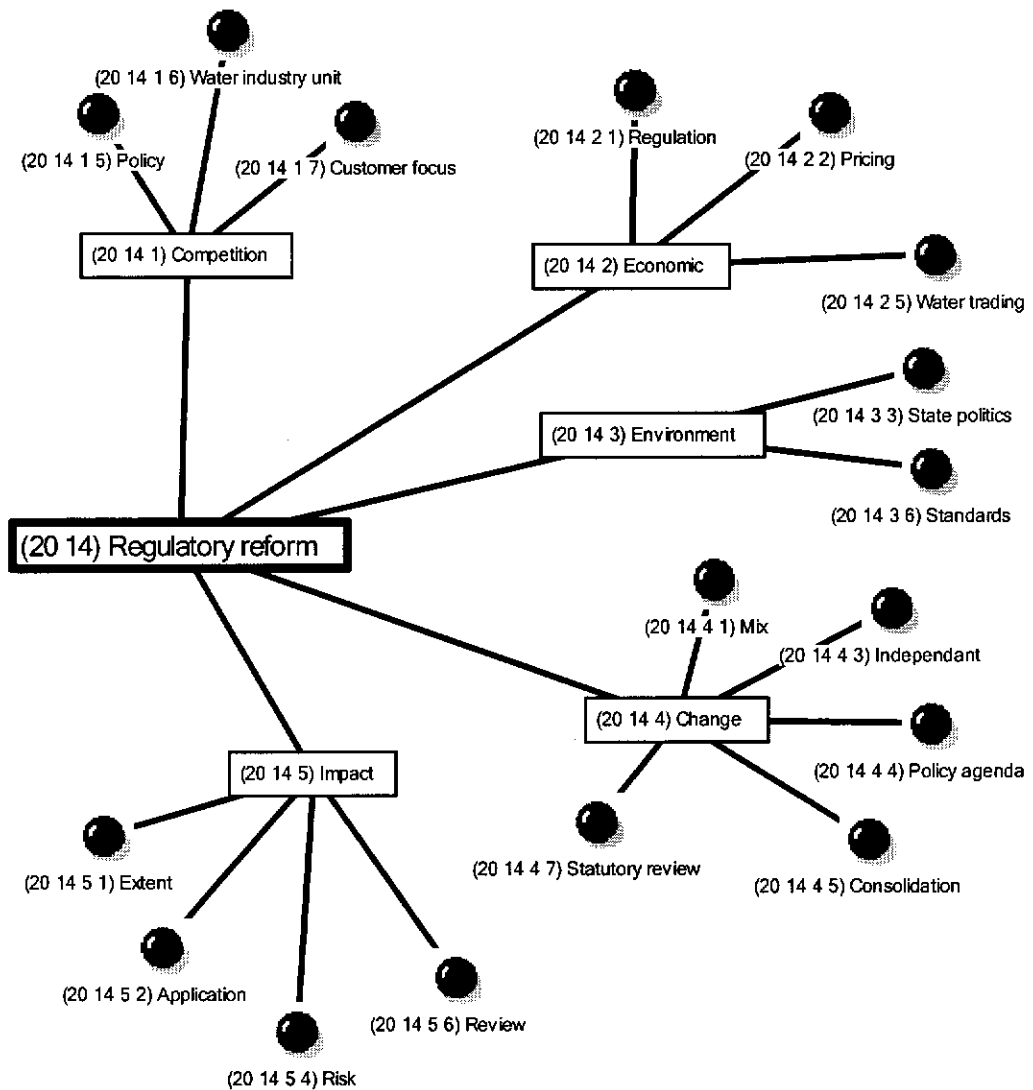


Figure 8.3. Category 'Regulatory reform'

Regulatory reform of the water industry has strong links to the category of Industry structure.

8.2.3.1. Competition

In terms of competition respondents saw the main arena as international rather than domestic competition. They thought that the Australian water industry should be united and look for international business opportunities.

//I think, the real competition's the international scene and I'd like to see the water industry workin' much better together...as a Australian water industry//I think we could also look at business opportunities for the water industry in the international market place and do it as a group//

//I'd like to see us really focus on doing the best we can as a unit across the country and stop all this parochial nonsense and economic chess games and get down to the real game//

Other respondents believed that there should be local competition to improve customer focus and that comparative competition would be a driver for it.

//it's not a customer focused industry//it's the absence of competition//

//you'd have a vastly different industry if you had some competition//

//that would ramp up the attention to customers//

//you've got the comparative competition, that's a driver//

8.2.3.2. Economic

Findings show that there is uncertainty in the water industry about economic regulation and in particular the pricing of water. Most utilities are not free to set their own price for water; it has to be approved by various state and territory government bodies. Utilities can make submissions on price but ultimately they do not control price as the majority of commercial enterprises do.

//I think the impression that I'm getting from talking to colleagues in the water industry is that they have a view that...they're uncertain about...the extent to which they will, well it's around the area of economic regulation//

// and pricing, I mean, the point I made before about economic regulation, I guess is really...the concern is driven by...an anxiety within the industry that, it concerns, about pricing levels which are not properly factored into the decision, and the industry gets...unsatisfactory price determinations...from the point of view of being able to undertake the business...activities they want to meet//

//deregulation of pricing so that it is not in the hands of government//there needs to be an independent body to review and determine price//

//if you start pricing, having major price changes in water, urban supply you run the risk of disrupting whole communities and I not sure if governments are quite ready for that, so I think there's some uncertainty in that area//

Respondents believe that water is undervalued; this is linked to valuing the commodity as a precious resource and discussed under the categories The Community and Water supply. Respondents said that in some states the price of water reflected costs, but not in all states and territories.

//it's undervalued, tremendously undervalued right throughout Australia//we're paying full price and most of the other states aren't, if you look at their costings//

Respondents said that water trading would expand and will result in changes to jurisdictions. This may assist in achieving a more holistic approach to water resource management.

//water trading will be more widespread but not a robust water trading system, it won't be efficient//

//there will be a lot of effort on behalf of the Federal Government; will have a national property rights to water this will force change in jurisdictions//

8.2.3.3. Environment

Respondents were uncertain about how far government regulators will change environmental standards for what is perceived to be a marginal gain in environmental outcomes for a high cost. Respondents also noted that there were different regulations in each state and territory.

//there's a reasonable amount of...uncertainty in terms of the environmental...side of life and in terms of, just how extreme or, practical//and what impacts that has...right through the business whether it be from a system planning point of view, operational point of view, compliance, environmental damage. I think there's a degree of uncertainty as to where that's all going to end up//

//there's still probably an amount of uncertainty associated to that and how far we might be driven//

//I think they understand that there's trade off between the year capital cost and...the standard//

//they understand that the community's not willing to pay the massive amount of money for the marginal gain in standard//

//I think...regulatory standards, making sure that they...we cannot make sure but...that they are practical and that we don't go...incurring huge costs for little or no benefit//

//there's just completely different regulation in each state//it would be good to have some overall regulator, I think, that...would be able to be consistent//

8.2.3.4. Change

Respondents said the industry was undergoing a change in the way it is regulated. There had been significant progress but there was uncertainty about how reforms would progress in the future. There has been and will continue to be increased regulation to allow more competition, this will shape the future of the industry. These changes include price regulation, environmental, water quality and service regulation. Respondents said that the mix of regulation had to be right; the

alternative was perceived to be more international players in the Australian water industry.

//I think the industry will go through...a change in the way it's regulated, I think there's going to be increased regulation//more highly regulated and opened up to more competition I think there'll be some more competitive pressures brought in there so that'll shape the structure of the industry//

//I think the future there is a much more regulated environment because I think the alternative will be that...there'll be a greater intrusion within the water industry in Australia of international players and I don't think Australia's prepared to go down that track//

//there has to be a better regulatory environment, there has to be tougher water quality regulations...there has to be...a fair dinkum price regulation//

//it's a question of getting the regulatory mix right//

//we've got a water reform agenda that's progressed significantly...the question is are we going to have a reform agenda number two...and what's it going to look like so I think that...one of the things we'd look to have happen is some of the uncertainty about the next policy developments that are going to occur be resolved//

Respondents believed that the urban water industry had progressed in its reform agenda and the focus should now turn to the 80% of water used by irrigators, a side of the industry that the urban users believe is part of the whole water industry.

//we're starting to talk about that 80% of the water again, but I think that if the urban industry isn't aware of and isn't concerned about the management of water in the full sense...that we've got a mistake and a problem. They can't be divorcing themselves from that issue...and certainly with respect to the COAG reforms what we see going on, I think, is we see progress within the urban sector, that this point has outpaced the progress in the agenda that was laid out for the rural sector...and I would think that the industry needs to be concerned about that so I'd like to see some catch up occur//

Other changes that respondents thought would be required are consolidation of the industry both in terms of regulators and service providers.

//from an industry point of view...I think the next five years is a period of consolidation really//

8.2.3.5. Impact

Respondents saw the impacts of tougher regulation as potentially constraining the industry with increasing demands for reporting, auditing and having an impact on

operating costs. Some respondents accepted that there would be increased regulation and believed in trying to work with and influence the regulatory bodies.

//many people seemed concerned about the extent to which they're regulated but I guess my view of...regulation is that those who are regulated often can't, it's a bit like adolescents with their parents, they often feel they are being unfairly constrained despite the extent to which...constraint is real or simply imagined//there is a...view among some parts of the industry that regulation is...less efficient than it could be and that that increases operating costs in a way, the costs of compliance//

//I think that we're actually getting over regulated//the multiple reporting requirements, the multiple audits...are quite stringent//

//I think that the strengthening regulatory environment is a concern but at the same time they are a necessary evil and I think...what we've adopted here is the position is that we will try and influence the regulator as much as we can...build relationships with the regulator and really try and influence them//

//my own view is that often there's a rhetoric that exists within industry sectors about regulation which is about simple whingeing about it rather than engaging in a properly critical way with the question of what is good and what is bad about the regulatory framework in which you operate//

//the key uncertainty is...policy...whether it be National Competition Policy or triple bottom line policy or whatever it is knowing what it is and having it applied correctly to the type of industry that we're in, is probably the key uncertainty from my perspective//

8.2.4. The community

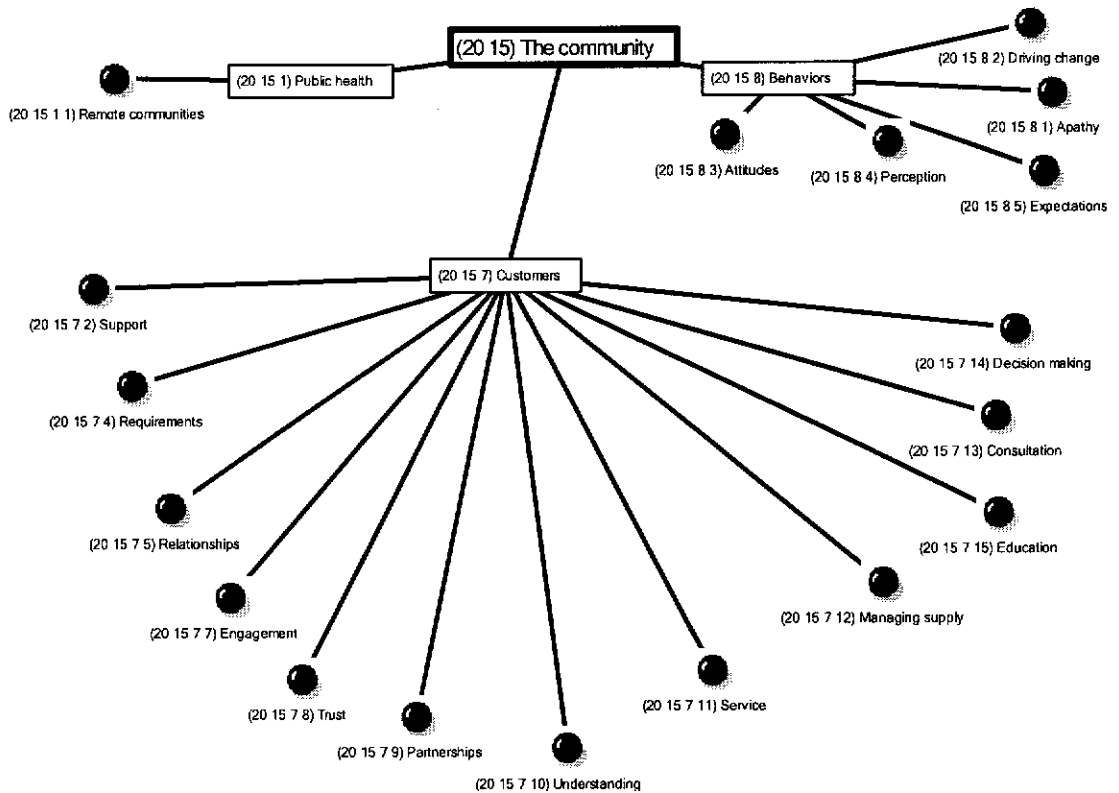


Figure 8.4. Category 'The community'

This category contains data concerning the community, customers and the public in relation to reticulated water supply.

8.2.4.1. Public health

For the water industry there are always emerging public health issues to be dealt with. Emerging issues is also a concept under the category Technology and research. Respondents noted that the area of greatest challenge was in remote and rural communities, particularly Aboriginal communities and the contribution water and water services could make to good overall health of the community. Respondents saw this as a challenge for the rural water suppliers rather than the strictly urban utilities. However, in states where there is a dominant or single water utility such as Western Australia, Northern Territory and South Australia the utility supplies both urban and rural customers.

//the greatest challenge//is for the...rural and remote communities and especially the...Aboriginal communities, and I think that challenge is about achieving health outcomes not just...a focus on the water business...it's about...the environmental

health infrastructure the...the condition of plumbing...the education...in use of water and...sanitation...has essential...building blocks of the...good health//the challenge is actually to...move away from a focus...on the business of water supply and...just see water supply and...sewerage or sanitation as being...elements of...the overall...environmental health approaches to...at a community level//

8.2.4.2. Customers

Respondents said that the relationship between the community and utilities was a major area of focus for the industry. Respondents thought that it had community support providing it demonstrated professionalism in dealing with issues as they emerged.

//I think the community as long as it sees a...professional and systematic job being done//then we'll retain their support it's when you get bumbling around...that...the message that comes out is one of...incompetence...and the like, that's when you're really in trouble//

Respondents realised that the community was becoming increasingly demanding of water services because the community was more knowledgeable and expectations had and would continue to rise in the future. Water utilities had to offer different types of services to meet the demand from a discerning public.

//the increased knowledge of the community and their expectations of being more, wanting to choose the sort of water services that they have, I don't know how far that's going to go//there could be an increasing demand for a variety of ways that you provide infrastructure or provide services to the community and I guess...the traditional universal centralised system that most water authorities have may be not satisfactory to communities as more people want to become, want to have their own, I guess, personal water services provided//so I think this trying to satisfy...customer requirements and customers...are increasing in their knowledge of what's available and what they can have because of, I guess, because of technology, the easy access to what's being done right around the world//

Respondents noted that utilities recognised that managing customer relationships would be important in the future.

//utilities will have less focus on regulation and more focus on customers//

//customer relationship management will be important in the future, it's about strategic alliances//

Respondents saw that part of customer relationships was engaging and informing the community about water services. Interestingly one respondent mentioned changing perceptions and keeping in touch with young people. Generational

changes in perception were a key element of the Business Council of Australia scenarios (BCA 2004).

//getting the community engaged and informed and being...able to undertake what we do with empathy//keeping in touch with...young people and changing...perceptions about...what is and isn't acceptable in terms of water use//

Respondents said that a key concept in water utilities relationship with customers and stakeholders was winning and maintaining trust and confidence in the water supply services. Central to this had been the community's acceptance of the Australian Drinking Water Guidelines and a quality focus to services by the industry.

//if things don't go well for the industry//would be...reduced community confidence in...water utilities and the way they were approaching their various roles//

//I'd like to think that in five years, all going well, that we would have the trust of our customers, we'd be seen to be leaders in sustainable development...we'd be able to demonstrate that our cost effectiveness of our service provisions that we have the adequate benchmarks...in place to be able to demonstrate that we're providing value for money//it's also been a key aspect its been winning the...trust of the...regulators and our key environmental stakeholders//

//I think...the adoption of...the Drinking Water Guideline Framework...and acceptance...by...the community...of that quality approach by the industry I think is...really going to...be a...key factor in how the...community sees the industry and therefore how the industry will develop//

In terms of providing a sustainable water service, in the face of reduce water availability and restrictions, respondents noted that water utilities must work in partnership with the community.

//I think that I would love to see that the...community and the water authorities are working in partnership about...using water...in a sustainable way//

Respondents believed that a better understanding between the community and service providers about the product and services would be required in the future.

//the community's desires and the understanding of the resources that need to satisfy those desires and a clean sort of mandate from the community and customers//

//better community understanding of the product//better understanding of own infrastructure//better understanding and management of catchments and a better understanding of these in the community//

A key to customer relationships is service delivery. Respondents realised that services needed to be improved and changed to meet customer needs. There had been improvements but these needed to continue and at the same time costs needed to be reduced and efficiency improved. A looming issue is how much the community would be prepared to pay for improved services in the age of user pays.

//the need to focus on customer service//customer service I don't think is there yet, which again it's a legacy from our...we'll tell you what we'll give you days//

//there's really been a massive improvement in customer service, real focus, we've measured ours at 20% improvement in the last five years//

//service standards need to be changed to reflect what customers want, so that means basically, so that you do have a customer driven business//

//the pressure for...improved services levels by customers, that won't change//customers expect...continue to expect improved efficiency you can't stand still because, if you stand still you go backwards//

//next five years I think...higher levels of service to customers and that may not be in terms of the quality of the product, but it's graceful reaction to customer concerns, timely response to questions and problems...those sorts of things, so I think improved responses to customers//

//we are going to have to know about problems before the customer experiences them, which isn't the case at the moment...customer service, I suppose, I'm really driving at, is going to be the prime thing...and the limit to it all will be what...costs, or what, the customer's prepared to go to, prepared to pay or what our owners are prepared to agree to//

Not all respondents agreed that water utilities were customer focused despite the rhetoric to the contrary.

//it's not a customer focused industry//it's the absence of competition//if you had some competition somewhere//that would ramp up the, the attention to customers, I mean there's a lot of people say they're customer focused//

As part of its increasing role of managing water resources respondents said that the urban water industry was being pushed to reduce demand for water from a political direction. This was generally supported by the community. In this context and in its relationship with customers respondents saw they needed to change customer expectations about the cost of water and the acceptability of water restrictions.

//I think the water industry will be affected by things like the push to reduce demand...potentially changing community expectations about...costs of water//and whether some of the prevailing orthodoxy's about...how water suppliers manage the

supply are actually appropriate or not, I mean I think that there's a tendency to see restrictions as always something that are only ever used in a crisis and whether or not we need to...examine the use of restrictions as a way of avoiding getting into that situation...and test acceptability with the public//

Respondents recognised that the only way the community would be more informed about water issues was through education by the water industry. Water was now higher on the community's agenda. In the future what would be important was for the community to accept the value of the commodity and be prepared to pay for it.

//the community value of water and its use//instil the notion that it should be used carefully//

//an acceptance, by people that water actually has a value//will I think be eventually realised by people that we have to pay more for it//but you're not going to do that though without fairly substantial public education//

//the education of the public really, I think, only is going to come about through the community consultation//will eventually produce an understanding by the community that the extraction of water and the distribution of it and the disposal of it into sewers and the treatment and then reuse, that whole water cycle, I think is going to become more and more on the agenda//you're probably talking about a generational change//people will start to value it as something that's quite an essential item to them and being prepared to pay for it//

Respondents agreed that in the future the water industry would have to undertake more community consultation particularly in the way it designs water services and allow the public a greater say in the decision making process. This would be in response to increased public knowledge, needs and expectations about water supply.

//one of the aspects of culture in water utilities is that they...have tended to...take a somewhat paternalistic approach to how they design and provide their services to the community and we may be entering a period where they are more consultative and...collaborative approach to that sort of decision making//

//the need to bring customers into the loop into decision making and make sure we understand exactly what customers expect, the service, customers expect us to provide//customers don't always know what they expect...but they probably know what they don't expect//

The community had to be involved in water supply issues and for that to happen, respondents said that the community had to be educated in how the water supply system works and the impacts of decisions. The concept of a scarce commodity had

to be marketed to the public so that people valued water. This will impact on some of the behaviours noted in the next section.

//one of the keys is that we can't be arrogant enough any more to think that we know best//I think the community's got to be educated to understand...when they push a button on the toilet where it goes, what it does and what it would cost to do something different//and be able to understand that impact and be able to participate in the decision making//I think that's absolute fundamental in making this major change//

//marketing the concept that it is a scarce commodity which should be valued, educated on the water cycle//

8.2.4.3. Behaviours

Respondents believed that one of the barriers to engaging the community in water issues was apathy. Most of the time water issues did not make the press until there was a crisis.

//engagement of the community is an issue//

//it's an A to Z issue, the majority of the time water is a Z issue, it's very low priority, it doesn't make the papers//when it does appear all of a sudden it's front page news, it's an A issue//

Respondents agreed that change came from consumers, but in order for the water industry to change it needed to supply the community with information to increase the level of awareness and drive the changes. The days of the industry espousing 'we have the technology trust me' mentality had passed.

//change gets driven at the consumer level, people come up with the demand for something//the experts, the folks in the industry are the ones who are responsible for perhaps putting out the supply of information, for the public to pick up on in order t' get them thinking and to kick around and...how d' y' get that level of awareness and that level of concern to act within the public such that they'll influence the political levels such that you get transformation that's needed//

//community is a key driver; cannot have the technological trust me mentality//

An issue for the industry, according to respondents was that community attitudes might change in unexpected ways. This could be addressed by the water industry being in tune with the community. This is related to keeping in touch with young people and discussed under the concept of Customers above.

//it's always possible that community attitudes will take a turn in a direction that we don't expect, we need to be...plugged into these sorts of things and...take appropriate response to that when needed//

Respondents thought that water utilities had not conducted enough research to determine community attitudes to change and what the barriers were, particularly in terms of conserving water.

//I don't think it's invested in very good social research to look at opportunities for the community to respond differently to the way the resource is used, I mean there have been measures of...community attitudes about water conservation and...what not, but we haven't actually looked at mapping out what changes are required to deliver certain outcomes and whether those changes are acceptable to people and if they, if at an attitudinal level they are acceptable what's getting in the way of people actually doing those things//some public policy goals are more complex than...fostering the right attitudes and providing people with a pamphlet telling them what to do//

Respondents believed that the public perception about water was that it should be cheap. This is probably related to apathy about water issues. Respondents said that the majority of people had a good water service and saw no need to move forward, which made it difficult for water utilities to improve services and water quality.

//I think that the public's...a lot of the public's perception//is, well what's all this about, water falls from the sky it's free...you shouldn't have to pay very much for it//

//I think, those people who have a good; have a service, don't actually see much wrong with it, which means that, from most of the community's point of view, there's not a lot of drive to move forward. In water quality terms the,...if the water comes out of your tap and it's clear or clear and clean and doesn't taste bad or it doesn't taste any different to how it's always tasted then in general people don't see any need to do anything//

As discussed above under the concept of Customers, the community's expectations about water services had and would continue to increase so, according to respondents, the industry should not expect any uncertainty in this area.

//I think the community is going to increasingly expect more, so it shouldn't be an uncertainty, it should be able to be something we can foresee//

//I think they realise that things are changing and that their kind of devil may care attitude...to some aspects of the resource is no longer appropriate//

8.2.5. Water supply

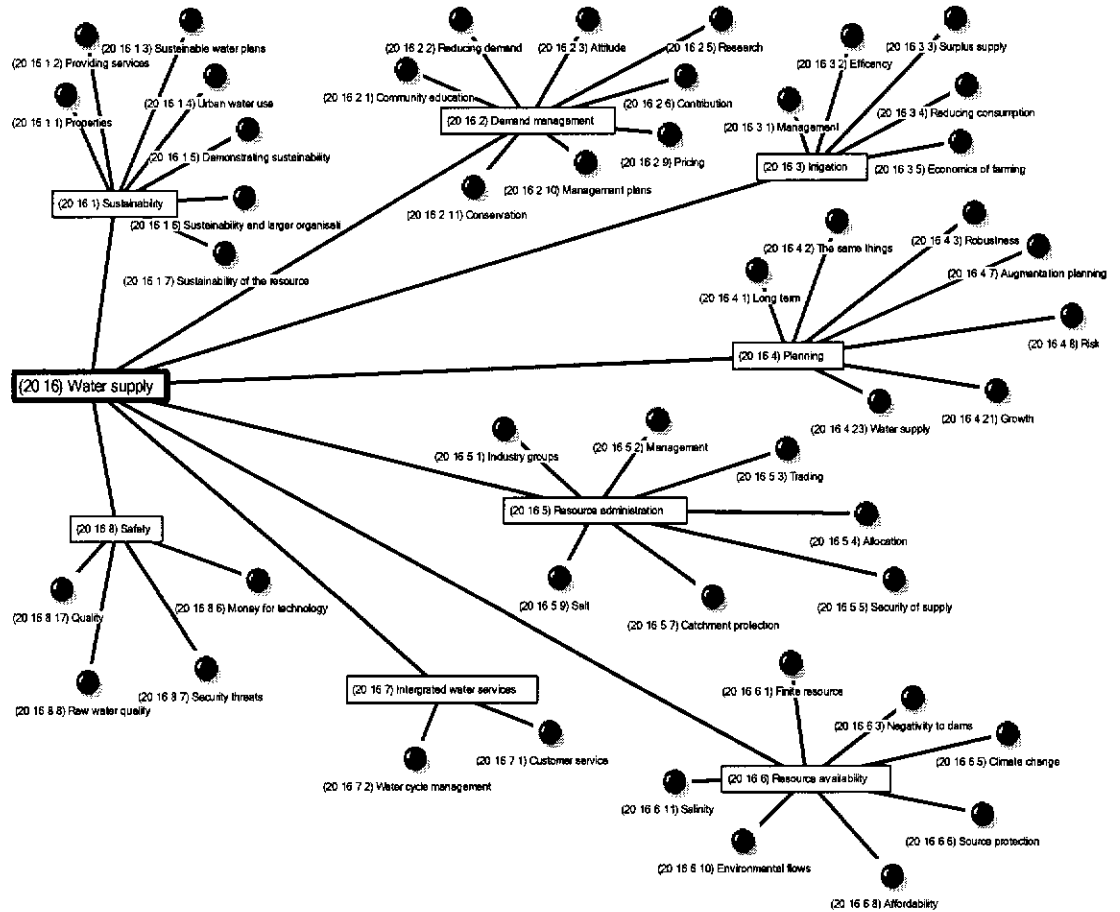


Figure 8.5. Category ‘Water supply’

The largest category of data was Water supply which contains data directly concerning water rather than issues surrounding water such as commercialisation and ownership of utilities. However, many of the concepts in this category overlap concepts in other categories.

8.2.5.1. Sustainability

Respondents said that sustainability of water supply had started to take a higher profile, not only for utilities but also in the wider community. Sustainability was destined to remain high on the agenda.

//the one thing that has taken a higher profile is in the last twelve or eighteen months is sustainability and I can't see that dropping off in the next five years//

Respondents saw that the concept of sustainability encompassed issues about providing services not only in the provision of water but also wastewater services and recycling. Respondents saw sustainable water plans that outlined the

sustainable management of the resource, was a key a role. This has traditionally been undertaken by government departments.

//one of the things we're doing is to work through and satisfy ourselves that the way we're providing the service is the most sustainable way in the long term//

//one of my...visions//we will have the plan signed off and agreed by the community on an ecologically sustainable plan//

//what we need to do in the next five years, is closely look at the resource and how we manage the resource//satisfy ourselves that...the way we do it is in a sustainable way//

Respondent's perception was that utilities generally had a good reputation within the community, however, utilities needed to distinguish themselves from the agricultural irrigation business to avoid negative publicity concerning sustainability and demonstrate that they were delivering sustainable water services. In terms of sustainability urban users are part of the bigger picture of water use in Australia.

//certainly I think the industry and the community's going to continue to deal with the issues of sustainability//generally I think the industry's has got a very good reputation but it often trouble differentiating...the urban water supply business from the rural or the irrigators//where the urban users are...perhaps receiving most of the...negative...publicity for...sustainable water resources//it's something it's going to have to deal with in making sure it does differentiate itself but also is seen by the community as being...environmentally...responsible//

//we've got to demonstrate that...well not only demonstrate but be sustainable, make sure that we do have a sustainable resource...and that our practices are sustainable//

//the sustainability theme is applicable right across all parts of the industry whether it be the urbans or regionals, the rurals or the irrigators//

Respondents noted that in some states Councils ran water supply services and suggested that the amalgamation of smaller utilities would achieve better services and more sustainable practices. Amalgamation of smaller utilities is also discussed under the category of Industry structure.

//you look at New South Wales they're even worse, they have got all the local Councils still running their water supply systems which I can't believe...is the most efficient way to run the industry//there has to be better service levels, there has to be better efficiencies...there has to be more sustainable practices...taking it out of local control and putting it into more professional organisations//

8.2.5.2. Demand management

According to respondents the water industry, and slowly the community, were realising that water was a precious resource and that there was a need to conserve water. As discussed above under the category of The Community in order for the community to respond and bring change there must be an increased public education program.

//I suppose the water industry everywhere is responding to the fact that water is becoming our...more and more precious resource all the time and that water supply issues are...significant//

//I think there will be a realisation by the community of the need to conserve water and...through the greater education of community//I can see the only way that there'll be the hope for the next ten years is that community education...will drive...conservation practices//at the end of the day it will be...community pressure that will bring change//

Respondents said that many water utilities had set targets for reducing the community's demand for water, particularly in cities that had experienced reduced rain fall in recent years. Demand management strategies were a combination of voluntary restrictions and some legal constraint. Respondents believed that the public had a positive attitude towards water conservation, paying for water and that utilities should build on this positive attitude.

//we'd be looking out for the next ten years we're going to be using//15% less per capita...

//well I hope that we will see a much greater emphasis on reducing the demand for water so that it is used as a scarce commodity rather than as a commodity which is there, on tap, to use just as ever you care//I hope we'll see a change in philosophy there to being something we look after more carefully//

//I think there is a really, really positive attitude amongst the public about wanting water conservation//I think the public are willing to pay for changes in the way their water is supplied//I think there's a good positive mood amongst the public that can be built on//

One of the levers used by the water industry to reduce the demand for water is price. Respondents thought that increasing the price of water instilled a sense of value in the product however, it was important to have a safety net for low income groups to ensure positive public health outcomes.

//I hope we'd see//an increase in price so that it is valued more than it is currently//I would like to see, personally, a base volume allowed at a low price for

what I will describe as the public health needs//would have to have a safety net for large families, big needs and, and low income groups//

Respondents said that in some instances the targets set for reducing water use were set by government. This represented a key uncertainty and an issue in terms of being able to meet the targets set and planning the augmentation of future water supply. The issue of demand and water pricing was an uncertainty for bulk water suppliers as well as water retailers.

//key uncertainties for us in terms of dealing with issues like security of supply is that we really don't know yet to what extent some of the demand management goals//fully able to be realised within the time frames that have been set//we don't have any objective assessment about whether or not we're going to pursue, or if government will pursue tougher goals with respect to water conservation//unless we know or can realistically plan for, in terms of per capita consumption and how we marry that with population pressures and different options for augmenting supply//

//so the uncertainty, I suppose, is what our customers do in terms of their pricing and their water conservation measures//

8.2.5.3. Irrigation

Whilst the focus of this study was urban water supply it became obvious during the interviews that issues surrounding agricultural use of water were sometimes difficult to divorce from urban use and indeed when talking about the whole water cycle and holistic management of water, agricultural use of water must be included especially when this amounts to 75% to 80% of water used in Australia. Respondents said that one of the key issues was the efficiency of irrigation practices and management of water use. One of the solutions to efficiency was to pipe all irrigation water in order to reduce losses. This had started to happen.

//I'm not sure that the urban water industry can just isolate itself out of the irrigation industry, the source of the water is one source...and yes we know that the urbans only take seven, or under 10% of the water but it's the same resource//the biggest issues in the water industry, water industry broadly, is irrigation, is proper management of irrigation//they waste more water than the cities use by a long stretch//

//I think there'd be some question marks about whether what we do with irrigation water is best practice//

//pipe some of these open channels to stop all the water losses//

8.2.5.4. Planning

Respondents said that one of the uncertainties for the water industry was long term planning and the availability of funds to support those plans through pricing and revenue streams.

//there are uncertainties about...some of the longer term planning or longer term strategies//if your in a budget sector agency while you may have three years worth of forward estimated, your budget confirmed on an annual basis and...five years seems like a luxury//some of the sorts of investment decisions that are made in this industry require longer planning horizons and I think that's always made difficult when...there's the degree of uncertainty about...pricing...and revenue issues//

Respondents noted other issues concerning planning referred to the lack of long term planning, particularly for developments and performance requirements that required a long lead time for planning and funding.

//lack of...government perception of long term planning for twenty years which has been the haul mark of the water industry in the past//

//water and its associated topics, has still got someway to go in the political agenda to be recognised as a medium to long term issue//one of the key factors that ought to be considered about any development is whether or not it can be supported by good water and wastewater or good water systems//

//expectations or performance requirements put on the industry are not clarified and the industry basically gets put in a position where it can't match them//

Another aspect of planning that concerned respondents was the type of systems being planned. Respondents believed that if the same type of systems were being planned in the future then the industry has failed; it had not moved to embrace new design concepts and customer requirements.

//building the same things we're building now exactly the same way systems that leak, sucking water from one area and pumping it out at the other end//if we're still planning to do that we've failed//

Another planning issue, according to respondents, was planning for future water sources. There had to be planning for growth in new areas otherwise there would be water shortages. Land had to be put aside for storages. If this includes new dams then this is at odds with other respondents who believed new dams would be difficult to build in the future. This point is discussed below under the concept of Resource availability.

//I think source augmentation or source is an issue for us//whether our planned augmentations will, at the time that we come to need them, be available to us//

//one of the risks, I suppose, in the future if you don't properly plan for water supply in the future and put aside land//that could become a crisis if there is then water shortages in years to come//

//population is going to be the other big issue//

//need to provide water for peak tourist demand because it//affects the way water authorities plan//

//the difficulty is, in terms of the future, is the water supply planning, we know whose role it is, but what are they going to do about it//with the population projections that are predicted for this area we want to make sure that we have got enough storage sites identified//

8.2.5.5. Resource administration

The issue in terms of resource administration that concerned respondents was the management and allocation of water resources particularly in the eastern states where water allocation policies west of the Great Dividing Range were being applied east of the Great Dividing Range.

//a lot of the focus is west of the Great Dividing Range//we are on the eastern side of the Great Dividing Range in the high rainfall area//one of our fears, I guess, is that there's a one size fits all type solution will be imposed//

Another resource challenge, according to respondents, was getting all the stakeholders to focus in one direction for the health of rivers and groundwater so that there could be a consistency and holistic management of the water cycle.

//the bigger issue is how do you manage this resource to support the health of the rivers, our underground aquifer storages//the challenge of getting all the various stakeholders together and having them focused in the right, in the one direction and all pulling together//

//consistency in the way water resources is managed//

Respondents said that a key uncertainty for the water industry was the availability of water in terms of the urban sector having a share of the resource being allocated to it by government departments and the yield from the environment. Respondents said that the requirements for environmental flows to maintain healthy rivers were increasing leaving less of the resource to be divided between competing demands. Often reform policies in terms of allocation of water had left water utilities uncertain about the future.

//the key uncertainty, I mean well obviously the availability of supply//

//long term source uncertainty probably's an issue for us//

//they haven't firmed up a lot of their water access rules//environmental flows...they're going through a process now of water sharing plans, developing water sharing plans through community process the outcome of that is not clear for us as to just what, whether we'll be able to retain our historical share of surface water resources//

//they're saying a certain bit needs to be taken out for the environment, there's us and there's other users and we need to share it equitable, so that's a risk of not knowing, or any certainty of what your future//resource shares going to be//

//water entitlements of utilities are poorly defined, reforms may focus on irrigation, utilities are unsophisticated in water allocation matters, may sustain collateral damage//

In terms of managing water resources respondents noted that there was an increasing focus on catchment management to protect water sources. More research was being applied to understand catchments and educate the community.

//achieve a number of things over the next five years...the ongoing improvements in catchment protection and catchment regulation//

//better understanding and management of catchments and a better understanding of these in the community//

8.2.5.6. Resource availability

The availability of water is strongly related to climate change, allocation of the resource and sustainable development, all of which are discussed elsewhere in this chapter. Respondents realise that natural water resources are finite.

//well certainly the amount of water is a good constraint, we ain't got much//

//available water supply I think that's going to become a bigger and bigger issue//

Respondents said that a historical solution to augmenting water supply had been to build dams to store water. However, construction of dams had major environmental impacts that were becoming unacceptable to the community as such there was an increasing negativity to building dams. At the same time water consumption was rising and dams were seen as the best way to store water. Solutions to this problem are to reduce demand, discussed above and alternative sources of water such as desalination discussed under the category of Technology and research.

//I don't think new dams are accepted//a lot of work is needed on managing the demand side of things, the water conservation side and also having a look at new sources of water//

//there is a considerable...development in the community of a philosophy which says we don't wish to build any more dams//serious environmental damage done with

the building of the dam itself. So I think those are very real constraints which the community has...against this effort//

//we're sort of looking at new dams and stuff but to build dams is getting harder and harder from a environmental perspective people as a whole don't want new dams built but they'll quite happy to consume more water//

//negativity to dams, they are important for providing water supply, without dams cities wouldn't be here//

8.2.5.7. Integrated water services

In the future respondents believed that the water industry would have to be a more integrated water service to meet customer needs by providing water services in different ways and being sustainable. The alternative was that the community might rely less on water utilities with implications for public health and increased pollution.

//I see very much...a demand for new services into the future//customers are looking to import solutions that...they feel are more sustainable//we'll be looking at customer desire for small scale technologies//

//I think...that we will be more advanced...in terms of having integrated water services and in terms of actually doing things differently//

//more people could become sort of independent of urban water authorities and be doing their own thing//if it's not coordinated and not worked with the rest of the community and not done on a community basis it could be a bit of a disaster//

Included in an integrated water service is stormwater management and water sensitive urban design to manage flood water. Respondents thought that this would increase in importance and drive towards the holistic management of the water cycle.

//unless we move towards a water sensitive urban design and all that sort of stuff then I think stormwater will be an increasing problem in terms of flooding and an increase in terms of...the effect it's having upon the waterways, in terms of quality and I think that could be a real big issue if we don't...take that into account//

//you can't have fragmented water management and at the moment it's very fragmented//

//a more holistic approach to water management or practically more water recycled//

//I think communities of the future will address a whole raft of issues such as water harvesting...and a number of sources of supply ...and possibly localised reuse built into the...concept planning for future developments//

8.2.5.8. Safety

Respondents saw the quality of raw water sources as a constraint for the industry particularly as the impact of chemicals used in the past and new chemicals on water sources was realised. Respondents said that the consequence of a problem with the safety of water was a loss of community confidence. This was demonstrated during the Sydney Water crisis in 1998.

//good, clean water source that would be a big constraint//what other future chemicals that are going to be out there that are going to have an impact//

//safety of our drinking water is...got'a be the number one priority in the uncertainty in that...we can have a loss of community support overnight if we get it wrong//

In terms of water supply one aspect of safety was the security threat issue. This is discussed towards the end of this chapter under the category of Security threats.

8.2.6. Industry structure

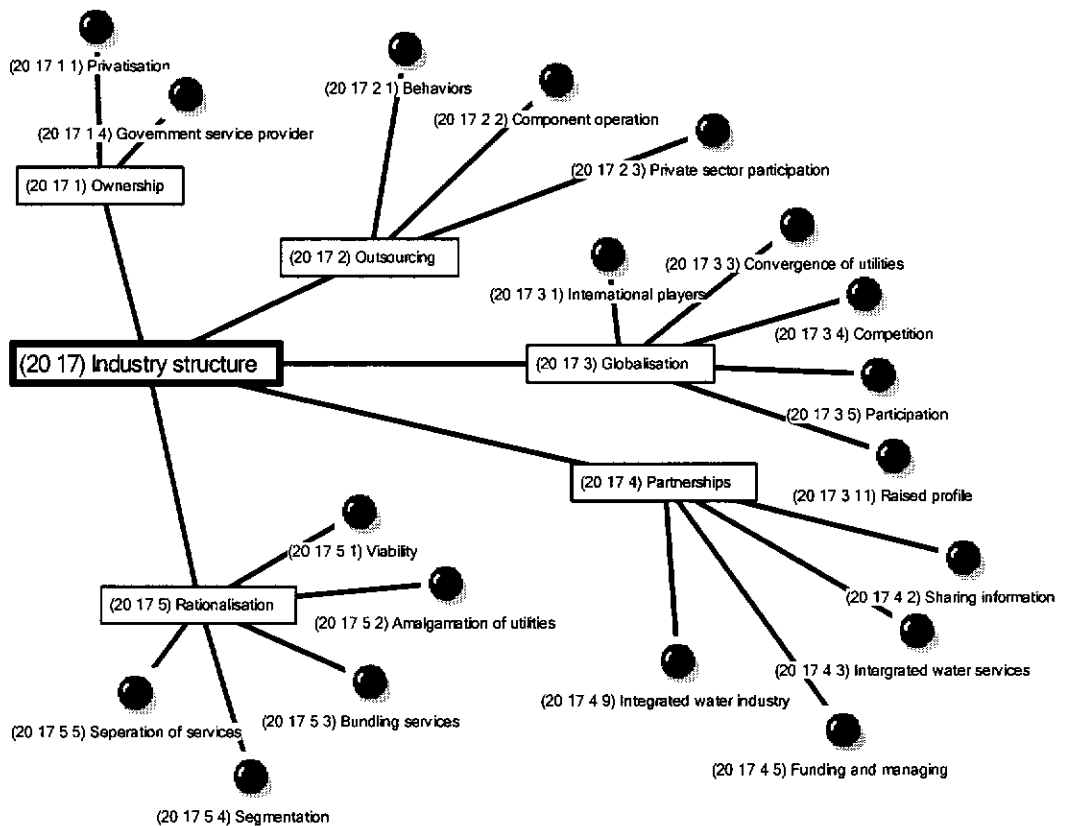


Figure 8.6. Category 'Industry structure'

8.2.6.1. Ownership

Under the concept of ownership, privatisation is concerned with competition and takeover from international players. The concept of ownership will be discussed later in this chapter under the category of Political environment in relation to the concept of government intervention.

Respondents observed that governments seemed to have taken privatisation off the agenda, possibly due to the poor outcomes of privatisation in other industries and the ground swell of opposition, in the community, to the privatisation of public utilities and globalisation generally. Respondents noted that there was still some uncertainty in the water industry in reference to the privatisation of water utilities however; the feeling was that water utilities should remain in public ownership. Respondents saw, in the future, changes in terms of there being more public, private partnerships.

//well, a few years ago everyone said we were going to be taken over//

//five years ago, seven years ago we were all facing, reorganising ourselves for privatisation I think that's...well off, I think it's at least off the agenda for the next five years I think that...we'll continue to see the more corporatised model//

//one of the uncertainties is where the privatisation...public authority...debate will go//

//I think there's a general reaction in most parts of the world to privatisation...and certainly in the political environment//it's not a community expectation that water, as an essential service, would be privatised, at least, I think, because of the enormously long life of the assets there are risks associated with that sort of change//

//now because of the Sydney Water Incident, Longford Gas and New York we are less likely to see privatisation//

//one of the key uncertainties must be the political regime under which we operate//will we remain a public service, or will we become private companies and...or will we be something in between//

//will stay in public ownership but more public private partnerships. Ones that don't act will be under pressure to be privatised; if you can't perform then someone else can do it//

//reform of world trade, pressure to have free trade. UK believes keeping utilities in the public sector is anticompetitive therefore the Australian industry needs to be competitive to be armed against international organisations//

//given that the current reasonably healthy state of the water industry in Australia, I think...the community would certainly, over the next ten years or so...be resisting quite strongly politically any major shift of governments to privatise water//

Another issue related to ownership that respondents were concerned about was the role of water utilities and whether they should be commercial or become part of the social infrastructure. This is related to the notions of water utilities being quasi tax collectors and giving returns to government as discussed under the category Commercial focus.

//whether or not the industry or elements of the industry remain totally commercially focused...or whether they remain part of the social infrastructure//

8.2.6.2. Outsourcing

Respondents saw there could be a move towards a few large organisations running components of the water supply and wastewater system, such as treatment plants, whilst the infrastructure would still be owned by government. A potential down side to this was seen as long contracts that may not allow the introduction of new technology.

//people are tending to come in and operate bits of the system like wastewater treatment plants and that may continue//the multi national water companies seem to have, just operating componentry//

//so whilst the assets may still be owned by//the people, the Governments//the actual operations, provision of the service I see more by these big players//

//I'd hate to see us create a structure in the industry that actually creates the wrong behaviours...for example I'd hate to see//large contracts for long periods of time locked in with companies that doesn't allow the introduction of new technology//all to save a dollar now we lock into a twenty year contract with a large company and we're going to be stuck with that way of doing things for the next twenty years...that would be a shame//

8.2.6.3. Globalisation

Related to the last concept is the concept of globalisation. Respondents had conflicting views on the level of globalisation or participation of international organisations in the Australian water industry. There was a level of awareness that globalisation had impacted on the industry.

//there'll be a greater intrusion within the water industry in Australia of international players//

//globalisation and whether there's something there that we don't anticipate that might be impacting on the industry//I think probably my expectations that...there

will probably not be a great deal of...additional to international players coming into the market//

Respondents saw that there could be convergence of utilities globally to the extent that technology and managing the water cycle rested in the hands of a few big players, in which case there would be a responsibility on the civilised world to assist developing nations with their water supply.

//issue of...convergence of utilities on a world scale. We're seeing a lot of the technology...being...aggregated in very few hands//being brought to bear on...the structure of the industry world wide//the impact for Australia remains I think the pressure on governments to adopt some of the international...models where they may not necessarily be...the best for Australia//our focus on understanding where we actually lie is probably the important element for the water industry there//

//globalisation to me is the idea of maybe ten to twenty big players around the world being the experts in managing the water cycle//so I guess that the industry in the civilized worlds, the industry in Australia, UK, Europe, The States...probably has a social responsibility which it hasn't recognised probably...to assist or insist that those less developed countries look at their environmental impacts//

Respondents suggested that a solution to the issue was for Australian water utilities to compete more with overseas organisations in the international water industry in order to improve the industry's reputation and raise its profile.

//need to begin competing with overseas organisations//there are five or six global players, how will Australia fare//

//we still see that they're out there as competitors so in a sense they are driving, they are another driver for our operational cost reductions//

//Australian utilities are not participating on a global scale//more involvement is required//

//we ought to be playing the game in the international scene far more//

//improve our reputation and improve our standing in the international water industry. I think we ought to be a significant player in...the...increasingly developing...collaborative processes that are going on at the international level//

8.2.6.4. Partnerships

The concept of partnerships is broader than ownership and operation of infrastructure. Respondents said that in order to have a more integrated water industry the industry would have to form partnerships with stakeholders particularly with the community, other utilities and governments for all to benefit. Respondents saw the water industry developing a stewardship role for water

resources. This point is in keeping with water industry's increasing role of managing the resource discussed under the category of Water supply. Sharing information in the widest sense was seen as a key component of partnerships.

//having integrated water services is where the industry's going to develop//I think they're going to be about partnerships with the community//I think there's going to be...partnerships with other...utilities...in terms of, in our instance with energy//there's going to be...partnerships there with energy authorities, other utilities//I think there's going to be partnerships more with other Government departments in terms of managing...our actual receiving water, things like rivers//it becomes more than just purely a...service provider, I think we're, developing more in a role as some sort of stewardship role in terms of saying we're looking after the resource, the water resources for the community//

//I think it's an industry that deserves to have a free and open exchange of information, ideas, technology and even people//

Respondents believed that there would be more partnerships with funding organisations in order for utilities to improve their ability to construct new infrastructure, whilst others believed that funding had to come from government because of the low returns on capital.

//alliances with suppliers such as companies with propriety technology//finance providers//more interwoven web of organisations//

//I think more partnerships with the private sector in terms of funding and managing infrastructure//I don't believe a government owed utility can fund and realistically can manage every water treatment plant or every storage, or every piece of infrastructure//a variety of innovative ownership models...to allow a utility to perhaps to significantly improve its capacity or constructive capacity//

//I think the only way the infrastructure ultimately will probably be funded is by more public investment rather than private investment//because the returns on investment aren't going to be significant to encourage private players into the field//

8.2.6.5. Rationalisation

This concept is about the amalgamation of smaller water utilities not only in Australia, which has already occurred, but also on a global scale. Respondents said that the objective was to improve services and reduce costs through economies of scale. There was a question mark over the viability of smaller utilities. Over the years Victoria had rationalised many of its water utilities. The other states where it was believed necessary were Queensland, New South Wales and Tasmania.

//there's a real question about the viability of those operations...both from the stand point of economics...and from the stand point of having the wherewithal//to operate

systems that are increasingly becoming more and more complex between health considerations and environmental considerations//

//Victoria provides an example of having gone through a pretty drastic reform process//so we've got three states essentially Queensland, New South Wales and Tasmania...where that issue of small Local Government utilities still needs to be dealt with//

In terms of globalisation respondents thought that amalgamation of smaller utilities would make the cost of technology more accessible. It would also be a defence against the threat of an international take over.

//the globalisation...issue will raise its head because the costs of the, of technology//will be to expensive for...small authorities to fund//

//I see a lot of little Councils coming together and becoming one bigger authority managing around a water cycle//there're two reasons for that, I think driving that will be economy of scale, the demand on the capital that's going to be required and the source management//

//from a commercial point of view a lot of the small Shires will band together as a defensive strategy for the large international players//

Politically amalgamating a number of small utilities was considered by respondents to be difficult.

//there's a need to restructure//none's been game enough to do it, it's politically hard//

Another type of rationalisation that respondents thought likely to increase, in order to cut costs, was the bundling of services such as one bill for electricity, gas and water services.

//Integrated supplier of services, bundling of services//

//I think it's certain things like the retailing end, we're going to have a lot of retailers like electricity, power and water coming together and common call centre and billing function coming together//

8.2.7. Reuse

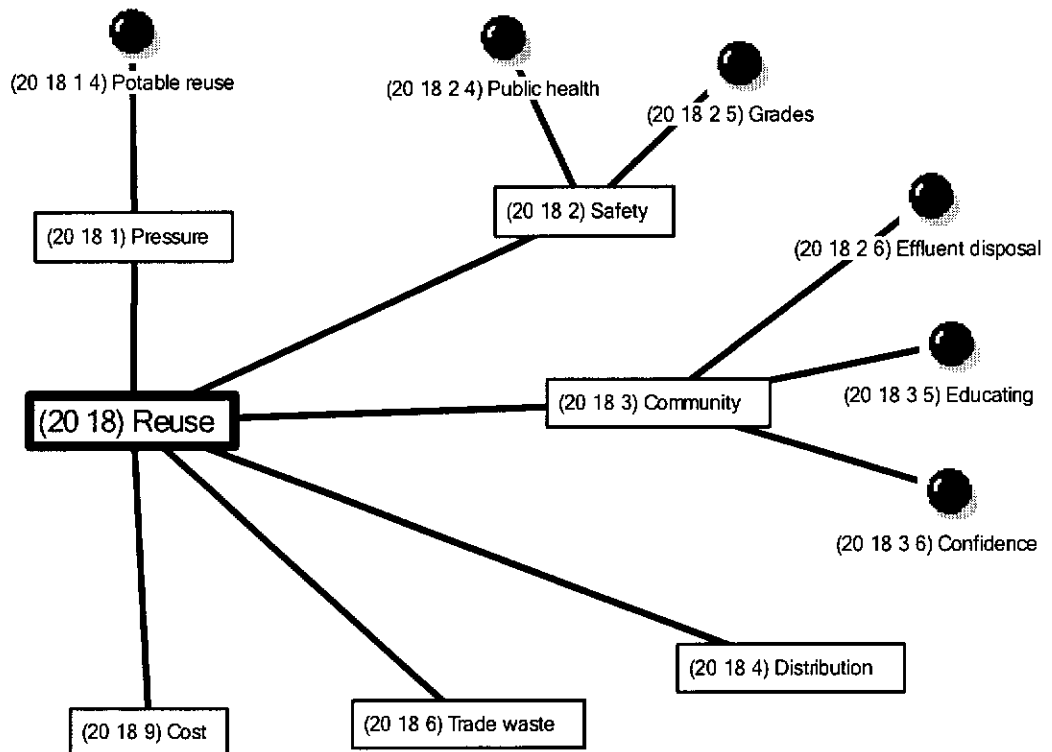


Figure 8.7. Category 'Reuse'

8.2.7.1. Pressure

Respondents said that there was increasing pressure to reuse wastewater however there are a number of issues to deal with such as the demand for reuse and environmental concerns. The drive to reuse wastewater was principally coming from state and territory governments who were setting a target percentage for reuse.

//I think there will be much more emphasis on water reuse//

//we're not sure what the demand's going to be, what are the other environmental the con'...issues that may come from expanded reuse//

//I think politics will drive the reuse side//

//Government has set a target of a 20% recycling of water within ten years...and that's a major change from where we are now//

8.2.7.2. Safety

Respondents noted that a major concern for reused water was safety and public health, the framework for reuse appeared uncertain. The concerns were not just

related to drinking water but in addition the use of recycled water on public open spaces. Being a conservative industry the uptake of reused water was likely to be slow. The cost of treatment was also a major concern for the reuse of wastewater.

//safety of reuse of effluent, I think is going to be something that we continue to grapple with//

//we've got' a be careful about getting sucked into...responses...that put the industry and perhaps the public health of the community at some risk that's not needed//

//if you have got//a secure enough water supply system then there are plenty of things the water can be recycled for in parks and gardens and other irrigation activities//before you need to resort to full potable reuse and end up with...difficulties...the equivalent is a lot like they've created with CJD and Mad Cows disease//

//whilst there's a lot of technologies that are emerging...they're incredibly expensive//

8.2.7.3. Community

According to respondents a major obstacle in the reuse of wastewater was gaining community acceptance particularly reuse for drinking water. Reuse for irrigation purposes, on parks and gardens, was not perceived to be such a problem. The community had to be educated about reuse to gain awareness and trust in the science.

//reuse is a significant issue//it hasn't quite gelled, yet...you've got consumer acceptability issues, which have come a long way but that's always going to drive things//

//whether or not we're going to get to the point where there's a consumer awareness that distinguishes...that trusts the scientific community, perhaps that's what it takes//

//most people do not have a problem with recycled water being used for irrigation, agricultural purposes, water gardens and parks and all that sort of stuff//well it's an emotive issue...which would need a considerable amount of education//

//community attitude to recycling, they are generally in favour except when it's in my back yard, negative attitude needs to be overcome, a major challenge//

8.2.7.4. Distribution

Respondents said that if reused wastewater was not for potable use then a second distribution system would be needed and this would be a more likely scenario in Australia, provided the health issues of grey water use were overcome.

//at the moment you can't mix it, we've not gone down the direct potable reuse route, the implications of that are that you need another distribution system//

//Australia wide...I think...we'll be looking for dual systems//

8.2.7.5. Trade waste

Trade waste was a concern for respondents because toxins entering the wastewater system via sewers could be detrimental to the bacteriological processes in wastewater treatment facilities and corrosive to the assets.

8.2.7.6. Cost

Cost was seen by respondents as a major constraint in treating wastewater to potable standards. The belief was that more research into less expensive techniques would reduce costs.

//largely if you're talking of replacing potable supplies with recycled water it's cost, cost is the constraint, not the technology//if we identified cost as the major problem we need research to get techniques, which are less expensive//

8.2.8. Technology and research

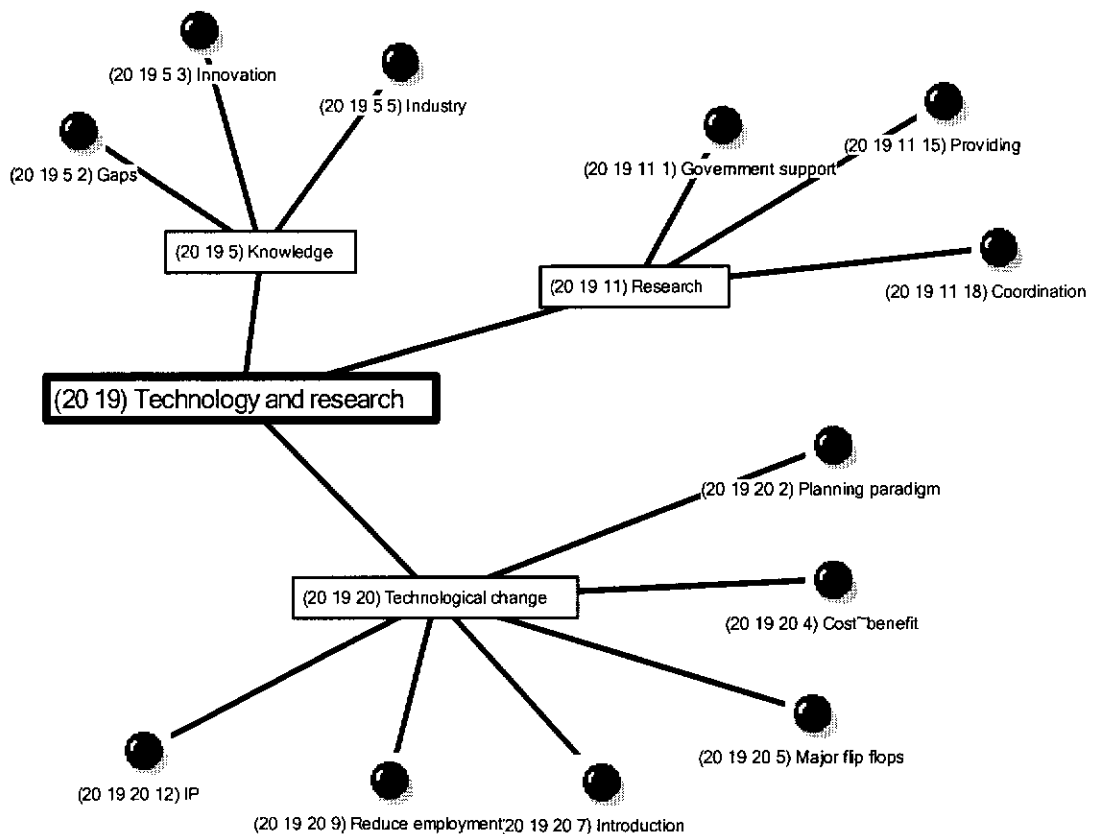


Figure 8.8. Category 'Technology and research'

This is one of the key uncertainties for the future of the water supply industry and the potential to have a major impact on future water services. The issues forms one of the axis for the scenario matrix as discussed in chapter nine, Discussion.

8.2.8.1. Knowledge

Respondents recognised that there were knowledge gaps that had implications for the water industry. The industry wanted to support innovation and saw a need to manage knowledge and recognised that a lot of information was in people's heads, many of who are near to retirement. Some respondents believed that the industry was not a knowledge industry and not receptive to new ideas. This relates to the category Barriers to change and the traditional mind set of the industry.

// a lot of information is in filing cabinets and people's heads and I think what I'd like to achieve with our IT strategy and our knowledge management strategy is that we harness that knowledge to deliver better outcomes//

// not receptive to new knowledge, not a knowledge industry, more a public works this is a problem for transition, how do you make it more of a knowledge industry// worst is the water industry this and the longevity of the industry//

8.2.8.2. Research

One of the key contributors to knowledge and sources of research for the water industry is the Cooperative Research Centres (CRC's) supported by Federal Government. Respondents said that the future of research was in the hands of the government of the day and thought it beneficial to have centrally coordinated research to address common water industry issues rather than individual organisation undertaking their own research.

// it's important that we have a corpus of people who have the confidence of the industry that they will do work which is of value and importance to the industry// I would hope that the industry would have sufficient recognition that they need this type of work done somewhere and that they nearly all have similar problems// it's beneficial to have a central group that addresses these sorts of issues so that we don't all go about doing the same sort of stuff// and therefore the fact that we've had CRCs which do the work for the industry irrespective of their geographic position in problems that are common to them all and that's a very important...way in which// I would like to see that what ever happens in the future that something of that sort exists either as a single institution if that's needed or a continuation of the type we currently have.//

Respondents believed that the current model for providing research was not secure and that this was a key uncertainty for the water industry.

//it's often difficult for any industry to have the spread of expertise whereas if the problem comes up and you can identify the things you need in it from a CRC or that type of loose network, ah yes we want one of those and one of those and you put them together, and that's something that's very hard to get in any one organisation. So I feel that's...a key uncertainty facing us is we don't have a secure model at present we have a good model at present but it's not a secure model for providing the research and knowledge the industry will continue to need//

8.2.8.3. Technological change

According to respondents a potential major impact on the water industry was treatment technology and in particular desalination. As costs come down and environmental issues are addressed there would be a major change for the industry, not only in the way systems were planned but also competition. The issue was not if it will happen but how soon.

//the way I see that the technology impact is it's...things like desalination as treatment technology improves then I think that we've got a chance...of getting costs down and alternative sources of water//then you will have a major change to the industry and that will open the way for real competition around product//so the issue is how fast is technology going to come along to change the cost structures...so with that comes a fundamental paradigm shift in how systems are planned//

The technology extends to treating effluent, recycling and industrial water users.

//so if you get the changes in technology so what should happen that they should be planning for...sewer mining...local treatment plants, on, private sector...onsite treatment plants for major industrials either closing the loop for their own production processes//

The cost of technology was seen to be difficult to justify, particularly computer technology, which required constant updating and quantifying the benefits.

//one of the issues is we're a long term business and technology has been moving so fast that people who went in early now find the fact that they need to spend a lot more money to actually catch up and others, didn't go in early and are now finding it's going to cost a lot of money to get into it, and again people haven't thought through how to quantify the benefits of it//

There are numerous examples of significant technological innovations that have changed whole industries such as lap top computers. Respondents thought that it was possible that such a 'flip flop' in technology could dramatically change the way water services were supplied. There seemed to be conflicting opinions in the industry as to the possibility of such a dramatic technological change.

//technological advances that represent major flip flops...it's happened in other industries//what if all of a sudden a device came along...that sat on the counter top...and with relatively low energy generated, the best, highest quality drinking water out of the air...was cheap, it was affordable, ubiquitous...and just took over the market place what would be the impact of that on the industry//what might be that thing out there that that's goin' to radically transform it...I think that we certainly need to keep that in mind//

//we may be a bit slow to take them up, but I think we will adopt them as they come along...I don't see any technological changes coming that will, sort of, be a show stopper for us, in fact I only see them helping us; unless somebody can develop a way of producing water that we haven't thought of//

Respondents felt that the uncertainty was where would technology go, and, what would be the impact? Would there be significant technological advances before water utilities had to invest significant amounts in old technology, and would utilities take up new technology? Some of this was a function of being a conservative industry that could be very slow to change and which some respondents believed was not driven by technology. Some respondents thought that the problem of slow uptake of technology stemmed from previous bad experiences.

//one of the issues I have is being able to introduce the new technology in time before we have to start reinvesting to much in the old technology//delay the capital investment while your buying time, if you like, for the new technology to come in and make [the old technology] redundant//it's that balance between the old and the new, I think that is a challenge//

//I think one of the concerns would be that we might select a technology and invest a lot of money in it; it turns out in the long term its not, doesn't work or it's not sustainable or it's whatever and the next generation has to pay for retrofit or something, there's always that sort of concern, we're always a conservative industry and we always pull back to what we know//

//it's a very interesting industry//it basically tends to be extremely slow to change, it's not driven by technology, although technology, I think will have an impact//

//people have had some very [emphasis] bad experiences with bespoke developments and, I think, have become much more wary, of both the cost and the benefits of it//

Respondents said that technological change was essential if the water industry was to overcome the problems of reduced rainfall, less water availability and generally to have a sustainable industry.

//more innovation is required, with this there will be failures that have to be accepted//extensive use of innovative technology is a prerequisite for the industry to be sustainable//

Respondents noted that a down side to technological innovation was reduced employment, which in smaller communities outside the major cities was considered to be unacceptable.

//there's a conflict there between where technology is and between the social responsibility of the organisation and its ability to actually utilise technology to its best effect in terms of becoming cost effective//

An area where that was considered, by respondents, to need more attention was the development and commercialisation of technology by the Australian water industry. There were export opportunities and with increasing globalisation there was an opportunity for Australia to be a world player in the provision of services.

//the use of intellectual property and the development of...commercial opportunities from IP of Australian industry has been quite limited because of...fragmentation and the lack of focus, lack of skills in taking advantage of commercial IP//the major growth in the water and sewerage business will be from new products and export of our technologies//we can have a role in the world stage with the number of small, a small number of large players, as almost a niche provider of services but we've really got to focus on where those opportunities are//

8.2.9. Work force

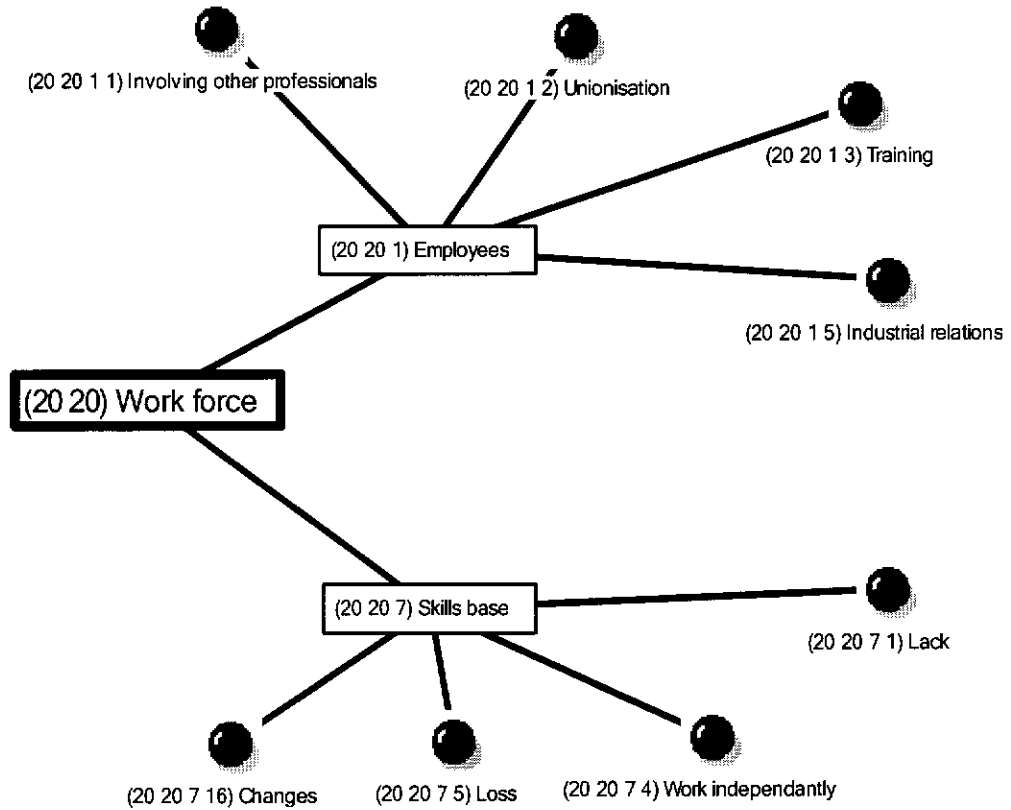


Figure 8.9. Category 'Work force'

This category focuses on water utility employees, the age of people in the industry, and the need for change as the urban water supply business changes.

8.2.9.1. Employees

Respondents said that traditionally water utilities had been run by engineers because engineering was a key component of the water industry however, the industry recognised that other professionals were required to bring different perspectives to the industry and to identify and solve issues.

//there's an interesting mix of people starting to come into the industry and I think that recognises that there are some really difficult questions to resolve and that there needs to be a range of different perspectives to resolving those//

Respondents commented on the training and skills development required for people already in the industry particularly employees who had been working for water utilities all their lives. As the industry's business environment became more complex employees work conditions were changing in relation to employment

contracts rather than permanent positions. Industrial relations were therefore going to become more complex and add a level of uncertainty for utilities.

//the industrial relations issues as we push public servants...a little outside the comfort zone they've had and they've been in for a long time, onto contracts, onto changed conditions, simplifying payment structures and expecting more...I think that too is going to generate some uncertainty and some complexity and issues that'll require some management//

8.2.9.2. Skills base

Respondents were concerned about the level of skills in the water industry particularly when it came to the construction of major projects such as treatment plants. This was because these sorts of projects are not undertaken regularly. Many projects involving new technology were based on overseas expertise. Downsizing was also considered to have impacted on the level of skills in the water industry. Respondents were also concerned that technological expertise would not be in Australian hands but centralised in a few large international organisations. This point is related to globalisation discussed earlier in this chapter under the concept of Industry structure. Respondents said that the issue of skilling was compounded by fewer young people entering the industry, automation and a perceived lack of collaboration within the industry.

//the level of technical expertise is fairly thin and I think that's probably because we're such a small player internationally we just don't build that many treatment plants every year//new technology and as it is being introduced like ozonisation and...ultra violet...a lot of that...is being introduced on the basis of...overseas expertise and practices//we will have to rely more and more on...overseas...technology and...wisdom and not that that's a bad thing but it may also be accompanied by...restrictions in terms of ownership//

//there's a concern by some of...declining expertise, centralisation of expertise in a large international companies//

//it is a challenge for the industry to look to the future and getting people into the industry, there are not a lot of skills in the five, fifteen year horizon, this issue needs to be addressed very quickly//

8.2.10. Political environment

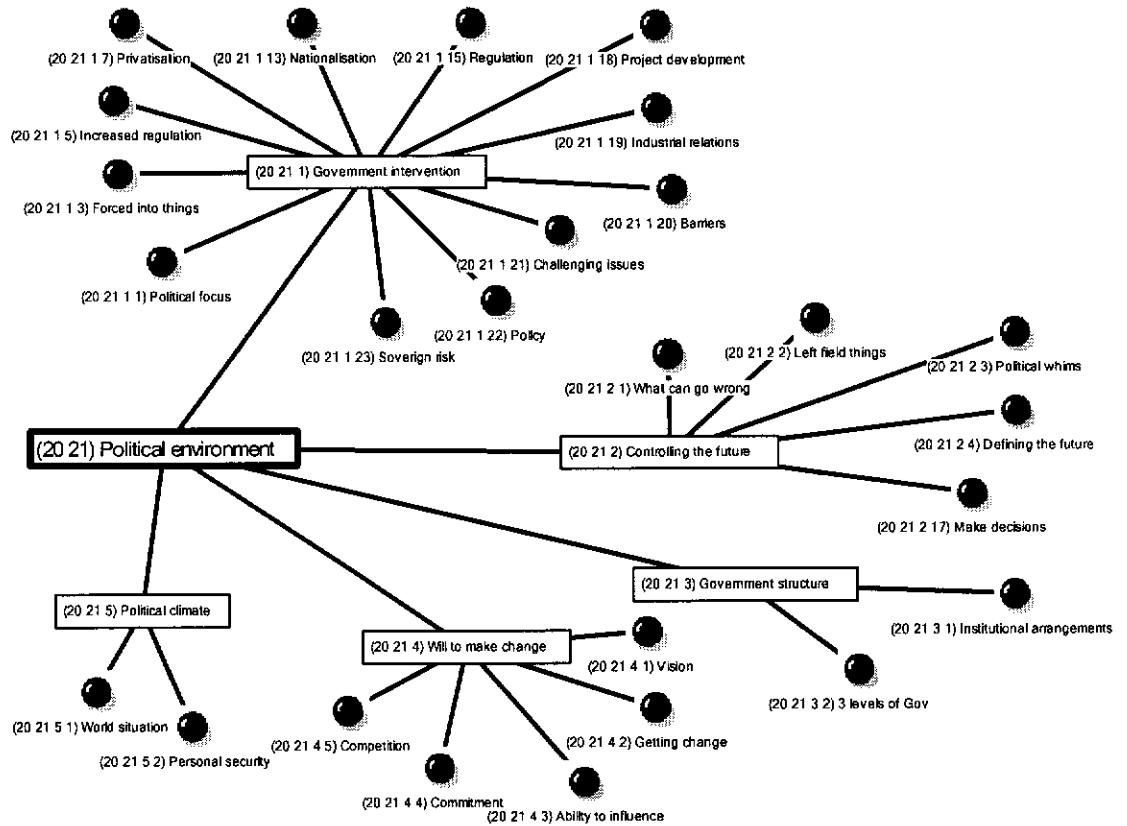


Figure 8.10. Category 'Political environment'

8.2.10.1. Government intervention

This concept refers to government intervention in water utilities, tighter regulation and issues of privatisation and ownership of utilities.

Respondents believed that there was a lot of political intervention, in water utilities, from governments and that often there was a short term political focus whereas the water industry had a long term focus, which was necessary for planning water supply.

//there's still a lot of political interference//

//long term sacrificed for the short term by politicians//

Respondents thought that the political focus on water issues could lead the industry to take actions or initiatives that were socially and environmentally undesirable.

//the increased focus on water around the place//there's sometimes the pressure to do something and sometimes you do things//to be seen that you're doing something...rather than because it's the right thing to do//

//one of our fears is that we'd be forced into a lot of things that are socially undesirable//might be forced to take on environmental and social initiatives...for political rather than for social reasons//

//one of our fears if we don't comply with those then the political process will step in and//tell you what to do and those decisions may not be the most socially and environmentally desirable//

Another area where respondents saw there was government intervention was in the area of increased regulation, particularly when there were water quality incidents such as the Sydney Water incident. Respondents saw the problem as a perception that the public were not willing to pay for better treatment of water whilst at the same time increased regulation, imposed by governments, put upward pressure on the price of water.

//there will be an increasing level of regulation in the future because people aren't going to want...excursions of cryptosporidium or giardia appearing in their water supply and yet...aren't going to be willing to pay for...increased or improved treatment to...minimise those sorts of excursions//

//the effect of things not going well is the inevitability, the increase in regulation unnecessarily, which adds significantly to the cost to the consumer and the community//

Respondents thought that drought would raise the level of political interference.

//if drought continues a couple of cities will be in real strife, which will bring about more political interference//

Respondents believed that the concept of privatising water utilities had fallen off the political agenda, at least for the time being. Privatisation was a concern for the future, which, some respondents believed, would be the path followed by government if the industry did not perform or there were further water quality incidents. An alternative point of view was that the industry would be pulled back into government control, which if water utilities did not perform they should expect governments to react that way.

//I think we've probably seen the limit to privatisation in the industry//

//the biggest concern that I have is, is the issue of...possible privatisation, this would be the worst thing that could happen...and the consequent out fall from some of those sorts of things//

//the down side scenarios of the water industry become the captive of government...agencies at presumably the state level and even potentially at the Commonwealth level where the ownership of these industries will be nationalised...much like the banks were when they failed to perform//

//if you stuff up you're dead, it'll be pulled back into Government...re-aggregated so there's only one boss to kick and generally the service will deteriorate//

//if water authorities cannot deliver then government will change the instructions and the industry should expect it//

//well again it would take a crisis like the Sydney crisis again and we could be going back again to statutory authorities that's probably the only real concern//

Respondents noted that another area of political intervention was from the economic perspective and in particular water pricing. This was discussed earlier in this chapter under the category of Commercial focus. One of the challenges for water utilities was that price was a demand management tool and yet increasing the price of water was a political issue. Reducing the demand for water reduced the need for new infrastructure, such as dams. At the same time building new dams was also a political issue.

//politics is important in pricing and a constraint, prices have to go up; needs economic regulation with independence as a solution//

//of course they want water prices not to become a political issue and they also don't want to build new dams and they also have to deal with the fact that pricing is sometimes a powerful tool in reducing demand and hence reducing the need for...new storages//

Other areas where respondents perceived the water industry was politically constrained was in the development of new projects, industrial relations, developing new services and a sovereign risk because utilities were publicly owned.

//I think other restraint//there are a lot of steps in getting something up politically//

//industrial relations a constraint because of unions and getting efficiencies//

//government ownership limits branching into other services//

//you'd have more political interference if things aren't good because we're all government owned right across Australia, so that, it's a sovereign risk//

8.2.10.2. Government structure

In this concept respondents focused on the three levels of government and the jurisdictional boundaries it imposed whereas water flowed through boundaries. Respondents said that there was a need to manage the water cycle holistically.

//water exists within a natural hydrologic regime and so you need to manage the water cycle...and if you look at our institutional set up there's a mismatch//

//I think one of the constraints of the industry is the three levels of Government in Australia//

//at a state level it's very parochial and then we're at the Federal level, we're one country with one problem, natural resource problem and yet there's three levels of Government fighting//

//jurisdictions are state based, policies and reform is Federal//Jurisdictional problems are the biggest constraint//

8.2.10.3. Political climate

Respondents said that over the last few years there had been a growing environment of uncertainty in terms of security and conflict. There was a growing belief that the next significant conflict in the world would be over water with repercussions for the water industry globally.

//the world political situation is very uncertain//I firmly believe that the next significant conflict could well be over an issue to do with water and I think that would have repercussions around the whole of the water industry and the world//

//the political climate...I think there's an uncertainty there//if you entered a period of political uncertainty where people's personal security and those sort of things become much higher on the agenda, will the industry, sort of, be able to keep transforming itself and performing as you'd really want it to//

Two concepts in this category of Political environment are very closely related, 'Controlling the future' and 'Will to make change'. 'Controlling the future' focuses on water utilities being in charge of their own destiny to the extent that they influence the political decision making process and therefore remove any future uncertainty. 'Will to make change' is about the political decision making process and whether politicians will have the courage to make decisions based on information from water utilities and the community desires.

8.2.10.4. Controlling the future

Respondents' perception was that whilst the water industry may face challenging issues it was in control of its destiny and would overcome the challenges. At the same time respondents were aware that issues come out of left field, over which they had no control. This particularly became evident after the events in New York on September 11 2001.

//well what can go wrong? You see again...that question is posed as though we are...ineffectual...in our, in controlling to some extent our future and it's nothing of the sort//

//there are a lot of technical challenges and public health challenges but...non of that, none of the things that you can foresee going on should, should end up with the industry going...bad it's not like...manufacturing //

//things that come out of left field like September 11...if there was to be...some horrific type of act like that...occur either in this country or some other country affecting the way our business needs to be run//define what you think the future should look like and how we're going to get there and one can identify...a pathway towards success//if you can define as clearly as possible the things that might happen//

An area where respondents thought there was uncertainty was political whims in terms of how utilities may be treated in the future and the institutional arrangements put in place by governments. This is related to the above points on privatisation under the concept of Government intervention; however, defining the future, for water utilities, would remove the uncertainty.

//on the uncertainty side I suppose//obviously political directions//I hope there aren't to many more of the next lot of political whims on the horizon//

//there may be some institutional arrangements that are a bit uncertain//

//from a political point of view what are going to be the future intentions//

//I think, we ought to be standing up and defining what we want the future to look like ourselves//I think that's one way of making sure there is no political uncertainty//

Respondents thought that what was constraining them was the will to make changes.

8.2.10.5. Will to make change

Respondents said that where there was political involvement then politicians needed to be convinced of the need for change and that there were plenty of opportunities for political wins. Part of the problem, respondents thought, was the industry itself having the courage to make change. This is related to the category of Barriers to change discussed later in this chapter. Related back to the last concept, 'Controlling the future', the industry, with vision, could manage change.

//the key uncertainty is really, is whether things are going to change and how they're going to change whether the politicians will have the guts to eventually make any substantive changes//

//a lot of the uncertainty relate to getting support from government to get the things done that we need to get done to run our business effectively//

//one of the biggest things limiting the industry is a lack of courage//

//the industry, the business the answers are always in your own hands everything is manageable you've just got to have a bit of vision//the only real concern I have is that to the extent where you need to have change that involves politicians//I think we've got an obligation to sell them the different...options//they're all the time looking for political wins...you've just got to produce the vision that suits the time//in the water industry there are huge opportunities for politicians to have victories//

8.2.11. Infrastructure

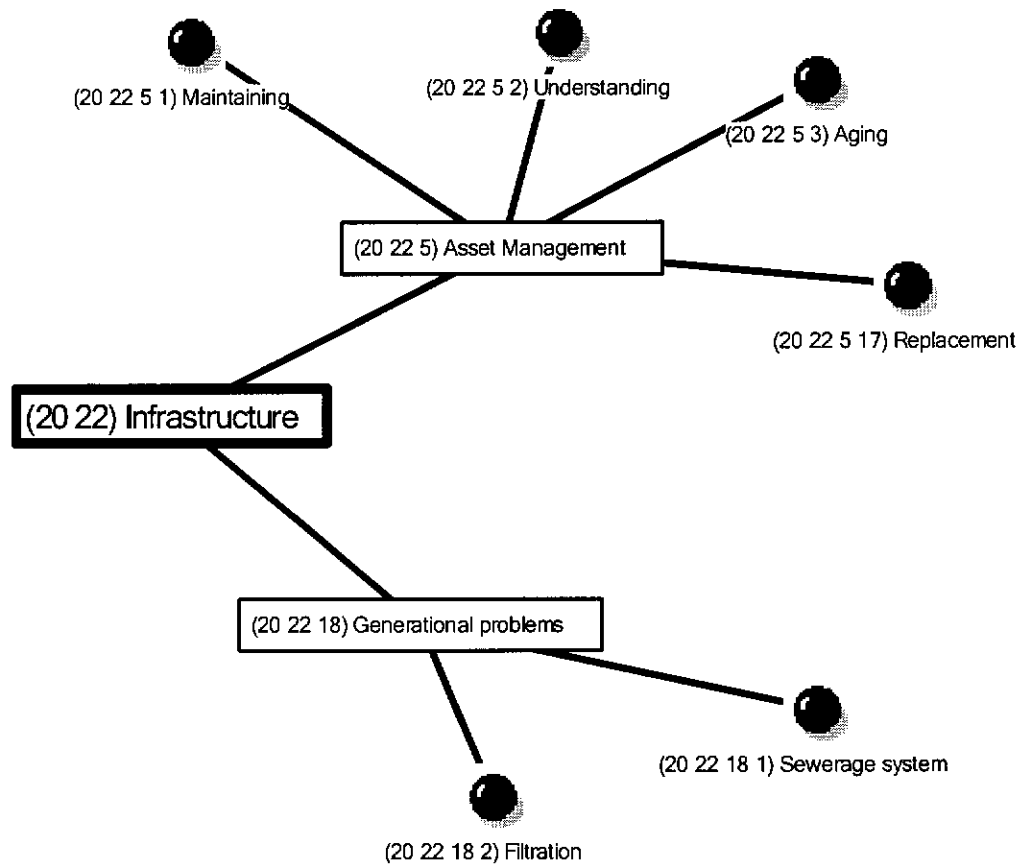


Figure 8.11. Category 'Infrastructure'

Comments about infrastructure concerned maintaining assets, costs and understanding assets.

8.2.11.1. Asset management

Respondents said that in the major cities like Sydney much of the water supply infrastructure had reached the use by date. Some assets had been in the ground for 100 years. For many water utilities maintaining and renewing aging infrastructure was a concern in terms of customer service, the unknown cost and people's appreciation that assets did not last for ever. For newer utilities the problem is less severe. Respondents saw that the answer to the issue was to have the cost of maintenance reflected in the price of water without which asset management would become reactive. This would require a change in political mind set, according to some respondents.

//our customer service levels could drop off if we don't spend the...resources that need to be spent on maintaining and renewing our system//

//people have to realise that the assets don't last for ever and therefore, you need to generate revenue through the water charging not just to produce the water but to maintain the assets, replace them//

//people are going to have to understand that because if you don't get that understanding then not going well could really mean...sort of...a very haphazard approach to asset management where you start to become reactive about planned replacement and renewal of assets//

In the longer term respondents thought that technology could come to the rescue of water utilities with newer infrastructure.

//the technology moves on as well, fifty years is a long time//

8.2.11.2. Generational problems

Some respondents said that water utilities had a backlog of problems that required fixing what respondents termed generational problems. To fix these problems in a shorter time frame required government financial support for capital projects, this was a major issue. Priorities were placed on projects required to meet customer service standards. One such issue was the filtration of Melbourne's water supply, one of the few cities in the world without a filtered water supply.

//we have to tackle these big what I call generational issues//

//the other big one//is filtration we're pretty soon going to be the only place in the world without a filtered water supply//

8.2.12. Climate change

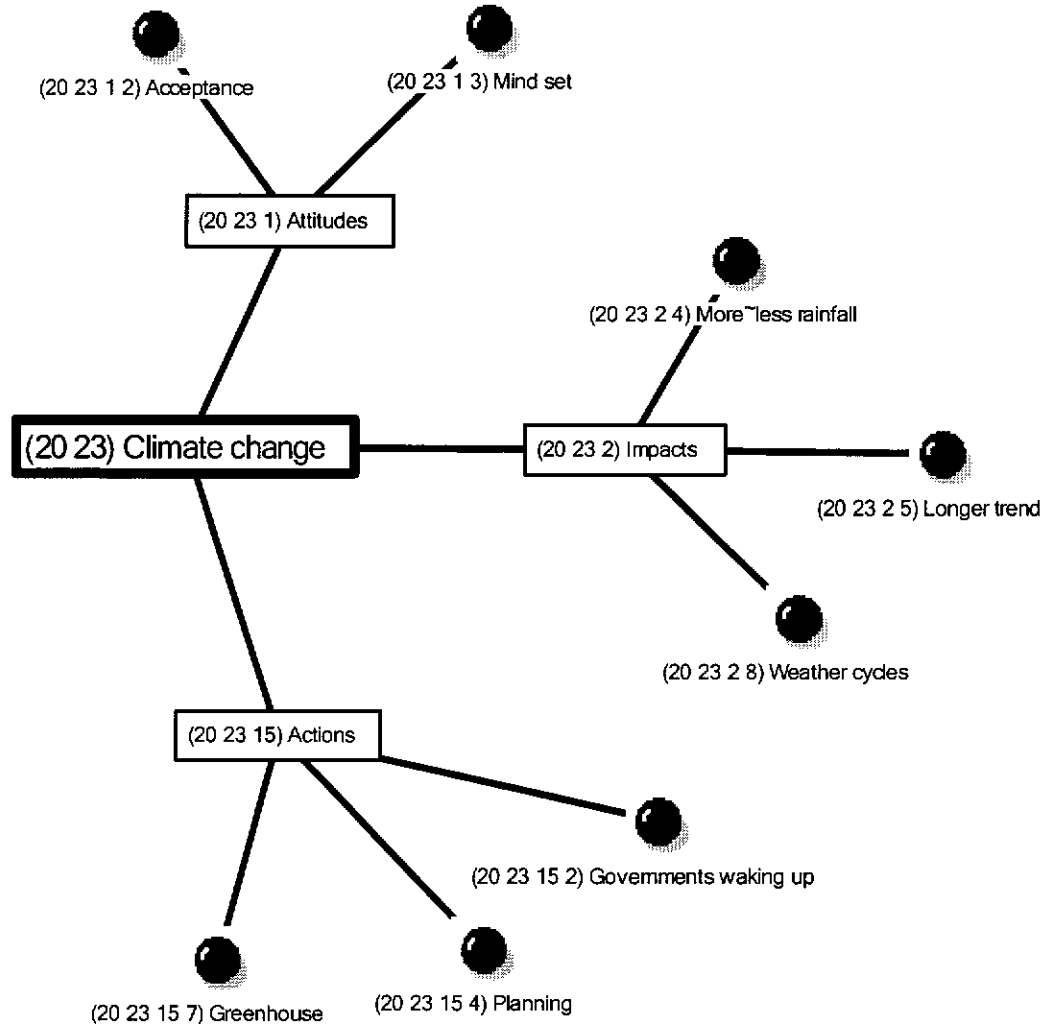


Figure 8.12. Category 'Climate change'

The impact of climate change was a major area of uncertainty for the water supply industry, according to respondents; this would have a significant impact on the industry however, there was a level of uncertainty as to what that impact would be.

//we're not sure what's going to happen in the...long term//

//climate change is a huge sweep and we know nothing about that//

There are three concepts surrounding climate change in the context of future water supply services.

8.2.12.1. Attitudes

Respondents said that one of the problems with climate change was the level of acceptance of the issue, which may stem from the fact that the community, in terms of water supply was generally an engineering community used to dealing with quantitative data with a normal distribution. In terms of climate change the future may not conform to that normal distribution.

//if you've got a community, that's an engineering community//assuming the normal distribution between the extremes//the potential implications of global warming are that the assumptions that we've made about extremes are no longer correct//what may come out in the future...is something that won't conform to that, so all of a sudden you say the basis for everything we've done perhaps becomes wrong and we have no idea what to replace it with...that's a hard message//probably a large part of the reason why there isn't concern yet, why it was an issue that hadn't been sold...So it's a huge uncertainty but not yet become a concern//

8.2.12.2. Impacts

The impacts of climate change are not well understood. Respondents asked would there be more or less rainfall and where would the changes be? How fast would the changes occur and would climate change accelerate? Respondents were aware of climatic cycles. This was particularly obvious during the interview period, being a time of severe drought. Not knowing the impacts also reflected on respondents' attitude to climate change and acceptance of the issue.

//and of course whether or not there's climate change we really don't know. At the present time we know that cycles like the one we're currently in occur with about the frequency of one in twenty, thirty years but whether what we're seeing now is part of a much longer trend we really don't know, so climate change is a big uncertainty at the moment//we don't really know whether that is driving climate change or what we're seeing is a much longer time scale, geological change, I'm not convinced one way or the other //

//are we really in climate change, or we just going through something that's cyclical//

//we don't know whether it's a straight line or whether it reaches a point at which things suddenly accelerate...and...until we get there we may never understand//

Respondents said that climate change impacted on water utilities' budgets because flood predictions changed, meaning that spillways for reservoirs had to be upgraded. It also impacted on revenue because sales of water changed.

8.2.12.3. Actions

Respondents' perception was that government was the body to take action concerning climate change in terms of greenhouse emissions and energy conservation. Respondents said that the water industry was a major user of energy and that it was a major expense for pumping water. The environmental agenda and greenhouse emissions respondents considered would be drivers for the water industry in the future.

//how big the environmental agenda becomes and I think that includes the greenhouse gas...and that really is sort of...that will drive the direction of this industry//

8.2.13. Water quality standards

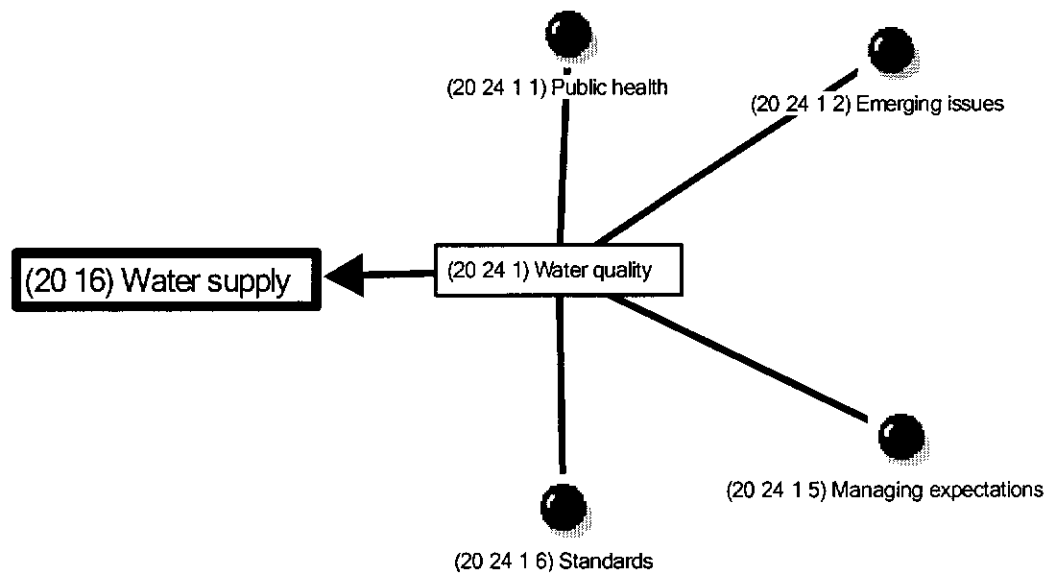


Figure 8.13. Category 'Water quality standards'

It could be argued that Water quality standards should be a concept under the category Water supply, it is certainly directly related, however, the researcher decided to keep these pieces of data in a separate category.

8.2.13.1. Public health

Respondents were concerned for public health from new organisms and trace elements in water and the increased concern being raised about chlorine by-products which might become an emotive issue.

//public health and chemophobia, trace elements in water could end up like genetically modified food, out of control, this could be emotional, and we might have to remove chlorine as a disinfectant//

8.2.13.2. Emerging issues

Related to the last point respondents were concerned about the potential cost to treat the problems that would emerge from improved technology and the understanding about the impacts of trace amounts of pollutants and chemicals in water.

//there's a couple of issues in terms of water quality, endocrine disrupters and other issues like that, that I can see on the horizon and I'm sure in ten or fifteen years time, you know, as technology advances and we become aware of other things too, other chemicals and other...issues//there's obviously going to be something there that we're not aware of at the moment and a lot of these things...will not be easy to manage and may need, high cost solutions//

8.2.13.3. Managing expectations

Respondents said that water utilities were facing increased customer expectations in terms of water quality particularly as more information became available. At the same time the water quality guidelines were becoming more stringent. Respondents were concerned about the cost of meeting increased customer expectations.

//the Guidelines are becoming more stringent, and that is ultimately going to, the constraint will be, can we meet those and what are the costs of meeting those//

8.2.13.4. Standards

A key uncertainty for respondents was future water quality standards, effluent standards and increased service levels. This was seen as an impact on the future cost of water.

//at what point are we going to say enough's enough this is the standard//

//and that of course drives in the need for expenditure which means that over time water will cost more//

8.2.14. Governance

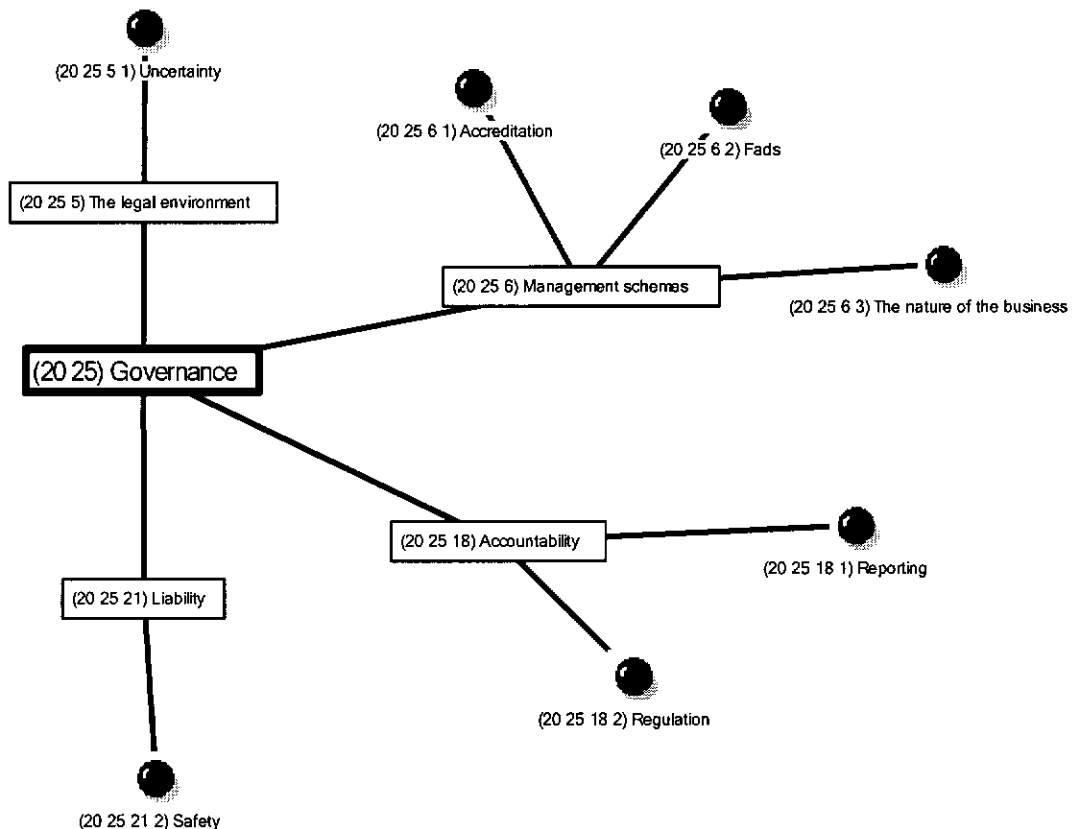


Figure 8.14. Category 'Governance'

Four concepts have been grouped under the category of Governance.

8.2.14.1. The legal environment

Respondents talked about the growing uncertainty of legal issues and the increasing numbers of legal matters to deal with in terms of employees, customers and the increasing complexity of the business environment as more commercial transactions were undertaken. This was seen as an increased cost for water utilities.

//so I think from a legal, well from an uncertainty point of view, I think the legal uncertainty or the complexity of the legal environment is increasing it seems to be increasing year by year//

This issue became one of the uncertainties considered for the scenario matrix and will be discussed in chapter nine, Discussion.

8.2.14.2. Management schemes

Respondents said that there was an increasing propensity for water utilities to embrace management schemes like ISO (International Organisation for Standardisation) and Hazard Analysis and Critical Control Point (HACCP) systems. This had particularly been the case since the Sydney Water crisis of 1998. It gave water utilities a set of procedures to follow in the event of an incident rather than management by crisis

//a considered procedure which should be the best course of action to minimise the damage to optimise the outcome and I think it's great that more are doing that//it's really about proper professional management of our complicated business//I think in the future all of the water industry ought to be having all of their operations under those sort of considered management schemes of one sort or another//

Another respondent saw the current propensity of management contracts for a set number of years after which senior managers move on leaving behind changed management ideas as a risk to the business. The right people, who see a long term future in the business, should be employed.

//there's far too much emphasis placed on people at the top//to be whiz kids and of course all they're going to do is keep trying to prove themselves and reprove themselves//

8.2.14.3. Accountability

Respondents thought that water utilities had to become more accountable, as they become more commercialised, to all stakeholders. There were increasing demands for triple bottom line reporting as the level of moral responsibility increased and tougher regulations were imposed.

//the other issue I guess and this is related to corporatisation, is accountability//that more and more will be...as monopolies that are not privatised...will have, and we're seeing//increasing requirements for reporting to customers and reporting not just the traditional annual report but triple bottom line approach//about really...being open and honest, giving the good with the bad which is really difficult for traditional Boards to come to terms with//

8.2.14.4. Liability

Respondents said that governing boards were looking at their liability particularly in reference to safety issues.

//board liability issue//people look more and more at safety//

8.2.15. Barriers to change

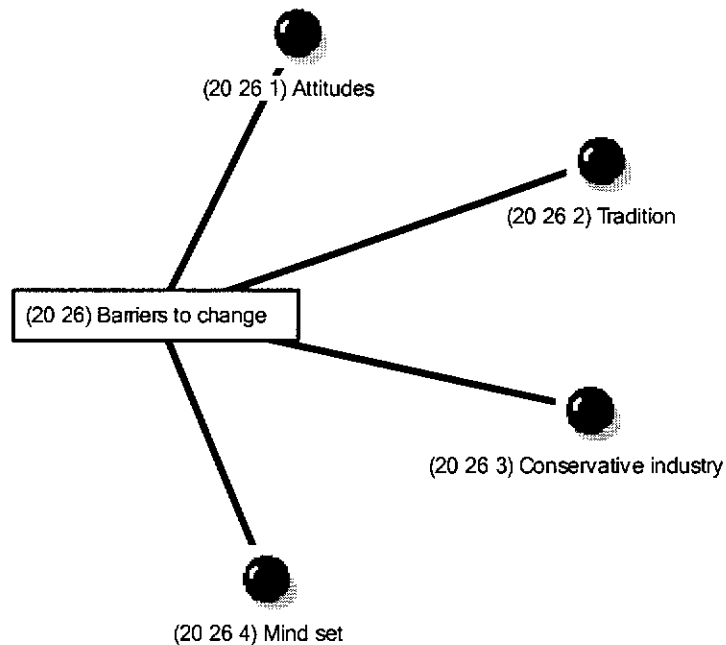


Figure 8.15. Category 'Barriers to change'

This category refers to the ability of the industry to change.

8.2.15.1. Attitudes

Respondents said that one of the barriers to change was the industry's own negative attitudes and willingness to change, which was passed onto government and decision makers.

//our own...negative attitudes and the limits that we have placed upon us by ourselves and political masters//

//own leaders sort of say things like well we can't do that, that's not feasible, that's not possible//

//our willingness to move//to get out of our comfort zone//it's just having the courage and then having the ability to win the support...of the people and of the governments//

8.2.15.2. Tradition

Another barrier, noted by respondents, was tradition particularly from the assets perspective and the type of water systems that had been designed in the past. Respondents asked the question what type of water supply system would be

designed today with water shortages, and what the potential for alternative water sources was in the future.

//the existing asset base that's in the ground, they're 150 years old plus and you can't exactly walk away from them with a new approach//

//from a green field perspective...if [you] plan some city on a computer model or what have you...and you sat a group of folks down who were open minded about approaching a situation and may be had a bit of a balance, integrated team, not just engineers...but a variety of talents at the table...you wouldn't necessarily come up with a system that looks like what we design nowadays//

8.2.15.3. Conservative industry

Respondents commented on the fact that the water industry was conservative; many employees had been in the industry for a considerable length of time, however, the industry saw itself as needing to be conservative when public health was at stake. This limited innovation and could prove to be a continuing barrier in the future when alternative water sources may be required.

//there are some understandable good reasons behind some of that conservatism, which are, as I always put it to my doctor, I can kill more people in a day than he can, if I get it wrong...so that has limited some of the innovation//

8.2.15.4. Mind set

Respondents thought water utilities had a mind set of big public works projects, such as dams, and was engineering driven. This needed to change particularly in the era of sustainability and had probably already started. This could also be as a consequence of increased commercialisation of water utilities.

//we're still engineering driven, we still like often to build large headline projects//

//public works and public health mentality is being applied in days of sustainability, this will crumble//

8.2.16. Security threats

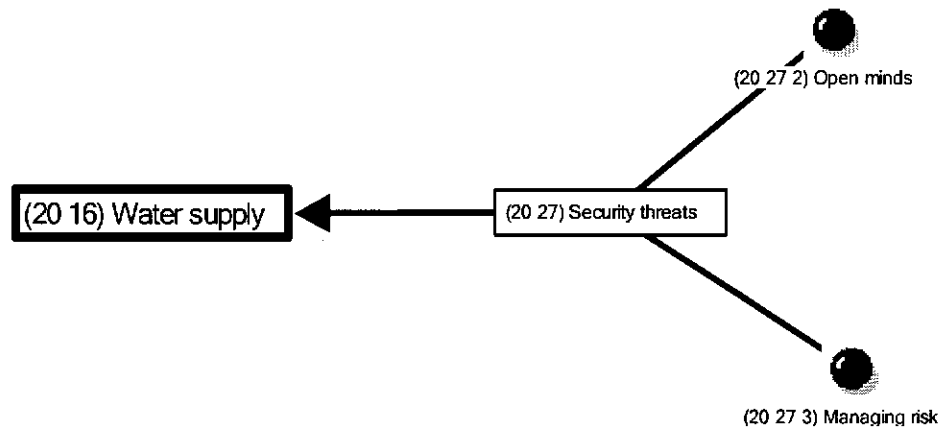


Figure 8.16. Category 'Security threats'

As with the category Water quality, Security threats could be a concept under the category Water supply however, the researcher decided to keep this as a separate category.

During the early part of undertaking interviews the tragic events of September 11 in New York occurred and later other world events. This has impacted on the Australian urban water supply industry and terrorism arose in a number of interviews. Terrorism has become a concern and uncertainty for the industry, however, in the context of scenario planning it can be considered to be a wildcard. Two concepts emerged.

8.2.16.1. Open minds

Respondents said that the events open people's minds to what could happen and raised the question about the level of concern.

//it is now much easier to contemplate some idiot poisoning the water supply//

//do we move to a new level of...concern or do we just get on with life//

8.2.16.2. Managing risk

The other issue raised by respondents, was that water supply has now become an issue of managing the risk and liability. The industry had spent considerable time and effort in putting procedures in place to manage a crisis, should it occur, and increasing the protection of public water supply.

//it's about managing the risk, the threat and then having a mechanism in place to deal with the crisis if it happened to arise//

8.3. Findings from questions 1, 2 and 8

In addition to the seven questions that focused on the future, interviewees were asked three other questions. Question one of the interview asked respondents to discuss watershed events either positive or negative that had occurred in the past that should be remembered in the future. The objective was to raise issues that had been milestones and may have moved the water industry in a certain direction and had a major impact. Question two asked respondents to discuss changes with long term implications that were facing the water industry at the present. Some of these issues were also areas of uncertainty for the future.

Question eight asked respondents what they would like to be remembered for if they left the industry. This question was designed to relax respondents before the final two questions of the interview. The data from this question was reviewed but yielded no further data of significance.

8.3.1. Past events

Whilst the majority of these past events are single isolated events, many had and will continue to have ongoing implications for water supply.

8.3.1.1. Terrorism

Two notable terrorist events that took place during data gathering for this study occurred in New York in September 2001 and in Bali in November 2002. Respondents noted that these events had impacted on the Australian water industry because it had made people aware that the unthinkable could happen. The events had raised people's awareness to the vulnerability of public water supply and lead to utilities implementing contingency plans.

//we've had an increase in inquiries about...how we protect the infrastructure from...a range of different hazards//there's certainly no doubt that we're...operating in a more anxious time where certain threats that people would not have perceived as real threats a couple of years ago they now think are potentially real threats

//the events of Bali a few weeks ago, the events in America, New York...Washington...that affected the world generally and inevitably affect water companies//

//the Bali issue and the...attacks into New York affect the industry as well because it says anything can happen//you could have a plan in place, but not necessarily for that specific event but to...ensure that you can recover...your services as best you can in a controlled way so really just reinfor', forces the issue of...emergency planning and risk management//

8.3.1.2. Water quality incidents

Many respondents said that the most notable water quality incident to occur in Australia in recent times had been the Sydney Water crisis (Sydney Water 1998?). Whilst there may not have been any actual contamination of water by parasites it had highlighted the potential consequences of such an incident as well as how to manage an incident. The incident was considered by respondents to be a milestone, industry changing event. Following the incident the McClellan inquiry (McClellan QC 1998) had been completed. There had been and will continue to be implications for the urban water supply industry. Most importantly the crisis focused the industry on the importance of water quality, which continued to dominate. It led to the restructuring of the New South Wales industry especially Sydney Water and the establishment of the Sydney Catchment Authority. Throughout the water industry there was now an increased focus on catchment management which would continue to increase.

//I think the big milestones the Sydney thing in 98 and...the issue there of course, from my perspective, was really the problem and...I still believe that it wasn't actually a water quality problem but it was a problem of...inappropriate...drivers for the...management of the...laboratories and...poor communications

//Sydney Water crisis certainly springs to mind as being very notable//what came out of the inquiry//significance far beyond...the local catchment//in particular the Sydney Catchment Authority...and with respect to that the fact that the Catchment Authority was given referral powers//

//was not so much a drinking water problem as such, I think, that was more in terms of how you communicate//when you have something that...you suspect//that there's a high risk and that you need to tell the public about it's just how you go about doing it//that's what that incident really showed up was the relationship that you have with your regulators and the way you need to talk to the community as a whole when there's a, I guess a crisis//

//I think the Sydney event was...a water shed event, if we didn't think water quality was important before then we certainly do now//

//certainly the incident that happened in Sydney//there's no doubt that was a//industry changing event//

//lessons to come out of that in terms of how companies react to results...or indications, how they make sure that ... they've got the right checks and balances in place before they create pandemonium...and...also how they...deal with the public...I mean the public communication element//

//brought...to the front a lot of...sort of, public health and...governance issues for water authorities throughout Australia//

//it focused attention nationally and internationally//in particular...the...desirability's of protected catchments or measures to prevent pollution//it's significant for the Australian industry because it has...changed...the approach in terms of...the drinking water quality framework and looking at a quality system...the hazard analysis and critical control point approach of the...food industry//

Respondents mentioned other, international, water quality events that had impacted on the Australian water industry. These had occurred in Milwaukee, Walkerton and the Perrier bottled water incident. In both Milwaukee and Walkerton there were a number of fatalities as a result of water contamination by bacteria and parasites. The Perrier bottled water incident raised the question about the safety of bottled water.

//the Walkerton incident... it's global potential even though it wasn't global//

//in the water industry there's always been a focus on public health//I think there was a crypto event in America//that killed 400 people//Milwaukee, so that's, they become pretty significant effects and there's a flow on effect to Australia//

//the Perrier bottled water issue in that...again with the Sydney Water crisis//it was a priority issue is the bottled water safe to drink//the importance of maintaining trust of...all stakeholders, customers, the consumers, community as well as the regulators in ensuring that...the water is safe//

8.3.1.3. Infrastructure incidents

In recent years there have been a number of incidents outside the water industry that have highlighted the importance of essential services and aging infrastructure such as the Auckland power incident and the Longford gas plant explosion. Respondents said that these had and would continue to impact on the water industry particularly in terms of replacing aging infrastructure. This was discussed earlier in this chapter under the category of Infrastructure.

//significant to the water industry too was what happened in ninety-eight and in ninety-nine in terms of utilities in general and I think that affected the Australian scene in terms of...I guess...maintenance and renewal of your assets//

//South Australia I think during the summer at one stage they ran out of power and I think in all those instances//that people started to ask much more questions about the maintenance and renewal of our services//

//the Longford issue here in Melbourne//was also an industry changing event even though it was gas it focussed on the significance of proper risk management//

8.3.1.4. Natural phenomena

Respondents said that past natural events had impacted on the water industry none more so than droughts and to a degree floods.

//the various water shortage//this last six, twelve, eighteen months has been a really interesting time in terms of a number of significant utilities in Australia with their reservoirs running low//

//flood events 1829 in New South Wales, these are important because of topography and the impact on urban settlements//

//the water industry in Australia lives from crisis to crisis, this can be caused by drought, lot of progress, and alternatives related to drought//

//in 1982 the drought stimulated demand management//

8.3.1.5. Regulatory reform

Some of the major events that have occurred are in the area of reforms to regulations. These are in the form of single reforms in certain states and national reforms. Many of the reforms have been under the banner of the Council of Australian Governments (COAG) water reform process. This process is continuing for the water industry and many of the reforms put in place are still and will continue to have an impact on urban water supply. Some of the reforms are structural reforms to certain organisations. Regulatory reform has been discussed previously in this chapter. This section will focus on particular events. Respondents said that the restructuring of the Victorian water industry seemed to have had an impact across the country and was noted as a model for industry change.

//as Victoria is concerned there was a really major...catharsis, you could describe, it when Melbourne Water//was chopped into four//that would probably be the most...spectacular change in Victoria's water administration//the other major catharsis//is when the innumerable, I think it was something like 126 water authorities for the various regions in Victoria, were amalgamated down to//something like less than ten//

At a national level respondents' said that the separation of regulatory functions from the service provider had been a major change. In most states this change in regulatory function had been completed. It had impacted on the setting of the price of water, allocation of water to competing users and environmental regulations. These issues have been discussed earlier in this chapter under the category of regulatory reform. National Competition Policy (NCP) had a major impact with most

water utilities moving to a commercial, licensed mode of operation rather than statutory authorities, some of these changes were continuing and the impacts are still being felt. Different states and territories have moved at different times through this process. Some respondents questioned whether NCP was the best model for an essential service industry.

//the COAG reforms and NCP would be the clearly defining points from a business point of view//

//the major water shed event would have to be the...adoption of National Competition Policy and its application to the water industry throughout Australia//so there's been some radical changes in the...environment that we work in and the structure of the industry whether that's been positive or negative I don't know//

//in January 1997 there was a change in ownership of the organisation//this changed the culture of the organisation putting more accountability back into the organisation//

//in 1997 \$1.4b was put into the reform program most going to the urban suppliers to set up a two part tariff//

//it would be true to say that the benefit is to the community//the idea is that we become more accountable to the community for the way we manage our assets and our pricing policy is more transparent//

Respondents said that in New South Wales the setting up of the Independent Pricing and Regulatory Tribunal (IPART) had a major regulatory impact. Similar things have occurred in other states and territories

//and just recently IPART has...become not only the price setter but our licence setter//if you go back to 1991 our original operating licence was largely drafted by ourselves and blessed by the Government, the current one is now drafted independently by IPART//still covers the same standards for customers, drinking water quality, water continuity, water pressure and sewer overflows, still covers those but it also now includes...a huge number of environmental provisions//

Respondents said that over the years the National Health and Medical Research Council (NHMRC) Australian Water Quality Guidelines had a major impact on water utilities in Australia. Rolling reviews to 'The Guidelines' are periodically undertaken and as such this is viewed as a continuing process of change rather than a single event, they do represent an area of uncertainty for utilities. Water quality was discussed earlier in this chapter.

8.3.1.6. Commercial focus

From a commercial perspective, respondents noted that, there had been a number of changes over the years such as the shift to outsourcing the operation of certain parts of the water supply, wastewater treatment processes, contracting out of construction and the corporatisation of utilities which was ongoing. Respondents said that one of the major changes was in pricing with a change to user pays pricing based on the volume of water used.

//corporatisation I think that was a...key change in the way that we did business that's forever changed...how we approached the service provision//

//outsourcing has been one of the major concerns//and that was part of the restructuring you could say organisational structures and using third parties and things like that//

//1982 when we changed our pricing system from valuation to user pays tariff for water and for sewer//that's been a milestone for this organisation in particular because it//cut back consumption quite dramatically//it enables to defer a major storage, which was due to be built in about 1987//now looks like being sometime 2040//

8.3.1.7. Sustainability and managing the resource

Respondents noted a couple of events in regard to managing the resource that were significant. Firstly the Australian Federation, which had set up the jurisdictional boundaries now, are viewed as an impediment to managing water resources holistically across the country. Secondly an event that tried to address the problems of the first is the establishment of the Murray Darling Basin Commission.

//the Murray Darling Basin Commission too, I mean...absolutely significant...again here you've got this issue of introducing a structure albeit virtual...that attempts to address that miss-match between natural hydrologic boundaries and institutional regulatory boundaries//

8.3.1.8. Public private ownership

Whilst not a direct water industry event in Australia respondents said that it was the privatisation of water utilities in Britain and other industries in Australia such as banking, telecommunications and electricity supply that was credited with reforming urban water supply in Australia.

//in the 90's there was this...urge that from Government to privatisation//obviously that shifted the focus to water and//a lot of I guess water authorities around Australia feeling pressure of privatisation//they started to have an organisational structure more...open to being privatised//

8.3.1.9. Public health and urbanisation

In terms of public health, respondents said that the introduction of water born sewerage and the quality of drinking water were seen as historical events of importance in shaping present day urban water supply. With greater urbanisation during the second half of the last century pollution problems had arisen as a result of wastewater discharges. These problems had been addressed by the Whitlam Government through the National Sewerage and National Water Programs.

//the...quality of our drinking water and the introduction of...water born sewerage that have had the biggest improvements in community health...throughout the history of the recent world//the value and the importance of both of those...sit very high on the priority for the community health//

//greater urbanisation that occurred in the...I guess, in the late 50's early 60's and some of the pollution problems that arose from that//these issues were taken up by the Federal Government, under Gough Whitlam through the National Sewerage and National Water Programs so they were the defining events in those eras//

8.4. Summary

This chapter presented the Findings from the data analysis. The data, as described in chapter seven, had been coded to 16 major categories to reflect the major issues for the future of the Australian urban water supply industry. Under each category were a number of concepts that reflect the theoretical basis of each category. In order to ground the data the concepts were supported by quotes from interview respondents

In addition data from events in the past was presented. These events were considered, by respondents, to be memorable and had the potential to influence the future direction of the industry.

From these findings the next chapter, Discussion, will enlarge on the major and critical issues for the future of Australia's urban water supply industry and in doing so select two key issues for the scenario matrix.

CHAPTER 9 - DISCUSSION

'I like less the story that a frog if put in cold water will not bestir itself if that water is heated up slowly and gradually and will in the end let itself be boiled alive, too comfortable with continuity to realise that continuous change at some point may become intolerable and demand a change in behaviour.' Charles Handy, (Moncur 2004).

9.1. Introduction

In chapter seven, Research Method, two phases of data analysis was described, the outcome of which was 16 categories containing data relevant to the future of Australia's urban water supply. These 16 categories, illustrated with data from the transcripts, were presented as findings in chapter eight. In order to answer the research question, within the framework of scenario planning, the researcher took the 16 categories presented as findings to a further level of analysis as described in section 9.2 of this chapter, in order to uncover two key uncertainties from the data that would form the scenario matrix (van der Heijden 1996; van der Heijden et al. 2002; Lindgren & Bandhold 2003). The two key uncertainties after careful analysis were 'Water availability' and 'Technological change' and the justification for their selection is discussed below in section 9.3 of this chapter.

The researcher chose to develop scenarios as a framework and carefully crafted stories through which to present a number of complex, interacting and critical issues that had emerged from the data. The two uncertainties were placed in a matrix and four scenarios were then written for the Australian urban water supply industry to the year 2025. These scenarios can be found in section 9.8 of this chapter. The scenarios have been named 'Decadent water use', 'Smart water world', 'Muddy waters' and 'Mad Max water world'. The stories describe four possible futures for the future of Australia's urban water supply industry and how the issues, from the findings, might unfold under each scenario.

Surfacing the driving forces of a business is part of the scenario planning process and according to Schwartz (1991), probably the most important part of scenario building. Schwartz (1991) and van der Heijden (1996) suggest that the selection of a small number of driving forces from many issues, as discussed previously, is critical to developing scenarios with significance. The robustness of the scenario planning process and the ultimate competitive advantage of the organisation can rest with these scenarios. It therefore becomes vital that these key driving forces reflect, as accurately as possible, the perceptions of industry stakeholders.

In the previous chapter eight the findings presented covered many issues that the Australian urban water supply industry faces in the future, issues that are

interwoven in a complex web such as the pricing of water, the political implications of setting water prices, the effect on the community's demand for water as prices rise, the preparedness of the community to pay for water and the impact on the augmentation time frame to have water supply available to meet the community's demand. Compounding the complexity are external forces of unknown impact such as climate change and the impact this might have on the availability of water resources. The discussion that follows and the scenarios demonstrate the complexity of the urban water industry in terms of the interaction of the various issues.

9.2. Discovering the key uncertainties

Following the principles of grounded research (Whiteley 2002) used for this study it was imperative to use the data from respondents to ground the study. To discover the key uncertainties the following steps were undertaken in further analysing the data.

Step 1 – A node coding report was produced for each of the 16 categories presented in the previous chapter eight, Findings.

Step 2 – Each of the node coding reports was searched for the following words; key, big, uncertain, drive and concern.

Step 3 - Each report was then summarised to retain the detail data concerning the key words found in step two and remove extraneous data.

Step 4 – These results were then combined into one document named 'Combined summary #2.doc'. This document was edited to leave the issues respondents had said were key uncertainties, uncertain, concerns, drivers and issues raised during the interviews. A total of 30 key uncertainties/uncertainties emerged from the data, 20 concerns, 5 drivers and 157 issues; 212 points in total.

Step 5 – These 212 points were reviewed and grouped into seven headings that respondents stated were key uncertainties, three uncertainties, five issues of concern and three headings that respondents had discussed as issues but were not key uncertainties or concerns. This gave a total of 18 headings. This data is summarised in table 9.1 below and was used to populate the scenarios.

Table 9.1. Key uncertainties, uncertainties, concerns and issues

| | |
|------------------------------|---|
| Key uncertainties (7) | Community outrage Water availability Government policy Technological change Security threats Research Regulatory risk |
| Uncertainties (3) | Emerging issues Legal issues Demand management |
| Concerns (5) | Competition and efficiency Funding, revenue and rate of return Price Knowledge and expertise Vision and culture |
| Issues (3) | Infrastructure Environmental sustainability Providing services |

Many of these headings are the same or similar to the 16 categories presented as findings in the previous chapter however, the difference is that the 16 categories presented as findings focused on data that were a fundamental group or class of data, as discussed in chapter seven, Research Method, whereas the headings in table 9.1 focused on data that respondents said were a key uncertainty, uncertainty, concern or raised as issues for the future.

The next sections 9.3 and 9.4, in this chapter will discuss each of the key uncertainties and uncertainties in more detail and the selection of two for the scenario matrix. The criterion for selecting two uncertainties was that one key uncertainty should be the most uncertain, Water availability, and the other should have the greatest impact, Technological change, on the water supply industry. These two matrix parameters are the most significant issues that shape the scenarios (van der Heijden 1996; van der Heijden et al. 2002). The following discussion will highlight some of the issues behind the uncertainties and propose reasons for water utilities concerns that respondents did not talk about during the interviews.

In selecting the two key uncertainties for the scenario matrix each was assessed for the level of influence water utilities had over the uncertainty and therefore the environment in which the uncertainty belonged. Van der Heijden (1996), describes three environments in which an organisation operates, figure 9.1. The innermost is the organisation's internal environment where policy and strategy is set and over which the organisation has full control. Surrounding this is the transactional environment in which other stakeholders operate and exert a degree of impact on the organisation. These stakeholders can be influenced by the organisation or in

the context of this study the water industry as a whole. These stakeholders would include governments. Outside this is the contextual environment over which the organisation has no control. In the contextual environment are the key uncertainties that the organisation faces in the future and which form the basis for scenarios.

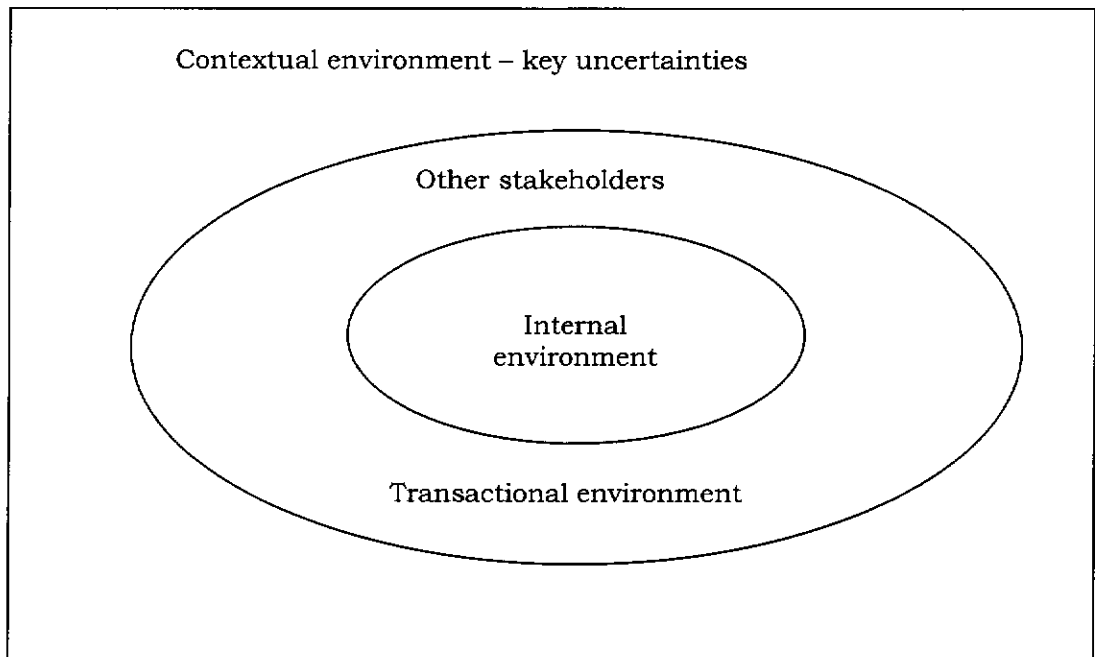


Figure 9.1. The organisation's business environment

Source: (van der Heijden 1996)

Lindgren and Bandhold (2003) use a similar model when discussing the arena in which the organisation operates. In a rapidly changing business environment the organisation needs to look for driving forces in its surrounding world, or contextual environment so that it can be prepared to adapt.

9.3. Key uncertainties

This section will discuss the seven categories the data revealed as being key uncertainties and shown in table 9.1.

9.3.1. Community outrage

As a method of integrating the data with relevant literature, especially selected as directed by respondents, key categories were matched with corresponding data. Data from respondents is depicted in italics and quotation marks. One such category was called Community outrage envisaged as a key uncertainty by respondents' concerns for water quality and the loss of community support when

something goes wrong with the water supply service either from the perspective of water quality or interruptions to supply as a result of infrastructure failure. The case during the Sydney Water crisis in 1998 was addressed by respondents. The data were in tune with historical accounts of water and wastewater services development.

Historically, at least in the Western world, as water and wastewater systems developed it became the culturally accepted norm that governments undertook responsibility for the services. Consequently the community took less interest and participation in the provision of water and wastewater services (Mouritz 1996). However there is now a growing awareness and concern in the community about the quality of tap water and together with the increasing use of bottled water points to community mistrust of the product (Means III et al. 2000a; 2002; Means III 2001; Cotruvo & Cotruvo 2003; Fox 2003; Breusch 2004). One of the aims of the National Water Quality Management Strategy was to develop a nationally consistent approach to water quality management in response to the growing community concern about water in Australia (EA & DAFFA; ARMCANZ 1994; Shadwick 2002).

Support for the community outrage concept reported in the data can be found in the Sydney Water crisis in 1998, *"I think the big milestone's the Sydney thing in 98"*, that saw three million people in Sydney having to boil their drinking water (Sutherland 1998). Some believed the crisis was a case of mass hysteria (Leech 1998), fuelled by media reaction *"and the way you need to talk with the community"*, (see below and figure 9.2), but as a result of public pressure the crisis resulted in the resignation of the CEO, the Chairperson and as respondents' said *"Sydney [Water] got split into two"* with control of water treatment plants and catchments going to the newly formed Sydney Catchment Authority. There were in addition numerous litigation actions against Sydney Water (EWN Publishing 1998a; 1998b; 1998c). This was a powerful community reaction to a perceived problem with drinking water. It shattered community confidence in the utility, public water supply and *"led to a lot of institutional work"*, which may ultimately mean that the community has to pay more for water as it demands more stringent water quality, forcing water utilities to provide more sophisticated water treatment facilities (Sydney Water 1998?; Lindsay 2000).

Further evidence to support the community outrage concept, which had global consequences, comes from *"the Walkerton incident...it's quite global potential even though it wasn't fairly global"*. This water contamination incident, which caused death and suffering, occurred in Walkerton, a small town in southern Ontario, in May 2000. Seven people died and over 2300 became ill due to drinking water that was contaminated with the bacteria *Escherichia coli* (O'Connor 2002). This was a

terrible and tragic event illustrating the extreme consequences of water contamination and human error.

A key issue for water utilities in the United States, according to Hoffbuhr (1999), is the public's lack of trust in government institutions because of perceived incompetence, lack of focus on customer needs and rising costs. This is mirrored in Australia and confirmed by the data *"incompetence...and the like, that's when you're in trouble"*. The public feel they have no control over issues affecting their quality of life. This is supported by the data because water utilities see *"the need to bring customers into the loop into decision making"*. For water utilities this cynicism can lead to increased standards and rising costs (Hoffbuhr 1999).

The data suggested that the fear of escalating costs is a barrier to introducing more sophisticated and available water treatment technology to improve water quality and reduce risks *"and the limit to it all will be what...costs"*. This raises some questions in terms of higher prices being a real or perceived barrier. It seems the issue of price is being raised by the industry, perhaps in response to perceived political negativity, rather than by the community. The data suggested that some respondents believed *"the public are willing to pay for changes"* in contrast the data from other respondents suggested that *"the increasing price of water"* is a concern for customers. Clearly the community are prepared to pay for safe drinking water as demonstrated by the increasing sales of bottled water, costing at least 1000 times that of tap water. Does the community need more sophisticated water treatment to remove every last particle of pollution or is the issue one of reducing or eliminating the risk of contaminated water being consumed? Will the cost of sophisticated water treatment decline with new innovations? Is the cost issue a short term barrier or long term barrier?

As water utilities become more commercialised *"in driving down...operational...and recurrent costs"* their financial resources will become stretched and it is possible that this may result in declining community trust (Langford 2000). To compound the problem community consultation processes have not, in the past, been widespread (Mouritz 1996). This is supported by evidence from the data *"it's not a customer focused industry"*. This is characteristic of Gleick et al. (2002) 'hard path' theory that traditionally water utilities have followed whereby the focus has been on supplying water. If water utilities do not develop a culture of community and stakeholder consultation it is likely that they will not get access to scarce financial resources (Hoffbuhr 1999).

Means III (2001), in developing scenarios for the US water supply industry, notes that one of the trends is an aging population, a trend being paralleled in Australia. Retirees are more health conscious, risk averse and politically active. This

demographic group will demand that water utilities disclose water quality information. Means III et al. (2000a) say that one of the instruments for communicating water quality data is via the internet. A better informed community aids in building trust *"we can't be arrogant enough any more to think we know best"*. As water reform progresses in Australia, community consultation will be important for its implementation. This is in empathy with Gleick et al. (2002), who theorise that the new 'soft path' is for water utilities to engage with the community in order to meet the needs of the community in terms of water services rather than delivering engineering solutions to meet generic needs.

Other areas that are likely to result in community outrage or loss of support and trust for water utilities could arise from poor planning to ensure water sources are available, particularly in the timely augmentation of water supply. The data resonated with *"that could become a crisis"*. This assumes that the traditional supply side solutions meet the demand for water rather than alternative sources of water such as from recycling and using less water. In terms of constructing dams there is less community support *"construction of large dams is just going to be increasingly difficult"*, the new approach is to curb demand. Public consultation is still important (Gleick 2000; Gleick, Singh & Shi 2001).

As the community's concerns about water use rises there will be increasing pressure to recycle wastewater as a demand management solution and an alternative source of water. This is reflected in the data with respondents' saying *"politics will drive the reuse side"*. The community's perception about recycling water is in terms of concerns about the safety of the product and cost, acknowledged in the data by respondents' as *"something that we continue to grapple with"*. Recycling water will require extensive public consultation (Langford 2000; Means III et al. 2000a). Technically wastewater can be treated to a standard acceptable for drinking. This is done in parts of the world, for example Windhoek in Namibia relies heavily on recycled water (Haarhoff & van der Merwe 1996).

In terms of recycling wastewater the issues, from the data seems to be the community's acceptance of the technology, *"consumer awareness that distinguishes...that trusts the scientific community"*, what the consequences are if the technology fails, and the cost of treatment, *"technologies that are emerging...they're incredibly expensive"*, which is not clear. According to the CSIRO (Dillon 2002) there are a number of barriers to reusing wastewater in Australia particularly public confidence. A failure to ensure public safety and health would seriously impact on the community's trust in recycling. Issues of public health and community attitudes will likely limit reused water to agriculture and industry (FDI 2004), which is reflected in the data, *"people do not have a problem with recycled water being used for irrigation"*. There are many examples of wastewater being

treated to a level suitable for agricultural purposes or irrigating parks and ovals and many state and territory governments have targets for the percentage of recycled water used, “recycling’s taking a very high profile”.

Returning to the issues of water quality incidents, respondents thought that any future incidents would result in government taking action in the form of tighter control on water utilities. This is reflected in the data “If water authorities cannot deliver then government will change the instructions”. Water Services Association of Australia (WSAA 2001) suggests that the outcomes of incidents must focus on public health, better regulation and risk management as well as infrastructure requirements. The likely outcome would be “going back again to statutory authorities” reversing the trend of recent years, under National Competition Policy, of water utilities operating under a corporatised model. This action would be in response to the community’s call for action over a water quality incident or a major disruption to water services.

Another outcome of increased regulations is the increased media attention and public awareness to drinking water quality which is part of the regulatory cycle (Means III et al. 2000a; 2002). Figure 9.2 from Means III et al. (2000a) illustrates the cycle.

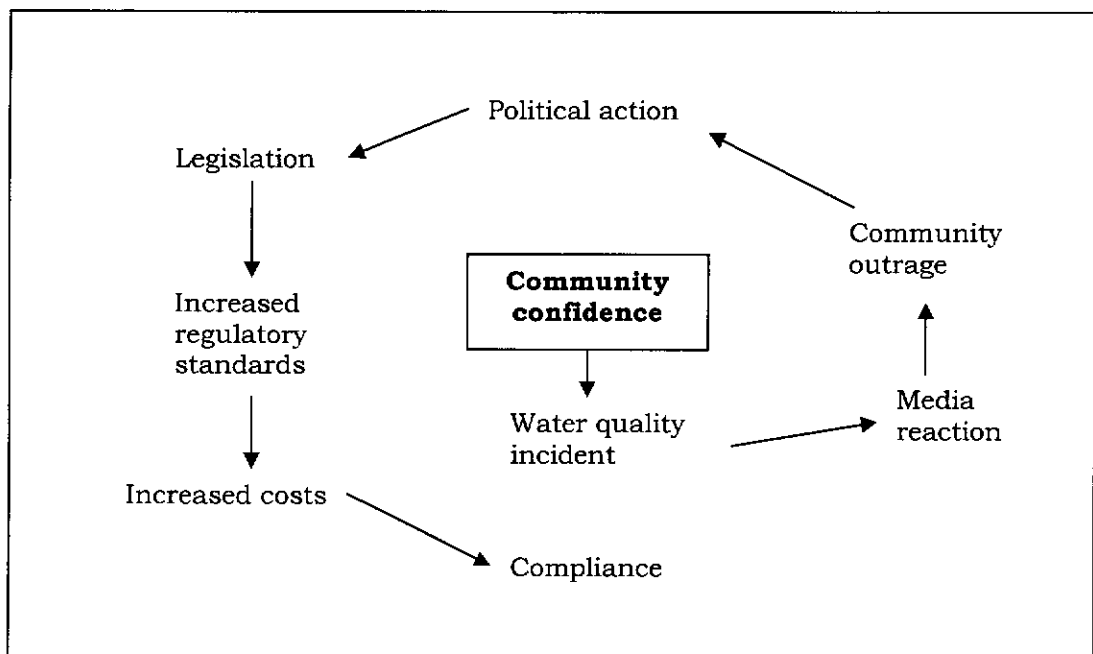


Figure 9.2. Water quality incident - regulation cycle

Source: (Means III et al. 2000a; 2002)

Findings presented in the previous chapter showed that in general the community's expectations about the quality of water and water services had increased "*the increasing knowledge of the community and their expectations*" and would continue to do so as more information became available. It is therefore essential for water utilities to be customer focused and responsive to the community's needs for improved service delivery (Means III 2001). Water utilities must engage the community in the decisions being made about water services. This is supported by the data "*customer relationship management will be important in the future*". This would include the debate about developing new water sources and the disposal of waste products. The community needs to be educated about water services, which "*is only going to come about through the community consultation*" including the use of recycled water to overcome negative attitudes and perceptions about water reuse. This would build a level of trust between water utilities and the community.

Linked to the Community outrage concept are service delivery and the maintenance of the water supply infrastructure. The concept of infrastructure is discussed below in subsection 9.6.1. Poor maintenance leads to declining water services with more interruptions and possibly a major interruption to water supply. The aging infrastructure has the potential to negate even the most sophisticated water treatment plants leaving water utilities open to community criticism (Means III 2001). Infrastructure failures in recent times were cited by respondents as examples of the impact of disruptions to essential services such as the Auckland power failure and the Longford gas plant explosion. This is supported by evidence from the data "*significant to the water industry too, was what happened in ninety-eight and in ninety-nine in terms of utilities in general*".

Research by Trainor (2002) has shown that utilities in general have had a long history of public sector monopolistic management with an engineering focus resulting in a lack of experience in customer relationship management. This resonated in the data with "*it's a legacy from our...we'll tell you what we'll give you days*". Means III et al. (2002) say that water utilities need to recognise that their customers are changing and understand what the community thinks about water quality so that information meets the community's requirements. Generally the community judges water quality on aesthetic criteria.

In reference to van der Heijden's (1996) theory about the business environment model the community is in the water industry's transactional environment, both exert a degree of influence over each other. The data revealed that utilities in the future must have a customer focus. However the community's reaction to a water quality incident is something of a wild card for water utilities. They cannot control the community's reaction, however, with a customer focus the reactions of the

community to incidents can be modified to the extent that the level of outrage could be reduced, predicted and therefore managed.

The researcher considered that the concept of community outrage would not be an uncertainty, as envisaged by respondents, with the greatest impact or highest level of uncertainty, in the context of scenario planning, and was therefore not selected for the scenario matrix.

9.3.2. Water availability

The category of water availability was perceived by respondents to be a key uncertainty. This resonated in the data and in the literature. The category encompasses concerns about the availability of water for harvesting and use by urban consumers, the farming community, industry and the environment in terms of maintaining river flows. This category covers issues concerning the availability of naturally occurring good quality water and the impact of climate change on the resource in the long term. The community's acceptance of the issue of climate change and not knowing what the impacts may be and whether climate change is a straight line change or could start to accelerate. The scenarios, presented later in this chapter, depict the implications of possible futures where there is plenty of water available or less water available and how such situations are addressed.

As stated previously Australia's use of water is about 22,000 gigalitres of water [1 gigalitre (GL) = 1,000,000,000 litres, approximately 444 Olympic swimming pools (ABS 2004)] used per annum across all sectors, irrigation, industry and domestic. This is approximately 31% of Australia's estimated annual water yield of 71,000 gigalitres (ABS 2004; FDI 2004). The trend over the last twenty years has been a substantial increase in water use from 16,000 gigalitres in 1983/84 to the current figure of 22,000 gigalitres (AATSE 1999; ABS 2004; FDI 2004). This equates to about 50 times the volume of Sydney Harbour (ABS 2004). The increase in water use has been attributed to increased irrigated agriculture which accounts for approximately 72% of natural water use (AATSE 1999). The data confirmed that most water is used for irrigation *"we know that the urbans only take seven or under 10% of the water"*. One of the problems is that water may not be available where it is required, most of the surface water in southern Australia is over allocated, whilst water is underutilised in northern Australia (FDI 2004).

Traditional planning for urban water supply has entailed forecasting demand for water and identifying projects to augment water supply in time to meet the forecasted demand. This is reflected in the data *"with the population projections that are predicted for this area we want to make sure that we have got enough storage sites identified"*. Projections often over estimate the future demand for water. Gleick et al. (2001) propose a new approach should be to meet demand from existing

sources by improving efficiency, treating and recycling wastewater and other demand management methods (Gleick 2000). The data was in agreement with this approach *“a lot of work is needed on managing the demand”* and *“having a look at new sources of water”*. This is the approach being taken in Melbourne to meet their demand for water (WRSC 2002). This is supported in the data by, *“if we can control demand we can allow the population of Melbourne to increase by about twenty five percent and not build a new dam by 2050”*. In regions where there is plentiful water there is little incentive in the community to reduce water consumption.

Gleick et al. (2002) write that historically and even today in many parts of the world, a community had a single source of water about which there were cultural norms and rules regarding the use of that resource. Groundwater sources where a number of individuals have bores to tap the resource fall into this category, where one person's over use or pollution of the resource impacts on other members of the community relying on the resource. Gleick et al. (2002) theorise that the traditional paradigm of end use water or reticulated water supply is not shared, as such the use of water is personal and providing there is enough water supply; why should society be concerned about how water is used? This theory is not readily supported by the data, but rather and as Gleick et al (2002) argue, a new paradigm is now emerging, motivated by water shortages, where individuals are becoming water efficient because of the costs and hardships to society of not being efficient. This is reflected in the data in that *“there is a really, really positive attitude amongst the public about wanting water conservation”*.

Climate change will alter the supply and demand for water. The uncertainty of the impacts creates barriers to investment and operational decisions, however, as Gleick et al. (2001) say there will always be uncertainty, decision makers must learn to live with the uncertainty and make responses based on imperfect information. The data resonated with the uncertainty surrounding climate change implications *“potential implications of global warming are that the assumptions that we've made about extremes are no longer correct”*. Some climate change issues are qualitative in terms of sociological and policy changes that are difficult to quantify. The water industry needs to acknowledge the uncertainties and put in place adaptive strategies (Gleick, Singh & Shi 2001). The data, however, suggested that climate change may not have been accepted by the water industry *“I'm not convinced one way or the other”*.

The impacts on water resources from climate change will not necessarily be scientific. Demographics, policies, prices and regulations will either moderate or intensify the impacts. The data reflected the various changes *“does the climate change, change the economics of farming...because it affects the social fabric of the place”*. A question is how will the water industry react? The choices made will

depend on cultural values as well as the available scientific information, *“need to prepare for and understand the environment”* and will add to the level of uncertainty because those choices are unknown (Gleick, Singh & Shi 2001).

In discussing the concept of sustainability, refer to subsection 9.6.2, Tibbs (1996), categorises environmental goods as resource supply, ecosystem services and social amenity. In terms of water, Tibbs (1996) suggests that the loss of ecosystem services, not having enough water, would overshadow social amenity and aesthetic concerns about water quality. The data resonated with this notion *“the sustainability theme is applicable right across all parts of the industry”*. Both quantity and quality of water are important, however it is the researcher’s opinion that for most of the time the public debate in Australia focuses on water quantity rather than quality. However, this focus changes quickly when there is a water quality incident such as the Sydney Water crisis in 1998 *“if we didn’t think water quality was important before then we certainly do now”*.

Niemczynowicz (1992) writes that the world’s water resources are constant in terms of volume and that its scarcity should not be a problem because water is indestructible and can be used many times over. Niemczynowicz (1992) argues that it is not how much water is available but how society uses it, whether society uses it wisely or wastes and damages water by polluting it. This is reflected in the data under the concept of Resource administration *“the bigger issue is how do you manage this resource to support the health of the rivers”*.

There are aspects of climate change that are inevitable such as melting of ice caps and abrupt events such as severe droughts that are occurring with increasing persistence (AGO 2003; National Research Council 2002). Much of the uncertainty surrounding climate change for Australia lies in the detailed impacts on a regional basis and the effects on society. The data reflected this with *“climate change is a huge sweep”*. Some of the lack of acceptance of climate change stems from the lack of understanding and uncertainty of the local impacts and the understanding decision makers require too adapt to changing conditions (AATSE 2002; CSIRO 2002); *“we don’t know whether it’s a straight line...or reaches a point at which things suddenly accelerate”*.

According to the Australian Greenhouse Office (2003) the 1990’s was the warmest decade in the last 1000 years. Further warming depends on the level of greenhouse gas emissions and aerosol use. The reliability of projections for future emissions compounds the scientific uncertainty. The impacts of climate change for Australia appear to be an increased heavy rainfall for the mid to high latitudes and an increase drying and drought for mid latitudes, more rainfall in northern Australia and less rainfall in southern Australia (CSIRO 2002; AGO 2003). This is supported

by the data *“declining rainfall and rainfall variations”* and the researcher’s own data analysis is that rainfall appears to have increased in northern Australia.

In the Perth region a 20% reduction in annual rainfall has resulted in a 50% decline in runoff to reservoirs since the 1970’s. In south eastern Australia climate change has resulted in record low storage levels in reservoirs (IOCI 2002; AGO 2003; FDI 2004). The data confirmed that *“if drought continues a couple of cities will be in real strife”*.

There has been and continues to be widespread debate in the scientific community about the cause of the rainfall fluctuations. Is it in fact climate change induced by greenhouse gas emissions or part of a natural cycle (AATSE 2002; AGO 2003)? This question was raised in the data with *“don’t really know whether that is driving climate change or what we’re seeing is a much longer time scale, geological change”*. Irrespective of the cause, water utilities need to adapt to the reduced or fluctuating rainfall and the availability of naturally occurring water resources (AGO 2003).

Reduced water availability will increase the demand for scarce resources, *“drier climate has increased demand”*, from competing water users threatening the environment and economic growth particularly for Perth and Adelaide. Water quality may decline because of increased soil erosion after droughts, reduced stream flow and higher water temperatures stimulating algal blooms (Means III 2001; CSIRO 2002; AGO 2003). In contrast to the data and some other literature previously cited the report ‘Water and the Australian Economy’ concluded that water quality would not seriously limit Australia’s economic growth within the next fifteen to twenty years (AATSE 1999).

However, increasing populations in water vulnerable areas will compound the problem because of the increased and inappropriate use of water, behavioural and attitudinal barriers in the community to water use and jurisdictional boundaries. The data resonated with *“if we can control demand we can allow the population...to increase”* and *“there is public support”*. The options to alleviate the problem include more efficient water use particularly by irrigators, because as reported in the data *“they waste more water than the cities”*, assisted by more information and water trading (AGO 2003).

Overall the impacts of climate change are expected to continue to be a source of uncertainty and will undoubtedly be complex (AGO 2003). Decision makers in the water industry need to allow for this uncertainty in their strategic planning for water supply services (AATSE 2002). This is confirmed by the data *“plan to manage for something that’s unpredictable”*.

Globally the lack of water resources is likely to lead to conflict (Alcamo, Henrichs & Rosch 2000) a concept that is supported by the data *“next significant conflict could*

well be over an issue to do with water". As stated previously, irrigated agriculture is the biggest use of water. The report, 'Water and the Australian Economy', suggests that a solution to this is to reduce meat consumption and therefore the amount of feed required for meat production, a large use of water (Alcarno, Henrichs & Rosch 2000). This is supported by the data *"I'd like to see irrigators achieve a reduction in consumption"*.

The impact of climate change, as a result of global warming, on the availability of water is a major uncertainty for water utilities in Australia. Most of the predictions are that Australia, in the southern areas, could become dryer (AGO 2003) and certainly the recent droughts with reduced runoff have led to less water in dams, water restrictions in many cities and higher capital investment required to augment water supply.

For those that have reduced rainfall how much less will they receive? Will climate change accelerate? Is it possible to reverse the trend? What will be the impact on the economics of farming? What will be the impact on the yield of water from the environment and flood predictions? All these issues leave an environment of uncertainty and contribute to the lack of acceptance surrounding the issue of climate change.

From the literature and the data the impacts of climate change on the availability of water is and will continue to be a key uncertainty for water utilities. In the short term the impacts currently taking place are uncontrollable, water utilities must therefore adapt. If the impacts are human induced from greenhouse gas emissions then in the longer term the impacts may be controllable. Climate change is in the contextual environment for water utilities. Utilities have absolutely no control over the amount of rainfall. What utilities can do is to plan for the uncertainty whether that is more or less rainfall. In view of the degree of uncertainty surrounding climate change and the impact on water availability the researcher elected to use this as one of the two key uncertainties for the scenario matrix.

9.3.3. Government policy

The category of Government policy encompasses a key uncertainty for Australian water utilities in terms of the political direction governments might take and how government policy will be applied. This category focuses on the relationship utilities have with government and the perceived miss-match between government short term focus and the water industry's long term focus.

The existing regulatory framework for water management in Australia is derived from the Australian constitution. Under the Australian Constitution States and Territories are responsible for the management of water. State and Territory laws are the framework under which water utilities operate. The Federal Government is

involved in water management and regulation through the Council of Australian Governments (COAG), environmental laws and international treaties (AATSE 1999; FDI 2004).

Until recently urban water supply in Australia had been managed by publicly owned utilities as statutory authorities or government agencies, most are now state owned corporations, "*corporatisation is more likely*". Reform of urban water utilities began in the 1980's in the eastern states and took on a national role in 1994 when COAG developed the National Agenda for Water Reform (The Agenda) based on competition policy and the principle of ecological sustainable development (AATSE 1999; FDI 2004).

The Agenda and National Competition Policy (NCP) provide a nationally consistent policy framework for water utilities to restructure and achieve transparent, efficient services, open to regulation and protection of the environment (Thomas 1996; AATSE 1999; WSAA 2001), which the data referred to as "*a water reform agenda that's progressed significantly*".

The Federal Government linked The Agenda to National Competition Policy payments with performance assessment being the responsibility of the National Competition Council (FDI 2004). FDI (2004) notes in its study, 'Thinking strategically about water in Australia', some customers now have cheaper water and revenues from water utilities have increased. This is inconsistent with some of the data "*there's always going to be limited financial resources*" and by contrast other data noted that "*I don't think there's a shortage of money*". The study also says that after ten years the COAG, Water Reforms have failed to live up to expectations and inconsistent with data presented in the previous paragraph. In 2003 COAG developed the National Water Initiative (NWI) to refresh The Agenda, details of which have not been finalised but according to FDI (2004) it is focused on the Murray Darling Basin and ignores issues of indigenous water interests (FDI 2004). A question the researcher raises, does this last point have the potential to escalate and impact on the urban water industry as the High Court Mabo decision has on the mining industry? At a meeting of COAG in June 2004 the issue of the Murray Darling Basin focus of the NWI became a point of debate and disagreement between states and territories (Ludlow, Foley & Prior 2004; Middleton 2004; Taylor 2004a; 2004b).

Since The Agenda was developed the focus of water reform has been primarily on urban water supply. The NWI appears now to be shifting that focus to irrigation water use, which is outside the main focus of this study but cannot be divorced from the holistic management of water in Australia.

As well as a national environmental agency, Department of Environment and Heritage, each State and Territory has its own environmental department with regulations that vary from state to state. Water utilities also answer to an economic regulator in each state covering issues of pricing, competition and service delivery (AATSE 1999), adding to the complexity of water utilities business environment. States and territories have and continue to resist Federal Government involvement in their water resource management (FDI 2004) even so there is general agreement that water should be holistically managed. The data resonated with this sentiment *“consistency in the way water resources is managed”*.

There is a concern within the water industry about the coordination of the water cycle and managing the water cycle holistically. This is supported by the data, *“have some concerns...about the coordination of the water cycle...nationally”*. Part of the problem seems to be the three levels of government with artificial jurisdictional boundaries that do not follow water catchment boundaries the data referred to *“jurisdictions are state based, policies and reform is Federal”*. There needs to be consistencies across the country, *“a holistic approach to water management”*, in the way water resources are managed and to have all stakeholders focus in one direction on issues concerning water and its sustainable use.

The literature suggests some reasons behind the lack of political direction on water resource management. Norgaard (1988) says that sustainability is a meta belief rather than just another agenda issue, meaning a new political arena has developed. This raises new objectives whilst others are no longer relevant leading to a change in political focus. Langford (2000) says that sustainability will influence political thinking. Hoy (2002) in citing Dr N Fleming suggests that a lack of political will to make changes is the barrier to a sustainable water industry and agrees that a holistic approach is required. The AATSE report; ‘Water and the Australian economy’, (AATSE 1999), concluded that policies are required to manage water holistically and to maximise the efficient use of water for the benefit of all. The literature is supported by the data with, *“the willingness for...our master to actually ...support a change, a fundamental change”*.

Another area influencing decision makers is the increasing public resistance to the construction of new dams meaning that water supply planners will have to reconsider their strategies for future water supply sources. The data supported this, *“people as a whole don’t want new dams built but they’ll quite happy to consume more water”*.

One of the key features of the National Agenda for Water Reform is the separation of water supply operations from the regulatory function (Shadwick 2002) creating a

further source of uncertainty for water utilities and discussed further in the subsection below, 9.3.7 Regulatory Risk.

The changes in principles concerning water resource development has, as Gleick et al. (2001) suggest led to fragmented decision making, supported by the data *“you can’t have fragmented water management and at the moment it’s very fragmented”*. Coordination of water policy at a national level could improve decisions making. Certainly, as the data supported, a holistic approach to managing water across jurisdictional boundaries is required, because water does not recognise jurisdictional boundaries, it flows under fences (FDI 2004).

Ruth Dunkin (BCA 2004) writes, in reference to education, that the lack of integrated and coordinated policy frameworks between State and Federal Governments leaves many organisations operating between jurisdictions with poor responses to opportunities or indeed issues. This would appear, as noted from the data, to be the case for the water industry and managing water resources across jurisdictional boundaries holistically. Relevant to the water industry is the short term focus and increasing regulation that stifles investment in research and infrastructure (BCA 2004). The data reflected the short term focus, *“how do y’ take this institutional system of decision making with short term horizons, election to election...get it to crank out a stand point policy that’s got a long term horizon”*.

Water utilities are uncertain as to the willingness of politicians to support the changes required, support for this comes from the data, *“willingness of the politicians to actually...support these innovative plans”*. Connected to this is the debate concerning the public or private ownership of water utilities. At present the focus on privatisation of water utilities in Australia seems to have dissipated, *“privatization has been talked about but I don’t believe this will happen”*, but what of future political direction? Will there be a swing back to a focus on privatisation? This represents a sovereign risk for water utilities, *“more control...more political interference...it’s a sovereign risk”*.

The debate, writes Bakker (2003), is about the public or private ownership of water utilities and is centred on a philosophical discussion concerning society’s worldview of water, whether water is be a common good or an economic good. The issue of whether water should be a common or economic good is in empathy with the data, *“public’s perception...water falls from the sky it’s free...you shouldn’t have to pay very much for it”*. This is a fundamental issue, and will be raised in the following chapter, Conclusions, in the debate on the privatisation of water services and is therefore discussed further in reference to the literature.

Bakker (2003) writes that the commodity school believes that private ownership of water supply systems is preferable because such organisations are responsive to

customers and efficient. The commons school believes water is essential for life and should be managed collectively by, for example, the state.

Bakker (2003) says that those who argue for privatisation say that water services will be more efficient in private hands and suggest that public utilities are inefficient and demonstrate poor cost recovery rates. Privatisation advocates say that through efficient operation and management water prices will fall and profits will be higher for reinvestment into the system. The opposing view says that water will become a global commodity which is inconsistent with the community's right to water as a common good. Other arguments for private or public ownership are that private organisations are not necessarily more efficient; as a result water will become more expensive. Public utilities have a stronger accountability to the community than private organisations. Bakker (2003) cites the collapse of Enron, in the USA, as an example of corporate accountability and notes that Enron had become a major water company through a subsidiary Azurix. The data supported the notion that water services should remain in public ownership, *"a general reaction in most parts of the world to privatization...and certainly in the political environment that we work in here...it's not a community expectation that water as an essential service would be privatized"*.

Bakker (2003) notes that historically in major cities such as London, New York and Paris private enterprise delivered water to wealthy suburbs. The poorer community relied on public wells and open waterways. A combination of cholera and typhoid outbreaks in the 19th century, as discussed earlier, together with lack of private sector funding resulted in the formation of public utilities to supply water. The public utility model has endured to provide water services to many first-world urban settlements with the objective of protecting public health from water related diseases. One of government's justifications for providing the service is that water is a public good (Bakker 2003). It is interesting to note that one of the present arguments for private sector ownership in water utilities is the availability of financial resources as opposed to the historical position of lack of funding.

Throughout the Organisation for Economic and Cooperative Development (OECD) there are different levels of ownership of water supply systems from fully public as in France to fully private as in the United Kingdom. However, a common theme throughout is that government is responsible for setting standards and regulations particularly as most water supply systems are natural monopolies. To a degree this is reflected in the data, *"when it comes to issues within Governments control many of which have very long term horizons which is why they lend themselves to being done in the Government sector"*. Borkey (2003) suggests that the private sector would not be needed in water supply if public management was efficient and well resourced financially and that private organisations would not require tight regulation to

protect the community if there were no market or corporate failures and price escalation.

Ignoring the private sector, Borkey (2003) argues, could isolate management and technical expertise, financial resources and efficiency gains. The water industry needs private sector participation for funding (Gresham & Shlaudeman 2000), *“there was the possibility of more financing from the private sector”*. In developing countries private sector involvement in water supply has some problems because of economic issues and as Senia (2002) says multinational water utilities will stay clear of situations where there is political instability. Another barrier to private sector involvement is the price of water. If it is too low private investment will not be attracted because of the poor rate of return on capital (Borkey 2003). Conversely by increasing the price of water and full cost recovery, including externalities and a reasonable rate of return, water supply systems become more attractive to private investors. This is echoed in the data by *“privatisation was driven by increasing prices”*.

In the USA Means III et al. (2000a) concluded that the public private ownership debate had created tension within government and water utilities but that market forces would decide the outcome based on the best value for the community. No matter whether water services are in public or private ownership, if community expectations are not met organisations will not survive. In 2000, 85% of water utilities in the USA were publicly owned; a ratio that was thought likely to change depending on whether public or private ownership is seen to provide the best service and whether water is considered a public good or commodity. The data reflected a similar reconsideration of the privatisation of water utilities in Australia, *“Government view is turned from...the ready benefits of privatization and people are having a harder look at what model is best for the future”*. Which ever model prevails the ultimate goal must be to provide what the community wants (AWWRF 2000). In Australia the private sector is playing an increasing role particularly in the ACT and South Australia. The model more likely to be followed is one of public/private partnerships rather than direct private ownership, *“may still see some BOOT schemes”*.

Private sector involvement in the water industry varies from service and management contracts, to gaining expertise whilst retaining ownership; build operate transfer, build own operate and build own operate transfer schemes; lease concessions and contracts to outright asset ownership (Gresham & Shlaudeman 2000). As the data pointed, to in the future there may be a *“more interwoven web of organisations”* involved in water services. In 2000 there was no clear financial model for water projects similar to the early days of private electricity projects (Gresham & Shlaudeman 2000).

Some writers believe that water is destined to become, during this century, what oil was last century determining the wealth of countries (Barlow & Clark 2002). The private sector has identified the value of water and according to Barlow and Clark (2002) global profits from water have reached 40% of oil industry profits in a situation where only 5% of water utilities are privately owned. There are a few major global players Vivendi Universal, Suez, Bouygues Saur, RWE-Thames Water and Bechtel United States. Other sources of profits for private water supply come from bottled water, in 2001 ninety billion litres of bottled water were sold globally for a profit of \$US22billion (Barlow & Clark 2002). Taken that water utility profits have risen, which is echoed in the data, *"most of the water companies, corporations or undertakings here are actually a revenue generator for their Government"*, does this explain why governments have shifted the focus from privatising water utilities in Australia? Are water utilities becoming quasi tax collectors? This is supported by the data *"taxing mechanism on the public"*.

Barlow and Clark (2002) argue that to avert the looming world water crisis, water has to be a common good rather than a commodity. They argue that commoditisation of water means that decisions regarding water are based on commercial principles rather than environmental, social or sustainable principles. With the commercialisation of water utilities the data supported Barlow and Clark (2002) *"corporatisation is...really going to drive a lot of change in the industry focused on ...its return...on investment"*. Gresham and Shlaudeman (2000) write that the perception of many is that water is too important to have in private hands. In the UK the lesson learnt from privatisation of water services is that private water utilities do not have a free hand because of government regulations. Any natural monopoly requires a strong regulatory framework (Survey: Private passions 2003).

Gleick et al. (2002) suggest that a new 'soft path' paradigm for water management is for decision makers to recognise the complexity of water resource management and to combine the decision making process such as meeting demand and environmental issues and in so doing reduce the cost to the community, in other words a holistic approach to integrated water management. The data reflected this focus to integrated water management, *"a water service provider that is really coming to terms with integrated water management"*.

These uncertainties in utilities' operating environment impact on, according to the data, their long term planning, which utilities need to put in place for future water supply, *"long term planning actually requires...longer planning horizons"*. From the data utilities' claim that governments have a short term focus which is at odds with an industry that needs to have a long term planning horizon, *"lack of...government perception of long term planning"*. During the interview process in discussing future uncertainties in the next five to ten years the data revealed that this was considered

to be a short term horizon for the industry. Compare this to say the telecommunications industry, which would consider five years as a long term time horizon. This lack of long term planning may result in water shortages in the future.

In order to reduce uncertainty water utilities should have a close relationship with government in order to influence decision making and convince politicians of the need for change. Change however often comes from the community in response to an issue as discussed in section 9.3.1, Community outrage. Politicians may therefore be more likely to follow public opinion and calls for change rather than utilities' calls for change. This could lead to increased political interference in the water industry which utilities are opposed to, this is reflected in the data, *"very much on the back foot and not able to, to get its message out and result...in increased intervention...by government"*. However, when there is an incident and as a response to public outcry government will step in and make changes as was the case in the Sydney Water incident (EWN Publishing 1998a).

The category of Government policy clearly belongs in the water industry's transaction environment. Water utilities have some control in their relationship with government enabling them to reduce some of the uncertainty and outcomes, even with changes of government. The private or public ownership debate may vary in intensity but will remain and no matter which model prevails water supply systems will still be required. Even if public water utilities were privatised, poor performance and community dissatisfaction could see a reversal back to public ownership, the uncertainty over ownership will always be there. It is therefore interesting to speculate exactly what is the cause of uncertainty in the public/private ownership debate. The researcher, therefore, considered that the category Government policy was not a key uncertainty for the scenario matrix.

9.3.4. Technological change

The uncertainty expressed in the data concerning the category of Technological change is where will technology go, what technologies will be invented and what impact will the developed technologies have on water utilities? The data revealed that this category is a key uncertainty for water utilities in Australia, *"uncertainties is in terms of technology and, and where that will go and what impact that will have"*.

As discussed in subsection 9.3.2 Water availability and in chapter one, Introduction, the water supply model for first world urban development has traditionally been one of pumping water through pipes from a primary source to a treatment facility and then distribution to the community, basically pumps and pipes technology. Increases in demand for water from the community have been

met by expanding the water supply system from source to tap. The removal of wastewater has followed a similar design with discharge from wastewater treatment plants to oceans and rivers and in most cases down stream from the intake of 'clean' water. Much of the current water supply technological development focuses on overcoming the effects of climate change and environmental pollution basically end of pipe cleaning technologies instead of focusing on clean and sustainable technology (Kemp & Soete 1992). A key question now arises in the development of urban settlements. Is the technology of water supply sustainable and if it is not what technology will replace it and what are the consequences for water utilities? This is reflected in the data, *"extensive use of innovative technology is a prerequisite for the industry to be sustainable"*.

Water technology is deeply embedded in the culture of western society (Mouritz 1996). Barns (1991) cites Stephen Hill's 'The Tragedy of Technology' in discussing the choice of technology. In the establishment of large scale technology, such as pipes and pumps for water supply, choices were made about the technology that reflect the political control and cultural meaning embedded in the system and perpetuated in the practices and values of society. The choice involves the alignment in society's cultural values with the technology. The challenge for any water supply technology is to deliver equity for the environment, economic efficiency and a high level of service to the community (Mouritz 1996). In other words the technology must be sustainable. Mouritz (1996) in his thesis cites Waoldrop in saying that the existing technology is locked in because niches that appear are based on the prevailing technology, which is difficult to change until a better technology is developed, a new paradigm or as the data revealed, *"technological advances that represent major flip flops"*. To foster innovation the policy and institutional environment must be conducive, with appropriate incentives and acceptance of the new technology by the community as revealed by the data, *"a secure model for providing the research and knowledge the industry will continue to need"*.

A new paradigm for water supply may emerge but because the functions of society and social behaviour are a result of existing technology this will not necessarily lead to changes in actions. The data resonated with *"extremely slow to change, it's not driven by technology"*. To change, mental inertia and resistance to new ideas must be overcome (Niemczynowicz 1992).

The growth trajectory of a particular technology reaches its limit when the negative externalities and congestion outweigh the benefits of the prevailing technology; at this stage a new or alternative technology takes the place of the prevailing dominant technology, technological bifurcation takes place (Kemp & Soete 1992) and from the data *"what might be that thing out there that, that's goin', and radically"*

transform it" [the industry]. Some of the drivers that may result in a bifurcation of water supply technology are aging infrastructure, limits on the availability of fresh water supplies and increasing water quality and environmental standards. For many years a new paradigm for water supply has been called for to address these issues and accelerate change in water supply technology (ASTECC 1995) the data reflected this, *"lot of people pushing recycling because it's the flavour of the month I, I would push it because I think it's fundamental to the way of the business"*. Pinkham (1999) suggests that a new paradigm for urban water supply is not only necessary but likely to eventuate and that new options are already emerging. However, as Foran (BCA 2004) says in discussing technology in general, progress is constrained by the lack of understanding in whole systems and the long lead time needed to replace established systems. This is particularly relevant to water supply technology and the data are in empathy with this *"being able to introduce the new technology in time before we have to start reinvesting too much in the old technology"*.

The traditional paradigm of water supply, increasing supply to meet demand, has left the demand for water from the community unsatisfied, (witnessed by the number of Australian capital cities with water restrictions). Some in the water industry believe this problem can be solved by more efficient technology and financial models (Gleick 2000). The literature would appear to support this view as does the data, to a degree, *"we're actually now looking more closely at those sorts of things [NPV] in particular areas of our economic analysis"*. The report 'Water and the Australian Economy' (AATSE 1999) called for a technological focus on water saving and efficiency particularly with respect to irrigation. This is necessary but is it the longer term sustainable solution? On a global scale the technological focus is on improving water efficiency (Alcamo, Henrichs & Rosch 2000). Technology is seen as a way to reduce costs, improve water quality, automate systems, reduce staffing needs and have more sophisticated treatment processes (Means III 2001; Means III et al. 2000a; 2000b). This perpetuates the existing technology through refinement and evolution rather than focusing on a new paradigm.

Water utilities that embrace innovation will deliver productivity improvements so that they become world competitive (Davis, Perkins & Dooley 1999). The Innovation Summit Implementation Group's report (ISIG 2000), 'Innovation, unlocking the future' says that innovation will be the driving force for business and the economy in the next 100 years. Water utilities need innovation so they can meet the community's expectations (Trainor 2002).

From a research perspective there is plenty of work being undertaken into alternative technologies to reduce water consumption but how much support does this receive from institutional structures? The data resonated with *"hopeful that the Government will continue to support"*. This is a paradigm barrier. Institutions

support the status quo in technology, making change to a new technological paradigm difficult (Mouritz 1996). Technologies will become cheaper in time "*filtration's getting cheaper*" and may be accepted by the community, such as waterless composting toilets. One of the potential outcomes of waterless technologies is that eventually customers could disconnect from the water services system (Hope 2000). Is this at the core of water utilities uncertainty? Do water utilities see this as a threat to their commercial viability? Another issue for water utilities, which was supported by the data, as noted previously, is that it is difficult to make infrastructure investment decisions when new technologies are perceived to be on the horizon (Lindsay 2000). Water utilities are resistant to investment in unproven technology because if it fails there will be a cost to the community to replace the failed technology. The data confirmed this, "*one of the un' the concerns would be that we might select a technology and invest a lot of money in it, it turns out in the long term its not, doesn't work or it's not sustainable*". There will always be looming technological innovations with more profound impacts on an ever closer horizon. There is commercial, professional and political interest in having fewer large scale systems because they are profitable, controllable but they are not sustainable (Fox 2003).

The dominant view about water supply is that there is little wrong with the system (Mouritz 1996). This is confirmed by the data, "*generally I think the industry has got...a very good reputation*". The technology has an inertia that is difficult to change. There are plenty of technologies to save water, but ensuring they are taken up is the challenge. Some of the barriers in the community are information gaps, "*the need to conserve water...through the greater education of community practices*", about the benefits and savings, inertia because of the lack of perceived importance of the problems and some sections of the community gaining benefit whilst others are paying for it (White 2002).

New technologies will have to integrate with existing technology and not fight against it (Niemczynowicz 1992); this is echoed in the data, "*balance between the old and the new I think that is a challenge*", so perhaps the focus should be on choosing a technology that is sustainable rather than using an economic criterion for making the choice. Niemczynowicz (1992) suggests there are two options for water supply, either to follow the high technology trajectory of the present system or a low cost energy solution based on biological systems and recycling; in other words sustainable development.

The technological choice depends on knowledge of economic, institutional, political, cultural and social factors, paralleling the STEEP (social, technological, economic, environmental and political) model used in scenario planning (van der Heijden 1996; van der Heijden et al. 2002). Innovations that fit the existing system are more

likely to succeed than departures from the system because of inertia to change, from cultural or professional constraints (Mouritz 1996).

Kemp and Soete (1992) suggest that new and alternative technologies face many barriers; the benefits take time to be realised, existing regulations, initial capital required and the adjustments required to existing institutional and infrastructure arrangements. A crisis can precipitate the transition to a new technology particularly when the existing technology is viewed as no longer being sustainable and a new techno economic paradigm is required.

Kemp and Soete (1992) write that the advancement of existing technology follows a trajectory that is difficult to deviate from because the prevailing technology has benefited from evolutionary improvements over time, reflected in the data by, *"we're always a conservative industry and we always pull back to what we know"*. It is easier for a new technology to overcome the barriers if it integrates with the existing techno economic system because, as well as the barriers noted above, new technologies are unknown and may have quality issues, therefore; introduction can be slow or fail. In the context of water supply where public health is at stake and the high degree of conservatism that prevails within water utilities, *"the industry's always been conservative"*, the introduction of new technologies faces even higher hurdles to overcome.

Radically different technologies find it difficult to displace existing technology particularly if they are delivering the same service (Kemp & Soete 1992). Cleaner technologies face even tougher barriers from prevailing technologies than new technologies because they threaten and compete against the existing technology. The demand for cleaner technologies depends on government regulations and because of higher costs the community's willingness to pay more. Cleaner technologies therefore require strong incentives such as regulations and the removal of instructional barriers (Kemp & Soete 1992). In terms of the community's willingness to pay for clean technology it is really an issue of whether the community pays 'up front' for clean production and or pays later, through other mechanisms such as cleaning up pollution or deterioration in the amenity of the environment. The data supported the notion that the community is prepared to pay, *"the public are willing to pay for changes in the way their water is supplied"*.

Water sensitive urban design (WSUD) is seen as the new paradigm for water supply based on water conservation and recycling, however the innovations are slow to eventuate because of regulators and developers who do not want to change (FDI 2004). Water sensitive urban design is discussed in subsection 9.6.3 below.

Another important innovation is in micro technology particularly for the water industry in terms of clean up processes and self contained systems for water and

wastewater, at affordable prices (BCA 2004). When technology reduces the cost of desalinated water to a point where it is equal to or is less than the cost of supplying fresh water, desalinated water will become widespread. The obstacles to overcome are the cost of energy and the impact of greenhouse gas emissions on the environment, which could be addressed through hydrogen fuel cell technology and environmental issues in terms of potentially harmful by-product disposal.

According to Tibbs (2000) technology could be used and is capable of solving all global and local problems. The pressure to act and change must come from the community in the widest sense. Tibbs (2000) discusses the concept of a meta-strategy for sustainable technology to meet the needs of a global society in harmony with the biosphere. Technological development and social values have to be balanced to achieve sustainability. Tibbs (2002) suggest that at present there is an imbalance which has led to techno economic instability. New technology is needed to solve the problems; however it could create more if the social values are not developed to govern the new technology so that social values influence the impact of new technology to either improve the situation or make it worse. Figure 9.3 illustrates Tibbs' point.

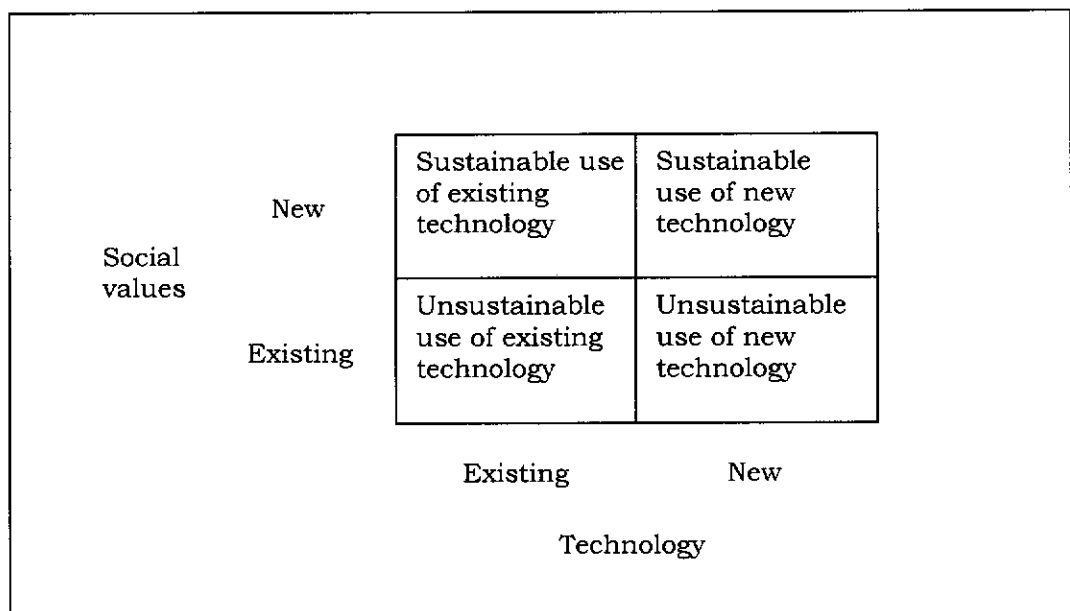


Figure 9.3. Development of values and technology for sustainability

Source: (Tibbs 2000)

This raises another question in terms of whether the uncertainty is because water utilities do not understand the social values and how they influence technological development.

The category Technological change is placed in the contextual environment of water utilities. The questions raised above indicate an underlying level of uncertainty for water utilities outside their control particularly with respect to social values and their impact on technological change. Therefore the researcher has chosen the category of Technological change as a key uncertainty for the scenario matrix because of the level of impact this could have on the urban water supply industry.

9.3.5. Security threats

The category of security threats became more prominent during this study, as noted previously in this study, as a result of the world events in New York and Bali. Water supply systems are vulnerable to terrorist attack and are certainly a major uncertainty for the water industry. Terrorist attacks have *“opened up people’s minds to what was never contemplated”*. Reservoirs would appear to be easy targets because of their size and accessibility; however, it is difficult to seriously pollute a large body of water with a chemical contaminant because of the dilution effect. Smaller parts of the water supply system closer to the distribution outlet are more vulnerable such as water tanks, *“just going to one of the suburban elevated tanks and dropping in a, you know, 10 litres of bloody Roundup or something”*, pump stations and pipelines (Pitchforth 2001; Fox 2003; Roberts 2003; Meeks 2004).

Throughout history there has been conflict over water. Gleick (2003) cites over 80 examples from 3000BC to the present. In terms of conflict over water in a global sense there is likely to be friction where water is scarce and political boundaries are involved leading to diplomatic tension and or violent conflict (Rook 1998). This is unlikely to happen in Australia although there could be local tension between individual users.

Over the last three to four years water utilities have spent time and financial resources to improve security at water supply facilities. Much of this is to prevent vandalism rather than the determined terrorist, which would be hard to prevent (Meeks 2004; Roberts 2003). This is reflected in the data, *“really it’s about managing the risk, the threat and then having a mechanism in place to deal with the crisis if it happened to arise”*.

Security threats for Australia focus on terrorist attacks. Water utilities have crisis management plans to deal with emergencies and are linked to intelligence sources. The category of Security threats is in water utilities’ contextual environment and is a wild card and therefore was not selected as a key uncertainty for the scenario matrix.

9.3.6. Research

Establishing a secure model for the provision of industry wide research was referred to in the data as a key uncertainty. Currently much of the industry wide research is conducted through centralised research organisations such as the Cooperative Research Centres (CRC); the data confirmed this, *“CRC’s have been a very important contribution to the water industry”*, and the Commonwealth Scientific & Industrial Research Organisation (CSIRO) with Federal Government funding. The uncertainty is the level of funding available in the longer term and whether changes in government policy will reduce the level of funding. This is reflected in the data with *“you’re always in the hands of the Government in power”*.

According to the CSIRO’s web page, the CSIRO (2004) through the research division Land and Water, seeks to find solutions to Australia’s water challenges by providing options for policy makers and managers that are sustainable. The CSIRO is also a major contributor to the CRC program (CSIRO 2004).

The CRC program commenced in 1990 to link industry and research and focusing on commercialising research outcomes. Funding has been provided by the Australian Government, universities, industry and the CSIRO. Of the 71 current CRCs five focus on water issues, covering the whole water cycle (CRCWQT 2004; DEST 2004).

The Business Council of Australia (BCA 2004) noted in their scenarios, ‘Aspire Australia 2025’, that a short term focus, cost cutting and the pressure for higher financial returns meant that research and development suffered. This is not specifically directed at the water industry; however, the industry is under similar pressure now that most water utilities are operating under commercial principles and highlights the requirement for a centralised research model. The data resonated with this notion, *“it’s beneficial to have a central group that addresses these sorts of issues”*.

The Innovation Summit Implementation Group’s (ISIG 2000) report ‘Innovation Unlocking the Future’, notes that well resourced research is vital to Australia’s competitiveness. Research is not only about solving problems but about finding innovative and improved ways to conduct business. This is as applicable to the water industry as any other industry. The report (ISIG 2000) continues by saying that public funding of research in Australia had declined and was inadequate to sustain international competitiveness. For the water industry this means that there could be an increasing reliance on overseas technology and solutions to solve problems. Is this a desirable outcome in the context of globalisation? The data answered this question, *“we’re seeing a lot of...the technology...being...aggregated...in very few hands”*.

There is a synergy in having a centralised industry research organisation rather than individual organisations performing similar tasks. This is confirmed by the data, *“the fact that we’ve had CRCs which do the work for the industry, irrespective of their geographic position, in problems that are common to them all and that’s very important”*. The issues identified for research are often water industry wide issues that require centralised research because no single organisation will undertake the task, such as techniques to improve water efficiency, water quality issues, reducing environmental impacts and reusing wastewater (AATSE 1999). A collective support for research reduces the cost (AWWRF 2000). This ultimately assists to contain the cost of water services.

Shadwick (2002) agrees that more needs to be done for research despite there having been efficiency gains through the National Competition Policy.

The disaggregated nature of the water industry has meant that individual organisations have been unable to fund research. Organisations such as the CSIRO, universities and the CRC provide a community research model but has, according to Cullen (2003), a short term focus on industry needs rather than a long term strategic focus. Part of this is because the research organisations are expected to source industry funding in addition to government funding, increasing the short term focus.

The Australian water industry needs secure funding and a national strategy model for the long term (Cullen 2003). This parallels the need for a national approach to the management of the water cycle.

The category Research is in the water industry’s transactional environment. Individual organisations and the industry as a whole can influence the research model and, to a degree, the level of financial resources available for research. Because of the ability to influence the outcome the researcher rejected the category of Research as a key uncertainty for the scenario matrix.

9.3.7. Regulatory risk

Water utilities in Australia are concerned about regulation and standards in a variety of areas from the environmental agenda to water quality, effluent quality, service standards and economic controls. The prime area of concern is future water quality and effluent standards; the risk is financial in terms of meeting the higher standards. The category of regulatory risk reflects the water industry’s concerns.

As part of the COAG Water Reform Agenda, state and territory governments around Australia were required to separate their water supply functions from the regulatory functions of water. The objective was to protect the community’s interest in the way water resources are managed, allocated and priced (AATSE 1999; FDI

2004). This process has been completed; water utilities are now answerable to an economic regulator that oversees price, competition and the provision of water services to the community (AATSE 1999). In addition all states and territories have a health department and environmental regulator as well as a national environmental regulator. Government has retained the responsibility to set and enforce regulations. This is reflected in the data, *“basically most of our regulatory arrangements are set for the next five years”*.

In Australia regulation surrounding water services covers four areas, service provision, health, the environment and price (Cullen 2003). The main reason for water quality standards or guidelines is to protect public health. In the USA and Europe there are mandatory standards for water quality (McKay & Moeller 2001) whereas in Australia the Australian Drinking Water Guidelines 1996, ‘The Guidelines’, (NHMRC & ARMCANZ 1996) provide guidance on what is good quality drinking water (NHMRC 2003). ‘The Guidelines’ are just that, guidelines. They are periodically updated as information on what constitutes good quality water becomes available. Throughout much of the Australian water industry there is a general consensus that ‘The Guidelines’ should remain guidelines and not become mandatory standards. This is confirmed by the data, *“not a good outcome for the water industry would be to see a numerical standard come about”*. Part of the reason for this is the compliant cost to upgrade water treatment facilities to meet what would become a standard number for constituents in water. These standards could then be used in a court of law. Water utilities in Australia generally do provide water to meet ‘The Guidelines’. Where there are shortfalls it is usually to an older guideline and in smaller and remote areas partly because of poorer quality source water.

McKay and Moeller (2001) note other reasons to have mandatory standards include the willingness of the community to pay more for water witnessed by the increase in the sales of bottled water, reduced community costs for the early replacement of infrastructure and equipment, and higher water quality for transient consumers such as tourists. The direction and numerical value of standards that the community may demand, therefore constitutes the uncertainty for water utilities and the financial risk in terms of funding allocation to meet more stringent regulations. The data are in empathy with this notion, *“the Guidelines are becoming more stringent, and that, that is ultimately going to...the constraint will be can we meet those and what are the costs”*.

Currently the regulatory functions in Australia are disconnected, reflected in the data, *“just completely different regulation in each state”*. Cullen (2003) suggests that an efficient framework for regulation is required in the form of an economic regulator to evaluate the benefits of standards put forward by other regulators. This

regulator would determine if standards are in the public interest and recommend price adjustments for water to cover the cost thus ensuring the viability of water utilities and eliminating the financial risk. The data added to this by saying *“international competition needs more work on the regulatory framework, some have a long way to go in efficiency”*.

In a perfect world with no breakdown in markets or price issues the public interest would not require protection with regulations. Society demands that water should be safe and possess an acceptable but not zero risk through regulations (Means III et al. 2000a). The data reflected the literature with, *“safety of our drinking water...is got’a be the number one priority”*. The ideal is to have an efficient water utility (or any utility) either publicly or privately owned with a vigilant government to oversee the service provider and protect public interests (Borkey 2003). In fact the idea that a water utility is privately owned is really a misnomer because of the high level of regulation in terms of pricing and service provision (Survey: Private passions 2003). However there are breakdowns in the market, therefore there will always be government intervention in water utilities, echoed in the data by, *“strengthening regulatory environment is a concern...a necessary evil”*. As discussed under subsection 9.3.1, Community outrage, when the community loses confidence in water supply government steps in and changes the regulations. An outcome in response to public outrage over the Sydney Water crisis in 1998 was the introduction of more stringent water quality regulations (Sydney Water 1998?; Hoffbuhr 1999; Lindsay 2000). As noted in the previous chapter under section 8.2.10, Political environment, the data revealed water utilities expected government to take action in response to incidents. Water utilities should, therefore, expect more intrusive regulations if they do not perform in terms of service delivery to the community.

As discussed in subsection 9.3.1, Community outrage, the National Water Quality Management Strategy was developed because of the community’s concern about water quality and the sustainable use of water. The strategy aims to protect water quality through economically sustainable development. Legislation and regulations have been developed to show a commitment to and be consistent with the strategy (EA & DAFFA). Information about water is becoming more readily available to the community particularly through the internet. This will impact on future regulations surrounding water as the community becomes more aware about water and environmental issues.

In the USA, as in Australia, more stringent water and effluent quality regulations have arisen because of the community’s concern about water quality. This is empathy with the data, *“water quality is probably an issue for parts of Australia”*. The arsenic rule, in the USA, and reduced levels of radon in water have costs

associated with them that exceed the collective cost of previous regulations. However, the health benefits will be significant with improved water quality at the tap (Means III et al. 2000a). The USA's Safe Drinking Water Act is constantly being updated with more zero tolerance levels and more contaminants being added to the list. Environmental regulations could increase to a level where onsite treatment is undertaken for wastewater (Kucera 1998).

It is imaginable that eventually one of the outcomes of more stringent water quality regulations could be that treating all reticulated water to drinking water quality becomes prohibitively expensive. Less than 1% of drinking water is actually ingested by people. The alternatives are to have bottled water for drinking, pipe water to decentralised and localised treatment facilities or to have dual water supply systems (Cotruvo & Cotruvo 2003), *"we'll be looking for dual systems"*. This could have positive outcomes for smaller communities with better water treatment facilities.

Cost drivers for water utilities, in terms of standards, are community services standards, health, environmental standards, all of which are increasing (WSAA 2001). Tougher environmental standards for effluent discharge, odour monitoring, nitrate and phosphate discharge and increasing environmental flows aggregate to increase the costs of supplying water. This is echoed in the data with, *"pressure to improve the environmental outcomes is only going to increase on us...and it gets very complicated because it's who funds it"*.

Community demands for improved environmental outcomes in terms of effluent quality and improved water quality will impose new costs on water utilities (AATSE 1999). This is in empathy with the data, *"regulatory standards, making sure that they...are practical and that we don't go...incurring huge costs for little or no benefit"*. With commercialisation water utilities are becoming more accountable. This will result in increased environmental standards. The aim of legislation is sustainable resource management to maintain the biodiversity of the environment (Mouritz 1996). Water utilities are concerned about environmental standards and what path the environmental agenda will take. This is reflected in the data, *"the environmental aspect...will continue to drive in all the time"*. Increasing environmental flows to rivers, *"one of the emerging issues...restoring environmental flows"*, particularly the Murray Darling has now become a national issue through the National Water Initiative. Other environmental regulations impact on the disposal of wastewater via ocean outfalls and the disposal of biosolids.

In the USA water quality and effluent quality regulations have become stricter and mandatory through the Clean Water Act and perhaps, because Australia has

similar water supply features, the factors shaping the US water supply may be mirrored in Australia (Manwaring 1999).

Another area of regulatory risk for water utilities and as noted in the data, *“framework on reuse...that’s a bit uncertain”*, is recycling wastewater where the lack of strong regulation can be an inhibitor because of a failure to protect public health and therefore, undermining community confidence (Dillon 2002). There is generally a lack of knowledge about the reuse of wastewater in the community in terms of cost and safety. Whilst there is political pressure for reuse schemes there is no national framework for the reuse of wastewater, *“I think politics will drive the reuse side as well”*.

Other areas of regulatory uncertainty cover demand management goals set by government and the use of regulations to influence the demand for water. Economic regulation particularly in the area of pricing is a concern with calls for price deregulation from water utilities. Both of these issues are discussed later in this chapter.

Water utilities are natural monopolies within their area of operation and with the move to commercialisation higher levels of regulation will be required (Survey: Private passions 2003; Borkey 2003) to keep pace with the corporatisation (AATSE 1999). Water utilities should expect this because public health is at stake. The data confirmed this, *“has to be a better regulatory environment, there has to be tougher water quality regulations”*. Good regulation should be independent, minimise the risk of political interference, transparent enforcement and conflict resolution and appropriate incentives. It should also be transparent in setting prices. Too much interference in regulation can deter investment (Gresham & Shlaudeman 2000), *“fair dinkum price regulation...independence and autonomy...a better outcome from a price and service point of view”*.

Both the data and the literature supported the notion that as a result of water reforms and commercialisation water utilities now find themselves in a different business environment to the early 1990’s. They are divorced from the regulatory functions and answerable to utility overseers in various forms. This has created a new level of uncertainty for water utilities not previously encountered in such depth. Costs, liability and community reaction is at stake leaving a sense of vulnerability for water utilities. But, as pointed out in the report ‘Water and the Australian Economy’ (AATSE 1999) the regulators depend on the larger water utilities for information to make judgements, information that if it is not provided can degrade regulation. Water utilities therefore have a degree of control over regulations governing the industry. In addition water utilities should have a relationship and engage with regulators to maintain a dialogue and therefore

reduce unexpected outcomes. Regulators are clearly in the transactional environment for water utilities. Certainly regulations will influence the future of the water industry but, it should be possible to eliminate much of the uncertainty with respect to regulation or at least for water utilities to be aware of what might happen. The category Regulatory risk has therefore not been used for the scenario matrix.

9.4. Uncertainties

This section will discuss the three categories that the data revealed were uncertainties for the urban water supply industry, as shown in table 9.1.

9.4.1. Emerging issues

The uncertainty under the category of Emerging issues is in terms of water quality and new particles or toxins being found in water and the health impacts of these pollutants. The data resonated with, *"as technology advances and we become aware of other things too, other chemicals and other...issues//there's obviously going to be something there that we're not aware of at the moment"*.

The technology to detect small concentrations of pollution has increased dramatically, *"you can actually analyse it [water] now with the best thing down to micro, micro levels"*; however, the ability to assess the impact on community health has not kept pace with detection technology. Detection technology will become more sophisticated with capabilities such as real time monitoring. The gap between detection levels and assessment of the impact will be grounds for community concern, uncertainty and speculation, therefore, as the data revealed, *"the biggest challenge for us [the water utility] how do we actually deal with those things"*. This applies to detecting new organisms in water, such as viruses and mutants (Means III et al. 2002). Advances in analytical chemistry and toxicology will find new contaminants in water not previously considered as hazardous (Hunsinger 2003).

In the USA future water quality regulations will specify the maximum level of contaminants in water, this is reflected in the data by, *"pharmaceutical compounds is another issue...that's certainly...on or if not at the top of the priority pile in Europe and North America is close to it"*. The list is increasing covering more chemical and microbiological contaminants. As detection technology improves public awareness and concerns will rise (Manwaring 1999; Means III et al. 2002). Whilst in Australia The Guidelines' only recommend levels of permissible contaminants the parameters are likely to become more stringent and encompass more contaminants. As the data revealed the outcome may be, *"a lot of these things...will not be easy to manage, high cost solutions...could be the order of the day"*.

In unprotected water catchments, where urban development is increasing, new contaminants will appear in water supply that may be known about, but have not previously been detected in a particular catchment, or, were not previously known. There will also be issues concerning the combination of contaminants and their impact on public health (Means III et al. 2002). These issues will challenge water utilities technically and financially and increase the need for public debate about the benefit and cost of water quality and treatment, meaning that, *“the real successes in industry is how it deals with those emerging issues”*.

Many of the new contaminants will be predicted through communication channels such as research papers, conferences and journals and informal communication (Hunsinger 2003). There is a need to understand the changes taking place in water catchments. This should eliminate some of the uncertainty in terms of the impact on public health in the short term; however, less certain are the financial implications for water utilities. Therefore providing water utilities keep their communication channels open emerging issues of water quality should not pose a major uncertainty. The researcher has therefore not selected the category of Emerging issues for the scenario matrix.

9.4.2. Legal issues

Respondents discussed and the data showed that, *“there’s a growing...level of...legal uncertainty”* and legal issues faced by water utilities in the future. As the business environment becomes more complex for water utilities there will be an increasing number of legal issues to be addressed. Many of these will be concerned with contractual arrangements and disputes particularly as utilities in Australia are now operating under commercial principles and as the data revealed, *“related to industrial relations issues or concerns with staff or with unions”*. Overseas, disputes have arisen as water utilities move into public private participation contracts and where utilities are privately owned (Stiegler 2001b; Lopez 2004).

In an age where there is increasing product disclosure information there will be more water quality information available to the community and rightly so. There will be increasing public concern about water quality and an increasing number of interest groups. Water utilities will be exposed to increased product liability litigation. The data confirmed this through, *“higher expectations of our customers and their increasing propensity to sue us or to threaten to sue us when things go wrong”*. It is suggested that there may need to be laws to protect water utilities from unreasonable litigation because the cost of defending litigation, whether justified or not, will be passed onto the community through water pricing (Kucera 1998). The literature confirms that after the Sydney Water crisis in 1998 there was reportedly up to 500 damage claims against Sydney Water citing illness and loss of business

(EWN Publishing 1998b). Overseas there have been cases of water utilities and other organisations responsible for developing water resources being sued over water quality issues (Stiegler 2001a; Bachtold 2003).

Water utilities have an increasing role as stewards of the resource and the catchment environment of water sources whether river systems or reservoir catchments. Other areas where there may be increased legal issues to deal with arise from environmental regulations and water utilities' impact on endangered species (Means III 2001). There has been a case where a water utility has instigated action to secure access to water (Barlow & Clark 2002).

Issues in reference to unions have been included in this subsection. In Canada unions became involved in a proposal to privatise a water utility to the extent that after public meetings the proposal was cancelled (Crawley 2003).

There is no doubt that there will be an increasing number of legal issues for water utilities to deal with; whether these issues arise from water quality problems, service provision, contracts or industrial relations. As water utilities operate more under commercial principles and commercial law, governing boards will be held liable for actions increasing the focus and cost of legal issues to be dealt with. This issue was not one that was raised widely during data gathering, and whilst there may be uncertainty about the exact nature of the legal issues and when they will occur, the researcher has rejected the category of Legal issues as a key uncertainty for the scenario matrix.

9.4.3. Demand management

The category of Demand management encompasses water utilities uncertainty about the supply and demand for water from the community and the role of alternative sources of water, especially the recycling of wastewater.

Traditionally the demand for water from the community has been met by supply side solutions as discussed earlier in this chapter in subsection 9.3.2 Water availability and in the literature (Gleick, Singh & Shi 2001). The prevailing paradigm is to treat all water to the same high drinking water quality and to use it once. An emerging paradigm for water supply, according to Pinkham (1999), is to manage the demand for water rather than meeting demand by supply side responses. Instead of treating all water to the same standard, provide a quality of water to match the use, *“one of the pushes has been to talk about water in terms of grades and fitness for use and purpose”* and to recycle water a number of times, allowing it to cascade down to lower quality use (Pinkham 1999). This is in contrast to the data that showed the focus of water utilities is to supplying high quality water, *“continue to have provided high quality bulk raw water”*.

Demand management for water has been defined as actions that result in less water being used in the future than if the actions had not been undertaken (Dziegielewski & Baumann 1992).

In Australia the focus on demand management began in the 1980's from the National Workshop on Urban Water Demand Management (Mouritz 1996). In the USA demand management has been institutionalised in water utilities for many years. Some of the reasons behind this are that it makes good business sense from the perspective of efficiency, it enables partnerships with the community, and to be effective, it requires behavioural science and incentives as opposed to regulations so that society has ownership of the objectives (Mouritz 1996). This last point is worth noting because the data raised the issue of the lack of definitive social research to determine the community's attitudes to water conservation and barriers to behavioural change, *"I don't think it's [the water industry] invested in very good social research to look at opportunities for the community to respond differently to the way the resource is used"*. In Australia water conservation has now become institutionalised with the development of conservation strategies in a number of states; for example Western Australia and Victoria (WRC 2002; WRSC 2002).

Water utilities have a number of operational options to reduce water use including reducing water losses from leaking pipes, reducing water pressure, reducing mains flushing and reservoir cleaning, metering and billing reforms and water audits, *"water efficiency in appliances should be a major effort"*. On the community side water utilities can provide more information to educate the community, offer financial incentives, and install water saving devices and retrofits (White 2001).

The installation of water efficient devices particularly in private dwellings has been practiced for many years, *"houses have dual flush toilets and that's probably taken ten years to get to that point"*. There are however some barriers to their installation such as information and knowledge on the benefits and costs, the capital needed to replace inefficient equipment, the issue of who pays and who benefits, and cultural inertia because of the lack of perceived importance (White 2002). Clearly this is an area where increased community consultation and education are required.

The barriers can be overcome by financial incentives, education, regulations and general support to the community. This is echoed in the data by, *"reducing demand, increasing prices will require a lot of education...and acceptance"*. It is faster and cheaper for water utilities to engage in water efficiency schemes to reduce the demand for water rather than relying on developing new sources of water to meet demand (White 2002).

Some of the uncertainty in demand management has arisen since water reform policy has been implemented because of the delegation as to who is responsible for

water efficiency, whether it is water utilities themselves or should it stem from government policy (White 2001)? Fox (2003) suggests that water utilities have an interest in demand management to defer capital expenditure, however, once a new augmentation project is completed there is less incentive to reduce the demand for water; water utilities would sooner sell as much water as possible in order to use the infrastructure to capacity. This is echoed in the data with, *“we say we encourage water conservation, commercially we don’t”*.

There are institutional barriers to demand management schemes that may contribute to the uncertainty felt by water utilities; the fear of lost revenue. However, there are long term financial savings to be gained by reducing water consumption through operational costs savings, particularly from peak load demands, and by deferring capital expenditure on infrastructure development (Mouritz 1996). Financial modelling can predict short falls in revenue to eliminate the uncertainty (Dziegielewski & Baumann 1992).

Water pricing has been used as a demand management tool, *“that the pricing is arranged in such a way that there will be a real incentive to use less”*, however, there have been mixed effects on the demand for water, reductions can be neutralised by climate variations and water restrictions (AATSE 1999). Schemes have been proposed to increase the price of water to encourage water conservation that entailed a low price for basic water needs, after which there are higher prices for increasing volumes of water use (Rosegrant, Cai & Cline 2002). The data confirmed the proposals discussed in the literature, *“a base volume allowed at a low price for what I will describe as the public health needs, in other words toilets and showers and then above that you pay more and above that again you pay even more”*.

As much as reducing the demand for water is an important part of conserving the resource and valuing water, it only delays the inevitable; either new water resources or alternative sources of water must be developed. It is becoming harder and more expensive to reduce water demand through demand management programs and there is an issue of how far the community will accept demand management measures and water restrictions (Day 2004). Few demand management schemes deliver more than a 10 to 15% reduction in water use (Dziegielewski & Baumann 1992).

One of the alternative sources of water is recycling by treating wastewater to a quality fit for use. Recycling has the potential to address water shortages. The concept of recycling is not new to the water industry. It has been practiced and is a major source of water in various locations around the world. In Australia about 14% of effluent is reused (Dillon 2002), and according to the data, set to rise, *“the*

Government has set a target of a 20% recycling of water within ten years”, principally for irrigation purposes. Issues that have inhibited more widespread use of recycled water, particularly for drinking water, include lack of public confidence in schemes because of safety issues, echoed in the data by, *“they’ve got to have confidence that you are doing the necessary tests”*, the reliability of the technology, lack of awareness about recycling issues, lack of regulations, poor integration of recycling into water management, economic considerations (Dillon 2002) and up to now a plentiful supply of natural water. The cost of recycled water is quoted as being \$1.60 to \$4.00 per kilolitre (Horn 2004). Dillon (2002) also notes that there is no national body or funding organisation for reuse schemes which may increase the public health and environmental risk. A failure in either area would seriously undermine community confidence and support of reuse schemes resulting in increased future costs and deferring schemes for years.

Another source of water is desalination of saline water, *“having a look at new sources of water, whether that’s desalination, whether that’s recycled water”*. Desalination technology has been available for about 100 years however, until recently costs have limited its use. Whilst the costs have in the past deterred projects, it is now becoming a viable option to the extent that the market for desalinated water is expected to double by 2020, (Pankratz 2000). Costs are now quoted as \$1.0 - \$2.20 per kilolitre (Horn 2004). A large scale desalination project has been proposed for Perth. The negative issues surrounding desalination are the energy costs and externalities such as greenhouse gas emissions and the disposal of hyper-saline solutions.

There is now a wider community call for recycling and desalination projects in order to conserve precious water resources and it appears that the community is willing to pay for alternative sources of water (Day 2004). This is substantiated by the data, *“I think the public are willing to pay for changes in the way their water is supplied and be that dual systems and reuse or what ever, solar powered...desalination”*. Both recycling and desalination present opportunities for private companies to become involved in water supply. Is this behind the underlying uncertainty that water utilities feel? Are water utilities concerned about competition and loss of market share?

One of the most visible manifestations of water supply augmentation, to meet the demand for water is dams and reservoirs. According to a report by the World Commission on Dams (Rio Grand/Rio Bravo Basin Coalition 2000) over 45,000 dams have been constructed around the world for public water supply and irrigation purposes. They have contributed to human development but in many cases at an unacceptable and unnecessary price in terms of the environment. They have not delivered equitable outcomes. In 2000 the World Commission on Dams

called for a halt to financial support of dam construction and to assess the alternatives for irrigation (Rio Grand/Rio Bravo Basin Coalition 2000).

Up to the 1970's-1980's there was little environmental consideration given to new water projects and in particular dams. Now because of community concerns and an unwillingness to accept the environmental impacts of reduced river flows the traditional paradigm of building dams for water supply has stalled. This is supported by the data, *"environmentally people as a whole don't want new dams built"*. The change in social, political and economic conditions include the cost of construction and funding restrictions, environmental issues from construction, inundated land and impacts downstream, social upheaval from displaced communities and new technologies for water supply. Globally there is a growing trend to decommission dams and move to recycling wastewater and desalination (Gleick 2000).

As noted above, since 1990 the World Bank (Rio Grand/Rio Bravo Basin Coalition 2000), a major source of finance for dam construction, has not given financial support of dam construction because of the perceived lack of value for money and the environmental impacts. However, in a change of strategy the World Bank has recently renewed funding for dam construction to assist in bringing clean water to billions of people (Pearce 2003). In 2003 at the 3rd World Water Forum there was a call to construct more dams, despite the past environmental damaged caused by such projects. Scientists at the Forum believed that construction of dams would divert funding from other water schemes such as harvesting water from roofs and spare land. In China these alternative schemes deliver the equivalent water capacity as the Three Gorges dam project (Pearce 2003). The community's opposition to dam construction as well as cost considerations means that water utilities have shifted their focus from augmentation projects to reducing water use by the community. The data confirmed this, *"that means that you've gotta be...a lot of work on managing the demand side of things, the water conservation side"*.

The issues surrounding demand management and alternative sources of water are internal to water utilities and in their transaction environment. The uncertainty is manageable by communication with the community and other stakeholders in the transaction environment, particularly government. Whilst there may be concerns about the goals set for reduced water use, *"government will pursue tougher goals with respect to water conservation"* and politically motivated schemes, they are manageable. Construction of new dams for water supply will meet increasing stringent environmental regulations and have to be justified against alternative water sources on economic and environmental criteria. There will continue to be wide community opposition to such projects, at least in the developed world. The

researcher, therefore, believes the category of Demand management does not represent a key uncertainty for the scenario matrix.

9.5. Concerns

This section will discuss the five categories that the data revealed were concerns for the urban water supply industry, as shown in table 9.1. Because the data in these categories were referred to as concerns by respondents, in contrast to uncertainties, these categories were not considered for the scenario matrix, however, the categories are an integral part of each scenario and influence the categories that were key uncertainties and uncertainties as discussed in the previous two sections 9.3 and 9.4.

9.5.1. Competition and efficiency

The data revealed that water utilities are concerned about the pressure to optimise assets for efficiency and productivity gains, *“economic drivers...particularly in the productivity gain area and optimization of assets and things like that is where there’ll be increasing pressure”*. Some of the key drivers for competition are benchmarking and reducing costs. Consequently water utilities have a concern about the viability of some smaller utilities and whether they are too small to be viable in the longer term, *“200 utilities servicing a very small part of the population...there’s a real question about the viability of those operations”*. These concerns are reflected in the category of Competition and efficiency.

All states and territories agreed to the National Competition Policy (NCP), as discussed above in subsection 9.3.3 Government policy, in a commitment to deliver pro-competitive reforms and incentives to Australia’s essential services. Government regulations can be an impediment to competition such as legislative monopolies, NCP is a basis for reducing the regulatory impediments to competition (Thomas 1996; AATSE 1999), From the data some respondents believed that NCP for the water industry needed reviewing, *“this whole question of National Competition Policy and it’s structures and so forth needs to be totally reviewed in my opinion”*.

In England and Wales there were twenty-four water utilities in 2000, all natural monopolies, with comparative competition relying on information from the utilities (Weir 2000). Interestingly competition in the UK has been slow to develop since privatisation of water utilities. The economic regulator, Office of Water Services (Ofwat), is now promoting competition, despite opposition from water utilities, to encourage new entrants to develop and exploit new water resources. If successful it is hoped that there will be innovations in water supply. Relaxing regulations is a key to encouraging new entrants (Sawkins 2001). In Australia the view, from the

data, concerning the Australian water industry is, *"I think you'd have a vastly different industry if you had some competition"*.

Thomas (1996) writes that in Australia because utilities are an input into other sectors of the economy any efficiency gains through reforms should be passed on to other sectors in the economy. Government estimated that 36% of the gains to GDP from NCP reforms would come from utilities (Thomas 1996). NCP and corporatisation has put pressure on water utilities to cut costs and operate more efficiently, *"just trying to get cost efficiencies"*.

Despite this NCP, water utilities are still essentially sheltered from competition because in each jurisdiction they are natural monopolies. This is confirmed by the data *"it's not a customer focused industry either...it's the absence of competition"*. This together with a lack of competitive pressure due to long term public sector management in engineering orientated organisations means that water utilities have not developed the strategic skills required in a competitive business environment or an appreciation of the future competitive environment. As competition develops, perhaps from new entrants using other sources of water, competitive skills will need to be developed or acquired (Trainor 2002). The data and literature reflect Morgan's (1997) concept of organisations as machines and classical management theory of bureaucratic organisations.

Through the COAG Water Reform Agenda water utilities around Australia have become commercialised, however, water utilities have not faced the same level of competition and privatisation as the electricity industry. There have been some private sector partnerships particularly in South Australia and the ACT but claims by the water industry that it is competitive have not, according to Davis et al. (1999), been tested either at a national or global level. The data are in empathy with the literature, *"I think, the real competition's the international scene"*

In 2000 Davis (2000) wrote that households were not allowed to disengage from the water services system and in addition it would seem that in New South Wales private companies do not have access to the sewer system because of state regulations (Day 2004). Perhaps if the situation were to change, more private companies could enter the water services industry and provide a real level of competition to monopolistic water utilities. In the future Kucera (1998) predicted that there would be greater pressure from the community to disengage from water services. New technologies and alternative sources of water would assist the community to do this and as competitive pressure increased the diversity of services will increase (Langford 2000). The data resonated with this notion, *"we're providing a service but there's going to be other things than just providing our water,*

wastewater, stormwater we might be providing services in terms of maintaining and managing your on site systems and things like that”.

The key driver for competition in the water industry is comparative, *“you’ve got the comparative competition, that’s a driver”*, based on benchmarking and publicised annually through the Water Services Association of Australia WSAAfacts and the Australian Water Association report on non major urban water utilities (WSAA 2001; AWA 2002). There is competition in outsourcing through the tendering process for subcontracting services and construction (AATSE 1999).

In the USA market pressure and the drive for efficiency forced the fragmented independent water suppliers to consolidate for economies of scale (Means III et al. 2000a). There has been similar consolidation in Victoria, which is confirmed by the data, *“if you include the irrigation supplies you have something on the order of 500 authorities...less than 10 years ago...and you’ve now replaced that with less than 30 authorities”*; however, in New South Wales, Queensland and Tasmania water services are provided by numerous local councils in regional areas. The data raised the question concerning the size and, *“there’s a real question about the viability of those operations”*.

Globalisation of water utilities will see further consolidation of water utilities into a small number of large organisations that might encompass different utility sectors such as water, gas and electricity. The data are in agreement, *“this issue of...convergence of...of utilities on...on a world scale”*. Means III et al. (2000a) suggests that these organisations could then unbundle into organisations specialising in supply and treatment or transmission and distribution of essential services. In addition organisations with none traditional water utility backgrounds, such as banks or computer manufacturers, could enter the market and bring their own qualities to water services (Swichtenberg 1998).

From a theoretical perspective it is interesting to assess Australian water utilities against Porter’s (1985) five forces of competition.

1. **Entry of new competitors** – It is very difficult for new competitors to enter the water market because of regulations and natural monopolies.
2. **Threat of substitutes** – Whilst there is no substitute for water new sources could be developed by, for example, recycling and desalination; however, these sources are usually developed by established water utilities. Bottled water is perhaps the main substitute threat, *“drive to bottled water”*, for reticulated drinking water supply. Looking at the bigger picture in terms of water services, technological development has potential to deliver substitutes whether they are delivered by established water utilities or new entrants.

3. **Buying power of buyers** – Until there are new entrants or new technologies buyers have little power other than protection through regulations.
4. **Buying power of suppliers** – Up until recently water utilities have sourced water and been the bulk supplier. This has changed with some states now having a bulk water supplier of untreated water to utilities for treatment and distribution. Water utilities through trading are able to purchase water from alternative sources.
5. **Rivalry among existing competitors** – None since water utilities are natural monopolies, or where they could compete for customers they are prevented from doing so by legislated licence areas.

From the data and the literature, competition in the water industry is closely intertwined with government regulation and technology. Water utilities are concerned about competitive pressure from alternative water sources and efficiency pressures and having to balance this with customer requirements and financial considerations. Corporatisation and competition has, according to the data, *“five years ago, seven years ago we, we were all facing, you know, reorganizing ourselves for privatization”*, been seen as a precursor to privatisation. Competition could change the industry quickly, however, the real competition is perceived to be in the global arena.

9.5.2. Funding, revenue and rate of return

Water utilities in Australia are concerned about having enough funding for investment in their water supply systems as well as pressure to provide an acceptable rate of return to owners. The data concerning these issues has been collected into the category of Funding, revenue and rate of return. The issue of funding is closely tied with many of the key uncertainties discussed above and in particular the price of water, discussed below in subsection 9.5.3.

Urban water services accounts for approximately 80% of the cost of water supply in Australia, 20% of costs are for irrigated water supply which only raises 5% of revenue because of under recovery of costs (AATSE 1999). Up until the 1980's urban water services, under the control of state and territory governments, was generally provided to the community below the cost of the service provision (AATSE 1999). This is substantiated by the data, *“on the other hand you've got most of the water being used at prices which probably don't incorporate the full cost of water”*. Under the COAG Water Reform Agenda water services have to be provided on a full cost recovery basis, including the cost of externalities and without cross subsidies, the objective being to have sustainable development for water. The underpricing of water leads to the lack of funds for infrastructure (Gresham & Shlaudeman 2000) and poor returns to government. This is reflected in the data with, *“our ability to*

fund infrastructure given very, very low returns ultimately will be a problem". The COAG reforms have delivered increased efficiencies and increased revenues to owners of water utilities (FDI 2004) but to date have not recovered the full cost of water services particularly for irrigation water. The National Water Initiative commits state and territory governments to full cost recovery for water (Taylor 2004c). Water utilities are seen as 'cash cows' for governments who have removed funds confirmed in the data by, *"what happens...is 120 million dollars a year comes out of the water industry and goes straight into consolidated revenue"*. This has implications for repairs, replacement of assets, catchment management and the management of externalities with the potential to impact on environmental outcomes (Cullen 2003).

The cost of providing water services naturally impact on the profitability of water utilities and the availability of funds. This is reflected in the data, *"fairly low rates of return on investment currently...bobbing around the 2 to 4 percent for the industry nationally...I think that's unsustainable for the industry"*. Costs are increasing in many areas, the drivers coming from the community in terms of service and water quality standards, water volume, peak demand for water as opposed to low demand and under utilised assets, water pressure and fire suppression. In addition the density of urban settlement impacts on costs, lower density increases costs of infrastructure; higher water quality regulations for drinking water, effluent water and source water imposed by government, externalities and the increasing demand for better environmental outcomes increase costs. Other cost drivers are stormwater inflows to sewer systems, aging assets, *"just how much money...or resources I should say is needed to be invested in the renewal and the maintenance of our, our infrastructure"*, and the cost of capital. The physical environment that water utilities operate in, such as the terrain, impact on pumping costs and different regulations in each jurisdiction impact on the financial performance of utilities that make benchmarking comparisons subjective (AATSE 1999; WSAA 2001). Eighty-five percent of water utilities' investment is in the water distribution network this presents an area for potential cost saving, if water systems were decentralised. This would enable funds to be freed and spent on water treatment (Mouritz 1996).

Increasing costs and the commercialisation of water utilities is a major driver for technological innovation (ASTECH 1995). Technology is seen as the saviour to reduce costs such as biotechnology for wastewater treatment and recycling. The data are in agreement with the literature, *"as treatment technology improves then I think that we've got a chance...of getting costs down"*. One way for water utilities to improve their financial performance is to increase the price of water; water pricing is discussed in the subsection 9.5.3 below.

A major cost for water utilities is treating water to deliver drinking water that is safe and aesthetically pleasing. The data resonated with this notion, *“just continued to try and drive down costs...we’ve tried to enhance service and, and there’s a limit”*. Generally the community is not well informed about the cost of providing water services (Mouritz 1996). The data confirmed the literature with, *“the community does not understand what it costs to supply water”*. With increasing pressure to have high quality drinking water it is important that the community is engaged in the debate about the benefit of higher quality water against the increased cost of treating water to a high quality (ARMCANZ 1994). After a water quality incident such as the Sydney Water crisis in 1998 the community makes demands about increasing water quality which imposes additional costs on water utilities (Lindsay 2000). This is echoed in the data with, *“water actually has a value we have to pay more for it...because it cost more to produce...substantial public education...about these matters”*.

Water services are capital intensive for infrastructure to meet higher standards in regulations and growth in demand for water and wastewater services. Water utilities are concerned about the future financial environment, the cost of capital and the willingness of financial institutions to invest in water infrastructure, *“remember capital’s a scarce resource and there are many competing demands for capital”*. Government budgets are tighter with competing demands for funding leaving less for water services. The commercialisation of water utilities may impact on the availability of government funding.

The private sector is a potential source of capital (Gresham & Shlaudeman 2000), but not without ownership implications and, according to the data, *“investors could see that it’s a great business, buy it up and then run down the assets”*. Globally because of the need for long term debt and low returns, particularly where water services are subsidised, private sector investment in none OECD countries has slowed (Borkey 2003). If capital becomes scarce from the traditional areas it will drive water utilities to seek alternative sources of capital from the private sector. Without funding for infrastructure replacements there is potential for service interruptions that will lead to community concerns about the management of the resource and service delivery (Means III et al. 2000a).

Water infrastructure is generally perceived to be a safe investment, *“lower financial risk than in other industries”*; however, the risks are increasing in part because of security concerns. Protecting water supplies will contribute to increasing costs. There is an increasing trend for customers to take legal action against water utilities after water quality incidents (EWN Publishing 1998b), as was discussed in subsection 9.4.2 Legal issues. This will increase water utilities’ legal costs. All these costs will have to be passed onto the community via increases in the price of water

(Kucera 1998; Pitchforth 2001). Water conservation and alternative technologies could impact on the future demand for water. Conserving water and reducing demand has been perceived to reduce revenue because less water is sold. The water industry has to compete with other requirements for capital that give higher rates of return (Pinkham & Chaplin 1996).

9.5.3. Price

Linked to the category of Funding, revenue and the rate of return to owners is the category of Price, in terms of the price of water to the community, the community's willingness to pay for water services and the political considerations of increasing the price of water.

According to the literature the National Water Reform Agenda required that price setting for water should be separated from the service provider to protect public interest, be based on consumption; and recover the full cost of water services. In the creation of commercial water utilities there has been a separation of the service provider and price regulation through the Australian Competition and Consumer Commission (WSAA 2001). The reform agenda has generally led to a two part tariff for water services in most states and territories across Australia. The data reflected the introduction of a two part tariff with, *"they're used to the two part tariff"*. The tariff is composed of a fixed annual charge to cover access to services and a variable charge based on volume. Approximately 50% of revenue comes from the usage charge. The variable tariff varies from state to state but averages around \$1 per kilolitre (CoA 2002) (1 kilolitre = 1000 litres). Some states and territories have a flat rate whilst others have a higher rate for increased volume of water used. Compared with other countries a \$1 per kilolitre is cheap and is not conducive for the community to value and conserve water. The community has shown a willingness to pay more for drinking water through the increasing sales of bottled water at a thousand times the price of tap water for basically the same quality (Barlow & Clark 2002; CoA 2002; Means III et al. 2002). This is confirmed by the data, *"a bottle of water of the shelf...costing 400,000 times the price of the irrigation water...demonstrated willingness to pay, on the part of the consumer"*. However, it is in contrast to the data concerning paying for tap water, *"general reluctance to pay more for water"*.

Historically there were cross subsidies from commercial customers to residential customers, this has now been removed, *"they're all pretty much used to user pays"*. Prices have stayed relatively constant or declined in real terms (AATSE 1999). The effects of the two part tariff, on the demand for water, have been mixed across the country and were discussed in the subsection 9.4.3 on demand management.

The principal of user pays for water is aimed at the sustainable development of the resources with prices set to include operational costs, infrastructure costs, asset management and renewal costs and environmental costs in connection with providing water services. The price of water should send signals to the community about the discretionary use of water, the cost of peak and drought demand and give incentives for conservation, *“the price should also have a component which is set aside for conservation measures”*, recycling and practising water sensitive urban design (Lehmann 2003). Peet (2003) argues that the over use of water originated because water is not treated as an economic good and is undervalued in terms of the cost of providing the service.

The price of water is not a market price set by the economic theory of supply and demand because the price is administered. This is confirmed by the data, *“pricing control by boards, authorities cannot set price, this is dictated by government”*. Prices are used to cover costs on a user pays basis and to influence water use. The price of water can be used as a signal to potential suppliers and regulated to control profits (CIE 2004). In setting water prices there are uncertainties in the area of environmental needs, caps on extraction, potential savings from demand management and the cost of water savings against the cost of augmenting systems or alternative sources of water such as recycling, and the impact on new entrants to the market using alternative sources (CIE 2004), *“it is hard to cost the price of water”*.

By contrast a manufacturer of goods or service provider would be expected to set a price to cover the full cost of the product or service being offered and be expected to make a reasonable rate of return, provided the market is prepared to pay. Because water is an essential service for the community's health and welfare, *“having major price changes in water urban supply you run the risk of disrupting whole communities”*, there are other factors that need to be taken into consideration when setting the price of water services including the cost of externalities, managing demand for water and encouraging behaviour that reduces the cost of water (Bowers & Young 2000).

Water trading is one solution. The theory is that by separating land ownership from water access rights the low value use of water will have to compete with other users and move to high value use through market forces (Wyatt 2004). The price of water should therefore reflect the true price of production and would fluctuate according to supply and demand (AATSE 1999). The data referred to, *“there will be a lot of effort on behalf of the Federal Government, will have a national property rights to water this will force change in jurisdictions”*.

In the world of private and public water suppliers commercial water systems work on the principle of full cost recovery where the price of water reflects the cost of the service and customers pay for what they use. Often public water suppliers subsidise customers so that they pay according to their ability (Bakker 2003). This encompasses the debate about water being a public or economic good as discussed above in subsection 9.3.3, Government policy.

In the USA it is estimated that water prices will have to rise by 300% per household to support future investment and replacement of assets otherwise service interruptions are predicted (AWWRF 2000; Means III et al. 2000a).

Increasing water prices has been used as an argument against the privatisation of water utilities because private utilities would include all externalities. This is substantiated by the data, *“privatisation was driven by increasing prices...otherwise the returns were not justifiable by investors”*. Evidence from the literature seems to corroborate the argument that the price of water from private water utilities will rise. In France water prices had risen 13% by 1999 where utilities were either privately owned or public private partnerships (Hall 2001). Beder (2004) adds to the argument for public ownership saying public utilities can be more efficient than private utilities when operated on a commercial basis.

In the UK the water price regulator Ofwat reviews water prices every five years. From the community's perspective Ofwat ensures water prices are transparent, focus on outcomes, are realistic, provide value for money and are affordable (Terry 2003).

So what should the price of water be? For water utilities the price of water services is a central issue. Since becoming commercialised many would like to see and feel that price setting should be deregulated. This is echoed in the data, *“deregulation of pricing so that it is not in the hands of government”*. However, because of water utilities' monopolistic characters this is unlikely to occur. As discussed above and confirmed by the literature in the future the price of water will rise because costs are increasing and because in the past there has been a failure to account for the real economic cost of water services in setting prices (Soltis 2001). The water reform agenda will correct under pricing (Shadwick 2002) and take into account externalities such as environmental impacts. Under the National Water Initiative this has begun (Taylor 2004c). In the future pricing structures can be expected to be more sophisticated with real time monitoring of water use with pricing at peak demand and under drought conditions, or pricing surcharges when water is scarce (DNRME 2003; DNRME 2004). This has been proposed in Western Australia (WRC 2002). Increasing the price of water will, in a regulated environment, be tempered by the political agenda and the community's higher expectations for service delivery

and water quality. The data resonated with comments such as, *“politics is important in pricing and a constraint”*. What is important is for the community to be informed and involved in the debate and to ensure that no sections of the community are disadvantaged from a public health perspective because of the financial burden imposed by higher prices.

9.5.4. Knowledge and expertise

Water utilities in Australia are concerned about declining expertise within the industry as a result of an aging and retiring workforce and downsizing. This is reflected in the category of Knowledge and expertise. There are issues in attracting new younger people into the industry and capturing the knowledge from the retiring workforce, *“one of the burning issues does seem to be a loss of expertise”*.

From the literature Popper and Lipshitz (2000) say that organisations learn in two ways; through the learning of individual employees and new entrants that have information the organisation does not have. Change is a basic part of the uncertainty in the business environment. It requires organisations to adapt to a new environment, adaptation that depends on the organisation to learn. Therefore organisations that fail to learn will not survive in a competitive environment. The data suggested that water utilities have recognised this problem, *“all I can see when I look in the future that there’s going to be a lack of well trained experienced people”*. Equally it can be argued that in a non-competitive environment there is little need for the organisation to adapt and therefore there may be little learning.

As discussed in the literature review, chapter two, the business environment is continually changing, new technologies, community needs and markets all change, the organisation must adapt to these changes. When it does the organisation evolves, it learns. To accelerate the learning employees must interact and learn new skills through training (de Geus 1997a), *“we’re actually looking to see over the horizon what skill base do our staff in the future need”*.

Organisations learn for improved efficiency and to be innovative in their business environment. Learning changes knowledge (Norgaard 1988). In an environment with more uncertainty then more learning is required for faster responses to the changing environment. Organisational learning occurs when individuals in the organisation come together to share experiences and develop new theories. This sharing of individual experiences, *“I’d like to see more sharing of information”*, leads to a new understanding about the business environment. The key concept is the collective sharing of information so that the organisation learns and develops a shared world view. Large organisations have learning disabilities that slow the rate of learning and adaptation to change (Senge et al. 1994; van der Heijden et al. 2002). Organisational learning is greater than the sum of individual learning and

the shared world view is based on the context of the organisation, its technology and values (Norgaard 1988). Therefore if people leave the organisation, *“a lot of technical expertise is retiring and not being replaced”*, not only are the experiences leaving but new people entering the organisation will not have the same shared world view, organisational learning is slowed. If organisations do not learn the mental model stays the same.

In the USA, according to Means III et al. (2002), the average age for utility employees is 44. Over the next ten years 34% will be eligible for retirement and together with an annual natural attrition rate of 9%, water utilities may see a 50% turn over in employees over the next ten years (Means III et al. 2002; Manning & Olstein 2004). The retiring ‘Baby Boomers’ take with them industry skills and a significant amount of undocumented tacit knowledge that new, younger employees may not have. This is confirmed by the data, *“really a lack of young people being developed within, within the industry”*. Part of the problem is that many procedures and the location of buried assets has not been documented, part of the engineering culture of water utilities (Manning & Olstein 2004). The situation is similar in Australia, *“average age of the industry is probably in their 50’s”*, although the figures may vary to a degree. This will have a major impact on water utilities’ abilities to learn and change their mental models about the business environment.

Not only are skills leaving water utilities, but there are knowledge gaps between the engineering skills; *“historically it’s been manned by...very much civil engineering discipline”*; and customer focused skills such as sales, marketing and customer services (Means III et al. 2002). Again this arises from the long tradition of engineering focused management in a public utility resulting in a lack of experience in customer relationship management (Trainor 2002). The data are in agreement with the literature, *“not a knowledge industry, more a public works, this is a problem for transition”*.

The benefits of knowledge management are seen in other industry sectors. Water utilities, however, are far removed from having the capabilities which could be a short coming particularly when dependant on information for customer relationships (Trainor 2002). The data reflected a lack of knowledge management, *“a lot of information in filing cabinets and people’s heads and I think what I’d like to achieve with our IT strategy and our knowledge management strategy is that we harness that knowledge to deliver better outcomes”*.

There is a need to develop integrated cross disciplinary skills of professionals in the water industry for a more holistic view of sustainability (CoA 2002). Workforce flexibility and empowerment will improve efficiency and, according to the data, *“a more holistic...approach to identifying problems and potential solutions”*. Water

utilities could have a base staff for planned maintenance and import staff to deal with unscheduled repairs. Flexibility and multi-skilling reduces maintenance waiting time, improves morale and reduces operational costs. This must be compensated for in remuneration packages. New technology will lead to empowerment and improve productivity. Organisational management and philosophy will be major features in future global water organisations (Manwaring 1999).

Learning, research and innovation and community engagement need to be embedded in the culture of the organisation for it to be successful (de Geus 1997b; Hoffbuhr 1999; ISIG 2000; Popper & Lipshitz 2000)

The private sector is seen as having some of the skills lacking in water utilities, particularly modern management techniques (Gresham & Shlaudeman 2000). According to Borkey (2003), and noted previously in the section on Technological change, water utilities run the risk of foregoing technological management skills by ignoring private sector involvement. With corporatisation and a change in the regulatory environment it is important for regulators themselves to maintain their skills base in a more complex regulatory environment (AATSE 1999).

The Australian water industry, writes Cullen (2003), needs to build a tradition of knowledge based decision making from research. Downsizing and underinvestment in state based organisations could be detrimental to research and managing water resources.

Sharing knowledge within the water industry is an issue. The nature of water utilities is that there is a lot of informal information (Rubin 2003). There are, in addition, barriers to sharing information due to perceived competition between water utilities. Whilst there are research organisations and industry forums for information sharing, in contrast to the literature, this is felt to be shallow. There needs to be a formal method to share information (Rubin 2003); *“a centralised body to...oversee all water resources, not just state by state”*. Water utilities are looking for sharing of operational expertise that comes from employee exchanges particularly to address specific issues. This is more critical for smaller utilities with limited financial resources and who are trying to build up their own knowledge base. The data reverberated with, *“that type of loose network, ah yes we want one of those and one of those and you put them together, and that’s something that’s very hard to get in any one organization”*. Knowledge is vital for the management of urban water supplies, funding, research and future technological developments are important for gaining knowledge (CoA 2002). Knowledge must be shared to be useful. The question is, as revealed by the data, *“how do you make it more of a knowledge industry”?*

9.5.5. Vision and culture

The data revealed that there is a concern amongst some water utilities about the lack of vision and the ability of organisations to react quickly enough to a changing business environment. This category is concerned with water utilities' internal environment rather than the mindset of the broader community with regard to water use and valuing the commodity. Vision is linked to organisational learning and knowledge discussed above in subsection 9.5.4.

From the literature, Senge et al. (1994, p302) define vision as: -

'a picture of the future you seek to create'; 'where we want to go and what it will take to get there'

Senge et al. (1994) write that to be successful an organisation needs a sense of purpose to bind its employees together to achieve the shared vision. The shared vision is created by people in the organisation sharing their experiences, vision, purpose and values and how these fit with the external environment, it concerns building shared meaning. From the theory on scenario planning van der Heijden (1993) says that for organisations the strategic vision needs to change as the business environment changes. Vision is often tacit and difficult to change because external signals calling for a need to change are filtered out.

The traditional view of urban water supply is pipes and pumps. The data confirmed that it is an engineering driven industry, *"a real mentality problem in the water industry in Australia, in other words we're still engineering driven"*. Mouritz (1996) says that for this to change there must be integration of water and land management in order to change the world view about water supply for more holistic and sustainable planning. The data suggested that there has been some change in mind set but further change is required, *"that mind set has changed to some degree but it continues to need to change substantially"*. Mouritz (1996) cites Clark in saying that the economies of scale doctrine of traditional water supply is inappropriate in the context of sustainability. The data reflected the literature with, *"public works and public health mentality is being applied in days of sustainability, this will crumble"*.

Part of the problem is that the culture of water utilities is entrenched in the technology, as discussed above in subsection 9.3.4, where the choice of technology is aligned with the cultural values in the established technology (Barns 1991). The data recognised that water utilities, *"are more than just an engineering organisation"*. Individual and consequently organisational culture takes time to change.

Davis et al. (1999) pose the question whether it is the mind set of pipes and pumps that is the issue or whether it is water utilities' fear of losing control of the water supply system; presumably as competitors enter the market and or the community is able to disconnect from the system because of alternative technologies. The data were in empathy with the literature on this notion, *"our willingness to move into...to give up our dung hills"*.

Sadler (1998), in discussing non metropolitan water utilities in Victoria, argues that economic rationalists, presumably since the introduction of National Competition Policy and the COAG Water Reform Agenda, have focused the water industry on the cost of supplying water and the role of government administration and away from public health, development and water supply issues. This refocusing is equally applicable to other parts of Australia's urban water supply industry. Sadler (1998) continues to say that a new mind set is required in water utilities that focus on water quality and services, customers, continuous improvement, employee empowerment, change and entrepreneurialism. The data are in agreement with Sadler (1998), *"we have customers, we have financial markets to...to manage and we have stakeholders and owners to satisfy and I'm not sure they, all those things are up front of mind for water utilities"*. Utility employees must have a shared vision for the future and a key for achieving this is the ability of the organisation to learn from taking risks in innovation and improvement and learning from the successes and failures.

Reforms in the water industry have brought corporatisation of water utilities and increased accountability for board members and senior managers to the community through customer service contracts and to stakeholders through statements of corporate intent (WSAA 2001), *"another positive step and that's the, the introduction of...triple bottom line reporting"*.

In his research Trainor (2002) concluded that the lack of strategy design and implementation skills could limit the vision required by utilities in a competitive environment. Therefore in the absence of a true competitive environment, water utilities are unlikely to develop the skills and vision for the future of water services. The data resonated with such notions as, *"our own leaders sort of say things like well we can't do that, that's not feasible, that's not possible and you know bloody well it is it's just a question of getting down to it and getting on to it"*.

Organisational learning requires employees to change their mental model of the business environment. Organisational learning was discussed above in subsection 9.5.4 and in the literature review. Pain, as de Geus (1988) says makes living systems change so organisational crisis makes organisations change. What is important is to have organisational change before a crisis so that decisions are not

made under the pressure of a crisis (de Geus 1988). The data referred to, *“the answers are always in your own hands...got to have a bit of vision and you’ve got to have a will to do something about things”*, in terms of bringing about change. As a result of climate change many parts of Australia are facing water shortages. Water utilities have aging infrastructure, work forces are retiring with few people entering the industry, community expectations are increasing in terms of water quality and service provision and environmental regulations are becoming stricter. The water industry may not believe it is in a crisis at the moment but others do (Archer 2001; Hoy 2002; ABC Television 2004b). With these and other issues such as competing demands for financial resources it would appear the storm clouds of crisis are looming on the horizon. The scenarios presented later in this chapter; *Decadent water use, Smart water world, Muddy water and Mad Max water world*, are a useful way to present different views of the future and begin the process of changing mental models and vision within organisations before the crisis storm breaks.

9.6. Issues

This section will discuss the three issues as shown in table 9.1. Whilst these issues were not considered for the scenario matrix they are an integral part of each scenario.

9.6.1. Infrastructure

The category of Infrastructure is concerned primarily with the aging and deterioration of older assets particularly pipes in the ground and the cost of repairs and replacements. Cost is an issue in terms of installing a separate water system for recycled water, which is not of drinkable quality.

Much of the water supply infrastructure was installed and greatly expanded during the last century as city populations increased, standards of living increased, and in rural areas for the expansion of irrigated agriculture (Gleick 2000). In most of the developed world water supply systems have always been centralised, based on piping water. With centralised systems, tapping one water source, regular additions to the system is easy to design and construct in increments (Gleick & et al. 2002). Historically the focus has always been on supply side solutions to meet the demand for water by increasing the extent of the infrastructure. This has now become a costly solution not only in terms of new construction but the cost of repairing and replacing old infrastructure (Gleick 2000). The data confirmed information from the literature, *“aging infrastructure within, within Australia and what that actually means and what sort of investments and expenditure will be required”*. Water services are a huge financial burden on governments, which will increase as infrastructure needs replacing. In Sydney some of the pipes are 150 years old and now below developed areas.

There is an increasing need to replace old infrastructure, which means that water is going to cost more to pay for the replacements (Pinkham & Chaplin 1996). This is reflected in the data, *“you need to generate revenue through the water charging not just to produce the water but to maintain the assets”*. This may be moderated depending on how well systems have been maintained over the years since their installation. There will be an impact on the political agenda because water price increases are considered to be bad news stories. The alternative is for water utilities to find alternative financial sources, capital which will have to be paid for. Any reduction in service level from failed infrastructure will incur a negative reaction from the community (Means III et al. 2000a; Means III 2001). The data confirmed that services may deteriorate if assets are not maintained, *“our customer service levels could drop off if we’re not, if we don’t spend the...resources that need to be spent on maintaining and renewing our system”*. In the UK, where there have been reactive repairs and replacements, water utility performance has deteriorated along with public image (Terry 2003). One option to solve the financial burden is to have private sector investment either through partnerships or privatisation of government owned water utilities (Gresham & Shlaudeman 2000). Higher water prices would mean more funds being available for infrastructure replacement (Rosegrant, Cai & Cline 2002). In an age of scarce capital and user pays it is probable the community will have to pay for the cost of infrastructure replacements (ASTECC 1995). In contrast Cullen (2003) says that water utilities have become ‘cash cows’ for state and territory governments, but by removing funds this is impacting on utilities’ abilities to replace aging assets and discussed in section 9.5.2.

It is not impossible to totally abandon the existing water supply technology because of the substantial investment in it (Manwaring 1999). It is argued that replacing and repairing old infrastructure with the same technology is a waste of money. What should be happening is as old technology deteriorates beyond repair it should be replaced by new technology (ASTECC 1995; Day 2004) so that the new technology operates next to the existing older technology. However, the data suggested this was a challenge for the water industry, *“it’s that balance between the old and the new I think that is a challenge”*. As the existing infrastructure requires replacing there is a window of opportunity to replace it with new sustainable technology (Mouritz 1996; Rosegrant, Cai & Cline 2002). As Niemczynowicz (1992) says that existing infrastructure or technology can be a constraint on society’s ability to change behaviours and adapt. This is reflected in the data, *“it [the water industry] basically tends to be extremely slow to change; it’s not driven by technology”*. Having new technology integrated with existing technology could overcome the problem.

The issue of technological innovation and adoption is discussed in more detail in the subsection 9.3.4 above.

The aging infrastructure impacts on the quality of treated water and in the wastewater collection system through the increasing number of spills resulting in environmental impacts (ASTECC 1995). Aging pipes means increased water losses from leaking pipes and breakages (Means III 2001).

The financial burden of future infrastructure replacement costs has been recognised for a number of years. There are computer software packages that can forecast the financial impact by assessing the age and condition of existing infrastructure, *“we’ve got models that say they deteriorate at certain rates and we should be spending a certain amount of money on them”*. One such package, The Replacement Planning Model, was developed in the USA in 1999 (Bell 1999). Most water utilities in Australia would now have similar tools available to them. The issue is how to pay for replacements and when to replace.

9.6.2. Environmental sustainability

The concept of sustainability is vast and much has been written on the subject. From the data the issue for water utilities in Australia the category of Environmental sustainability is one of being environmentally responsible and being seen to be ‘green’. The category focuses on the provision of sustainable water supply by extracting water from the environment and the disposal of wastes with minimum environmental impact.

Sustainable development, writes Tibbs (1996), arises from the world view that the present rate of human development cannot be sustained indefinitely. Sustainable development proposes a future without environmental destruction and extreme social inequity. The agenda is for responsibility and action to change the way society lives in order to prevent a global crisis.

According to Norgaard (1988), society’s focus on sustainability began in the late 1980’s because of a realisation that development based on a limited supply of fossil fuels was unsustainable and damaging the environment. The ecosystem had become more important than the use of energy. It meant that political decision making would be more difficult because of the change in Western society beliefs and encompassed a co-evolutionary understanding of systems to explain why development was unsustainable and what needed to be done for sustainability (Norgaard 1988).

Norgaard (1988) argues that sustainability may be the start of a new world view just as progress and development was. Sustainable development encompasses the concepts of environmental systems, technology, society, knowledge and values, intertwined rather than in isolation. As with the urban water industry the uncertainties, concerns and issues discussed in this chapter are intertwined and difficult to view in isolation. The data confirmed that sustainability is an issue for

the water industry as a whole, *“the sustainability theme is applicable right across, right across all parts of the industry whether it be the, the urbans or regionals, the rurals or the irrigators”*.

Sustainability is undoubtedly a global focus, the United Nations Agenda 21 (United Nations 1992) calls for global participation and defines sustainable development as:

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

In terms of water resources Agenda 21 (United Nations 1992) proposes to protect the quality of freshwater by using an integrated approach to the development and management of water resources. The Dublin Statement noted that fresh water is a finite and valuable resource essential for life, development and the environment (Gleick, Singh & Shi 2001); the data supported this, *“the water industry everywhere is responding to the fact that water is becoming our...more and more precious resource”*.

Sustainability includes the principles of resource efficiency, distribution equity, ecosystem protection and public participation which must guide planners and policy makers. A key principle is the involvement of the community in dialogue to address their needs and wants and protect the common good aspects of water for recreation, cultural and community values. This is reflected in the data by, *“we will have the plan signed off and agreed by the community on an ecologically sustainable plan”*. The questions are how much water does the community need, should the community pay and use as much water as it wants and how much water should be available and of what quality? There is a global concern about water, its pollution, impact on public health and the long term sustainability of water resources at the current rate of use. Sustainable development is a major challenge (Gleick, Singh & Shi 2001).

In Australia the National Water Quality Management Strategy arose because of public concerns about water and its sustainable use (EA & DAFFA; Shadwick 2002). The strategy is part of the national commitment to ecological sustainable development (ARMCANZ 1994; DEH 1994) that in terms of water resources encompasses the precautionary principle, intergenerational equity, conserves biodiversity and ecological integrity and improves valuation, pricing and incentive mechanisms (WRC 2002). This is echoed in the data with *“closely look at the resource and how we manage the resource and make, satisfy ourselves that the way we do it, that we do it in a sustainable way”*. Through COAG progress has been made over the last ten years towards more sustainable water management. The National Water Initiative objective is to further sustainable water management by improving the security of water access, returning over allocated systems to

sustainable levels, ensure ecosystem health on a catchment basis, improving water use by trading and water conservation and the use of stormwater and recycled water (DPMC 2004). The data resonated with, *“going to be an increasing pressure on the water industry to be more...proactive in an environmental sense”*.

The philosophy of water development is changing (Gleick 2000) and understanding water use requires a new dialogue for water management (Gleick, Singh & Shi 2001).

The community's awareness and change of values in wanting to maintain the integrity of water resources and the environment will result in innovative water management to meet the needs and wants of water users (Gleick 2000). This is reflected in the data by, *“developing water sharing plans through community process”*.

Lehmann (2003) writes that water is a key sustainable issue that requires a new urban water management paradigm of water sensitive urban design. It incorporates the use of stormwater, recycled water and conservation. Water sensitive urban design couples urban water management, urban design, landscaping and architecture in order to maintain the water balance as close as possible to the situation prior to development. The data were in empathy with this concept, *“communities of the future will address a whole raft of issues such as water harvesting...and a number of sources of supply...and possibly localized reuse built into the concept planning for future developments”*. The outcomes are less water use, less stormwater runoff and pollution and reduced infrastructure costs (Lehmann 2003). Unfortunately water sensitive urban design is the exception; it can be as cost effective as traditional urban design as well as having utility and aesthetically pleasing outcomes (CoA 2002).

Stormwater is an issue for water utilities because the infrastructure is separate from urban water supply and is generally managed by councils' rather urban water utilities. Stormwater can be highly contaminated with pollutants from the catchment particularly in industrial and developed catchments. The data confirmed the problems with stormwater, *“stormwater will be an increasing, in terms of flooding and an increase in terms of...the effect it's having upon the waterways in terms of quality and I think that could be a real big issue”*. The issue for water utilities is that polluted stormwater enters the sewer system putting additional pressure on the infrastructure in terms of volumes and with toxic pollutants that can cause deterioration of the infrastructure and impact on treatment processes; it is therefore an externality on the cost of sewerage treatment.

With the aging stormwater systems around Australia there is an opportunity, as with the reticulation system, to replace the existing systems with ecologically sustainable systems and recycle stormwater (CoA 2002).

Resource management needs to be on a catchment basis across jurisdictional boundaries, if necessary, and communication between the water industry, scientists, government and the community (Gale 2000). The data were in agreement with the literature, *“better understanding and management of catchments and...a better understanding of these in the community”*.

Part of the problem is that issues of sustainability influence political decision making, *“and political pressures I’m sure are there to”*. A conflict arises between the short term political agenda and gaining recognition and the long term view needed for sustainable development.

9.6.3. Providing services

The category Providing services covers the community’s desire for different types of water services. The data revealed that water utilities fear that if different services are not provided, particularly as water becomes scarce, then the community will adopt its own solutions to save water, which could be uncoordinated and pose a threat to public health.

Historically water services were developed, at least in major industrial cities, during the industrial revolution in answer to growing populations’ increased demand for water and the removal of waste. Piped water and sewers virtually eliminated cholera and typhoid epidemics in cities (Gleick & et al. 2002), particularly once the connection between clean water and disease was established (ABC Television 2004a). The data substantiated this with, *“the...quality of our drinking water and the introduction of...water born sewerage that have had the biggest improvements in community health”*, in the context of watershed events.

Water utilities are bound to provide a service that is essential for life and public health, *“the greatest challenge in the ***** is for the... rural and remote communities and especially the...aboriginal communities, and I think that challenge is in about achieving health outcomes”*, as well as managing the resource sustainably. Utilities must have the resources to perform these duties. The key element in service provision is a satisfied community (Seppala, Rajala & Katko 2004). This is echoed in the data with, *“the community as long as it sees a...professional and systematic job being done of these emerging issues, as they crop up, then we’ll retain their support”*.

Gleick et al. (2002) say that there are two ways to provide water services, the traditional ‘hard path’ based on a centralised system of source water, pipes and

pumps and the 'soft path' still based on a centralised system but with extensive decentralised components delivering diverse water services matching the needs of the community. The 'soft path' identifies and satisfies community needs for water services. For example in waste disposal the community wants convenience, cost effective and hygienic waste disposal and would accept alternatives to flushing toilets, such as composting toilets, if these criteria were met (Gleick & et al. 2002). Small scale technologies for waste disposal and treatment in suburbs and offices have the potential to recycle wastewater (CoA 2002). The data resonated with, *"the traditional universal centralized system that most water authorities have may be not satisfactory to communities as more people want to become, want to have their own, I guess, personal specific...water services"*.

One of the expected outcomes from the National Competition Policy reforms should result in better water services for the community (Shadwick 2002). Since the reform, water services to customers are now covered by a customer service contract lodged with the utility regulator in the state or territory water utilities operate in. This is confirmed by the data, *"the current one [licence] is now drafted independently by IPART and very comprehensive document, it still covers the same standards for customers, drinking water quality, water continuity, water pressure and sewer overflows"*.

Community expectations are increasing for the services already provided, *"customers have an increasing expectation of improved service levels"*, and for alternative services such as recycling; or at least asking why there is not more recycling of water. The challenge for water utilities is to introduce innovative water services that meet environment integrity, are efficient and provide a high level of service to the community (Mouritz 1996). There needs to be a mind set change from providing water services as per vision statements to being flexible, specialised and responsive to customer needs (Mouritz 1996). The data supported this because, *"customers...are increasing in their knowledge of what's available and what they can have"*. Water utilities need to engage with the community to determine their needs and wants and which ones can be satisfied (Gleick, Singh & Shi 2001), particularly as the community becomes more technically informed (Grant 2000) and, *"because of technology, the easy access to what's being done right around the world"*.

The question arises as to what is the underlying issue with providing services to customers, is it cost of individualised systems, health implications of ad hoc systems, which is certainly an issues of concern, or is it competition and losing control? The literature and data reflect that water utilities are not necessarily customer focused and still operate under the pipes and pumps paradigm of water services. Perhaps with greater competition services will diversify; an area where the water utilities could take the lead in providing innovative services (Langford 2000).

Alternatively there is an opportunity for the private sector to take a greater role and provide competition.

9.7. Summary of discussion

To conclude this section of chapter nine the two categories selected for the scenario matrix were 'Water availability' as the issue with the greatest uncertainty and 'Technological change' as the uncertainty most likely to have the greatest impact on the urban water supply industry. In terms of scenario planning these are the key uncertainties (van der Heijden 1996). Table 9.2 below summaries the above discussion and selection of key uncertainties.

Table 9.2. Summary of key uncertainty selection

| Key uncertainty/uncertainty | Comment |
|------------------------------------|---|
| Community outrage [CO] | With customer focus community reaction could be modified, transactional environment |
| Water availability [WA] | From the perspective of climate change no control, contextual environment and a key uncertainty |
| Government policy [GP] | Some control in relationship with government regulators, transaction environment |
| Technological change [TC] | Contextual environment high level of impact on the industry a key uncertainty |
| Security threats [ST] | Contextual environment, no control more of a wild card issue |
| Research [R] | Transactional environment with some influence over outcomes |
| Regulatory risk [RR] | Transactional environment with some influence over outcomes |
| Emerging issues [EI] | Communications channels should eliminate some of the uncertainty, transactional environment |
| Legal issues [LI] | Little control, data from only one respondent |
| Demand management [DM] | Uncertainty manageable by communication, transactional environment |

In sections 9.3 and 9.4 each of the ten categories listed in table 9.2 was discussed and assessed according to the level of impact and uncertainty the category had on the water industry. Figure 9.4 below presents the assessment graphically with the level of impact on the vertical scale and the level of uncertainty or control on the horizontal scale, less control being more uncertain (Lindgren & Bandhold 2003). These ten categories from table 9.2 are depicted by abbreviations in Figure 9.4. The two categories selected for the scenarios are clearly clustered in one area of the

matrix. The category of Security threat was not selected because of its wild card character.

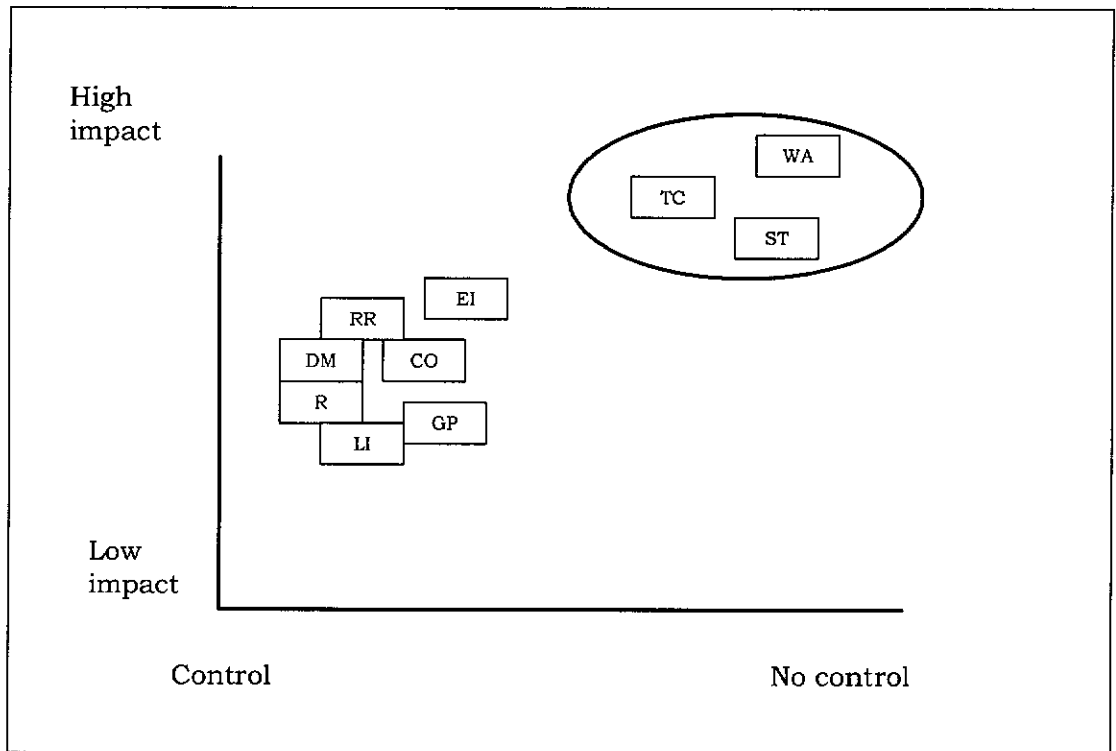


Figure 9.4. Summary matrix for key uncertainties

From the discussion of the categories, which were key uncertainties, uncertainties, concerns and issues, it is evident that they are all interlinked. Decisions under one category have an impact on other categories. The scenarios below present different futures for the water industry to 2025 based on the categories selected as the key uncertainties and populated with other issues revealed in the data. The scenarios illustrate the complexity of the water industry and its business environment. Figure 9.5 is an influence diagram of the 18 categories shown to be key uncertainties, uncertainties, concerns and issues presented above. It attempts to depict the complexity and interconnections between the issues as a model.

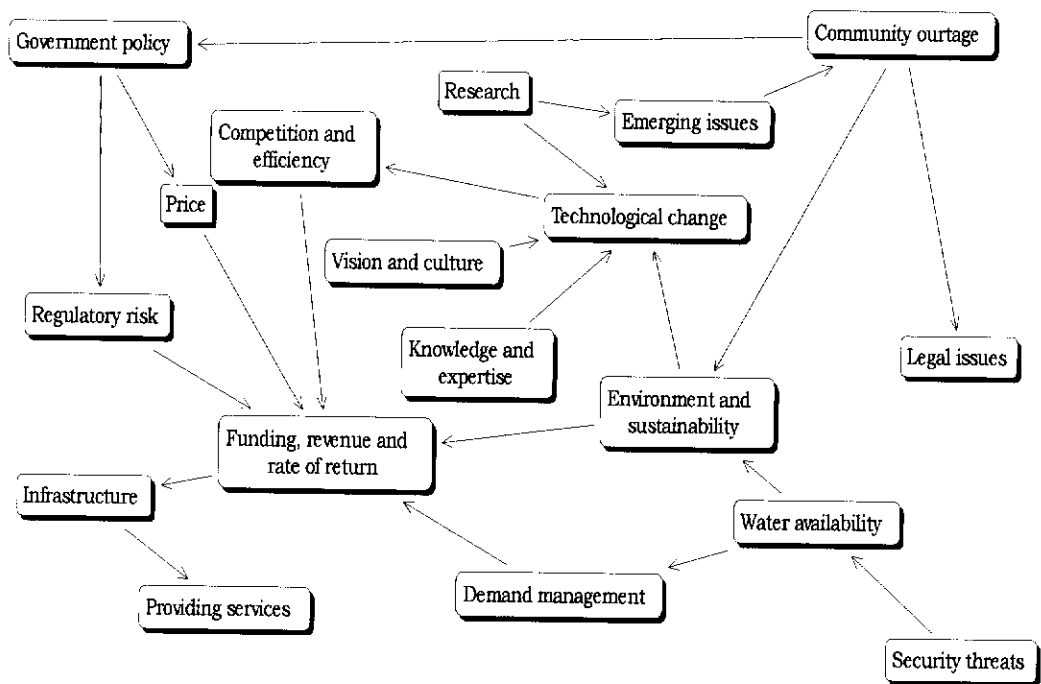


Figure 9.5. Model of urban water supply

9.8. The Scenarios

The researcher acknowledges that the scenario planning process requires scenarios to be developed through a group process which includes the selection of the key uncertainties for the scenario matrix. This study has used scenarios in a desk top format to present the complex issues as they relate to Australia's urban water supply industry and to describe four possible futures. From the data the researcher has selected the categories of 'Water availability' and 'Technological change' to form the scenario matrix. The discussion above is the basis for this selection. To determine the critical issues for the urban water supply industry preliminary scenario development is a useful tool and serves to illustrate the process of scenario building. The scenarios presented for this study are open to reinterpretation and development. These preliminary or skeletal scenarios, as constructed by the researcher, are stories about the future structure of the water industry. In the grounded theory method (Glaser & Strauss 1967) theories are open for discussion and modification as new evidence is gained from the business environment. This is certainly the case with these scenarios; however, they do serve to highlight the critical issues for the water industry. These will be used as

feedback to the industry and will outline possible future business environments for the urban water supply industry.

In order to populate the scenarios, with information from the interview data, the issues from the categories discussed above were de-dimensionalised. An example of this is shown below in table 9.3 below using some of the issues from the category Water availability as an example. Briefly the key uncertainty is the availability of naturally occurring good quality water and the impact of climate change on the resource in the long term, and the engineering community's acceptance of the issue of climate change and not knowing what the impacts may be.

Table 9.3. Water availability issues

| Issue from interview transcript | De-dimensionalised issue for scenario |
|--|--|
| Acceptance of climate change | Attitudes to climate change |
| Climate change/global warming, not knowing Straight line or sudden change in climate Climate change and the economics of farming | Climate change |
| Availability of water supply/resource | Yield of the environment/resource |
| Long term source uncertainty Affordable high quality water | Source availability |
| Need to plan for uncertainty | Planning for uncertainty |

Having selected the two key uncertainties they were arranged into a matrix, as shown in figure 9.6 below, to enable four scenarios to be developed, each with an underlying theme as follows: -

Scenario A – Plenty of water available and high level of technological innovation.

Scenario B – Low water availability and high level of technological innovation.

Scenario C – Plenty of water available and low level of technological innovation.

Scenario D – Low water availability and low level of technological innovation.

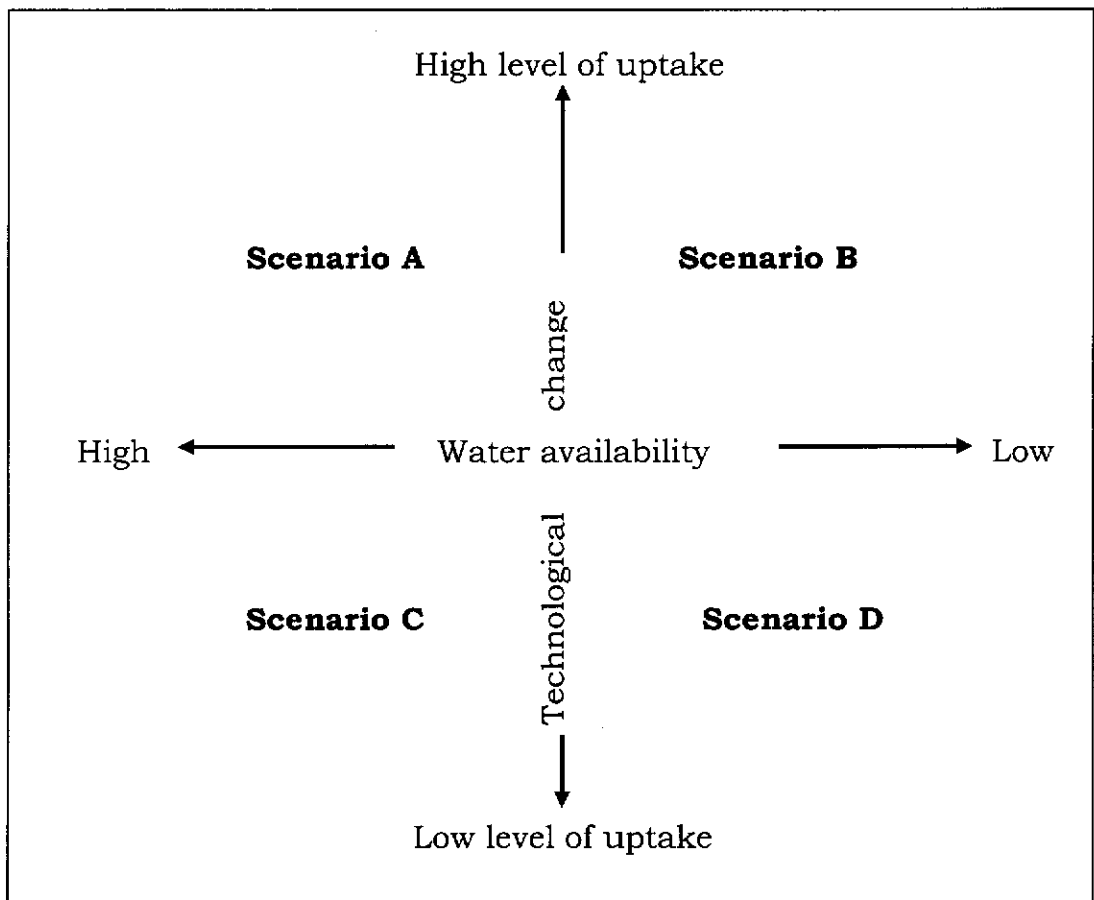


Figure 9.6. Scenario matrix

For each scenario a starting event was selected, such as incorporating a piece of news that recently appeared in the press, as a catalyst to influence the direction of each scenario. Each of the scenario issues was then reviewed to determine the dimension it would take in each of the scenarios; these were the 212 issues noted in section 9.2 of this chapter.

Broadly the main players in the Australian urban water supply industry are water utilities, government and the community as well as external players such as irrigators and international organisations. Data from the interviews contained information on the characteristics of each of these groups. This was taken into consideration and incorporated into the scenario writing.

Each scenario was written describing the events that lead to a description of the urban water supply industry in 2025. The time frame was chosen to accommodate the long term planning horizon of the industry and not to be too far into the future for the scenarios to be dismissed by current generations. Each of the scenarios was given a name to encapsulate the theme of the scenario.

Scenario A – Decadent water use - plenty of water and high technology

Scenario B – Smart water world – lack of water and high technology

Scenario C – Muddy waters – plenty of water and low technology

Scenario D – Mad Max water world – lack of water and low technology

The next four subsections contain the scenario stories.

9.8.1. Decadent water use. Plenty of water available and high level of technological innovation.

9.8.1.1. Introduction

Cheaper energy, provided by hydrogen fuel cell technology and nanotechnology, has dramatically reduced the cost of pumping water, a major operational cost for water utilities. The driver to develop new and cheaper energy sources came about at the end of 2003 when Russia ratified the Kyoto Protocol. This pushed the draft treaty over the 55% emissions (Article 25) threshold turning the Protocol into an international treaty. Consequently, greenhouse gas emissions around the world were dramatically reduced over the next year aided by severe tightening of emissions requirements and penalties for polluting.

Now, in 2025, the effects on world weather cycles have been incredible. Global warming, according to scientists, has been reversed. There is still scepticism in the community about, what is now, global cooling. Some experts say it is just part of the bigger climate change cycles we have seen in the past and nothing to do with reduced greenhouse gas emissions. Climatologists predict expanding polar ice caps that will impact on northern latitudes with permanent ice much like the last ice age and the occasional iceberg seen on the Barrier Reef. Will cooling accelerate? What ever is to be done?

9.8.1.2. The Australian urban water supply scene

The last El Nino to impact Australia was at the beginning of the century. Since then, because of climate change, the Pacific Ocean currents have cooled resulting in increased rainfall over much of Australia. The problems associated with stormwater have not risen because the incidents of extreme storm events have diminished with the change in weather patterns. The latest digital image from the Mars Shuttle, as it leaves the international space station, shows Australia as a green emerald in a sea of blue.

There is a plentiful supply of good quality fresh water in Australia, but it wasn't always the case, grandparents recall to their grand children the Christmas of 2004 when the water police patrolled streets enforcing water restrictions. These stories are just myths to the children. In addition since 2004 the public have come to expect higher quality water services provided by water utilities.

Over the last 20 years a number of technological innovations have dramatically impacted on the Australian urban water supply industry by reducing operational costs and contribute to efficiency gains. One innovation that was widely taken up from 2010 was hydrogen cell power generation producing much cheaper and cleaner power than fossil fuel power generation. This meant the price of water could be kept down. Cheaper water and plentiful supply has resulted in the unchecked usage of water since 2015 and utilities have now lost the argument of rising costs to justify an increase in the price of water. With unchecked

usage revenue has risen and utilities are providing a good dividend to Government. The community is happy. They have plenty of cheap water and there is little upward pressure on water prices. The increased revenue means that utilities have funds for repairs and maintenance of aging infrastructure; service standards are high and kept there by Government regulations. Low interest rates and a balanced debt to equity ratio allow utilities to fund new projects as required. Cost containment and efficiency gains have also been achieved through bundling of services particularly billing. Customers now receive one utilities bill for mobile phone, water, gas and power. All billing data is collected by agencies via remote wireless communication technology.

The community's attitude to water supply is complacency and apathy, it's an 'A' to 'Z' issue, as it was at the end of the last century, and water is not highly valued as a commodity to sustain life. The only time there is community outrage is when there is a water quality incident, which are very few, or when services are interrupted. It's a land of plenty, for most. The community generally supports the water industry's policies and strategy, plenty of information is available via web sites, utilities are customer focused at least to keep the price down and the community is kept informed about major decisions regarding water, not that there are many. There is little pressure from the community to change the way water services are provided, all they expect is to be able to turn on the tap and safe good water will appear.

The use of technology has focused on operating efficiencies to reduce costs, improve services and treat wastewater; volumes of which continue to increase. Given the plentiful supply of water there has been little focus on alternative sources of water, such as desalination. The efficiency focus has increased automation and remote control of operations; fewer people are employed in the industry, which has caused some downsizing, job losses and industrial relations issues. Unions have waged industrial action but this has had minimal impact on services and whilst there have been some legal actions taken most have been resolved through out-of-court settlements. The high level of technical skills required to operate systems has attracted younger engineers to the industry but fewer other disciplines, as a result the industry is still predominantly engineering focused. Some engineering organisations specialise in building and operating treatment plants for utilities under public private partnerships arrangements. This has required complex contracts for services. Utilities now employ their own advisors in an effort to contain escalating legal costs, one of the few areas where costs have significantly increased in recent years.

Recycling wastewater is now unnecessary as an alternative source for drinking water and there is limited use of recycled water for irrigation. Whilst the technology exists it has instead been applied to treating wastewater to a higher standard, to minimise environmental impacts, before discharge via ocean outfalls. Any reuse is done as a one off boutique solution to address particular issues and as 'feel good' pet projects. There is little demand or

need for reuse therefore neither the framework nor the instruments to encourage reuse have been developed. In fact utilities secretly deter reuse and conservation of water so as not to reduce revenue from sales of natural water. Consequently the community is not particularly well informed or interested in reuse.

The population's ongoing unchecked use of water has meant that volumes of wastewater have risen although technology has improved the quality of the effluent, driven by Government regulation. The prime disposal is via ocean outfall. Biosolids are recycled to agricultural use and are deemed safe. By 2012 another technological development; smart bugs, enabled wastewater and biosolids to be treated cheaply and quickly resulting in improved effluent quality and reduced operating costs.

Industrial wastewater is treated on site to remove toxins and then discharged to the sewer for a price and at a regulated quality. Utilities, being highly commercialised raise revenue from water sales to industry and waste disposal. Water utilities are seen to be environmentally responsible and have a 'green' image. Since 2015 environmental flows have been returned to rivers particularly the Murray Darling although this is as much as a result of irrigation efficiencies in water use as the increased rainfall. Irrigators have become more efficient in their use of water but still consume over 80% of water mainly due to vastly expanded irrigation areas supplied by cheap piped water.

Over the years the Government's environmental agenda has focused on pollution and the use of technology to solve problems, however, salinity continues to be an expensive issue to deal with.

In terms of infrastructure, the increased rainfall has meant that owners of dams have had to review the Probable Maximum Flood (PMF) predictions by the Bureau of Meteorology. In some cases large projects have been undertaken to upgrade spillways to ensure the safety of people at risk from dam breaks. In constructing new dams this had increased costs and widened environmental issues. However, because Governments are anxious not to have water supply problems, projects to harvest water, such as new dams, generally get quick approval. There is still resistance to new dams from environmentalists however; the recreational and tourist industry had successfully lobbied to have new recreational playgrounds. Since 2020 the environmentalists have been losing ground particularly since water supply is plentiful for environmental flows. Utilities provide sustainable services and integrated water management is well practised.

The application of readily available cheap technology and plenty of water has meant there has been little need for the industry to focus much on global issues. The good revenues being paid to Government have attracted the interest of large global organisations but Governments have recognised the industry as a cash cow and whilst allowing the Government owned corporatised model to continue have shown no increased desire to

privatise the industry. The industry has become insulated from global competition. Plentiful water supply has not attracted private companies to set up using alternative water sources such as desalination. Government has kept the industry on a leash but a loose one. Most utilities are still monopolies and have economies of scale to be viable. Many of the smaller service providers amalgamated and corporatised twenty years ago, in 2005, when water supply became short and as a barrier against takeover by international players. Since then smaller Council service providers have sprung up as city populations have moved into rural areas and demanded reticulated water services rather than rainwater tanks. Competition is comparative through benchmarking, focusing on service and environmental standards rather than the cost of water.

States and territories still manage their own water resources through government planning departments with cooperation between jurisdictions where necessary. Utilities work with departments to ensure they get their allocation and access to the resource, not that there's much of a problem, there is plenty for all. The relationship between utilities and Governments is still much the same as it was 20 to 25 years ago. Utilities are threatened with Royal Commissions and restructuring if problems occur, the last time this happened the Sydney Catchment Authority was formed in 1999.

Generally utilities are well run, accountable and produce good annual quadruple bottom line reports (financial, environmental, social and governance). Management is visionary in terms of efficiency and producing low cost water with the aide of technology. Innovate or die is the name of the game. The last Council of Australian Governments (COAG) water reform agenda in 2003 focused on irrigation water use to improve efficiencies. This averted further water restrictions 20 years ago, since then reforms have focused on introducing new technologies.

Regulations and standards covering water quality, service provision and the environment have increased over the years keeping pace with new discoveries and issues that have emerged. Technological advances enabled utilities to address these emerging issues and tougher regulations cheaply. The community expects good quality water and generally receives it. There is little demand for point of use treatment technology, however, a few private organisations provide services although these tend to come and go as fortunes change. The regulations do however act as a barrier to international organisations trying to gain a foothold in Australia. In this area there may be cooperation between Governments and utilities to actively put up barriers to international competition; however this has never been proven, as it would be against international trade agreements.

Water trading has never really become widely practiced since the beginning of the century when efforts to have rigorous water trading failed and combined with increased rainfall had meant that by 2010 water trading had died a natural death.

The biggest problem that has been overcome in the last 20 years was the aging infrastructure. In 2005 utilities were facing huge costs to replace old infrastructure. However, reduced energy costs enabled utilities to save money, which together with new cheap materials with life expectancies spanning centuries saved the day for many utilities. The first nano-machines became available in 2007 enabling existing pipes to be relined cheaply with new high tech materials from the ceramics industry. Massive infrastructure replacement programs were undertaken between 2010 and 2015 throughout most capital cities. Government subsidised cheap loans to utilities assisted the programs. The need to repair aging infrastructure was driven by past incidents involving aging infrastructure such as the Auckland power failure and similar power failures in the USA and Canada. Utilities were also concerned about alternative suppliers of water services taking market share, such as localised desalination plants, however, climate change and reduced costs of conventional water supply systems proved too much of a barrier for competitors.

Over the decades catchment protection has continued to be on the agenda but with the advent of cheaper treatment processes, governments have allowed access to catchment areas for recreation. As a result the prime barrier to ensure safe water has become treatment. Catchment protection has focused more on preserving the environment so all can enjoy it. Any health implications from toxins or pollutants have been addressed by treating water.

Government and utilities continue to support research into water industry issues; however, funding has not increased substantially. Research has focused on developing technological solutions to solve water quality issues. It has become a knowledge industry with few gaps on the technical side.

9.8.1.3. Conclusion

In this scenario, set in 2025, there is an affluent society with plenty of water that sees technology will solve problems. Generally it seems to be a win-win situation, the community has plenty of cheap good water, a happy community means governments and utilities are happy. There are, though, issues to be concerned about. There is general complacency about water, its decadent use and under valuing it as a life essential commodity by the community, governments and utilities. There seems to be no uncertainty about future water supplies. This complacency could lead to a disconnect between customers and utilities and a heavy reliance on technology. If anything should happen to the water supply utilities may not be prepared to deal with a crisis because there are no alternative sources of water and this will result in community outrage. New pollutants could start to appear in water supply and go undetected, particularly as recreational use of water has increased. The water supply is highly vulnerable to external shocks and acts of terrorism. The water industry is

engineering focused with few other disciplines and has therefore, a rather one eyed view of the world. It is vulnerable to world events and not focused on what's going on elsewhere.

9.8.2. Smart water world. Low water availability and high level of technological innovation.

9.8.2.1. Introduction

In 2004 the new leader of the National Labor Party seized on the findings of a report from the Australian Greenhouse Office in order to develop a policy for Australia's future water needs. He appointed Willie Drinkup to his shadow Cabinet to be responsible for water issues and vowed to make a new Cabinet position, Minister for Water, if elected in 2004. The new policy "Rewatering Australia" focused on restructuring, regulation, recycling, reuse and reducing.

Meanwhile late in 2004 an El Nino oceanic and atmospheric phenomenon in the Pacific Ocean developed, resulting in drastically reduced rainfall to many parts of Australia. The future looked bleak and dry.

At the end of September 2004 the Prime Minister dissolved Parliament and called a Federal election on 5th November. The Labor Party was swept to victory in a charismatic style campaign with the mandate to do something about Australia's crippling water position. Willie Drinkup was made Minister for Water and immediately set about restructuring the industry.

9.8.2.2. Australia's urban water supply in 2025

Since 2004 successive Governments have focused on developing constructive policy to manage water holistically. This led to the removal of all jurisdictional boundaries by 2007 as far as water is concerned, centralising decision making and planning in the Federal Government. Heated debate ensued with some political turmoil; however, States and Territories were calmed as the Federal budget focus shifted from defence to water technology to solve water shortages. Governments have taken a long term view of water with a coordinated strategy for the whole water cycle. There has been widespread cooperation between governments, utilities, the community and industry to ensure a secure supply. There is now, in 2025, Federal control of water management, water entitlement and allocation of the resource.

Governments, since 2005 have introduced regulation to ensure natural water sources stay pristine. All catchments are protected with many inaccessible to the public. Environmental flows have been maintained where possible; however reduced rainfall has impacted on some waterways.

Since 2004 the community has come to value water as a precious resource and is very supportive of the strict government imposed water conservation measures. These measures have been very successful in reducing demand much in part to the regular public forums that have kept the community informed. The community takes a very active interest in water issues particularly in respect of pollution and water losses. The water feedback shows on the

web and interactive TV provide the avenue for the community to drive government policy and decision making. Utilities are very responsive and focused to community needs. Higher prices are accepted as long as the disadvantaged have a safety net. There are generous concessions to enable everyone to conserve and recycle water.

Demand management strategies implemented 20 years ago stimulated private sector and public funded research into water treatment in order to utilise alternative sources of water such as desalination and recycling. Research resulted in improved treatment technology at reduced costs. The break even point between the costs of desalinated and recycled water versus the cost of producing natural water was stimulated by cheaper energy and higher prices for natural water. Many water consuming appliances, such as dishwashers, have been developed into efficient machines that only require one filling during their lifetime; solids are removed and are safe to use on gardens.

Now in 2025 you can choose what water source you want to use, desalinated, recycled, the new kitchen top water maker or expensive primary source water. Technological solutions to provide water have flourished since 2004. The community now has a wide range of services to choose from at a price to suit individual pockets and taste.

With the diversification of water sources water quality regulations over the last 20 years have become higher and continue to do so as Government funded research finds new particles and pollutants in recycled water. This has, on occasion, produced concerns about the cost of treating recycled water and particularly addressing the issue of endocrine disruptors. This was a major issue in 2010 when recycling became widespread. However, research into cheaper and more effective treatment methods quelled fears of increasing costs after a couple of years.

With the heavy reliance on recycled water customer expectations have been raised not only for water quality but also for services. Generally these expectations are met; however, when treatment plants fail they can have catastrophic consequences. Utilities are now highly accountable for water quality and service delivery standards. Over the last 20 years there have been two major water quality incidents that have resulted in fatalities from ingestion of low quality recycled water. There has now emerged a wide and strong public debate about recycled water and the public health implications. To address some of the issues utilities have implemented sophisticated risk management process and a water quality assurance scheme for all service providers.

In 2025 there is a comprehensive framework for water reuse through regulation and strict water quality guidelines. All houses now have their own recycling and treatment for grey water. The public recognises the importance of recycling; however there are concerns about the reliability of the technology. Government and utilities provide water quality monitoring equipment to encourage community involvement. As a result community knowledge about

water quality and recycling is very high. Demand for the cheaper recycled water has far outstripped demand for natural water. Several companies now produce recycled bottled water claiming it to be better than the real thing. Government legislation has been introduced to ensure recycling is coordinated in order to prevent ad hoc systems interfering with the management of the water cycle. This has been seen by some as a big brother approach to managing water. Internationally Australia has been accused of erecting barriers to overseas competition by having high standards and regulations for water supply services.

Substantially reduced demand for natural water, on site treatment of grey water, desalination and recycling generally has meant that the aging infrastructure of 20 years ago has required less replacement. Some pipes have been relined at smaller diameter and with multiple pipe systems but a lot of new systems have been installed as the old paradigm of water supply systems has changed. The change has focused on local treatment plants and redistribution of recycled water. No new dams have been built in the last 20 years and upgrading of dams to accommodate increased rainfall has not been required, saving millions of dollars. As a result funding requirements for infrastructure have eased in some areas and been readily available for desalination and recycling projects mainly from international organisations.

Water services are efficient and reliable. The community has accepted the scarcity of water but has been more critical of water quality, particularly with the high reliance on recycled water. Any water quality incidents attract severe government retribution. Generally utilities are well run and have a high standing in the community. The spin off from this is that utilities are now sought after and interesting places to work. There are few industrial relations issues to be dealt with. They have a diversified work force that is highly skilled both technically and from a management perspective. This is needed in the complex business environment of utilities. Utilities have had to invest heavily in training and are considered to be learning organisations with few knowledge gaps. This sharing of information became essential in order to have a holistic management of the water cycle.

Nationally the environmental agenda remains a high priority for Government. The shift to recycled and desalinated water required strict environmental standards to control waste products and to ensure that natural water supplies were protected. Again the initial high cost of treatment declined as new treatment technologies were developed such as smart bugs to treat biosolids. There have been numerous technological showstoppers over the last 20 years as researchers' focused on water treatment issues. The quantity of effluent has also been reduced to insignificant levels because of recycling. Over 140 expensive ocean outfalls constructed prior to 2004 are now used to bring water into desalination plants.

As part of the water reform agenda at the turn of the century most water utilities became corporatised. Since then water utilities have developed a strong commercial and competitive

focus and in recent years balance sheets have been robust. Even smaller utilities and a number of private water supply organisations are viable in providing water services to communities. The business environment has become very competitive for alternative sources of water particularly where desalination and recycling are concerned. This has controlled excessive price rises, stimulated innovation and led to operating cost reductions. Many services are now bundled such as billing and metering, saving costs and improving community services. Benchmarking has led to productivity gains and water losses have all but been eradicated. Energy consumption has declined because less water is being used and new systems that have been installed are energy efficient. This together with solar power generation has contributed to reduced greenhouse emissions.

Debt has increased to assist in paying for alternative sources of water. Prices are controlled but the mechanism for setting prices is done with public consultation. The community has accepted gradual and well controlled price rises for the precious, natural commodity. This has enabled water utilities to maintain their revenue streams. Government is happy with the return from utilities and providing utilities perform they continue to operate under a relaxed corporatised model. Privatisation is off the agenda in order to maintain the holistic management of the water cycle.

Technology has enabled some operating efficiency gains; however, most of these have come from overseas. Australia has focused and gained significant competitive advantage in developing innovative inexpensive technologies for alternative water supply. This has created new export opportunities for equipment manufacturers. Globalisation has led to the convergence of technology into the hands of a few big players, which is of concern for the local market. In 2025 the Australian Water Industry stand at the World Trade Fair is the largest and shows off the most recent inventions. Australia has world recognition for smart water use technology and innovative ways to produce water. A major part of the next Mars Cargo Shuttle will be taken up with Australian water manufacturing equipment.

Innovative new technology is constantly being introduced resulting in a fast changing industry much like the telecommunications industry was 25 years ago. Utilities have become highly adaptable and flexible. The image of water utilities being run by engineers in cardigans and Hush Puppies has gone. Employees have a visionary view for the future of the industry to continue to deliver sustainable water services.

Technological innovation has resulted in a sustainable water industry for Australia. The down side is that it has cost jobs in some areas because of smarter communication systems, decentralisation and automated water treatment plants. In fact the water supply system now looks radically different from 20 years ago.

Over the years the irrigators have played their part in this fully integrated industry by becoming highly efficient in their water use, this has drastically reduced their water losses

whilst expanding irrigated agricultural areas. However, some marginal agricultural areas have suffered as rainfall has decreased. Industry has also played its part by treating all waste on site. Industrial water use is now a closed system.

As we look back from 24 December 2025, the historical emphasis on water supply in 2004 came just in time to save Australia from economic disaster arising from water shortages. Climate change is now widely accepted and positive action over the last 20 years has been taken to address the issue of reduced rainfall. Today we see an Australian water industry fully integrated into all facets of society with all stakeholders working together to meet society's needs for water with environmental and economic benefits. The water industry is sustainable and responsible, driven by the recognition that water is a highly valued precious commodity, essential to life.

9.8.2.3. Conclusion

In summary reuse, desalination and alternative sources of water are the key to this reduced natural water supply environment. The health concerns of recycled water are a key driver for water quality and service standards. Managed holistically the water cycle is sustainable aided by smart technology to contain treatment costs. However, when things go wrong with the treatment of wastewater the results can be devastating. It would therefore be likely that litigation could increase in this situation. Security threats would continue to be a problem but with local treatment sites the impacts would be localised but with more potentially vulnerable targets. The smart water world in 2025 is highly dependant on technology to solve the consequences of reduced rainfall. It is up to the industry to be bold and innovative in adopting technological solutions to address a world of scarce naturally occurring water. Utilities must maintain community confidence and education on water quality for continued community interest and support in water issues.

9.8.3. Muddy waters. Plenty of water available and low level of technological innovation.

9.8.3.1. Introduction

The Dingdong Dam disaster inquiry in 2005 noted that the summer of 2003/04 was a bad year for bushfires in the Australian Alps. Most of the Dingdong Dam catchment was burnt leaving nothing but dead trees. Fortunately the dry summer broke early with plenty of heavy rain, filling reservoirs to capacity and allowing all water restrictions to be lifted. A similar story was seen in many parts of Australia.

Heavy snow during the winter of 2004 brought many tourists to the town for the ski season. However, unusually warm winter weather meant the disaster was in the making. Snow started melting rapidly in the denuded Dingdong catchment which led to immense runoff and erosion. Mudslides washed debris into an already full reservoir. The spillway and outlet pipes quickly became clogged with dead vegetation allowing the water level to rise to a dangerous height in the reservoir. Authorities could not reach the spillway to clear the debris because of boggy ground conditions.

The First of August 2004 was a beautiful, sunny day. By 11 am muddy water and debris from melted snow had overtopped the 100 year old Dingdong Dam wall. Authorities were concerned and began to implement an evacuation program from the town below the dam wall. Nobody, however, expected subsequent events to unfold so quickly. At noon a huge mud slide not far from the wall sent millions of tons of rock and dead trees into the reservoir starting a tidal wave travelling towards the wall. The trees, hardened from fire, acted as battering rams against the wall and by 12.20 pm the top of the wall had started to crack. Muddy water could be seen pouring through the cracks. Suddenly at 12.45 pm a huge piece of the wall collapsed, the dam was breached sending millions of litres of water and vegetation rushing down the valley towards the town destroying all in its wake. Because evacuation had been slow many people were caught in the flood.

One of the key findings from the inquiry focused on the condition of the aging dam and the lack of long term and regular inspections. Prior to the disaster, repairs and maintenance had been skimped and a major review of the integrity of the dam wall, scheduled to be undertaken in 2003, had been deferred because of budget restraints.

9.8.3.2. 2025 and the deterioration of Australia's water supply system

The poor condition of the aging Dingdong Dam was, and still is in 2025, symptomatic of aging water supply infrastructure throughout Australia. Over the last 25 to 30 years there have been repeated crisis in essential services, throughout the world, as a result of aging infrastructure not only in water supply but also gas and electricity supply. Memorable examples that come to mind are the Auckland power failure and Longford gas explosion

both in 1998, the New York and surrounding cities power blackout in 2003 and explosions at the Moomba Gas Plant in 2001 and 2004. Whilst it may not have been through aging infrastructure the Sydney Water Crisis in 1998 was the tip of the iceberg for the water industry. Consequently over the last 20 years water utilities in Australia have spent billions of dollars on repairs and maintenance of infrastructure to avoid major supply interruptions. A proportion of these costs have been passed onto the community through increased water prices. However, there are still service interruptions in 2025. Poor services and the high price of water are causing much community unrest.

Looking back over the last 20 years, other decisions and events since 2004 have contributed to the woeful state of today's urban water supply. By the beginning of 2004 Australia's population had topped 20 million and was predicted, by the Australian Bureau of Statistics, to barely reach 24 million by 2025, at a 1% growth rate. In order to boost Australia's industry base, successive Governments increased immigration levels, which together with international pressure to take more refugees resulted in a population growth rate of about twice the 2004 predictions. Today, January 2025, Australia's population is nearly 30 million. This has put enormous strain on water utilities to meet the rising demand for water and wastewater services.

A natural phenomenon also contributed to the present situation. Since 2004 La Nina, cooler sea-surface temperatures in the Pacific Ocean, has dominated weather cycles resulting in wetter climatic conditions. The community now gives little thought to climate change and drought. Water, although an expensive commodity, is not considered precious by the community, it is plentiful; in fact many areas have too much water. Urban flooding from stormwater has become a major public health and social issue. Increased rainfall meant that utilities have had to upgrade dams, at high costs, to cope with increased Probable Maximum Flood levels.

Because water around Australia is in plentiful supply there is little focus or dialogue on water conservation. There is no framework for recycled water because there is no demand and in any case it is too expensive to treat, expensive technology and power costs are to blame. As a result there are no instruments to educate the community about recycling water. The general community is ill informed and mistrustful of reuse schemes. There are some ad hoc systems run by small community groups trying to reduce their water bill. These systems are poorly designed and have become a major issue for water utilities and a public health issue because of the pollution they cause.

It is now 2025 and across the nation the water cycle is not being managed sustainably. There is an uncoordinated planning process because of jurisdictional boundary issues. The three levels of government still work independently of each other in regard to managing water resources. Jurisdictional issues and parochialism is a major barrier to achieving a fully

integrated water industry. Despite successive changes of government, water issues have not been high on the political agenda at Federal level, perhaps because there is no shortage of water. From the water utilities' perspective, governments have always had a short term planning horizon, whereas utilities have a long term focus for planning new infrastructure. Utilities complain that government decision making over the last 20 years appears to have become slower and more changeable. Now in 2025 this has resulted in the relationship between water utilities and government being antagonistic and uncooperative.

Looking back, by 2010 Australian water utilities were under a lot of pressure financially. Whilst prices rose to pay for some new infrastructure and repairs, water utilities still had to borrow funds and therefore became heavily debt laden. There was and still is little competition to put downward pressure on prices even the comparative competition of benchmarking has had little impact. The difficult financial situation meant that water utilities cut spending on research and technologically innovative solutions to improve service provision. Price rises became a political issue as governments were accused of siphoning off funds needed for repairs and maintenance. The community still believes that governments use utilities as quasi tax collectors.

Moving on to 2020, financial returns to governments from water utilities had declined to a point where some State governments privatised water utilities in the belief that the private sector could do a better job. The prospect of a constant revenue stream attracted some international organisations that saw water utilities as cash cows where assets could be allowed to deteriorate. Australian Governments saw privatisation as a solution to repaying the debt incurred by water utilities. With privatisation, there have been many industrial relations issues since 2020 arising from redundancies. Unionisation has increased and legal costs associated with industrial relations issues have become a major corporate expense.

The sovereign threat of privatisation has left water utilities with negative attitudes towards change. Governments have not supported utilities; as a result adapting to a changing business environment has been slow. Utilities have focused on trying to keep the water supply system running and plugging the leaks rather than being proactive to improve services and introduce innovative technology.

Today in January 2025 water utilities are poorly regarded as career options because of the low level of technological innovation and resistance to a changing business environment. Few young people enter the workforce and with the lack of technical training the skill level has fallen behind most other industries. Most of the employees have now been in the industry for 40 years.

The increase demand for water since 2004, as a result of increased population and lack of water conservation, has produced increased volumes of wastewater. Over the last 20 years the environment has suffered as a result of archaic waste disposal practices. Ocean outfalls

are regarded as the cheapest way to dispose of effluent. The number of ocean outfalls has increased to 200, from the 140 operating 20 years ago, to cope with the increased volumes of wastewater. Practically every coastal community now has their own ocean outfall. Trade waste has become a problem as industry discharges waste to the sewer. Industry claims it is too expensive to treat waste onsite. Why not have the utilities do it collectively instead? Pollution incidents from poor quality effluent occur regularly without reprimand from government environmental agencies. The cost of cleaning up effluent pollution has escalated. Beaches at exclusive holiday resorts are regularly closed during the summer due to uncontrolled effluent discharges. The community is concerned about the environment; however, it is not high on the political agenda. Major projects to supply water are pushed through the government approval process despite environmental concerns from the community.

On a positive note, environmental river flows have been maintained because of good rainfalls except for the Murray Darling, which continues to be a problem as more water is pumped from the river for irrigation. Currently there is little environmental responsibility being shown by water utilities or irrigators. The water industry is producing larger volumes of greenhouse gas emissions because of the increased energy required to pump water.

Today in 2025 the major concern of the community is water quality. Because of the lack of funding to repair systems and inadequate catchment protection there have been a number of water quality incidents over the last 20 years. With the higher prices for water the community expects higher quality services. Previously undetected pollutants and particles in water are being discovered all the time, increasing the cost of water treatment. Public health and water services are a major social issue. The community argues that some of the revenue from water sales should go into supporting Australian research into treatment and cost efficient technological solutions instead of relying on a few global monopolies to supply equipment. Government and the community say utilities need to be more accountable for their assets with scheduled repairs and maintenance programs outlined in their triple bottom line reporting. Utilities say they cannot afford scheduled repairs and maintenance programs.

Governments, since 2010 have tried to address some of the community concerns regarding service delivery, pollution, water wasting and water quality by introducing regulations and higher standards. Utilities viewed these measures as authoritarian; as a result the rift between the regulator and the utilities has deepened. To compensate utilities, Government deregulated the price of water in 2020, to coincide with privatisation. This has resulted in price escalation despite claims by politicians and utilities that it would not. Since price deregulation, the utilities' positions have been that if the community wants higher standards of service and better quality effluent they have to pay for it.

The community is caught in the middle of this dilemma in 2025. They are paying for a poorer service. Many have tried to reduce water consumption but when water is flowing down the streets from a burst pipe it is difficult for people to become motivated about water conservation. Governments and utilities don't listen to complaints and give little information about what is going on with water supply. Complaints about poor service just seem to fall on deaf ears. Utilities say they are customer focused but in reality few are. In 2025 there is a lack of responsiveness to community needs for different services other than expensive options from overseas using dubious, unreliable technology. Prices rise and more dams are built to meet the demand for water and the first the community knows about it is in the media. The community wants good quality reliable, safe water services and an end to a costly muddy water supply and damaging pollution. Some parts of the community are finding it difficult to pay their water bills and are being threatened with having their water supply cut off.

9.8.3.3. Conclusion

In summary, the industry is still a low tech industry much as it was in 2000. There have not been any major technological show stoppers to improve the industry's performance. There doesn't seem to be any shortage of water and there is no planning for water shortages should the weather cycle return to an El Nino dominated weather pattern. Indeed climate change hasn't really been widely accepted. Utilities are caught in a spiral of escalating repairs and maintenance costs and the need for new infrastructure. Funding is very tight and government over the years has withdrawn support because of the imbalance between the short term and long term focus. In this situation, community outrage is explosive and potentially frequent. Government has seen the way out of the dilemma by privatising utilities; there would certainly have been approaches from global organisations promoting better, cheaper services. Security threats and incidents would have a major impact on the water supply system because of the centralised supply and treatment facilities.

9.8.4. Mad Max water world. Low water availability and low level of technological innovation.

9.8.4.1. Introduction

Since the turn of the century scientists have warned that half the worlds population in over sixty countries could be facing shortages of drinking water by 2025. In 2003, 6.4 billion people did not have access to clean water and 2.3 billion lacked proper sanitation, a factor in seven million deaths per annum. Part of the problem is climate change and part is because of the management of water by governments. Future wars, the vice-president of the World Bank said, would be fought over water as wars over oil had been fought in the past. The thought of conflict and crime, in Australia, over water had always been far from peoples' minds. At the same time an article in the magazine Nature warned that 25% of flora and fauna around the world would become extinct by about 2050. Some of the hardest hit areas would be those that were flat lying such as much of Australia. The drier reduced rainfall climate that was seen in Western Australia at the beginning of the century has now, in 2025, become evident right across Australia. The water industry is now in crisis.

9.8.4.2. Australia's water supply crisis in 2025

In order to try and avoid a water crisis in Australia various Governments since 2004 have orchestrated a dramatic increase in water prices in order to reduce demand and to pay for aging infrastructure and new projects. Strict water restrictions, such as watering gardens are forbidden, other than with grey water. Today, in 2025, water conservation has reached its limit with most households using less than the basic minimum for survival. Demand management interventions are legally imposed with heavy fines for violations. Governments have tried to improve the situation by allowing more dams to be built but many dams have failed to provide the predicted water yield and have only compounded environmental problems particularly salinity. Many land holders have built their own dams and once again there is debate about building pipelines from the north to supply southern cities.

For utilities the reduced rainfall and run off, as a result of climate change, has meant that most dams have not required upgrading to cope with severe storm events. Governments have also imposed strict regulations to protect water supply catchments against pollution in order to preserve the quality of a decreasing water supply. This has been good for the environment but has increased community tension because access is prohibited. The limited water supply has led governments to enforce water entitlement regulations. In order to alleviate the antagonism between irrigators and the urban users, environmental river flows have been reduced to the detriment of rivers and aquatic life. The environmental agenda has decreased as the Federal Government's focus shifted to water entitlements and public health issues. Water services are not sustainable even with restrictions.

In a bizarre way the reduced water consumption has meant that the overall repairs and maintenance costs for water utilities declined as has overall operating costs such as energy consumption to pump water. Some of this is attributed to abandoned and poorly optimised parts of the system. Wastewater volumes have also declined assisted because of the community's ad hoc effluent disposal systems. Less effluent is being discharged via ocean outfalls. However, the quality of effluent has not improved over the years. The greasy slick in Sydney Harbour is still a permanent feature.

In the past the community supported water restrictions, but now in 2025 there is growing tension between the 'haves' and the 'have nots', which has led to frustration. Why has the situation got so bad? The community for years wanted change, an end to wasteful irrigation practices and called for alternative water services, improved water quality and services, and an end to environmental damage. Why, they ask, has nothing been done and who was responsible for water supply planning? Why aren't there technological solutions to solve the problem?

Other perhaps more subtle events since 2004 have contributed to the present crippling state of Australia's urban water supply. By 2010 the Australian dollar was strong against all other currencies, as the price of gold and other commodities climbed. This made it too expensive for overseas students to come to Australia to study and with the introduction of full fees for higher education, education institutions were severely impacted. Most universities cut back on courses and some became insolvent. Students opted for courses that led them into higher paid careers such as law and specialised medicine in order to pay off their education debts. Consequently engineering and the sciences suffered. Utilities such as water could not attract graduates. Additionally, less money became available for research as the Federal Government withdrew support particularly for water supply research institutions.

By 2020 the Asian economies were beginning to slow, reducing demand for Australia's agricultural products and raw commodities. The value of the Australian dollar came crashing down as commodity prices fell. Now in 2025 imports for Australia are expensive, which added to globalisation and the lack of focus on research has meant that technology is now in the hands of a few international organisations. As far as water is concerned, Australia is no longer the smart country. Basically no new technology has been introduced for 20 years; the design of water supply systems in 2025 is the same as it was 150 years ago.

Trying to manage the water cycle in this situation has become impossible, there is increased parochialism and jurisdictional issues as communities protect their precious water supply. There is no country wide integrated water industry. Water shortages have led to an extensive black market for water which has impacted on irrigated agriculture as water is sold to higher value markets such as urban water supply and bottled water producers. Farming productivity has declined as areas have become too dry and uneconomic to farm. Where

farming is still viable, the escalating cost of water has made agricultural produce very expensive.

Many communities, using water diviners, have found their own water resources, particularly groundwater and guard it vigorously. These communities generally have water at lower quality because of sub standard services and poorer quality source water; they cannot afford expensive treatment processes. In these communities ad hoc waste disposal systems have contributed to public health problems and groundwater pollution. The Government blames communities for the health problems but does nothing about the water situation because there are no alternatives.

The community has called for more recycling of water despite the negativity and mistrust of the archaic technology. The cost, however, to treat wastewater to a potable standard is too high because of high energy costs and poor technology that has not advanced enough to produce a reliably safe product. Risk adverse utilities, accountable for their actions, have stalled most recycling projects in the fear of increased litigation. A number of senior managers have received suspended jail sentences over water quality incidents. However, reused water does supply some agricultural water demand. The framework to successfully manage recycled water, has never advanced because of the above stated high costs, poor technology and the various Governments being unable to come to an agreement. Consequently the instruments and knowledge to encourage recycling are lacking. Most individuals do however use grey water on their garden. This, together with ad hoc waste disposal, has contributed to the public health problems.

The coxsackievirus water contamination incident in 2020 was symptomatic of the situation. The consequences of the incident are still being felt by Sydney residents with increased occurrences of cardiovascular disease, respiratory illnesses and central nervous system disorders. Apart from the health implications for the community, litigation procedures by those impacted continue through the courts adding to the financial burden of utilities. The incident arose after untreated biosolids were disposed of on agricultural land just prior to an unpredicted rain storm. The incident, which has had severe effects has been compared to the Mad Cow Disease and SARS epidemic over 20 years ago and water contamination incidents at Walkerton and North Battleford in Canada at the beginning of the century.

The community was totally outraged after the incident resulting in a deep seated mistrust of Governments and utilities. After the incident State and Territory Governments hurriedly legislated to convert all water utilities into statutory authorities ending 20 years of corporate freedom for water suppliers. Many communities took water supply services into their own hands after the incident to the point where today safe water is a very precious commodity. This has lead to the ongoing community conflict between those that have safe water and those that do not. Only yesterday on Australia Day 2025, a water tanker was hijacked as the

temperature soared to 45°C, to be found two hours later empty. The driver reported that the hijackers looked like something out of the ancient Mad Max movie from the last century.

As the community adopts more of their own solutions to the situation government is slowly losing control. Low income groups are suffering the most as successive governments have focused on short term fixes and votes rather than addressing long term issues. Successive changes of government have led to a changeable political direction and a poor relationship between utilities and government that has become antagonistic. Policy application is strict as is the allocation of scarce water resources.

There have been some good news stories in recent years. The severe water shortages and restrictions have seen the proliferation of rainwater tanks as people try to capture every drop that falls. Good news for the tank manufacturers, but bad news for the community as the incidents of gastroenteritis has risen from people drinking water from poorly maintained tanks. Chlorine chemical manufacturers have also prospered as people try to disinfect rainwater, however there is rising concern about carcinogenic chlorine by-products.

Nationally and globally Australian water utilities have become known as low value organisations, inefficiently managed with minimal funding. The reduced water consumption has meant that utilities now have severely reduced revenue despite increased prices. This has left them in a difficult situation because they cannot afford to improve water quality or service standards. Reduced water consumption has also impacted the bulk water suppliers who traditionally have supplied retailers and who have now, in 2025, almost disappeared. Efforts by water utilities to bundle services with other utilities have failed because other organisations' fear being exposed to the high risk water industry. The rate of return to government has declined. Water utilities have become something of a welfare institute to provide a basic service.

The water industry's poor image has meant that many employment opportunities are unfilled. People quit water organisations leaving fewer people to do the same amount of work. This has resulted in industrial relations issues and increased unionism. The level of technical expertise has also declined as utilities say they cannot afford the time to let people go on training courses. In reality management consider there is little to learn, the system hasn't changed enough. Few organisations share information and because of the lack of technological innovation, systems to harness knowledge have not been established. Generally utilities have a negative attitude to change and with little technological innovation, management focuses on supplying and obtaining a water allocation with little future vision, it is very much a day to day survival situation.

The poor state of the industry has failed to attract international interest from investors. Locally the community has complained about the poor service levels but has now drifted into apathy about supply interruptions and poor quality water. Government has withheld

information in order to stem the flood of negativity about poor water supply planning. This has compounded the community's lack of motivation and involvement. There has been support for water conservation, but because of irrigation wastage and the lack of planning and information, community involvement is not constructive.

In 2025 the major competitors to traditional water utilities are bottled water suppliers. At \$10 a litre, bottled water suppliers have proliferated. This has quietly allowed State and Territory Governments to be relaxed about drinking water quality standards. This has meant that poorer quality water is now being used for reticulated supplies. As a result water quality issues are arising more frequently and are expensive to fix. There is no water quality assurance scheme. This is adding to the looming public health crisis as people who cannot afford bottled water drink poor quality tap water.

9.8.4.3. Conclusion

In summary this is a crisis situation. Water supplies in 2025 have declined to subsistence and unsustainable levels because of climate change. The lack of technological innovation has meant that alternative sources of water have not been developed. This together with other seemingly unrelated events has snowballed to a situation where many parts of the community have taken things into their own hands with uncoordinated, ad hoc solutions to the problem. This has resulted in community tension, mistrust and a worsening public health situation. If this scenario is to be averted it is vital that technology is embraced to develop alternative water sources. The situation could be visualised as a scene from the Mad Max movie where communities guard their precious water supply. Water has become the liquid gold as people realise more than ever it is one of the essential ingredients for life. The water supply system is highly vulnerable to outside security threats, although the consequences could probably not make the situation much worse.

9.9. Other scenarios

A number of other researchers and groups have written scenarios about water utilities and water supply. Some have used different key uncertainties to this study and some the same, but none in a combination of the same two key uncertainties; some scenarios have a global focus and others use a quantitative research paradigm. The following is a brief discussion of some of the other scenarios presented in the literature.

9.9.1. The Australian Science and Technology Council (ASTECC) scenarios (ASTECC 1995)

This is probably the most relevant study to this research. Completed ten years ago the aim of the study was to identify the science and technology requirement of the Australian urban water industry to address issues facing urban water supply. The time frame for the scenarios was 2045. Four scenarios, Market World, Eco-Event, Public Health Crisis and Slow Deterioration were developed.

The ASTECC (1995) study focused on technological solutions whereas this study considers the level of technological innovation and uptake of that innovation to solve the issues facing urban water supply, rather than specific technological solutions, in an environment of plentiful or scarce water availability. The availability of water is not a key focus of the ASTECC (1995) study and a major difference from this study. Two key elements have changed since the ASTECC (1995) study. One is that most major cities in the southern part of Australia now have some level of water restrictions. Rainfall has reduced the runoff to reservoirs which are now at almost record low levels. The second issue is that the focus on the privatisation of water utilities in Australia has waned. Some might argue that the commercialisation of water utilities is merely the a step on the way to privatisation, this is supported by the data and discussed in section 9.3.3 above; however, the focus now seems to be more on public/private partnerships and utilities operating on a commercial basis.

An outcome from the ASTECC (1995) study was the recommendation that the water cycle must be considered holistically rather than as individual components such as urban water supply.

9.9.2. The Rocky Mountain Institute scenarios (Pinkham & Chaplin 1996; Pinkham 1999)

The Rocky Mountain Institute (RMI) developed scenarios for the USA urban water industry in 1995. The scenarios were titled Mandate, Approaching Apocalypse, Seeking Camelot and Off to Market. Their time frame was 2010 which the researcher considers short for the water industry because of the long term planning

horizon. RMI used the Federal Government's role in the water industry, as a key uncertainty in their scenarios, to investigate policy making powers and responsibilities. At the time of their scenarios, 1994, US Congress role was unclear, unpredictable and shifting due to elections in 1994 which probably justified the short time horizon of 2010 for the scenarios. The other key uncertainty used for the RMI scenarios was the financial environment in terms of the cost and availability of capital. Both of these key uncertainties were issues raised in this study but not considered to be the key uncertainties. The RMI's goal was to generate dialogue about forces outside the control of key stakeholders in the water industry.

9.9.3. The Australian Academy of Technological and Sciences and Engineering (AATSE) scenarios (AATSE 1999; Thomas 1999)

The Australian Academy of Technological Science and Engineering (AATSE) describe three scenarios in their report 'Water and the Australian economy'. The time horizon for the scenarios is 2020, taking a base year for data of 1995; the scenarios are named Trend Scenario, Non-Adaptive Scenario and Adaptive Management Scenario. The focus is on water availability and how industry might manage with water shortages being experienced in the southern part of the country and growth, by either continuing as at present and the consequences of that, or, adapting to change whereby water trading plays a major role and the research needs to adapt. The focus of the study was on economic growth within the availability of water resources. The study used a simulation model called MONASH to develop the scenarios. As such they are not scenarios in the context of scenario planning used by this study.

9.9.4. The American Water Works Research Foundation (AWWRF) scenarios (Means III et al. 2000a; 2000b; 2002; Means III 2001)

The American Water and Wastewater Association Research Foundation commissioned a study to identify the strategies US water utilities needed to adapt to trends in the USA water industry. Sixty trends were identified and used to develop scenarios named Business as Usual, Rise of the Oligopoly, Consumer Rules and The Empire Strikes Back. The seven major trends were infrastructure replacement costs, increasingly stringent regulations, industry restructuring, increasing community expectations, transforming workplace, technological innovation and water resource management. It is interesting to reflect that all of these issues emerged during data gathering for this study.

9.9.5. The Kassel World Water Series scenarios (Alcamo, Henrichs & Rosch 2000)

These scenarios, to a time horizon of 2025, focused on the global situation with regard to water availability. Three scenarios named Business As Usual, Technology,

Economics and the Private Sector and Values and Lifestyle were produced using a simulation model called WaterGAP. The core issue was the amount of water used for irrigation, the largest user and how to achieve a sustainable water world. The issue of water availability is a key issue for this study and whilst acknowledging that irrigation is the major user of water in Australia, it was not a key focus for this study.

9.10. Summary

This chapter began by describing the steps taken by the researcher to develop 18 categories that the data revealed were key uncertainties, uncertainties, concerns or issues for Australia's urban water supply industry. The discussion of each of these categories drew on the data, theory and literature to evaluate each category against van der Heijden's (1996) organisational business environment model in order to select a category of data that was the most uncertain for the urban water supply industry and a category that might have the most impact. These two categories of data were Water availability and Technological change. These two categories were then used as in a scenario matrix as a basis to develop four scenarios for the future of Australia's urban water supply industry. The scenarios were named '*Decadent water use*', '*Smart water world*', '*Muddy waters*' and '*Mad Max water world*'. The next chapter, Conclusions and future research, draws on the scenarios and data as a basis to determine the *critical issues for the future of Australia's urban water supply industry* and therefore addresses the aim of this study.

CHAPTER 10 – CONCLUSIONS AND FUTURE RESEARCH

'Irrigation of the land with seawater desalinated by fusion power is ancient. It's called rain.' Michael McClary, (Moncur 2004).

10.1. Introduction

This chapter presents the conclusions from the data analysis of this study. It brings together the biological metaphor as discussed in the literature review, the scenarios developed from the research data and the theory of chaos and complex adaptive systems in the writings of Pascale (1999) and others (Boulding 1987; Miller 1993; Beinhocker 1997; Pascale, Millermann & Gioja 2000). The concepts are used to model and develop a theory about the Australian urban water supply industry.

The conclusions from this study are on different levels. There are critical issues at a practical level that were discussed with participants during interviews and there are critical issues underlying these that have emerged from analysis of the data to form a theory about the urban water supply industry. In addition the study raises some critical questions about the nature of water services. The scenarios presented in the previous chapter are used to support the conclusions; however their most important purpose is as a basis for dialogue amongst water industry stakeholders as to how society in Australia wishes to have water services provided in the future.

Water is a basic resource that is essential for life as we know it. We enjoy the amenity that water provides, have a water culture and in most urban situations take it for granted, clean water comes out of the tap when we turn it on and wastewater is taken away conveniently and hygienically. But do we, in the western world, value water and water services enough and are water services being provided sustainably? This study suggests we do not as has been outlined in the discussion chapter and will be further proven in this chapter.

Approximately 1.5 billion cubic kilometres of water covers over 70% of the earth's surface of which only 3% is fresh water and 75% of this is frozen as ice. Life consists primarily of water, the human body consists of 65% water and a potato is about 80% water. Water is continuously circulated within the biosphere, the water molecules that were drunk by the dinosaurs are being drunk by people today (Brand 2001). Water is clearly essential to life as we know it.

Ultimately water quality and services are a public health issue which is partly why, historically, water utilities came into being; it is an essential service and must be available to all. The safety of urban water supply is not negotiable.

This study shows that the Australian urban water supply industry is in stable equilibrium. By using the biological metaphor and combining the concepts of

organisational learning, scenario planning methods and concepts from complex adaptive systems theory, it is possible for the water industry to imagine a different and sustainable future and therefore take strategic steps to have a favourable outcome. The study suggests that the industry's external environment is changing faster than the industry itself and that the prevailing technological paradigm is becoming too inconvenient and is causing costly side effects.

10.2. Conclusions

10.2.1. Urban water industry, complex systems in equilibrium

From a technical perspective the concept of supplying water is simple and has been in operation for thousands of years. Water is moved from a source via channels and pipes by gravity and pumping. Similarly wastewater is removed from its point of generation by pipes and disposed of in the environment by dilution. The traditional paradigm has been that all water supplied to the community should be treated to drinking water quality and delivered in one system of pipes irrespective of the use to be made of water (Davis 2000). However, the issues for water utilities and the business environment they operate in are far from simple. The previous chapter of this study illustrated that the issues concerning urban water supply are all interrelated. It was difficult during the course of this study to discuss one issue in isolation. The business of urban water supply is therefore a complex system.

Water utilities in Australia operate as natural monopolies within regulated licence areas and until recently they were government owned agencies. Since the introduction of the COAG Water Reform Agenda water utilities have undergone a transformation from the traditional concept of a publicly owned service provider to service providers operating under commercial principles. There are now two part tariffs, regulatory functions are separate from service provision, and there is a concentrated focus on costs and financial returns. An objective of the COAG reforms was to promote competition to achieve realistic prices and better water services to customers. This is a new operating environment for water utilities, a new corporate environment. The data revealed that water utilities were concerned and had uncertainties about aspects of this environment; particularly in regard to regulation, which prior to the reform agenda was in their operating environment. Now changes in regulations imposed on water utilities impact on their costs. Obviously there is a financial uncertainty, but is there also an uncertainty about loss of control with increased competition? The concept of user pays is displayed in the various tariff structures around the country which means that from a philosophical perspective water is now being treated as a commodity as opposed to a common good. However, the issue of equity must be addressed to ensure services are provided to all parts of the community irrespective of people's ability to pay.

A critical issue and fundamental question is whether the philosophical perspective of water as a common good, as displayed in the commercialisation of water services, fits with society's philosophical perspective about water?

The reason why this is important is because if the commercialisation of water services is different from the way society views water, there will be miss-trust and conflict between water utilities and the community when the actions of utilities do not match the deep seated values of the community.

Traditionally water utilities have been dominated by a conservative engineering focus. Conservative because water quality and supply is a public safety and health issue, and engineering focussed because of the pipes and pumps technical paradigm of water supply and the lack of competition. This is interpreted as equating to Morgan's (1997) machine metaphor of some organisation. Morgan (1997) says that some organisations can be mechanistic at least in parts of their operations, particularly where safety is a premium and be successful in such areas. However, this is at the expense of adaptation to change, unquestioning bureaucracy and dehumanising employees. The urban water industry has been successful in implementing the pipes and pumps technology but has this left these mechanistic organisations unable to adapt to a changing business environment?

Adizes (1988) adopts a biological comparison to describe corporate lifecycles. Adizes (1998) argues that the growth and aging of organisations is a function of the relationship between flexibility and controllability. When organisations are flexible they are growing and age with increasing control. As the organisation ages it has increasing difficulty in dealing with problems as it becomes less flexible. The research data suggested this is characteristic of the water industry. The industry has past the Prime position in Adizes (1988) corporate life cycle model and is beginning to display the characteristics of aging as opposed to growing. Adizes (1999) uses the term Aristocracy in his model of corporate lifecycles as organisations begin to age. The water industry shows characteristics of Aristocracy. According to Adizes (1999) these characteristics include: -

- change is minimised;
- the past predominates over future vision;
- control systems, benefits and facilities are introduced;
- have formal procedures;
- is risk averse at the expense of entrepreneurship; and
- people are rewarded for how they do things rather than what they do.

Pascale (1999) argues that equilibrium is a constant threat to established organisations. Equilibrium is hidden in strong values in the organisation's culture and vision; the further an organisation is drawn into equilibrium the harder it is for the organisation to adapt to external changes. Not only do organisations in equilibrium find it difficult to adapt but as Pascale (1999) says, stable equilibrium is a precursor to death. Notwithstanding, Miller (1993) says if an organisation is fully aligned with its environment even simple ones can survive.

A critical issue is whether urban water utilities are aligned with and connected to their external environment?

Miller (1993) argues that over time simple organisations behave more like machines rather than as an organism resulting in the loss of randomness, knowledge and the iconoclasts that question the organisation's prevailing world view. Flexibility is diminished, creating a barrier to organisational learning and adaptation.

The research data from this study suggested that this describes the Australian urban water supply industry. The interview data confirmed that the industry is conservative with a dominant engineering focus and strong values. Water utilities have become simple, stable organisations in equilibrium.

Pascale (1999) notes four criteria for complex adaptive systems: -

1. The system must not be hierarchically controlled, but have many parts working in parallel. Water utilities tend to be hierarchically controlled as is the whole industry and the relationship between utilities and regulators.
2. A system continually moves its building blocks to form multiple levels of organisation. Water utilities do not show characteristics of self organising to build new patterns.
3. The system shows entropy, winding down over time unless new energy is injected. Water utilities have an aging work force with an increasing number of employees retiring and fewer entering the industry, the system is losing energy.
4. Systems have pattern recognition that is used to anticipate the future and learn to recognise change. Water services are still operating under the traditional paradigm of pipes and pumps but are they anticipating the future or are they still planning the same types of water services as in the past?

The urban water supply industry does not display the characteristics of a complex adaptive system.

10.2.2. Urban water industry, adaptation and evolution

In recent years the environment in which water utilities operate has changed, change that is becoming faster. There is increased demand for water because of population growth in cities, less rainfall resulting in low water storage levels in reservoirs, community opposition to the construction of dams, increasing speed of technological change, community awareness of water issues through the media and the internet, ever increasing amounts of information available, community concern about the environment and more stringent environmental regulations. There are a number of trend changes in society as a whole; demographics, attitudes, values, and behaviours that are generational changes. Society's values are changing. People are more environmentally and social equality conscious. Society is moving from the growth at any cost phase, into the next era where people are life style conscious; a society, where quality, health, safety and convenience are important.

The interview data noted an increasing rate of change in many parameters that impact on water utilities, little is slower. When change in the external environment is faster than internal change an organisation is in trouble (Pascale, Millermann & Gioja 2000).

A critical issue for the water industry is will this rate of environmental change out pace the rate of change and adaptation of water utilities?

Does this statement mirror the miss match between short term political goals and long term planning for water services as discussed by interview participants?

Boulding (1987) writes that Darwin's theory of natural selection proposed that species that evolve or adapt to their environment survive. Using the biological metaphor, people in an organisation are the genetic material that creates variety, life is renewed as people leave and enter the organisation. Social norms, corporate values and traditional paradigms counteract diversity in an organisation (Pascale 1999). If the genetic material in organisations is not revitalised, the ability for the organisation to create variety fades.

A critical issue for the water industry is to rejuvenate its genetic material through the work force as people retire and leave, taking information with them.

Pascale (1999) in discussing cybernetics and the law of requisite variety argues that for an organisation to survive it must encourage internal variety otherwise it will not be able to deal with variety from an external source. The water industry's external environment is changing, at an increasing rate with a commercial agenda, community expectations and the availability of water.

A critical issue for water utilities is to have internal variety in its work force by being dynamic, multi skilled and multi disciplined.

Beinhocker (1997) writes that codes, conduct and economics guide complex systems however, if the menu of rules is fixed the system stays complex, if the rules evolve then the result is a complex adaptive system. To survive an organisation must evolve faster than its market innovates and adapts. In nature the evolution of species is a balance between standard designs that work and enough variation for future innovation and adaptation. This is applicable to organisations where at the edge of chaos an organisation that is conservative and at the same time radical has the maximum fitness to survive in its business environment. Employees need to be carefully chosen, have access to ongoing training and be multi skilled.

10.2.3. Urban water industry, learning from recognising danger

Pascale (1999) writes that nothing innovative emerges from organisations with a high level of order and stability. At the other end of the continuum total chaos is too random to unite. Pascale (1999) argues that generative complexity is at the edge of chaos where little changes result in major impacts, the edge stimulates awareness. As discussed in the literature review of this study, pain causes organisations to change, the edge of chaos is where organisations feel pain and is where organisations learn and adapt and therefore survive. They become complex adaptive systems (Pascale 1999). From the perspective of intelligence, organisations have an advantage over nature because theoretically on recognising impending danger they can take action to avoid the encounter. The decline in corporate longevity, however, would seem to suggest that organisations do not take action or do not recognise the dangers, or, are organisations reluctant to change from their familiar environment (Pascale, Millermann & Gioja 2000)?

A critical issue for the water industry is to be able to visualise impending dangers.

Scenarios can help organisations to visualise impending danger and therefore respond before it is too late. Water utilities need entrepreneurial risk taking in order to learn from successes and failures. Admittedly this is difficult when water quality and public health is at stake. The future, visualised in scenarios, is a tool to change mind sets, take action and therefore alter the future.

The challenge and critical issue for the urban water industry is to have established standards and routines as well as having diversity.

Water utilities have to be conservative because public health is at risk. This could be self fulfilling and why there has been little change in the industry. At the same time they must be innovative in the services that are provided or face increasing

competition. Since commercialisation, water utilities are now generally governed by Boards that are accountable, and risk averse and adopt the precautionary principle. In a non-competitive environment there are negative implications for an organisation's ability to learn and adapt and change mind sets to develop a new paradigm about water services. Pascale et al. (2000) say that learning disabilities arise from conflict avoidance. Whilst there may not be any real competition within the water industry at present, it is not far away as providers of new water services begin to emerge and enter the market.

A critical issue is the readiness of water utilities for competition.

10.2.4. Urban water industry and attractors

The water industry is bound by the traditional technological paradigm of water services; it is in the culture of the organisations supplying the service. Changing organisational culture is a slow process.

A critical issue for the water industry is to change the traditional culture faster in front of a water crisis.

Technological innovation is part of the answer and requires entrepreneurial risk taking whilst being cognisant of safety and public health issues.

Perhaps the critical issue for the Australian urban water supply industry is to move from stable equilibrium to become a complex adaptive system.

Is it possible to move the water industry to the edge of chaos?

In doing this there will be, from the transactional environment, political barriers, and from water utilities internal environment barriers from the prevailing culture. Yet change is required within the industry.

In navigating the edge of chaos Pascale et al. (2000) discusses attractors that act as a compass to influence the direction an organisation takes. Strange attractors emerge in a hostile environment where survival instincts are required when an organism interacts with its environment. The strange attractor is like a magnet. It changes behaviour in the present, meaning the future is altered. Strange attractors emerge from facts in the organisation and its environment, when what is there takes form. They flourish in a challenging environment and are a catalyst for innovation. In terms of the water industry, will the combination of more information, the power of electronic communication and community awareness, the quest of sustainability, water shortages and the quest for the delivery of safe drinking water, and removal of wastewater conveniently and hygienically, lead to technological innovation, communication and efficient water services coalesce to form a strange attractor? The strange attractor is a collection of emotions,

aspirations and expectations to fulfil community needs and wants for water services.

Pascale et al. (2000) discusses other attractors and perhaps the one most applicable to the water industry is a point attractor that attracts an organism to a stable position and eventually total stillness. The water industry is not in a hostile environment of competition and therefore the environment for the strange attractor to develop is not fertile. The water industry needs a strange attractor to be the catalyst for innovation. The scenarios in this study alert the industry to the impending dangers.

What is the strange attractor that will change the water industry's behaviour and therefore change the future?

10.2.5. Urban water industry and the scenarios

The scenarios in the discussion chapter used 'Water availability' and 'Technological change' as the two key uncertainties facing the future of the urban water supply industry. The previous chapter argued why each of these key uncertainties was selected for the scenario matrix.

The 'Decadent water use' scenario portrays a future where there is plenty of water resulting in water not being valued by the community. The focus of the water industry is to keep the community satisfied with cheap services and without water restrictions. The scenario highlights the importance of technology for efficient and cheap water supply services operating under the traditional paradigm of pipes and pumps whilst these work, there is no pressure from the community to change, utilities are still engineering focused which does not attract new genetic material to the industry. The scenario relies on technology to keep services cheap. It raises the question about the value the community puts on water as a necessity for life and the discretionary use of water? Do utilities understand the community's needs and wants? In this scenario the water industry is in stable equilibrium and may not be able to withstand a major external shock. There is also a question over the sustainability of the services.

Information from Australian water utility annual reports (Melbourne Water 2002; Power and water 2002; Sydney Water 2002; Water Corporation 2002; SAWater 2003; ActewAGL 2004; Brisbane City Council 2004 and Hobart water 2004) reveals that urban water utilities focus on maintaining water supply to the community despite some regions of the country experiencing drought conditions and imposing water restrictions. Unlike this scenario, where water was in abundance and not valued by the Australian community, many parts of Australia have, in the last decade, experienced reduced rainfall and drought conditions that have impacted on the availability of water for urban use. Australian water utilities have engaged in

major educational programs to encourage water saving by the community. In addition Australian urban water supply utilities have focused on augmenting new water resources to address water shortages. Technology is used to keep costs down however, in most instances profits are increasing. There is a heavy focus on commercial outcomes.

The 'Smart water world' scenario focuses on a holistic management of water, the removal of jurisdictional boundaries and technology to provide safe alternative water sources. The community have come to value water. Government takes a strong lead in regulations because of the need to protect public health. There is a change to a new paradigm for water services that is diversified to meet the community's needs. The scenario highlights the need for community consultation, education and involvement in decision making. The adaptive water industry attracts new people to the workforce meaning water utilities learn and become part of a knowledge industry. This scenario requires vision for the industry to become a complex adaptive system with the flexibility to address external variety.

In addressing this scenario similarities with the scenario and the strategic objectives of some Australian water utilities are seen in that they have instituted wastewater recycling schemes and have investigated desalination projects however, generally the paradigm of urban water supply remains unchanged. Australian water utilities report on improving customer relationships and education through for example web site information and involvement in community events to gain community trust and increase awareness.

The 'Muddy waters' scenario focuses on the availability of funds for the repair and maintenance of infrastructure. In an environment of plentiful water the infrastructure has deteriorated to the extent that water services have become unreliable. The price for water services has risen to raise funds but the community does not value water and mistrusts utilities because they are not being kept informed. Water services under the traditional paradigm have become expensive so people try to find their own solutions; these are ad hoc and result in public health issues. The lack of technological innovation and uptake has meant that water and wastewater treatment is costly, consequently there are water quality incidents compounding the public health situation. Government distances itself from the problem by privatising utilities. The scenario highlights the need for research and technological innovation to solve issues and the need for community consultation and education about water issues. Water services under this scenario are not sustainable.

In this scenario the availability of funds for repairs and maintenance are described in the strategic objectives of Australian water utilities report on asset maintenance

and statistics on interruptions to water services such as supply interruptions and pipe blockages. Increasing profits should address the availability of funds for asset maintenance however, the dividend return to owners, i.e. governments, has the potential to limit funds available. Some Australian water utilities report on their level of innovation to address the prevailing paradigm of urban water supply.

In the 'Mad Max water world' scenario water shortages have reached crisis point. Technology has not come to the rescue to develop alternative sources of water. Water consumption has been curtailed through enforcement and high prices, which has dramatically reduced water use but at the same time heavily impacted on water utilities revenue. Consequently there are no funds available to maintain the water supply system or for augmentation. Public health becomes a major issue as the community adopts its own answers to the problems. Water has certainly become a very precious commodity to the extent that social conflict has arisen to secure the precious resource. In this scenario the environmental agenda is neglected. Again technology is a critical issue if this scenario is to be avoided irrespective of the economic and financial situation. This scenario depicts a system in crisis.

As in this scenario Australian water utilities operating in drought areas have imposed water restrictions in order to curtail water usage and some have developed plans for longer term demand management. There is some focus on alternative sources of water such as desalination however, information from Australian water utility annual reports (Melbourne Water 2002; Power and water 2002; Sydney Water 2002; Water Corporation 2002; SAWater 2003; ActewAGL 2004; Brisbane City Council 2004 and Hobart water 2004) does not indicate strategic planning for a crisis situation.

10.2.6. Urban water industry and water availability

A key uncertainty for the scenarios was the availability of water primarily because of climate change. There is scepticism about climate change at all levels of society. There are uncertainties about the rate of climate change and whether change will accelerate. Irrespective of this it is clear that parts of Australia are experiencing less rainfall now than in the past.

A critical issue is for the water industry is to come to terms with and adapt to a finite water resource and increasing demands for water.

Whilst there is debate about whether climate change is real or not there is no doubt that less rainfall means less run off to reservoirs, reduced storage volumes and the potential for reallocation of the scarce resources by resource managers. The availability of water is a key uncertainty for urban water suppliers.

The planet Earth is a closed system therefore the amount of water stays the same but it may not all be fresh; it can become polluted and undrinkable, and it may be in difficult locations to access. Society has the technology to address the problem of water availability. An issue arising from this at a practical level is how water utilities will ensure there is enough water to satisfy basic community needs?

Severe water shortages have the potential to put society under pressure meaning there could be increased social unrest. In other parts of the world there have been conflicts over water both historically and recently. This is likely to continue because of increasing population pressures.

A critical issue is to avoid social unrest because of water shortages.

Potential answers are to provide water from alternative sources such as desalination and reuse schemes. Historically the shortage of water has been postulated as causing the demise of ancient civilisations. Whilst it is incomprehensible this could happen in the 21st century, water shortages could impact on the economic viability of some urban settlements. The focus must now be on drought proofing the community.

A critical issue is how the water industry embraces technological innovation as an input to solve water resource issues.

10.2.7. Water services and technology

Technological innovation and adoption was the second key uncertainty used in the scenario matrix for the urban water industry. The scenarios show that technology is vital for the future to provide alternatives to the traditional paradigm of water services and for the efficient and cost effective operation of the service. Water utilities are not the inventors of new technology; this is in the domain of research institutions and the private sector. The water industry has to become technology driven in order to solve issues or face strong competition from organisations that do embrace technology.

A critical issue for the water industry is to ensure there is a secure research framework with a long term strategic focus.

In introducing new technology particularly for alternative sources of water the community must have confidence and trust utilities. Fears about new technology must not be a barrier to its introduction or the existing water supply paradigm will never change.

It is critical for the water industry to have community trust and support.

10.2.8. Urban water industry and communication with stakeholders.

The data from the interviews gave conflicting views about the level of community focus water utilities exhibit. Some consider themselves to be community focused others said the water industry was not community focused. It might be expected that the level of community focus is low based on the lack of competition and the monopolistic character of water utilities. Research by Trainor (2002) into other utilities would seem to corroborate this.

A critical issue is the need for water utilities to communicate with other stakeholders and for community consultation, education and participation in decision making.

In terms of community focus, a critical issue is whether the industry has the skills for community relationship management in the new commercial world.

Most of the time water is a low key issue until there is a crisis such as water shortages or a water quality incident, at which time water becomes headline news. This again falls in the area of community education about water services. Does the community understand about water, what is involved in delivering safe water to the tap, and, the costs?

A critical issue for the water industry is the community's attitude to water.

The increasing sales of bottled water and growing home water treatment industry indicate that the community has lost confidence in public water supply or prefers the convenience of bottled water, or, for health reasons prefer water to sugary drinks.

The community must be kept informed about water issues, educated and be involved in decision making. To be successful the water industry must understand community values and what the community wants, needs and expects from water services.

It is critical that the water industry is community focused to build trust.

Competition will increase the need to be community focused as will the use of alternative sources of water such as recycling wastewater. Without a community focus the water industry can expect to face strong community outrage when things go wrong with water services; especially as the community is constantly learning more about water via the media and electronic sources.

A critical question is whether the rate of community learning is faster than the water industry's willingness to change?

In another area of stakeholder communication the urban water industry must maintain a close relationship with regulators. Regulators rely on water utilities for

information and the industry must provide insight for government in order to have a degree of control over the future of the water industry.

10.2.9. Urban water industry and commercialisation

Water utilities have become commercialised as a result of the COAG reforms. There is upward cost pressure from an increasing focus on water quality, service provision and achieving environmental outcomes. Aging infrastructure requires maintaining and replacing, and water services need to be expanded to new areas. Capital must be paid for and owners require annual dividends. At the same time water utilities are not free to set prices because of regulations applied to the natural monopoly status of water utilities. Commercialism will increase as the competitive environment strengthens.

It is critical for water utilities to have a full range of commercial skills as a private organisation would have in offering a product or service to the community.

Data from the interviews concerning the community's willingness to pay for water services indicated that water utilities are not fully cognisant as to whether higher water price is a real or perceived barrier. The process of setting the price of water in the future must be transparent.

A critical issue for water utilities is the community's willingness to pay for water services.

The researcher suggests that there should be a greater emphasis on the volume tariff for water and sewer use rather than the fixed tariff as a demand management tool. This may have a more positive impact to reduce water consumption. Water utilities are generating good returns, they are viewed as cash cows; but have they become quasi tax collectors?

A critical issue is whether water utilities should make a profit or should water service be provided as an essential service and water treated as a common good?

In terms of demand management the initial impetus from schemes to reduce water consumption will begin to slow at some stage. At this point there will be upward pressure on demand for water as urban populations grow. The solution is alternative sources of water and sustainable water services.

Water sensitive urban design will become critical in the future.

As discussed in the previous chapter, there are a few global water organisations. Whilst the debate about the privatisation of water utilities in Australia has submerged these global organisations continue to pursue acquisitions. They

recognise that water can provide a good return on investment and that this will increase as water becomes valued more as a commodity. Issues in the USA and other developed countries are important because the Australian urban water supply industry is similar and issues happening globally could be mirrored in Australia. Therefore it is important for the domestic industry to understand global trends and issues. The dangers in globalisation are the loss of control of water services, infrastructure and potentially access to water resources. What are the consequences of having the nation's essential services controlled by a global organisation?

A critical issue is for the industry to be aware of global trends.

10.2.10. Urban water industry and government

The water industry operates under three levels of government, federal, state and Local Councils. An issue raised in the data was the different legislation applicable to water supply in each state and territory. This is seen as a barrier to the holistic management of water in this country. The discussion chapter highlighted the need for the holistic management of the water cycle, encompassing not only urban water supply but all water users.

A critical issue is to have nationally coordinated management of the water cycle operating across jurisdictional boundaries.

10.2.11. Water services and mind sets

How many of the people in water utilities spend their time looking at the present and extrapolating from historic data to make forecasts about the future and planning the same technological systems? The data revealed that there was a belief in the industry that there will not be any dramatic changes in the future. There is a need for predictions, but in an environment of change and uncertainty, different tools are needed. The scenarios presented in this study are such a tool. They embrace an organic perspective for strategy development.

It is critical for the water industry to think outside the traditional paradigm of pipes and pumps if it is to avoid crisis management.

An organisation can change thinking away from the traditional paradigm by using scenario planning methods to challenge prevailing mind sets. The scenarios, presented in the previous chapter are stories based on contextualised data from participants. The scenarios serve to illustrate what could happen and they offer challenges and opportunities to the urban water supply industry. Stories allow a degree of contextual development that can generate interest more easily. The exact year of the scenarios is not important, what is important is to have the debate and dialogue about the future urban water supply paradigm and generate awareness

about possible surprises. Scenarios can help the organisation to learn by illuminating the possible dangers and offer a number of options and challenges to create pathways for change. For scenarios to be effective it is not the story that is important but the changes to manager's mental models (Flowers 2003). This methodology gives greater flexibility to an organisation rather than relying on a single strategic vision for the future developed from a mechanistic perspective. The scenarios can accelerate the rate of organisational learning. If from this study there is constructive dialogue within the industry about these issues then an un-stated goal of this study has been achieved.

The scenarios are not presented as predictions about the future; the future will almost certainly be variations on the underlying themes, and vary in different climatic regions of the country. For example parts of northern Australia could have a future with plentiful water resources whilst southern regions may, and appear to be having, reduced natural water resources.

Nothing fails like success because it means an organisations stops learning (Boulding 1987). As noted in the data the answer is in the water industry's own hands. It knows the prevailing technical paradigm of water services must change. The future will be different and change may be dramatic.

A critical issue is for the water industry to be prepared and adapt to a different future.

What if the community disengaged from water services and relied on alternative services provided by competitors to water utilities? Providing the services are priced to meet the community's willingness to pay, are convenient and safe they will offer an alternative to the existing water service.

The conclusions from this study are not meant to castigate the water industry. Generally water utilities provide a good service to the community. The conclusions are meant to assist the industry to a better and sustainable future. By considering the scenarios, questions are raised about how society values water, how it uses water and how water services will be funded in the future?

Will the urban water supply industry hear the approaching rapids as it paddles down the river of providing traditional urban water services, or is it prepared to have a different and sustainable future? Will this or could this be achieved by becoming a complex adaptive system?

10.3 Summary of critical issues

The critical issues discussed above in section 10.2 Conclusions can be distilled into six major areas of criticality for the Australian urban water supply industry.

10.3.1. Determining the nature of water services

Does the Australian urban water supply industry's view of water services fit society's view of water services in terms of a commercial commodity or a common good? Do we value water? Should the industry make a profit and operate under commercial principles in a competitive environment or provide an essential service?

10.3.2. Changing corporate culture

Organisations providing water services need to be flexible and adaptable to a changing external operating environment by becoming complex adaptive systems and avoid the threats of conservative equilibrium. The industry needs to determine how it will learn and adapt challenge the prevailing paradigm of water services and be ready for a different future.

10.3.3. Rejuvenating corporate genetic material

The Australian urban water supply industry needs to accumulate the skills to meet the challenges of the external environment and become multi disciplined through variety in the workforce to address commercial, customer relationship management and global issues.

10.3.4. Adapting to climate change

The Australian urban water supply industry needs to adapt to changing climatic conditions and use technological innovation to address the availability of water to meet society's demands and avoid social unrest arising through water shortages.

10.3.5. Improving community orientation

The Australian urban water supply industry must be community focused and build trust by engaging the community, educating the community and understanding the community's values and attitudes to water such as the community's willingness to pay. The industry needs to question whether it is in concert with society's changing values.

10.3.6. Managing the water cycle holistically

Water must be managed holistically across Australia; jurisdictional boundaries need to be put aside.

10.4. The metaphor

Water utilities are like dinosaurs. They are happily living as monopolies in an environment with no predators or competition and are successfully filling an ecological niche in the business environment. They are perhaps unaware of the impending dangers and looming crisis. Can the environment sustain the dominant urban water supply organism? Will there be enough water from traditional sources

to sustain the system or will this eventually be their down fall and extinction. Will there be an external shock, on a global scale, outside the water industry's control such as the asteroids that led to the extinction of the dinosaurs. Some dinosaurs adapted to their environment and evolved to become different species and survived the changes; others did not and became extinct because the rate of change was too fast. The species that adapted and evolved looked and behaved differently to their ancestors but still provide the service of being part of the ecological system, so perhaps the critical issue is:-

What form does the urban water supply industry have to evolve into to satisfy the community's demand for water services in the future?

10.5. The theory

The study suggests that unless the water industry adapts and evolves to the new environment it may not survive in its present form. This is because the environment in which urban water utilities operate has changed, and is continuing to change. In order to survive the industry needs to become a knowledge and innovative industry through its workforce. The genetic material in the organisation needs revitalising.

Plenty has been written in the literature, the rhetoric, about how urban water supply could be in the future but on the ground, the reality seems to be that the traditional paradigm of urban water supply dominates. Little has changed.

Nature is a wonderful thing. Organisms adapt and evolve to fill environmental niches, the needs and wants of nature. If an organism becomes extinct and fails to fulfil a niche, another organism moves in to do the job. Similarly with the urban water supply industry. Water supply companies were initially established to fulfil the need of a community that wanted the convenience of water delivered to their homes. Wastewater services were developed for the convenient and hygienic removal of wastes. Public utilities filled the niche when private organisations could no longer afford the capital expenditure to maintain the service. These community needs and wants remain but there is a change in community values that require the services to be sustainable with equity for all. Water utilities must provide these services on a commercial basis. The business environment of water services has changed; will water utilities survive in their present form? Figure 10.1 depicts a model, in the context of the biological metaphor, of how urban water services might be in the future. It is meant to illustrate that drinking water and wastewater are linked by the 16 categories that the data revealed to be key uncertainties, uncertainties, concerns and issues. For example as climate change impacts on the availability and quality of natural sources of water then the reuse of wastewater to supplement drinking water supplies becomes more important. It is important for

the industry to change because the environment in which the industry operated has changed and the industry must adapt. Water services cannot stay the same as they have for the last 150 years because as we are all learning the prevailing paradigm is unsustainable.

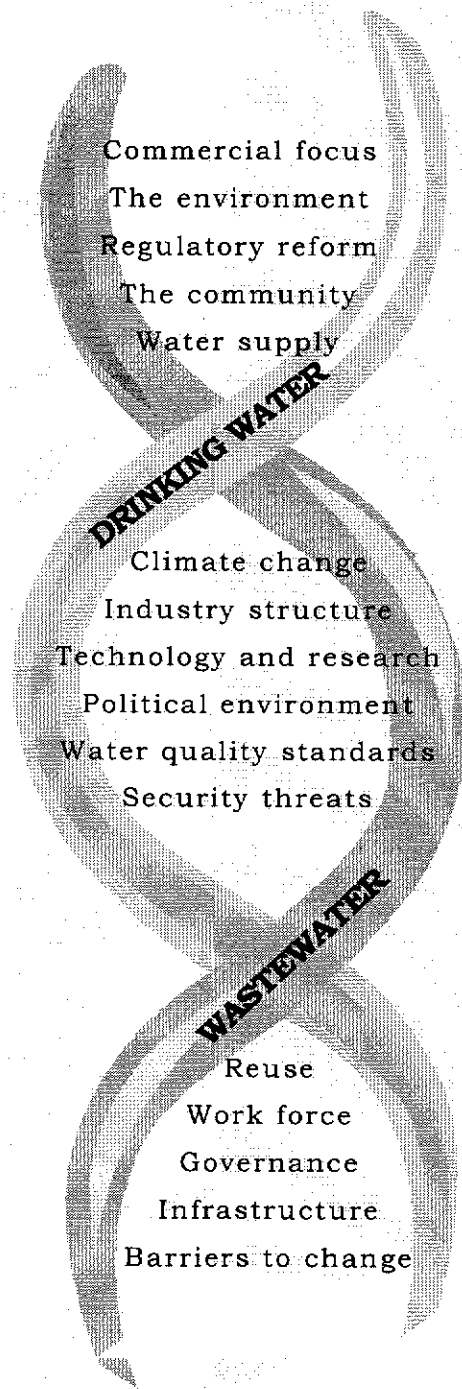


Figure 10.1. Model of future urban water services

10.6. Study limitations and opportunities for future research

This study raises a number of questions that could be the focus for future research.

1. Community attitudes and behaviour to water and water use. This study raised a question over whether water utilities are fully aware of the community's attitudes to the precious resource of water and the community's behaviour towards water use. Understanding the community's attitude to water is important if the water industry is to attempt to change behaviours. One respondent commented on the lack of rigorous social research in order to understand the community's behaviour. This presents an opportunity for further qualitative research.
2. Community attitudes to recycled water. One of the solutions to address water shortages is to treat and recycle wastewater, as discussed in chapter nine. Recycled water is used in many parts of the world as part of the drinking water supply. However, in Australia recycled water is not returned to the water supply system as drinking water, but is used to irrigate open spaces such as golf courses and ovals. Many people in Australia have an aversion to drinking recycled water, the so called 'yuck factor' (ABC Television 2004c), but do we really understand why? This presents an opportunity for qualitative research to understand the perceived barriers that people have to using recycled water for drinking. It is important to understand why so that water utilities can use the wastewater resource, which consists of 99.9% water.
3. Community attitudes to alternative water services. Technologies have been developed and continue to improve water saving; for example composting toilets. If these technologies provide clean, safe and hygienically convenient alternatives to current technologies then what are the community's attitudes and barriers to using them? The community has accepted low flow shower heads and dual flush toilets, but what are the community's attitudes towards dual pipe systems? This is another area for qualitative social research.
4. The issue of the price of water and the community's preparedness to pay for water services was raised in subsection 9.3.1. Community outrage. The community has shown a preparedness to pay for bottled water at approximately 1000 times the price of tap water. However, does the water industry understand community attitude towards paying for water? This presents a further opportunity for qualitative social research in the area of the community and critical issues concerning urban water supply.

Many of the issues raised by this study relate to the relationship between water utilities, governments and the community. They are about perceptions, attitudes

and behaviours that require rigorous qualitative research to understand, give insight and inform society, as a whole, about water use. The ultimate goal must be to provide sustainable water services for future generations.

This study does not aim to suggest, from a technical perspective, how water services should be provided, but, and the importance of this study is to highlight the critical issues for the future of the water industry and stimulate debate about water services. A change in the paradigm for providing water services means that the traditional methods for developing strategy from a mechanistic perspective may not be applicable. A different approach, from an organic perspective, based on the scenarios planning method may be more applicable for a different future.

It is approximately ten years since the Australian Science and Technology Council's study and scenarios were completed. This study could be used as a basis to develop a new set of scenarios by extending this study from the desk top to a full scenario exercise involving the Australian water industry. The fact that this is a desk top study and has not involved representatives from the water industry in one forum is a limitation to this study in that the researcher's views influence the outcomes. However, the researcher has referred, throughout the scenario development, to the interview material in order to strongly ground the conclusions in the data. Notwithstanding, the scenarios in this study are preliminary or skeletal scenarios developed through interpretation of data by the researcher, they are therefore influenced by the researcher's values. These scenarios are open for debate and reinterpretation as new data becomes available. Indeed, since the data were gathered for this study there has been ongoing political debate and issues raised in the media about water services in Australia.

The researcher hopes that this study has raised some very important and critical issues for the urban water supply industry to consider and address in order for water, this precious resource, to be available to and satisfy the need of this and future generations.

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