CRANFIELD UNIVERSITY

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Improved Water Safety Planning: Insights into the Role of Organisational Culture

School of Applied Sciences

PhD
Academic Year: 2009 - 2010

Supervisors: Dr. Jen Smith and Professor Simon Pollard
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ABSTRACT

Unsafe water, as many recent outbreaks have shown, has the potential to cause widespread illness and even death. Water Safety Plans (WSPs) are advocated as the best way of ensuring good safe drinking water using a risk management approach. Using a case study approach to generate qualitative data, organisational culture and WSP development in water suppliers of varying size, development and structure was studied to look for examples of best practice or barriers to effective implementation.

Despite WSPs being promoted since 2004, suppliers are still experiencing challenges in implementation, with deeper organisational culture barriers prevalent such as: lack of awareness and recognition; uncertainty; complacency; poor internal relationships; competing priorities; and contrasting internal cultures, in addition to the commonly espoused reasons of a lack of time or resources. Concern was raised that the public health motivator of WSPs was becoming lost, as a wide range of additional 'added value' drivers and benefits were identified such as cost savings or commercial drivers. This was echoed in broader organisational missions and drivers identified; whilst may employees still identified quality and public health as important, more formal declarations often prioritised other areas.

In response to identified organisational culture barriers, a 'taxonomy' of positive cultural attributes and a number of practical tools were developed that may assist suppliers in developing a supportive organisational culture for sustainable WSP implementation. These positive elements included: managerial commitment; learning culture; effective internal and external relationships; accountability; open reporting culture; continual improvement culture; empowerment of staff; organisational commitment; proactivity; leadership and advocacy; mindfulness of public health; image and competitiveness. A number of recommendations can be made to those wishing to implement WSPs. Primarily, it is urged that organisational culture and how it can impact on effective WSP implementation should be considered. Perceived lack of time and resources may actually be representative of deeper cultural barriers, and recognise that WSP implementation is more than just following a set of instructions, it will require instilling a water safety 'culture' within the organisation.

<u>ACKNOWLEDGEMENTS</u>

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Abbreviations

ADWG	Australian Drinking Water Guidelines
AS/NZS	Australian/New Zealand Standard
AWWA	American Water Works Association
BC-CMA	Bonn Charter Capability Maturity Assessment
CCP	Critical Control Point
CDC	Centre for Disease Control
CEO	Chief Executive Officer
CMM	Capability Maturity Model
GM	General Manager
HACCP	Hazard Analysis and Critical Control Point
HRO	High Reliability Organisation
IACCM	International Association for Contract and Commercial Management
IGRC	International Risk Governance Council
ISO	International Organisation for Standardisation
IWA	International Water Association
MoH	Ministry of Health
NHMRC	National Health and Medical Research Council, Australia
P-CMM	People Capability Maturity Model
RMA	Risk Management Association
RM-CMM	Risk Management Capability Maturity Model
WEDC	Water, Engineering and Development Centre
WHO	World Health Organisation
WSP	Water Safety Plan

WTP   Water Treatment Plant

LIST OF PUBLICATIONS AND PRESENTATIONS

Note: The author of this thesis was married during the course of her study and some publications are listed under her maiden name of Corinna Edgar.

Publications

Edgar, C. and Smith, J. (2008) *"Partnering with IWA to provide technical support for water suppliers",* Drinking Water Safety International. Vol. 1. Issue 1. February.

Edgar, C; Omar, Y; Webster, J. and Smith, J. (2008) *"Network partner research update",* Drinking Water Safety International. Vol. 1. Issue 2. September.

Omar, Y; Edgar, C; Pollard, S. and Webster, J. (2009) *"Lessons for WSP pilot projects",* Drinking Water Safety International. Vol 1. Issue 3. July.

Pollard, S; Smith, J; Edgar, C; Williams, T. and Breach, B. (2008) *"Putting the Bonn Charter into practice: Addressing the challenges to water suppliers",* Water* and Sewerage Journal. Issue 3.

Summerill, C. and Smith, J. (2010) *"Organisational culture influences on WSPs: tools to assist suppliers",* Drinking Water Safety International. Vol 1. Issue 4.

Summerill, C; Smith, J. and Pollard, S. (2010) "Organisational culture and water quality risk management" Science of the Total Environment, Vol 408. No. 20. pp.4319-4327.

Summerill, C; Smith, J; Pollard, S. and Williams, T. (2010) "Securing executive buy-in for preventative risk management – lessons from WSPs. Accepted for presentation at IWA World Water Congress, Montreal, September 2010.

Summerill, C; Smith, J; Webster, J. and Pollard, S. (2010) *"An international review of the challenges associated with securing 'buy-in' for water safety plans within providers of drinking water supplies",* Journal of Water and Health. Vol. 8. Issue 2.

Summerill, C; Pollard, S.J.T.; Smith, J.A.; Breach, B.; Williams, T. (2010) *"Securing Executive Buy-in for Preventative Risk Management – Lessons from Water Safety Plans.* Presented at IWA World Water Congress, Montreal, September 2010.

Posters and presentations

Edgar, C. (2008). "*Global progress of implementing risk management practices in utilities*", workshop presentation at IWA World Water Congress, 8th-12th September, Vienna, Austria.

Edgar, C. (2009) "*The IWA Bonn Network: Organisational culture influences and securing buy in for WSPs*", platform presentation at Malaysia Water Conference, 19th – 21st May, Kuala Lumpur, Malaysia.

Edgar, C; Smith, J; Pollard, S; Breach, B. and Williams T. (2008) "*Putting the Bonn Charter into practice: Challenges to water suppliers*", poster presentation at IWA Water Safety Plan Conference, 12th – 14th May, Lisbon, Portugal.

Summerill, C. (2010) "*Ensuring safe drinking water: A cultural assessment tool to assist water suppliers*", presented at IWA Young Water Professional Conference, Cranfield, UK, 14th-15th April.

1 <u>INTRODUCTION</u>

1.1 Context and background

1.1.1 Background

Delivering good, safe drinking water that has the trust of consumers should be the main goal of water suppliers as outlined in the International Water Association's (IWA) Bonn Charter for Safe Drinking Water (IWA, 2004). A source to tap risk management approach, Water Safety Plans (WSPs), described in the 3rd edition of the World Health Organisation (WHO) guidelines on Drinking Water Quality (WHO, 2004a) and also supported in the Bonn Charter, can assist in progress towards this goal.

Following on from the Bonn Charter, the IWA wished to promote an implementation plan and sought to enhance knowledge transfer between water suppliers. In 2007, the Bonn Network project was initiated with the aim of assisting water suppliers to achieve aims of the Bonn Charter. The Bonn Network is made up of fifteen suppliers from twelve countries throughout Europe; North and South America; Asia; Africa and Australasia. The members assist in developing tools[1] to support implementation of risk management strategies in relation to improving drinking water quality. The IWA partnered with Cranfield University to conduct research to support founding Network members in their progress toward better risk management, and to develop a 'toolbox' of resources that will enable suppliers to implement the aims of the Bonn Charter.

Work on the project was split into two main areas: networking and knowledge exchange (led by the IWA); and research and technical support (led by Cranfield University). The main areas of research expected from Cranfield by the IWA were the development of a self assessment model, tool development and a research focus on organisational culture influences on commitment and advocacy of the Bonn Charter and WSPs as a means to ensure public health protection. Research was split into two areas, the work reported in

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[1] *For the purpose of the toolbox a "tool" is defined as anything that will provide practical help and support to managers and operators involved in any aspect of drinking water quality control. The tools provided by the toolbox will thus include but will not be limited to: Technical and management guidance; procedural checklists; statistical techniques; tips from other practitioners.*

this thesis and another project aiming to discover the cross-cultural factors that influence the development and implementation of WSPs in developing countries (Edgar *et al.*, 2008).

1.1.2 Terminology

In this thesis, the term water 'supplier' will be used, in line with terminology used in the Bonn Charter. The Bonn Charter defines 'water supplier' to include public and private suppliers, including local public authorities. Here, a supplier may be public or private, and be responsible for abstraction, treatment and distribution or any combination of these steps in the supply of drinking water (i.e. a 'supplier' may be a public utility responsible for abstraction, treatment and distribution; or a private supplier responsible for abstraction and treatment only).

1.2 Problem statement

Unsafe water, as many recent outbreaks in both developing and developed countries have shown, has the potential to cause widespread illness and even death (Hrudey and Hrudey, 2004; WHO, 2004b). The Bonn Charter advocates the use of WSPs as the best way of ensuring good safe drinking water. There is concern that some suppliers have lost sight of their public health responsibility. This research, to some degree sets out to assess whether this is in fact the case and if so what the implication of this is. If the supply of safe drinking water is being taken for granted, the question arises over whether WSPs can ever be a truly implemented and preventative risk management practice incorporated into the day-to-day business of a water supplier, or if tokenism will occur, which is a potential outcome of inappropriate implementation (Hamilton et al., 2006).

The objectives of a WSP are threefold, i) to prevent contamination of raw water sources, ii) treat water to remove contamination and iii) prevent re-contamination during storage, distribution and handling. The primary aim is to protect public health through system assessment, operational monitoring and management plans; guided by health-based targets and overseen by surveillance (Davison et al., 2005). One aspect that most WSP guidance and documented WSP case studies agree on is that 'buy-in' from across the organisation, particularly senior management, is imperative to successful

implementation (IWA, 2004; WHO, 2004a; National Health and Medical Research Council (NHMRC), 2004; Godfrey and Howard, 2004). However, practical guidance on how to achieve this is limited, and focuses on policy endorsement, or efficiency arguments to generate support. The consideration of organisational culture is gaining attention among water suppliers seeking to implement effective risk management (MacGillivray and Pollard, 2008; Pollard et al., 2008b). Organisational culture can act as a filter to the uptake of new practices (Johnson, 1992), and there is an increasing interest in the influence of organisational culture on risk governance, with defective organisational cultures being attributed to failures in a variety of areas (International Risk Governance Council, 2009; Kimbrough and Componation, 2009; Economist Intelligence Unit, 2009). However, this is an area where empirical evidence is still lacking (Kimbrough and Componation, 2009). Therefore there is a need to explicitly look at the effect of organisational culture on WSP development, to ensure successful implementation and therefore improved public health protection, which is the focus of this research.

We recognise that utility managers manage several competing priorities. However, without executive commitment, and a supportive organisational culture WSP development may inadvertently become a token gesture and not fulfil its potential. Hellier (2003) noted, in describing the application of Hazard Analysis and Critical Control Point (HACCP) in a water company, that even the best management systems do not deliver safe water alone; well trained people committed to the protection of public health will always be essential. The outcomes of this research can be translated into guidance and tools to help not only water suppliers but also regulators, promoters of WSPs, and external implementers of WSPs such as consultants and aid agencies, who should instil a risk management culture within suppliers that they work with in order to ensure sustainable WSP implementation.

1.3 Aims and objectives

The aim of this research is to explore to explore the relationship between organisational culture and WSP implementation, and how the role of public health is perceived throughout organisations. It will build on existing work in risk management capability

to investigate Bonn Charter implementation within the international water sector, and the underlying business processes within organisations that create a basis for successful water quality risk management. Furthermore, research will develop tools to assist water providers develop and implement Bonn Charter goals, regardless of their size, risk management maturity, or working environment[2]. In order to achieve this aim, a number of objectives need to be reached:

i. Investigate organisational culture and WSP development in water suppliers of varying size, development and structure to look for examples of best practice or barriers to effective implementation.

ii. Develop a taxonomy of positive cultural attributes, test and add to this iteratively during case studies generating empirical data.

iii. Identify and investigate how the public health role of suppliers is perceived and advocated within these organisations, and other underlying organisational cultural influences that may affect levels of commitment.

iv. In addition, a requirement of this thesis is to produce a practical, Capability Maturity Model based tool relating to WSP development: a 'Bonn Charter Capability Maturity Assessment' that will enable investigation of objectives 1 and 2 and additional tools to assist suppliers in assessing and developing organisational culture that supports Bonn Charter implementation

1.4 Thesis structure

Chapter two reviews the current literature, detailing and critiquing relevant work relating to drinking water quality risk management, organisational culture and leadership; water quality and public health; risk management benchmarking and cultural assessments. It determines that whilst risk management techniques such as WSPs are regarded as one of the best ways to ensure safe drinking water, suppliers are still finding implementation difficult and serious health related incidents continue to occur; and may be attributed to organisational culture challenges. Chapter three goes on to describe the methodology used in this research: a multi method case study approach using

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[2] Political, legislative, social, economic

qualitative methods of semi-structured interviews; document analysis; and observational methods.

Chapter four describes and provides an explanation of the relationship between aspects of organisational culture and WSP implementation in four case studies representing a variety of water supplier types. These represented a variety of organisational cultures and a range of levels of WSP implementation. Benefits of WSP implementation were identified and managerial commitment and leadership discussed, including features that were hindering WSP implementation. Organisational commitment to roles and the organisation were identified and whilst this was lacking to WSP development specifically, it was discussed how this could be applied to WSP development. Commitment to public health protection was espoused by employees but beginning to be taken for granted and lacking in formal declarations.

Chapter five describes the development of a 'cultural taxonomy' aimed at solidifying the information gained from the literature and evidence from case studies into a taxonomy of supportive cultural attributes. All suppliers exhibited the attributes described, indicating a cultural capability to successfully implement WSPs. A way of measuring alignment to the taxonomy was needed and therefore in Chapter six, the taxonomy was incorporated into a self assessment tool, the 'Bonn Charter Capability Maturity Assessment' tool (BC-CMA). Chapter six also describes the development of a number of practical tools based on literature review and empirical understandings to assist water suppliers in understanding and developing organisational culture and how this impacts on WSP implementation.

Chapter seven discusses the research findings in an academic context and how these can be translated into practical guidance. A number of positive attributes of organisational culture were identified; failure to implement WSPs may be representative of cultural contradictions and barriers; protection of public health should be a primary driver of WSPs but may be beginning to be taken for granted; and organisational culture may be modified through effective leadership to ensure sustainable WSP implementation.

Chapter eight offers conclusions, reiterates the new insights provided and critically reviews this research. It also offers suggestions for further research to develop this subject area further; and discusses the novelty and contributions to science:

- This is the **first formal evaluation of the role of organisational culture in WSP development**. Until recently, work has been focused on more technical aspects of implementation.

- It identifies deeper, **cultural barriers to effective WSP development** that should be an important consideration to WSP promoters striving for sustainable implementation.

- Identification and empirical testing of a **taxonomy of positive organisational culture attributes** that contribute to successful WSP implementation (managerial commitment; learning culture; internal relationships; accountability; transparency; external relationships; continual improvement culture; empowerment; organisational commitment; proactivity; leadership and advocacy and mindfulness). It also adds two empirically derived attributes: Image and competitiveness.

- It identifies that in relation to a wide range of organisational missions, there are also a wide range of drivers for undertaking WSP projects and a wide range of perceived benefits. **There is a risk that the primary aim of WSPs (protection of public health) and of a water supplier (good safe drinking water) are beginning to be taken for granted**.

- Describes the **development of new tools** and a 'capability maturity assessment' to make suppliers aware of the subject of organisational culture and assist in developing a supportive culture.

1.5 Motivation

It is important to state from the outset how it is intended for the work presented in this thesis to be judged. The work is a piece of social sciences research, based mainly on qualitative methods using a case study approach as will be described in more detail in Chapters two and three. The work is based more in the interpretive and critical social sciences that aim to analyse socially meaningful actions, based on the richness and

depth of data that are provided in qualitative data produced through interviewing people; allowing an empathetic understanding and interpretation of culture (Chapter 2.6.1; Neuman, 2003).

Analysis is mainly explanatory in nature, using explanation building approaches to make sense of the data and to generate new theory; via a combination of inductive (theory building) and deductive (theory testing) reasoning (Chapter 2.6.4). In this type of research therefore, a hypotheses and theory are not developed prior to the research but rather arise through analysis of the data. Using multiple case studies as presented in this work, the aim is not for statistical generalisation as would be the case with positivist research, the aim is instead for *analytic* generalisation where theory that has arisen in analysis of previous case studies is used as a template to compare with results of subsequent cases and so on – a theory *building* approach (Chapter 3.3.1).

2   <u>LITERATURE REVIEW</u>

The following chapter details insights from existing research and literature relating to this project. It explores the cross discipline subjects of: drinking water risk management (section 2.1); a rationale for WSPs (section 2.2); organisational culture and leadership (section 2.3); organisational commitment and buy-in (section 2.4); capability and cultural assessment (section 2.5); and methodological approaches (section 2.7).   The main subject areas and their interrelationship are summarised in Figure 2.1. The following review draws on existing WSP guidance and case studies; and where existing information on WSPs and culture are scarce, refers to related safety culture literature.
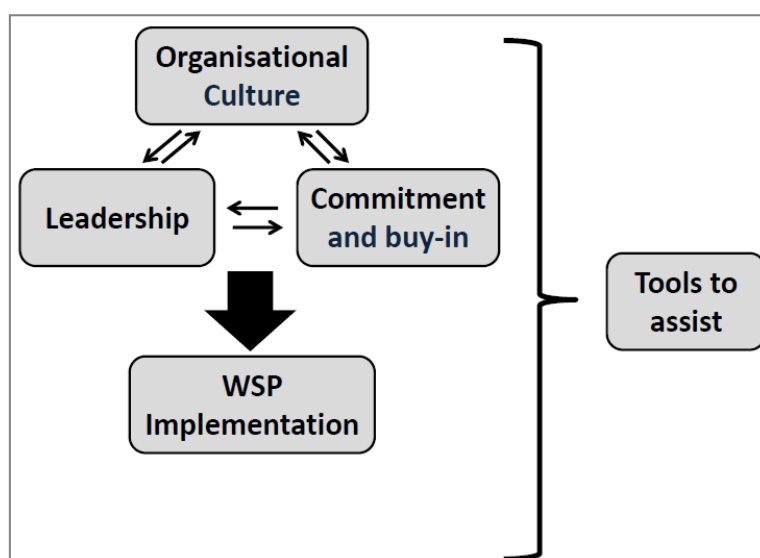
Figure 2.1 Main themes of literature review and their relationship

2.1 Drinking water risk management

As the limitations of end product testing were realised (Deere and Davison, 1998; O'Connor, 2002; Rizak et al., 2003), 2004 became a key year for the promotion of WSPs, a preventative catchment to consumer risk management approach for the provision of safe drinking water. Though related approaches, such as ISO quality certification and the HACCP methodologies had previously been used (Havelaar, 1994; Deere and Davison, 1998; Gissurarson and Thoroddsson, 2000; Hellier, 2003), the revised WHO guidelines for drinking water quality (WHO, 2004a), the IWA's Bonn

Charter for safe drinking water (IWA, 2004), and before them, the Australian guidelines for drinking water quality (NHMRC, 2004), placed a renewed emphasis on preventative risk management. Such methods are rapidly being implemented throughout the world, shown by a summary of worldwide WSP initiatives in Table 2.1.

The WSP methodology alleviated criticisms of using HACCP for the supply of drinking water. These criticisms were, mainly that (Hamilton et al., 2006):

- HACCP is concerned with hazards and there is no analysis of the risk posed by each hazard.
- Transferring the Critical Control Point (CCP) aspect to water can be difficult, and only readily applied to the treatment process, making source to tap plans difficult.
- There is a risk of identifying hazards retrospectively to suit existing controls.
- HACCP methodologies can become exercises in documentation rather than a risk management approach.

However, the HACCP approach was intended to be flexible, and integration with other quality and risk standards such as ISO 9001 and AS/NZS 4360 can help overcome these issues. Hrudey and Hrudey (2004) recognised that the HACCP principles can provide a useful foundation for a broader approach. Havelaar (1994) identified limitations of HACCP for the whole supply chain due to a lack of direct control over source water catchments and at the customer tap. He argued however, that surveillance of steps in the abstraction of water, or in the distribution system for example is essential in defining critical limits for the true CCPs in the treatment process.

Table 2.1 WSP initiatives around the world

Country/ Region	Title/Summary	Reference
Australia	Australian drinking water guidelines, Framework for Management of Drinking Water Quality, recommend risk-management approach to water quality management based on HACCP, ISO 9001 and AS/NZ 4360. Risk management plans are a regulatory requirement in some states (Victoria).	NHMRC: http://www.nhmrc.gov.au
Bangladesh	'Development and implementation of WSPs for small water supplies in Bangladesh': Case study describing how WSPs can be developed and implemented for small systems in developing countries. Describes development of simplified tools for community use.	Mahmud et al. (2007)
Europe	European Commission Drinking Water Directive – WHO led working group providing guidance to the EC on how to integrate the WSP concept into revised legislation.	WHO (2007) http://ec.europa.eu/environment/water/water-drink/revision_en.html
Europe	TECHNEAU, an integrated project funded by the European Commission, challenges the ability of traditional system and technology solutions for drinking water supply to cope with present and future global threats and opportunities. Work Area 4 is focusing on risk management.	Techneau (2007) http://www.techneau.org
Europe	Water Safety Plans in Pictures' A WECF initiative to provide tools to schoolchildren and local communities in rural Europe to improve water safety based on WHO WSP methodology.	WECF (2008) http://www.wecf.eu
Hong Kong	Water Safety Plan for Water Supplies Department developed in 2005, implemented in 2007.	Government of Hong Kong http://www.wsd.gov.hk
Iceland	HACCP and water safety plans in Icelandic water supply: Preliminary evaluation of experience.	Gunnarsdottir and Gissurarson (2008)
India	Case study of Water Safety Plan development in Guntur, India according to WHO guidelines.	Godfrey and Howard (2004)
Japan	Japan's trial introduction of HACCP into water quality management' - Investigation into a practical procedure in introducing the HACCP into water quality management in Japan.	Yokoi et al. (2006)

Latin America	'WaterPlus' Partnership between PAHO, CDC and EPA to implement WSPs in Latin American and Caribbean countries.	http://www.cdc.gov/nceh/globalhealth/projects/waterplus.htm
New Zealand	Public Health Risk Management Plans are a regulatory requirement for supplies to more than 500 people under The Health (Drinking Water) Amendment Act 2007 and encouraged for smaller supplies through guidance.	New Zealand Ministry of Health (2007) http://www.moh.govt.nz/water
Pacific Islands	Pacific Water Safety Plans Programme to implement WSPs in Pacific Islands - Joint programme with SOPAC, WHO and IAS, funding from AUSAid.	http://www.sopac.org/Water+Safety+Plan
Portugal	Water Safety Plans: methodologies for risk assessment and risk management in drinking water systems. Book chapter giving overview of first 2yrs implementing WSPs in Portuguese water company, demonstrating value of the methodology.	Vieira (2007)
South Africa	Annex C of South African National Drinking Water Standard (SANS 241) sets out a guideline recommending implementation of WSP approach.	http://www.dwaf.gov.za/
Taiwan	Integrated water management plans towards sustainability: the Taiwan experience. Water Safety Plan, was developed as the 'Green Blue-Print' for the development of strategies and guidelines of national sustainable water environment.	Chiang et al. (2007)
Uganda	Case study of Water Safety Plan development in Uganda according to WHO guidelines.	Godfrey and Howard (2004)
UK	Funding for improvement plans under PR09 will only be considered if identified through the WSP approach, and 2007 amendments to Water Supply (Water Quality) Regulations 2000, state that risk management plans should be developed for each supply system.	http://www.dwi.gov.uk/

2.1.1 World Health Organisation: Water safety plans

The third edition of the WHO Guidelines for Drinking Water Quality (WHO, 2004a) advocated the use of WSPs, a comprehensive 'source to tap' risk assessment and management approach, as the most effective way of ensuring the safety of drinking water. The approach was further expanded on in a complementary publication, 'Water Safety Plans' (Davison et al., 2005) and more recently the WSP Manual (Bartram et al., 2009). The objectives of a WSP are to prevent contamination of raw water sources, treat the water to remove contamination and prevent re-contamination during storage distribution and handling. The primary aim of WSPs is public health protection, involving system assessment, operational monitoring and management plans, which are guided by health-based targets and overseen by surveillance, as shown in Figure 2.2.
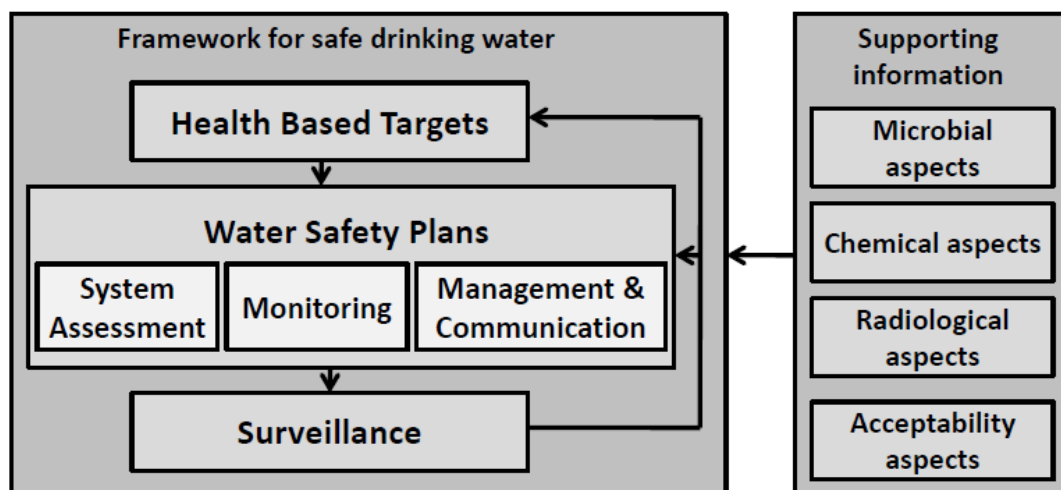
Figure 2.2 Drinking Water Quality Framework (adapted from WHO, 2004a)

The most up to date WSP guidance describes an eleven step approach (Box 2.1). The WSP process should not be seen as a one off exercise, and the cyclical nature, involving review, approval and audit to ensure continuous improvement is emphasised. What is important is that the WSP guidance is flexible, as long as these steps are followed, there may be different methods used. For example risk ranking approaches may vary depending on the organisations current risk management practices. Risk assessment is 'not a goal in its own right' and should be seen as a tool to aid management decisions and assist in incremental improvements to water quality (Davison et al., 2005). The main improvement on HACCP and ISO was the assessment of risk. Yet in an industry

grounded in engineering, quantification of risk when considering public health outcomes can be difficult, water is subject to a wide range of hazards and a wide range of health outcomes which can be difficult to compare and thus prioritise. As outlined in the WHO Guidelines, some outcomes will be acute, some delayed, some severe and some mild. Some may have implications for specific vulnerable populations, and some hazards may have multiple effects (WHO, 2004a).

Box 2.1 Eleven step WSP approach (Bartram et al 2009)

Preparation:
    1) Preliminary actions including team assembly.
System assessment:
    2) Document and describe the system.
    3) Identify hazards and assess risk.
    4) Determine and validate control measures; reassess and prioritise risk.
    5) Develop, implement and maintain upgrade/improvement plan.
    6) Define monitoring of control measures.
Management and communication:
    7) Verify WSP.
    8) Prepare management procedures.
    9) Develop supporting programmes.
Feedback:
    10) Periodic review.
    11) Revise the WSP following incident.

2.1.2 *International Water Association: The Bonn Charter*

The IWA published the 'Bonn Charter for Safe Drinking Water' (IWA, 2004), identifying its goal as "*good safe drinking water that has the trust of consumers*". The Bonn Charter supported the use of WSPs as the most effective way to achieve this goal, incorporating it into a framework that would ensure that consumers had access to good, safe and reliable drinking water (Figure 2.3). The Charter goes beyond health, ensuring water that is not just safe to drink but of good aesthetic quality and supplies in which consumers have confidence. This is an important issue to highlight, if *safe* drinking water was supplied but was considered unpleasant to drink, or consumers did not trust it, then they may avoid it and seek their drinking water from other, poorer quality sources.
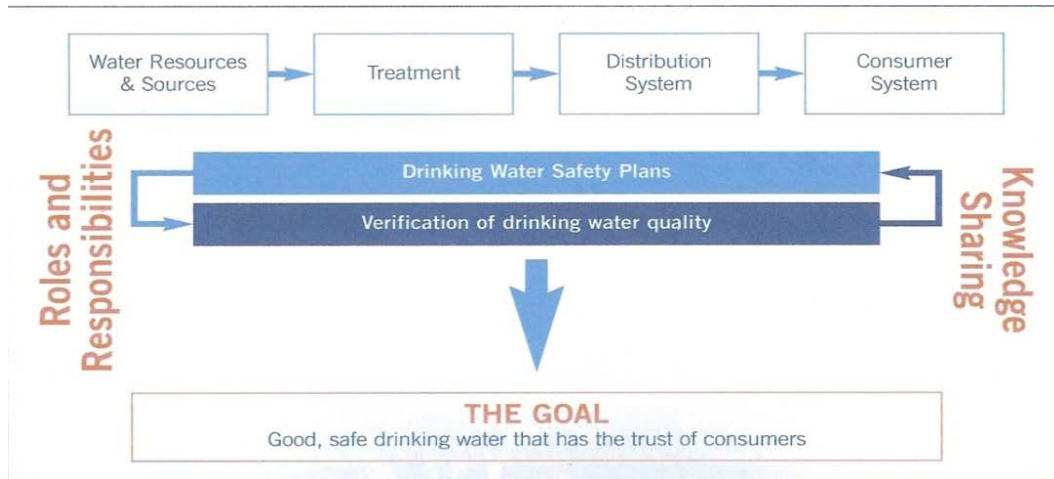
Figure 2.3 The Bonn Charter (IWA, 2004)

The Bonn Charter also talked of the importance of transparency, trust in the way that businesses are operated as well as the roles of governments, regulatory authorities, water suppliers and consumers in achieving its aim. The impetus for the Bonn Charter was the need for a consistent framework within which the quality of drinking water could be assured; and the development of the 3rd edition of the WHO guidelines for drinking water quality that emphasised the importance of risk management approaches that would complement traditional end product monitoring (IWA, 2004). The framework was developed by water industry professionals during workshops conducted in 2001 and 2004 and the five responsibilities of water suppliers were identified as follows:

i.   In conjunction with partners, develop and implement drinking WSPs, covering catchment to consumer, and regularly verify their implementation and effectiveness using the appropriate operational controls and monitoring.

ii.   Put in place systems for testing the quality of water supplied including those necessary to meet regulatory requirements and make the compliance results available to the public.

iii. Ensure the full cost of service provision is identified and that appropriate investments are made in the provision of water services in line with Government established frameworks for financing.

iv.   Ensure staff with sufficient skills and training are available to those involved in the management of each element and;

v.   Maintain adequate and auditable accounts in line with government requirements.

A number of aspects relating to organisational culture can be identified within these roles that may impact on the success of adopting the Bonn Charter and achieving its goal. These include: stakeholder engagement; accountability for protection of public health; transparency; the importance placed on training and people; and quality assurance.

2.1.3   Australian Drinking Water Guidelines

The Australian Drinking Water Guidelines (NHMRC, 2004) were also revised in 2004, to incorporate a framework for the management of drinking water quality.   The regulators identified that some suppliers in Australia were already using a risk based approach, centred around systems such as HACCP, ISO 9001 and the AS/NZS4360 standards. The National Health and Medical Research Council (NHMRC), along with Hamilton et al. (2006) also argued that these approaches were generic and not easily translated to water quality management.   In response, it adapted these, to create a preventative risk management framework in the context of drinking water supply. The framework consisted of 12 elements and associated actions.   These elements are summarised in Figure 2.4. From here-on in, the term 'Water Safety Plan' (WSP) shall be used to encompass any approach of source to tap risk management as discussed in the documents above.
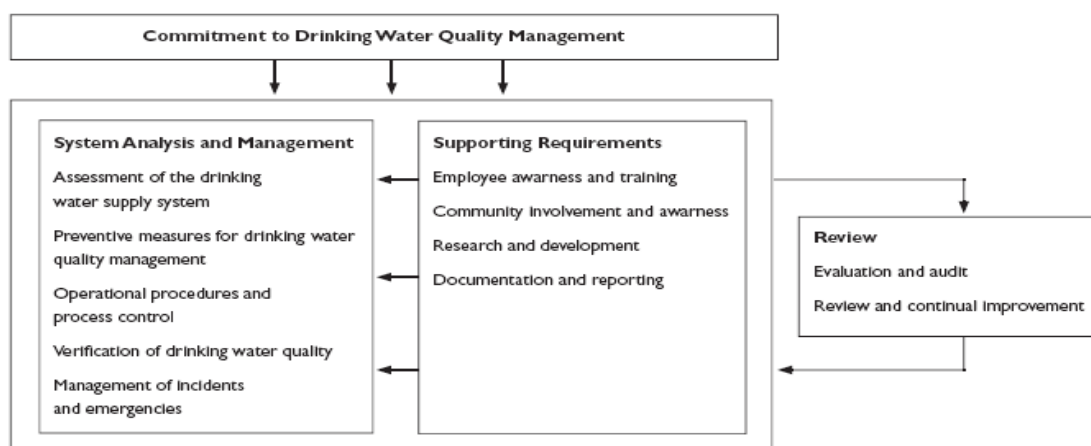
Figure 2.4 Australian Drinking Water Guidelines Framework for Management of Drinking water quality (NHMRC, 2004)

2.2 A rationale for water safety plans

WSPs were first publicised in the 3rd edition of the WHO Guidelines for Drinking-water Quality in 2004. The approach had been developed by water industry experts at meetings held since the year 2000 in response to limitations in traditional methods of ensuring the safety of drinking water. End product testing for example only highlighted problems after the water had already been consumed; and the use of bacterial indicator organisms could not identify potential viral and protozoan contaminants which behave very differently to bacteria, and are often present in greater numbers in the environment, therefore showing poor correlation with bacterial indicators (Ashbolt et al, 2001; Davison et al, 2005). Indeed there are a number of case studies that describe outbreaks of human disease attributed to the water supply, despite monitoring results within acceptable limits (MacKenzie, 1994; Furtado et al, 1998; Hunter and Quigley, 1998; Mason et al 2010). There are therefore deficiencies in such an approach. However it is recognised that operational and end product testing are important in verification and to ensure that the WSP is working effectively (Bartram et al, 2009). Indeed, monitoring results may also be misunderstood, and the WSP approach aims to improve understanding. When analysing the reason for outbreaks, Risebro et al (2007) identified that in some cases, chronic treatment deficiencies were the result of poor understanding of or action on microbial results, something which the WSP would aim to overcome.

Risk management approaches which aimed to prevent contaminants entering the water, or removing them from the water prior to distribution rather than testing the end product, were seen as the most cost-effective and protective means of ensuring a safe drinking water supply. A harmonised framework was first described by Bartram et al, (2001), recognised the need for a risk management approach based in a number of factors, such as: recognition that hazards of greatest concern share human excreta as a common source; health effects may occur as a result of short term exposure; pathogens of concern are widespread and occurrence varies widely and rapidly in time and space. The framework also recognised that hazards previously managed in isolation should be understood holistically; there was an increasing demand for evidence based decision making and information to support cost-benefit analysis (Bartram et al, 2001). The resulting WSP framework of risk management covering catchment to consumer was

therefore developed that was based on sound science and supported by appropriate monitoring (Davison et al, 2005). The WSP methodology was based on HACCP methodologies that were being used by water suppliers in the US (Barry *et al.* 1998) and Australia (Deere and Davison 1998; Gray and Morain 2000; Deere *et al.* 2001). The experience of the application of HACCP by water utilities has informed the development of the water safety plan approach.

Lack of access to improved water supplies affects 884 million people (WHO/UNICEF, 2010). Diarrhoeal disease causes 1.8 million deaths annually, mostly in developing countries and mostly attributable to contaminated water supplies; millions more become ill through water-related diseases, some of which are life threatening (WHO, 2004b). Recognising the importance of WSPs for developing countries, the Water, Engineering and Development Centre (WEDC), published a series of books to assist implementation of WSPs in developing countries. Rouse (2007) recognised the benefits of WSPs in developing countries was enormous, so much so that the first stage of WSP development, the setting of health based targets, need not be done: "*It is known already that the benefits greatly exceed the costs*". Provision of safe drinking water to the poor can also have the added value of helping to alleviate poverty and allow people to escape the 'poverty trap'; Ahmed (2003) identified that poverty is a multi-dimensional phenomenon, but by providing clean safe drinking water then more time will be available for work and education (not having to collect water, and less water borne disease). It was argued that the 'water crisis' in developing countries was primarily one of management, and a holistic approach to water quality management was needed (Ahmed, 2003). WSP implementation could therefore assist in this.

However, disease outbreaks are not restricted to less developed countries, and developed nations should not become complacent. Hrudey and Hrudey (2004) documented over 60 case studies of waterborne pathogen outbreaks in affluent nations from the last 30 years, analysing the causes of these failures in order to identify factors that might prevent future ones. They caution against viewing public health protection as equivalent to other business priorities and offer guiding principles for the provision of safe drinking water (Hrudey and Hrudey, 2004):

- Pathogens pose the greatest risk (pathogen removal and disinfection should be of paramount concern).

- Robust, effective multiple barriers to drinking water contamination are needed based on the contamination challenge to the raw water source.

- Trouble is preceded by change, so change should be taken as a warning.

- Operators must be capable and responsive.

- Drinking water professionals must be accountable to drinking water consumers.

- Ensuring safety is an exercise in risk management, requiring sensible decisions in the face of uncertainty.

The act of water treatment also introduces potentially significant hazards that may pose a threat to drinking water. Human error, for example can cause problems in dosing of chemicals for treatment such as aluminium sulphate or lime, which if overdosed can have health implications, illustrated by the Camelford aluminium contamination event in the UK (Altmann et al., 1999).

WSP methodologies specifically refer to health based parameters. However, the aesthetic quality of water should not be overlooked when assuring the safety of water. McGuire (1995) argued that consumers are likely to believe that water is unsafe to drink if taste and odour problems occur which can counteract the efforts made in the provision of safe drinking water. McGuire stated that 'perception is reality' and if consumers perceive a risk (for example through taste and odour) then the water supplier must deal with it irrespective of its (lack of) health impact. Yet, in some cases, what are considered aesthetic issues may in fact be an 'early warning' of a more serious health issue (Hrudey and Hrudey, 2007). This brings us back to the main aim of the Bonn Charter: 'good safe drinking water that has the trust of consumers' – safe water is paramount, but maintaining the trust of consumers is also vitally important.

Whilst the WSP concept has been familiar for some years, WSPs *per se* are still not globally common. Many water suppliers argue they have been managing risk in this way for years, yet outbreaks and accidents continue in spite of reports identifying the reasons behind such events. In the UK for example, there have recently been a number of *Cryptosporidium* incidents, with boil notices issued (Table 2.2) despite

Cryptosporidium risk assessments being a regulatory requirement since 1999 (DWI, 1999) and the active promotion of WSPs since 2004 (DWI, 2004).

Table 2.2 Publicised Cryptosporidium incidents in the UK 2005-2008 (www.bbc.co.uk/news, 2009)

Location	Date	Details
North Wales	August 2008	45,000 people issued boil water notice following increase in *Cryptosporidium*
Northampton	June 2008	250,000 people issued boil water notice following contamination of water.
Catterick Garrison	Dec 2007	Boil water notice for military area and 2000 residential properties following contamination.
Scotland	Summer 2007	Several Scottish towns issued with boil water notices following detection of cryptosporidium over summer months
Norfolk	Jun 2007	6000 households told to boil water
North Wales	Nov 2005	231 cases of cryptosporidiosis. 70,000 homes told to boil water for 2 months.

In summary, there is a need to manage drinking water risk both in the developing and the developed world, and WSPs can assist in improving supplies as well as maintaining them. In developed countries they can assist in refining operating procedures, and in developing countries, raise awareness of the causal agents and establish investment priorities (Rouse, 2007). Despite an increasing interest in this area, uptake is limited in developing countries and outbreaks still occur in developed nations. It is thus important to understand the mechanisms that ensure effective implementation of WSPs and commitment to public health protection.

2.3 Organisational culture

2.3.1 What is organisational culture?

Schein (2004) defined organisational culture as "*A pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way you perceive, think, and feel in relation to those problems*". Put more simply, this can be defined as "*the way things get done around here*" (Deal and Kennedy, 1983), or the attitudes, experiences, norms, beliefs and values of an organisation.

There are many frameworks in the literature for the analysis of organisational culture. Hofstede et al. (1990) used layers of an onion skin as an analogy to describe the manifestation of culture in terms of practices. Most superficially, 'symbols' such as words, pictures or objects that carry a particular meaning; to 'heroes' which are people who serve as models for behaviour; and then to deeper 'rituals', activities that are superfluous but essential to the culture (Hofstede et al., 1990). The deepest level was termed 'values', the broad feelings and values of culture which Hofstede *et al* acknowledged can rarely be discussed or observed but are manifested in behaviours. Johnson (1992) described a 'cultural web' (Figure 2.5) that detailed the 'paradigm', the deepest level of culture as a set of beliefs removed from organisational action which lies within a web and that links this to actions such as: stories and myths; symbols; power structure; organisational structure; control systems; and rituals and routines.
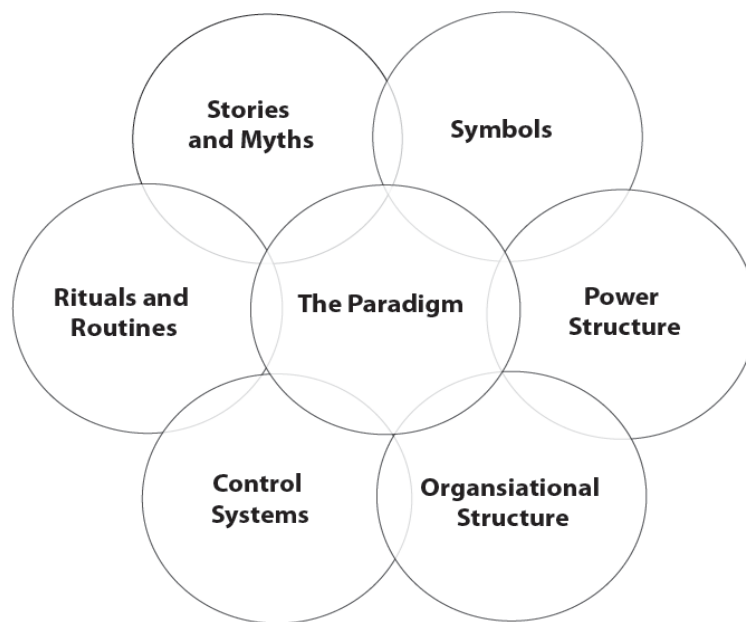
Figure 2.5 Johnson's Cultural Web (1992)

Similarly to Hofstede, Schein (2004) outlines three levels of culture, from superficial artefacts to espoused beliefs and values to the underlying 'basic assumptions' of an organisation. Artefacts constitute the visible organisational structures and processes of the organisations whereas espoused beliefs represent a deeper understanding of organisational culture by investigating espoused justifications. The basic assumptions are unconscious, taken for granted beliefs, perceptions and feelings (Schein, 2004),

analogous to the paradigm from Johnson's web or the values in Hofstede's cultural framework. The principles of all three are similar; there are several layers of culture within an organisation, and researchers seek to understand the underlying, often taken for granted, 'basic assumptions' that form the paradigm of an organisation in order to make sense of the more visible artefacts. Researchers then went on to attempt to categorise different types of organisational culture, a summary is given in Table 2.3.

Table 2.3 Categorisation of organisational cultures

Reference		
Deal and Kennedy (1982)	Four cultures based on feedback, reward and risk	-**Work-hard, play-hard** (rapid feedback and low risk) -**Tough-guy macho** (Rapid feedback and high risk) -**Process culture** (Slow feedback, low risk) -**Bet-the-company** (Slow feedback, high risk)
Hofstede et al. (1990)	Five cultural dimensions	**-Power distance index:** extent to which the less powerful members of organisations accept and expect that power is distributed unequally. **-Individualism vs. Collectivism:** Ties between individuals are loose or integration into strong cohesive groups. **-Masculinity vs. Femininity:** Distribution of roles between genders. Masculinity = assertive; Femininity = modest and caring. **-Uncertainty avoidance index:** Tolerance for uncertainty and ambiguity. **-Long term orientation vs. Short term orientation:** Thrift and perseverance in long term vs. tradition and saving one's 'face' in short term.
Handy (1985)	Based on work by Roger Harrison	**-Power culture:** Concentrates power among a few, radiating out from central figure like a web. Decision making is quick. **-Role culture:** Hierarchical, beurocratic. Power based on position rather than the individual. Routine and procedures valued. **-Task culture:** Teams formed to solve specific problems or tasks. Power derives from expertise. Multiple reporting lines. **-Person culture:** Individuals see themselves as superior to the organisation; persuasion rather than command or management.
Carmazzi (2007)	Five cultural types	**-Blame culture:** Individuals blame each other to avoid punishment, few new ideas as individuals fear being wrong. **-Multi directional culture:** Loyalty to specific departments with limited communication between departments. 'Cliques' form, lack of cooperation. **-Live and let live culture:** Complacency, little future vision. Certain amount of cooperation and communication. Personal relationships are formed. **-Brand congruent culture:** Individuals believe in the service or product of the organisation and feel good about what it is trying to achieve, and have similar goals. **-Leadership enriched culture:** Organisation is seen as an extension of self. Exceptional cooperation, more like a 'family'. Leaders develop other leaders.

There are, however, criticisms of categorising organisational cultures in the ways described in Table 2.3, mainly that they are too simplistic and that in complex organisations many sub-cultures may exist within different teams and departments, and these may indeed contradict each other (Smircich and Calas, 1987). Strong cultures exhibit an alignment of organisational values, where weak cultures have little alignment and control must be exercised. However, it must not be thought that 'one size fits all' and some aspects of culture will have less impact on the effectiveness of risk management than others (Schein, 2004). Indeed, sometimes there are problems associated with strong cultures, where all members are aligned and do not challenge organisational thinking, a phenomenon termed 'groupthink', where there is a reduced capacity for innovative thought (Janis, 1971). This could inhibit effective risk management of drinking water, for example, if a supplier continues with a reliance on end product testing because that is the way it has 'always been done'. Some cultural aspects will work well for one organisation but not another, and in many of the categories outlined above, there is no 'right or wrong' culture, but simply a way of defining different cultural types, a feeling supported by authors such as Fletcher and Jones (1992) and Hofstede et al. (1990).

It is important here to touch on the subject of national cultures. Differences in culture will exist in different countries and regions throughout the world, exhibiting different customs and traditions. Again, here there is no 'right or wrong' culture, just differences. Hofstede notes this and has profiled different countries according to his cultural dimensions, stressing the importance of recognising such differences when working in different countries (www.geert-hofstede.com). The study of national cultures is outside the scope of this research[3] but it is recognised that the national culture of a country or region will influence the organisational cultures being studied and thus this will be studied implicitly.

2.3.2   Why is understanding organisational culture important?

Organisational culture acts as a filter to the uptake of new practices. Johnson (1992) argues that the external signals an organisation is subject to are filtered in terms of the

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[3] A related research project is being undertaken also in relation to the Bonn Network: 'Sustainable implementation of risk management systems in developing countries – the influence of culture', Yahya Omar.

paradigm (the basic assumptions); and therefore strategies that managers advocate will be 'configured within the bounds of this paradigm'. Johnson (1992) acknowledges that environmental factors and organisational capabilities will affect performance but it is people that create organisational strategy and the mechanisms by which they do this are at the cultural and cognitive level.

Hall (1973) defined 'explicit culture' as being represented by things people talk about and can be specific about, and 'implicit culture' as referring to those aspects that are not readily talked about, but rather are often taken for granted or exist on the fringes of awareness. Webster (2006) stresses the importance of the distinction between explicit and implicit culture, and the need to move towards explicit culture with regards the development of WSPs. Given the challenges of implementing any change within a sector, with skill shortages and loss through retirements of corporate expertise, the consideration of organisational culture is gaining more attention among bodies seeking to implement effective risk management (MacGillivray and Pollard, 2008; Pollard et al., 2008a), and to ensure that this 'implicit' culture does not get lost.

Schneider and Shrivastava (1988) maintain the strategic behaviour of organisations can be understood by exploring the basic assumptions (thoughts, feelings actions articulated in stories, symbols and behaviours) of organisational culture. The authors describe three levels at which these psychodynamics operate: individual; group; and organisational, with the individual and group level contributing to the organisational level, and *vice versa*. Individual psychodynamics contribute to organisational mission, particularly of those at the top such as Chief Executive Officers (CEOs). Wider organisational buy-in for projects or new ways of working may be helped or hindered by the views of these key individuals. Group dynamics also facilitate or hinder performance, particularly within strategic decision-making groups. As Schneider and Shrivastava (1988) note, there are often sub-cultures within organisations with different basic assumptions. Within the context of WSP implementation, where stakeholder involvement (both internal and external) is so often quoted as important, this may be highly influential. There are different aspects to these basic assumptions that must also be considered - namely the number, pervasiveness, intensity and explicitness (Schneider and Shrivastava, 1988). Broadly shared basic assumptions (*e.g.* guardian of public health)

between departments may promote greater commitment (*e.g.* to WSPs). The intensity with which this is held may result in uncommitted compliance (*e.g.* 'lip-service') or incorporation (the belief that WSPs are truly implemented with the aim of protecting public health). The ongoing questioning and testing of these basic assumptions may help ensure performance and good decision making, and in this case ensure employees are aware of *why* public health protection is important.

Alvesson (2002) stresses the importance of studying organisational culture, of its significance in how organisations function including strategic change, leadership, interaction with customers, and how knowledge is created, maintained and utilised. He also identifies the importance and linkages between organisational culture and knowledge management and stakeholder engagement, two vitally important aspects of WSP implementation. '*No one should be dying or suffering because knowledge that already exists in one part of the world has not reached other parts. It is up to each of us to take the responsibility to ensure the knowledge flows easily to where it is needed*', Geoff Parcell was here talking about AIDS care in a publication regarding knowledge management (Ramalingam, 2006), but this sums up the importance of knowledge management and could equally be applicable to water quality. Millions of people become ill or die every year from illnesses associated with unsafe water, WSPs can help to reduce this, but good knowledge management is needed to ensure that WSPs are effective. Suppliers need to learn from each other and be open to the fact that knowledge flows back and forth and is continually improved and updated both within organisations and between organisations.

WSPs involve managing risk from 'source to tap'. Rarely, if ever, do water suppliers have full control over the whole supply chain. This is more evident at either end of the supply chain, raw water catchments where other landowners and environmental authorities may be influential, and consumer households where the actions of consumers and plumbers may affect water quality. Therefore, to effectively manage risks from source to tap, it is essential to engage relevant stakeholders such as governments, regulators, other water suppliers, local authorities, health agencies, land users, contractors, plumbers, manufacturers of materials and products, and consumers themselves (IWA, 2004). However, many water suppliers are still finding it difficult to

engage stakeholders in the WSP process. There are many reasons why both suppliers and stakeholders may not wish to become involved such as , a lack of time or financial incentive; the need for leadership; iterative changes may be incomplete or slow; personnel turnover and a lack of proof that stakeholder groups work (Morrison, 2003).

The willingness of suppliers to involve stakeholders and the willingness of stakeholders to be involved may need a shift in the culture of organisations. Certainly an understanding of the different working cultures is needed. Guidotti and Ragain (2008), when looking at risk-communication with the public, suggested that health care providers are highly trusted by consumers, and thus communicating via these groups may be beneficial. However they also suggested that the main obstacle in working with health care providers is cultural. Water professionals are grounded in engineering (driven by precision) and health care providers grounded in medicine (driven by uncertainty). They suggested attempts to understand different cultures and a two-track approach to engagement – firstly at a local level where utilities establish relationships with local healthcare and secondly, organisations representing water suppliers as a whole should co-ordinate national or regional scale activities. In summary, effective risk management is not achieved by just completing a risk assessment. Culture, knowledge management and stakeholder involvement are just some of the factors that can influence its success.

2.3.3 *Organisational culture and its influence on effective risk management*

Organisational culture can play an important part in the capability of an organisation to manage risk. It is gaining more importance for organisations wishing to implement effective and sustainable risk management strategies. PricewaterhouseCoopers (PWC) developed a risk culture survey in response to this, in the belief that "*sub-optimal risk culture can undermine a company's ability to manage risk across the organisation*" (PWC, 2003). Essentially, any organisation can 'go through the motions' of doing a risk assessment (e.g. as part of a WSP), but in order to be truly effective the whole organisation must be attuned to a mindful risk management culture. PWC identified some key points that indicate cultural problems within an organisation in relation to risk management:

- Lack of awareness and understanding of business risks throughout the enterprise.
- Business risk and control perspectives at the 'top' not linked to perspectives of people on the 'front lines'.
- Inability to operationalise risk management strategies through action plans that align key business initiatives with systemic risks.
- Improper ethics and compliance practices.
- People strategy is not working well.

Much can be learnt from the activities of 'high reliability organisations' (HROs) to remedy these problems. These organisations, such as nuclear power plants and air traffic control centres, have less than their fair share of accidents. Investigations into their risk management culture have identified some interesting results. Reason (1998) stated that there were two methods of dealing with risk and evaluating hazardous events, firstly the 'person' approach that focuses on blaming individuals for errors (such as forgetfulness, inattention, moral weakness). Secondly, the 'system' approach focuses on the conditions under which individuals work, trying to build defences to avert errors or mitigate their effects. It is this that underpins a sustainable risk management culture.

With reliance on end product testing, as was the norm in the water industry before WSPs, high levels of compliance can exist, but still with serious flaws in the design of a system or risk management processes (Hamilton et al., 2006). Reason (1998) represented the way in which incidents occur using a 'Swiss cheese' model (Figure 2.6). There are many defences, barriers and safeguards in order to protect, in this case water quality, but there will always be weaknesses (the 'holes' in the cheese). These holes will open, close and move depending on actions taken, thus the *human* element of risk. If you take the analogy that each defence is a slice of Swiss cheese, then normally one hole will not result in a disastrous outcome as other barriers will compensate. However, occasionally these holes may line up, allowing a hazard to occur.
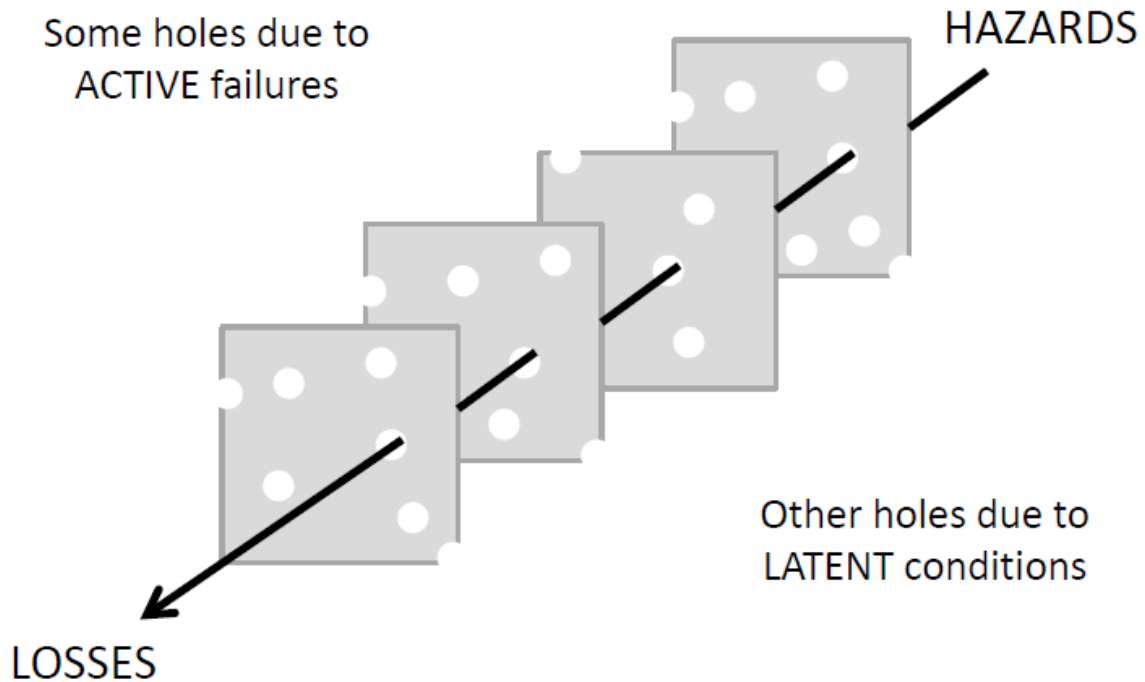
Figure 2.6 'Swiss Cheese' model of incident causation (Reason, 1998)

Reason (1998) argued that these holes arise due to active failures by individuals which are hard to foresee, and latent conditions which are ultimately affected by the culture of the organisation that can be identified and remedied before an incident occurs. Latent conditions can act in one of two ways, by causing error-provoking conditions such as time pressures and understaffing, or create long-lasting weaknesses such as untrustworthy alarms or unworkable procedures. Person approaches are dangerous as when an event occurs they look no further that the active failures and thus prevent learning from experience and bringing about system wide changes. Rather than taking the person approach, HROs focus more on the system at large, seeking to remove error provoking properties through (Reason, 1998):

- Establishment of an effective reporting culture;
- Analysing in detail the occurrence of incidents and close calls to uncover the recurrent 'error traps'; and
- Striving to imagine new scenarios that could occur and protect against these.

These approaches contribute to developing a 'mindful' organisation; one that has a collective 'preoccupation with the possibility of failure and its root causes', has a

reluctance to oversimplify, is sensitive to operations, committed to resilience and deferential to expertise (Weick and Sutcliffe, 2006). These organisations recognise that mishaps will occur, but rather than make short term repairs, they use these events to learn from experience and make changes for enhanced resilience. Applying this to the water sector, Hrudey et al. (2006) developed these ideas to suggest elements that water suppliers may wish to consider when trying to develop mindfulness and thus a strong risk management culture, such as:

- Informed vigilance actively promoted and rewarded.
- An understanding of the entire system, its challenges and limitations are promoted
- Effective, real-time treatment process control, based on understanding critical capabilities and limitations, is the basic operating approach.
- Fail-safe multi-barriers are actively identified and maintained.
- Close calls (near misses) are documented and used to train staff about how the system responds under stress and to make such events less likely in the future.
- Operators, supervisors, lab personnel and management all understand that they are entrusted with protecting the public's health and are committed to honouring that responsibility.
- Operational personnel are afforded the status, training and remuneration commensurate with their responsibilities as guardians of the public's health.
- Response capability and communication are improved.
- An overall continuous improvement mentality pervades the organisation.

Reporting close calls is a fundamental aspect of mindfulness, yet encouraging employees to report close calls is not an easy task as it requires people to confess to mistakes. Reason (1998) suggested ways of engineering a reporting culture by ensuring confidentiality, using a different department to analyse reports than those with the authority to impose disciplinary actions, giving rapid, useful and accessible feedback and making it easy to complete and file such reports. Reason also argued that first it was important to consider trust and create a *just* culture based around how blame and punishment is handled. A truly no-blame culture is not feasible, but Reason enforced the feeling that all members of the organisation should be aware of where the line is

drawn between behaviour that will result in disciplinary actions, and those which will not; a 'fair-blame' culture. Close calls and early warnings are vital warning signs that must be considered important in managing risk. Hopkins (2005) warned against cultures of risk-denial, where the significance of such events is either missed or dismissed by considering them 'normal', downgrading intermittent warnings, putting an onus of 'proof' that these events are a risk.

There has been documented evidence that failures can be directly attributed to deficits in risk culture. Kimbrough and Componation (2009), reviewed case studies of failures in risk management and concluded that notable failures including the Titanic, Three Mile Island and NASA shuttle disasters could be blamed on cultural issues that could have been prevented through innovation and collaboration; improved communication and clearly defined and specialised tasks. They also found a positive correlation between successful enterprise risk management and flexible, organic structures. In a report on risk governance deficits, The International Risk Governance Council (IRGC, 2009) identified two clusters of deficits after analysing several well publicised case studies, firstly those related to assessing and understanding risk and secondly those relating to managing risks, including the issue of organisational culture. The report argues the importance of understanding cultures and that a 'good' risk culture creates a sound basis for how the competing pressures for risk taking and risk avoidance are resolved. Farrell and Hoon (2009) argue that an effective risk culture is one in which individuals understand that risk and compliance applies to everyone and that there is a common understanding of the purpose of the organisation, and that this may be becoming lost. This could be a risk in the water industry, and affect WSP 'culture' where there are a great deal of competing priorities other than public health protection. Farrell and Hoon (2009) also found that many companies showed deficiencies in risk culture, such as a lack of understanding of risk assessment, and a lack of risk training or guidance. When managing risk in terms of drinking water quality, water suppliers may benefit from lessons learned from HROs and organisational failures such as those discussed. However, developing mindfulness will not be an easy task and will involve a cultural shift.

2.3.4 *Leadership and organisational culture*

In the context of this study, it is important to understand leadership, because leaders not only influence organisational culture but also have the power to effect culture change. There are many definitions of leadership:

- *"Leadership defines what the future should look like, aligns people with that vision, and inspires them to make it happen despite the obstacles"* (Kotter, 1996).

- *"The process of influencing others to understand and agree about what needs to be done and how to do it, and the process of facilitating individual and collective efforts to accomplish shared objectives"* (Yukl, 2006).

- *"Leadership is an act of motivating people to act by non-coercive means"* (Popper and Lipshitz, 1993).

- *"Leaders have the capacity to establish direction and to influence and align others toward a common goal, motivating and committing them to action and making them responsible for their performance"* (Bnet, 2009).

In summary, leaders have the ability to influence, inspire and motivate others. It should be noted here that none of the definitions use the term manager, or management. Leadership and management are different constructs that complement one another. Kotter (1999) distinguishes the two. Management is about coping with complexity through planning and setting targets, ensuring a plan is accomplished through controlling and problem solving. Leadership on the other hand is about coping with change by setting direction, developing a vision and aligning people; achieving a vision by motivating and inspiring people. Leaders, therefore, do not have to be managers.

Charismatic leaders influence commitment in the workforce. This is supported by Shamir et al. (1993) who argue that charismatic leaders engage followers' self-concepts in the interest of the mission articulated by that leader. However, Schein (2004) highlights that such leaders are rare, and most actively embed values in the organisation and influence commitment to practices (e.g. WSPs) through primary embedding mechanisms such as:

- What leaders pay attention to, measure & control on a regular basis;

- How leaders react to critical incidents and crises;

- How leaders allocate resources;

- Deliberate role modelling, teaching and coaching;

- How leaders allocate rewards & status; and

- How leaders recruit, select, promote and excommunicate.

And secondary articulation and reinforcement mechanisms including:

- Organisational design and structure;

- Organisational systems and procedures;

- Rights and rituals of the organisation;

- Design of the physical space, facades and buildings;

- Stories about important events and people; and

- Formal statements of organisational philosophy and character.

Despite a lack of documented guidance on generating buy-in for WSPs and the specific influence of leaders in this regard, much can be learnt from the organisational culture literature. Setting the right tone at the top of an organisation has a marked influence on an organisational culture of risk management. Tolbert and Zucker (1996) identify three stages for the implementation of a new practice: (i) 'Pre-institutionalisation', where there are few adopters and limited knowledge; (ii) 'Semi-institutionalisation', where knowledge of the practice is widely diffused but it has a short history and is not yet permanent, possibly with a 'fad' quality; and (iii) 'Full institutionalisation', where the practice is efficient and necessary. One could argue that WSPs within the global water sector are in the semi-institutionalisation stage (ii). What happens during this stage determines whether the practice becomes institutionalised, or forgotten. Tolbert and Zucker (1996) are clear that acceptance of a new practice as the norm is strongly affected by the actions of management. To change cultural attitudes that have become embedded within an organisation for many years is not easy, but organisations can make steps to improve it through effective leadership (Schein, 2004). In his studies of culture and organisational incidents, Reason (1998) argues that by changing aspects such as the structures, practices, policies and procedures within an organisation, then

beliefs, attitude and norms can be attuned. Earlier, the culture of HROs were discussed, investigations into their management culture reveal important insights for water utilities seeking to progress towards best practice (Bradshaw et al., 2009). Leaders within HROs recognise that human error occurs, but also that human variability and an ability to adapt to changing events is an important safeguard.

Fernandez-Muniz et al. (2007) showed that leaders influence the safety culture of employees in two ways: indirectly through support and funding for implementation and development of a safety management system; and directly through positive attitudes and behaviours. They argue that positive words and formal declarations are insufficient to modify employee behaviour, and so managers must become personally involved in day to day actions in order to demonstrate commitment and modify behaviours; demonstrating leadership rather than management *per se*. Likewise, Flin (2003) argues that good safety management goes beyond knowing the 'safety script' and Hopkins (2005) cautions that too often, leaders think that they can achieve safe operation by publicly stating that safety comes first, but then leaving it to others. This, he argues, inadvertently conveys a message about priorities and summarises several surveys which found that whilst senior managers considered they put safety first, 'coal-face' workers did not agree.

"*Following the incident, the director came to us and asked us what we could do to prevent any similar thing from happening again*", this quote comes from an interview with a water utility employee (Pollard et al., 2007). While this shows that leaders in the organisation paid attention to quality and was concerned that incidents did not occur in the future, it also highlights a concern that in order to take risk management seriously, such an event needs to occur in the first place. If such events do not happen for some time, there is risk of complacency. Again, we may learn from the experiences of safety culture. In their guidance document 'Strategies for leadership' the American Hospital Association (Conway, 2001) considered hospital executives and their role in patient safety and acknowledged that through effective leadership, significant safety improvements could be made "*without waiting until a highly public sentinel event forced their hand*".

Leaders are instrumental in creating a mindful culture. Kotter, (1990) proposed six tasks that are needed to effect culture change: (i) establishing direction; (ii) aligning people; (iii) motivating and inspiring people; (iv) planning and budgeting; (v) organising and staffing and (vi) controlling and problem solving, of which (Ruchlin et al., 2004) argued the first three were leadership tasks and important in creating a high reliability organisation: (i) establishing direction; (ii) aligning people and (iii) motivating and inspiring people. Kouzes and Posner (2002) identified five 'practices' of exemplary leadership:

  i. **Model the way:** Leaders' actions are important, and they must be actively involved and demonstrate their commitment. Clarification of values, and aligning actions with shared values.

 ii. **Inspire a shared vision:** A clear vision of the future and being able to enlist others.

iii. **Challenge the process:** Searching for opportunities and willingness to experiment and take risks.

 iv. **Enable others to act:** Leaders foster collaboration and strengthen and encourage others.

  v. **Encourage the heart:** Recognition of others' work and celebration of values and victories to create.

Clarke and Ward (2006) also highlighted the pivotal role of leaders in high reliability organisations relating to safety behaviour, showing that leaders influence tactics such as rational persuasion, consultation, coalition and inspirational appeals had a significant effect on individual employee behaviour. However, Kotter (1995) went on to identify some common errors of leadership, as reasons why efforts for cultural change fail. These can potentially be applied to WSP implementation:

- **Not establishing a great enough sense of urgency** (e.g. provide a realistic timeframe for WSP implementation).
- **Lacking a vision or under communicating the vision** (e.g. ensure all staff are aware of motivators for completing WSPs and what is expected to be achieved).

- **Not anchoring the changes in corporate culture** (e.g. ensuring WSP responsibilities are included in daily procedures or targets).

- **Not systematically planning for and creating short term wins** (e.g. performing a pilot WSP on a system that will show the most benefit).

- **Not removing obstacles** (e.g. ensure that staff are provided with sufficient resources to complete WSP).

- **Not creating a powerful enough guiding coalition** (e.g. ensuring that staff with sufficient responsibility are dedicated to the WSP team).

In developing WSP implementation strategies therefore, leaders should guard against such errors from the outset. Lessons may be learned from organisations such as HROs and positive leadership attributes by those wishing to influence behaviours relating to public health and safety in the provision of drinking water and effect culture change to ensure sustainable WSP implementation.

2.3.5 *Specific insights into organisational culture, leadership and WSPs*

Considering sections 2.3.2 and 2.3.3, it is vital that organisations or promoting external agencies acknowledge the impact organisational culture can have when trying to implement new practices, such as WSPs. However, from the current guidance literature and documented case studies, it is an area that needs more research.

The introduction of the WSP manual (Bartram et al., 2009) does touch on the issue of organisational culture, though it is not discussed explicitly. The manual reinforces certain aspects, in order to prevent the 'badge on the wall' mentality mentioned previously. For example, reiterating that (i) the approach should be dynamic and practical; (ii) that there are many ways to undertake such an approach and it should be suited to the organisation; (iii) that the WSP cannot be performed solely as a desk study; and that (iv) nothing should be taken for granted, to avoid complacency. Several case studies touch on the issue of organisational culture. In developing WSPs for community managed supplies in Bangladesh, culture played an important part (Mahmud et al., 2007) addressing cultural issues included: the provision of hygiene training to communities, adapting the WSP guidance in order to provide pictorial tools where literacy was low; and acknowledgement that the documentation aspect of WSPs would

be difficult due to cultural barriers and a reluctance to document. In Jamaica, the value and importance of leadership was acknowledged in the lessons learned, that engaging leaders not only within the water company but also from relevant stakeholders would assist in implementation (EEM Ltd., 2006). In reviewing the challenges and lessons learned from implementing WSPs in Uganda, Tibatemwa *et al.* (2004) identified some organisational culture issues, mainly that changing the attitudes and work mentality of staff to a new way of working was not an easy task.

Despite the above accounts that culture must be considered, there is a lack of explicit evidence describing what leadership attributes and organisational cultures might be influential in increasing enthusiasm and competency of employees and stakeholders to proactively manage risk. This raises a broader and arguably more fundamental issue of the differing motivations between the various stakeholders associated with WSPs, and within any single stakeholder group. For example, in the context of low-income countries, public health and water quality are often the main drivers of national Governments, public health professionals and organisations such as WHO. For donor organisations, water quantity is often emphasised, especially in emergency and relief contexts: *"In the initial phase of a disaster, quantity is more important than quality"* (Sphere, 2004). For those implementing projects, completion within budget and time are often the main drivers. For the collectors of water, invariably women and children, improved access is the primary concern, whereas for men, water quality is paramount (Webster, 2006). Similar differences occur within organisations in developed countries: the vision of public health may originate with leaders, but managers are under pressure to deliver the corporate vision to budget and time, and field implementation may be more concerned with quality and service. The danger is that the rationale and vision get diffused. Whilst most guidance available indirectly refers to organisational culture (implementation of WSPs in itself is aiming to create a culture shift, from a reliance on end product testing to preventative risk management), there is little explicit consideration of the effect of organisational culture and the impact of leaders.

2.4 Organisational commitment and buy-in

2.4.1 Managerial commitment

One aspect that most WSP guidance and case studies agree on is that 'buy-in' from across the organisation, and particularly senior management, is imperative to successful implementation (Godfrey and Howard, 2004; IWA, 2004; NHMRC, 2004; WHO, 2004a). Attempts have been made at guiding utility managers on the benefits of WSPs. Davison et al. (2005) offers some arguments that senior managers may find attractive in the WSP concept, such as the demonstration of best practice application, potential savings and improvements in asset management. The WHO WSP manual acknowledges *"Implementation requires commitment at all levels within the organisation"* (Bartram et al., 2009). The Australian guidelines for the management of drinking water quality (NHMRC, 2004) suggest actions such as WSP policy production, communication and engagement of stakeholders as demonstration of commitment. Godfrey and Howard (2004) offer valuable suggestions to those in developing countries promoting benefits such as cost savings, the demonstration of best practice, quality assurance versus quality control and offer a decision tree for promoting the case for WSP development. The guidance is however, concise, and managers may require a more developed rationale. One might also argue, however, that listing benefits such as cost savings first, though of added value, might detract from the primary aim of WSPs, the protection of public health.

Notwithstanding the useful pointers above, there remains limited evidence of what managerial commitment to WSPs looks like, and how to generate it. Managerial commitment is linked to organisational culture and also generating commitment amongst other employees, Hopkins (2005) argued that creating the right mindset among employees is ultimately an issue of management culture within the organisation, and a management commitment to ensuring safety in the workplace. Woerner (1996) stated, *"without true management commitment and visibility throughout the operation, the safety program will never reach its greatest potential"*. Here he was talking about occupational health and safety, but the same could be said of water safety initiatives. Where literature on commitment to WSPs is lacking, some investigations have been made into management commitment to health and safety in the workplace, studies have

demonstrated a close correlation in workplace safety perception and the perceived support from management (Cooper, 2006; Gyekye and Salminen, 2007). Flin (2003) suggested that once managers are committed, they should regularly check that this commitment is being communicated to their employees through surveys of perceptions and upward appraisal surveys. Demonstration of commitment was also highlighted through time allocation and prioritisation of safety, particularly when in conflict with competing pressures. To summarise, management needs to actively demonstrate its commitment to WSP implementation as well as espousals of commitment. Without this, commitment from elsewhere in the organisation will be hard to generate.

2.4.2 Organisational commitment and motivation

WSPs assist in refining operating procedures, raising awareness of the causal agents of waterborne disease, and establishing investment priorities (Rouse, 2007); yet despite the benefits, organisational buy-in can be elusive. WSPs may be misconstrued as bureaucratic exercises in auditing unit processes, as an imposed regulatory burden, or as 'another head office initiative'. Preventative risk management, by its very nature should deliver fewer adverse incidents, but because tangible operational evidence for this can be scare especially when operations appear 'OK', investment may be hard to justify. Gaining commitment from across the organisation is therefore vitally important.

There are many different definitions of organisational commitment, particularly when talking about specific targets. Meyer and Herscovitch (2001) reviewed various definitions to come up with a general agreement, that "*commitment is a stabilising or obliging force that gives direction to behaviour*". Meyer and Allen (1991) determined that there were three components to organisational commitment: (i) Affective- reflecting a desire to belong to the organisation due to feelings of comfort or personal competence; (ii) Continuance- reflecting a need to remain due to the costs of leaving and (iii) Normative- reflecting an obligation to remain as a result of loyalty or the receipt of favours that require payment. Meyer and Allen (1991) suggested that organisations should not view commitment as a mechanism to reduce turnover but consider the other effects that increasing commitment had on personal wellbeing and willingness to work toward organisational goals (such as in this case, WSPs). Further research identified a strong correlation between affective and normative commitment, and we can determine

that such loyalty and desire to remain part of an organisation will be strongly correlated with organisational culture.

Cohen (2007) built on previous models of organisational commitment, taking into account criticisms of earlier models (such as the correlation between normative and affective commitment) and that commitment perceptions change through employment time. Cohen proposed that organisational commitment was two-dimensional: instrumental and affective. The instrumental dimension relates to: "*An attachment resulting from one's perception of the quality of the tangible exchange between his or her contributions to the organisation and the rewards he or she receives*". The affective dimension is based on a psychological attachment and internalisation of the goals and values of the organisation: "*a psychological attachment to the organisation such that the individual identifies with, is emotionally involved in and feels a strong sense of belonging to the organisation*". Cohen's model also took into account commitment propensity, developed before entry into the organisation and commitment, developed after entry.

Meyer and Herscovitch (2001) presented a general model of workplace commitment. They determined that commitment is a mind-set that can take different forms and binds an individual to a course of action that is of relevance to a particular target. Affective commitment had a stronger relationship with focal behaviour than normative or continuance commitment, and different forms of commitment will combine to influence behaviour. Meyer and Herscovitch (2001) were then able to make a number of recommendations to management, which we could consider when thinking about organisational commitment to WSPs. These recommendations included giving due consideration to the desired outcomes of employee commitment and therefore determine if it is more beneficial to focus on establishing commitment in a broad sense, to the organisation, or to more specific targets (e.g. WSPs or public health protection). Affective commitment is most effective and the authors suggest that wherever possible, managers should try to develop this, which may also overlap with creating the desired organisational culture. In developing commitment, it is important to take into account the different mindsets (wants to; ought to; has to) and how strategies in developing such commitments will be perceived by these.

Commitment to the adoption of a new practice (such as WSPs) may be dependent on the processes involved and reasons for that adoption, DiMaggio and Powell (1983) identified three typologies for organisations adopting new practices:

i. **Coercive**, where the practice is imposed by a more powerful authority;

ii. **Mimetic**, where an organisation adopts the practices of more successful organisations; and

iii. **Normative**, when the organisation adopts practices that it considers appropriate.

One might argue that where the process is normative, internalisation of the practice will be greater. Commitment to the job, and practices (such as WSPs) is important. Kostova and Roth (2002) discuss the 'ceremonial adoption' of a practice, which occurs where a practice is implemented but employees do not believe in its true value, and thus results in a low level of 'internalisation'. This may occur where there are regulatory pressures to implement, yet the practice appears contrary to the organisational beliefs and values. This may be the case where a regulator stipulates that WSPs should be produced, yet the culture of the water supplier is rooted in compliance testing alone. Internalisation is vital for staff, because positive perceptions of improvement impact on implementation as well as ensuring longer term institutionalisation (Kostova and Roth, 2002). It is here, in internalising WSPs within the organisation, where managerial commitment is vital.

In discussing commitment, one should also consider motivation, the factors that make someone committed to a particular goal. This will be an important consideration when trying to generate commitment to WSPs. Motivation can be thought of in terms of intrinsic, i.e. motivation by internal factors such as pleasure, or the feeling of importance of significance of a task, or extrinsic, motivation by external factors such as money, coercion or fear of punishment. There are many theories of motivation. Herzberg et al. (2004) split motivation into true motivators and what he termed 'hygiene' factors that were not true motivators in their own right, but *absence* of these factors caused de-motivation. Hygiene factors, or needs, in the workplace could include things such as salary, status, job security, satisfying needs for personal life and relationships with colleagues. True motivators on the other hand included achievement, recognition, responsibility and opportunity advancement. Another famous theory is Maslow's hierarchy of needs (1943):

i. **Biological and Physiological needs** - such as air, food, drink, shelter, warmth, sleep;

ii. **Safety needs** - protection from elements, security, order, law, limits, and stability;

iii. **'Belongingness' and love needs** - work group, family, affection, relationships;

iv. **Esteem needs** - self-esteem, achievement, mastery, independence, status, dominance, prestige, managerial responsibility; and

v. **Self-actualisation needs** - realising personal potential, self-fulfilment, seeking personal growth and peak experiences.

So, once a person's biological needs have been satisfied, they will need satisfaction of safety needs to be motivated and so on up the hierarchy. Also discussed by Maslow (1943), were cognitive needs, for example, knowledge and meaning. Building on Maslow's work, Douglas McGregor developed his 'Theory XY' model suggesting that there were two main styles of management, theory X, which was an authoritarian style and generally a poor motivator of employees; and theory Y, a participative management style that produced better performance and results, and increased motivation (McGregor and Cutcher-Gershenfeld, 2006).

Adams' (1963) 'equity' theory considers the influence of other people's situations, for example making comparisons with colleagues situations. Adams maintained that motivation arises when people feel that they are fairly or advantageously treated. When they feel unfairly treated, then de-motivation occurs. The equity model therefore does not depend on reward and effort, but comparison of the ratio of reward and effort with others. Locke (1996) identified that commitment within the workplace was strongly influenced by the setting of goals, that goal setting was a motivator. His research showed that the more specific and difficult goals were, the higher the performance and commitment. However, employees had to feel that the goal was also important and attainable before being committed, and that goal setting is most effective when feedback showing progress is provided. More recently, Nohria et al. (2008) describes a new model that gives direction to leaders wishing to fulfil a number of drives that motivate employees. Four 'drives' and associated primary levers were identified. The first drive, to 'acquire' goods (physical or otherwise) that increase well being corresponds to the primary lever of reward systems. The second, to 'bond' was dependent on culture, in

which leaders could develop by fostering friendship, valuing collaboration and encouraging sharing of best practice. Thirdly, the drive to 'comprehend' was dependent on the primary level of job design. Leaders could therefore increase motivation by ensuring jobs had distinct and important roles, and were meaningful. The last drive, to 'defend' oneself, was dependent on performance management and resource allocation processes. Leaders could increase transparency, emphasise fairness and build trust in order to increase motivation amongst workers.

In summary, motivation is a multi-dimensional construct, and money alone is not an effective motivator. Once basic needs are satisfied, employees will need effective relationships, cognitive needs, recognition, achievement and opportunities to generate motivation, and such factors should be taken into account when generating WSP commitment.

2.4.3 Existing insights into commitment, motivation and WSPs

A recent IWA survey discussed a range of barriers that prevented water suppliers implementing WSPs effectively, such as a lack of skills, knowledge and finance, poor institutional arrangements, and uncertainty over how best to implement them. This uncertainty may result in an unwillingness to invest in WSP development. Reasons for this resistance and therefore a lack of commitment (Zimmer and Hinkfuss, 2007) included:

- More work for staff.
- Competition with other projects.
- Resistance to change/cultural barriers.
- Cost/time constraints and,
- An absence of upfront investment, with a lack of demonstrable outcomes.

Two problems for those seeking to secure executive support for WSPs appear to exist: (i) the lack of guidance on developing a compelling narrative that will secure buy-in; and (ii) an absence of a clear picture of what true commitment looks like. Mahmud et al. (2007) described the successful implementation of WSPs in community-managed supplies in Bangladesh; systems traditionally challenged by the use of untrained community members to operate the water supply. The authors detail how the WSP was developed, but less so on how commitment was generated. The first stage of

development was a conference where the discussions on the importance of WSPs took place and this "*resulted in a firm commitment from all stakeholders to implement WSPs in rural water supplies in Bangladesh*". A number of questions arise:

- What were the important aspects of WSPs that generated this commitment?
- Who were the stakeholders involved?
- Were the community operators involved at this point?
- What constituted *firm commitment?*

Following success of a pilot project, evidence could be used to generate more commitment using this example through regular interaction and sharing of information between organisations undertaking WSPs in Bangladesh (Mahmud et al., 2007). The WSP manual (Bartram et al., 2009) includes a number of case studies, one of which in the UK, briefly mentions managerial commitment, sought via provision of a short document outlining the methodology, implementation and expected achievements to senior managers and the board to obtain approval. Again, detail on the mechanisms and demonstration of commitment is limited.

Many examples from developing countries benefit from external funding and/or expertise in the form of research projects, and future commitment could have been generated by the implementation phase. Commitment may not be so easy to get in an organisation with little money or in those organisations yet to undertake a pilot project. Gregor (2007) comments on the importance of local commitment and buy in when implementing WSPs in developing countries, where the driver comes from external aid agencies and non-governmental organisations (NGOs). Commenting on WSP implementation in the Pacific Islands, Gregor (2007) describes the aim of enhancing local capacity and involving governments in water safety planning so that when external agencies leave, a legacy of local ownership and sustainability is secured. Local commitment was developed through participative workshops, and one-on-one training for water utilities with experts. Similarly, reflecting on the development of a separate WSP in the Caribbean (EEM Ltd., 2006), senior managers at the water authority and key stakeholders were not engaged until the end of the process, which then proved difficult. It was recognised that had regular meetings with senior management been

incorporated, buy-in to the recommendations from the plan may have been easier to secure.

From developed nations, there is limited reference to managerial commitment in the case study literature. Mullenger et al. (2002) describe the experience of South East Water Limited, Australia, in implementing HACCP plans for drinking water. They document a wide range of benefits for the organisation, such as a greater understanding of water quality issues, more streamlined work procedures and improved customer responses, giving rise to a reduction in the number of complaints received. Initial managerial commitment is not discussed, but it was noted that "*the initial reaction of most staff to the implementation of HACCP was not favourable*". Although these attitudes changed towards the end of the project, little detail was given on attempts to secure commitment at the outset, and the role that senior managers played.

Perhaps further investigation into the core priorities of the water supply business is needed when considering buy-in and management commitment. Cost-benefit arguments and being able to demonstrate to stakeholders that best-practice is being undertaken may be helpful in getting the 'go-ahead' to a project and be considered strategic added value, but will this truly generate commitment? Can checklists of what managerial commitment looks like ensure it is there in practice? As the WHO guidelines initially stated, WSPs are the most effective means of protecting public health, and as such commitment and buy-in and advocacy of public health protection via supply of good, safe drinking water as a 'basic assumption' of the organisation may give some insights into true WSP commitment. As Hrudey and Hrudey (2004) observed, "*So many outbreaks appear to have been caused by neglect or complacency that is incompatible with recognising safe, clean drinking water as a top priority in life. No amount of economic rationalisation can make sense of providing mediocre service to the public for something so vitally important*". Public health appears infrequently within corporate aims and objectives, and serious water quality incidents continue to occur, perhaps what is needed is a commitment to protecting public health, rather than a commitment to WSPs *per se.* In stressing the need for commitment, it is not suggested that the sector is not committed to public health protection; rather that it requires a renewed visibility. It is important to avoid a 'badge on the wall' mentality for WSPs, which has been

associated with the inappropriate implementation of procedures such as HACCP and ISO 9001 for example (Hamilton et al., 2006).

2.5 Capability maturity models and cultural assessment tools

One of the objectives of this research is to develop a 'Bonn Charter Capability Maturity Assessment' that will enable investigation of organisational culture and its influence on WSP to assist suppliers in using the Bonn Toolbox more effectively (Chapter 1.3). Many authors (Fletcher and Jones, 1992; Hofstede et al., 1990) consider that there is no right or wrong culture. However, though a 'correct' culture may not be definable, there are cultural attributes and assumptions that contribute to more successful WSP implementation and internalisation. For example, water quality is more likely to be assured if there is a culture where reporting 'close calls' is encouraged and learnt from as opposed to employees fearing reporting close calls due to an unfair blame culture.

2.5.1 Risk management process benchmarking

The WSP approach is intended to be a cyclical one, benchmarking exercises are increasingly being used to identify best practice and support continuous improvement and learning. Benchmarking has been used extensively over the last 20 years and is now an accepted management practice, bringing many advantages to organisations, but also some criticisms about its usefulness (Francis and Holloway, 2007). Benchmarking broadly falls into two categories, *metric* and *process*. The International Benchmarking Network for Water and Sanitation Utilities (IBNET, 2010) makes the following distinction:

- Metric Benchmarking is the quantitative measurement of performance against other organisations over time using Key Performance Indicators (KPIs).

- Process Benchmarking is the management analysis of a utility's own business processes and comparison with those of organisations with exemplary performance in those processes.

Larsson et al. (2002) identified merits that process benchmarking can have over metric. Metric benchmarking can identify areas where there is a performance gap, but does not provide an understanding of the reasons for that gap. It can be used to provide trends,

set performance targets and make comparisons with peer organisations. Process benchmarking however can provide "*a systematic process for searching of best practices, innovative ideas and highly effective operating procedures that lead to superior performance, and then adopting these practices, ideas and procedures to improve the performance of one's own organisation*" (Larsson et al., 2002). Process benchmarking can be performed within an organisation, between peer organisations or even different sectors in order to seek best practices.

Why do we need to benchmark, and what are the advantages? Process benchmarking provides a tool for initiating and sustaining continuous improvement with the aim of learning from 'best practice' (Rouse, 2007). This can be used to identify and implement the necessary changes to reach higher levels of process maturity (Francis and Holloway, 2007). Benchmarking is an important tool for developing and implementing water policy. Such tools can assist in identifying performance gaps and making comparisons across providers that can inform policy makers, those providing investment and also consumers (Berg and Corton, 2008).

However, benchmarking alone will not lead to process improvement. It can identify areas that need to be improved but must be accompanied by effective management procedures and a willingness within the culture of the organisation to embrace change (Main et al., 2006). Particularly when benchmarking between organisations, 'best practice' processes may need to be adapted (e.g. to take into account different cultures, structures, resources). In order for that process to work effectively in the target organisation, these processes must be implemented and continually reviewed in order to strive for continuous improvement (IBNET, 2010). Lincoln and Price (1996) warn that badly managed benchmarking can be a waste of time and money, and identified five 'tips' that help make benchmarking effective:

   i.   Do it quickly or not at all.
  ii.   Decide on either broad and shallow or narrow and deep.
 iii.   Use Critical Success Factors – i.e. the key areas.
  iv.   It is not essential to find a best-in-class company to benchmark against.
   v.   Manage change from the start – otherwise the study may identify and recommend changes that never get realised.

In the context of this study, the following review will concentrate on process benchmarking, as the aims of the project are to develop a tool that will allow water suppliers to benchmark their capability to implement the Bonn Charter and thus learn from best practice, rather than to benchmark the outcomes (i.e. water quality or public health data).

Capability Maturity Models (CMMs): MacGillivray *et al.* discuss the design (MacGillivray et al., 2007a) and application (MacGillivray *et al.,* 2007b) of a Risk-Management Capability Maturity Model (RM-CMM) specific to the water industry. CMM development originated in the software industry in 1986. The Software Engineering Institute (SEI) developed a process maturity model that would assist in improving software processes, and assessing the capability of software contractors (Paulk et al., 1993). The developers maintained that without an organised strategy for improvement, even managers that knew areas of weakness would find it difficult to decide upon which improvement activities to undertake first. The CMM aimed to design an evolutionary path that would allow organisations to increase their process maturity in a stepwise manner, building on the foundations laid down in the previous maturity level (Paulk et al., 1993). At each of the five maturity levels (Table 2.4), key process areas were defined that indicate to the organisation where improvements should be focused to reach that maturity level, with each process area containing a number of related activities – these process areas must be satisfied before the maturity level can be reached.

Table 2.4 Brief description of five CMM maturity levels

Level	Description
1 – Initial	Process ad hoc and chaotic. Success depends on individual effort and these successes are not repeatable from project to project.
2 – Repeatable	Basic project management established to track cost, schedule and functionality. Able to repeat earlier successes on projects with similar applications.
3 – Defined	Management and engineering activities documented, standardised and integrated into standard processes for the organisation.
4 – Managed	Detailed measures of process and product quality are collected. Processes and products are quantitatively understood and controlled.
5 – Optimising	Continuous process improvement enabled by quantitative feedback from the process and form piloting innovative ideas and technologies. Capacity for double and triple-loop learning.

The original CMM software model argued that increasing maturity corresponded to decreasing differences between targets and actual outcomes; decreasing variability in results; decreasing costs due to increased productivity and quality, and an increase in process efficiency (Paulk et al., 1993). The CMM was also considered to be advantageous in the selection of contractors; something that could also be of great benefit to the water industry, where work is increasingly being contracted out. Recent surveys of water suppliers show that review of suppliers and contractors risk management plans was rarely performed, creating a weak point in the supply chain (Zimmer and Hinkfuss, 2007).

However, CMMs have been criticised for being overly bureaucratic, focusing on an organisations' capability to satisfy the specifications of some other organisation, for example regulators, and not the organisation's capability to satisfy the needs of the end users. In his criticism of the CMM, Bach (1994) highlighted a number of potential problems:

- The CMM reveres process but ignores people, and that innovation does not appear in the model. Individual 'heroics' tend to be seen as a negative factor and appears on level one. Bach argues that the innovation and expertise of individuals should be encouraged and strategies developed to keep such personnel, with systematic problem-solving leadership enabling innovation rather than process control to enable standardised solutions. The same could be said of a water industry specific CMM because reliance on innovative techniques in areas where public health is at stake, rather than tried and tested proactive processes, may have catastrophic outcomes (MacGillivray et al., 2006).

- Another criticism is that adoption of the CMM encourages institutionalisation for its own sake and that organisations can become focused on achieving a higher maturity level rather than the true goal of improving processes, Bach termed this 'level envy', and this can blind organisations from the most effective use of resources.

MacGillivray et al. (2007a) developed a water utility specific risk-management capability maturity model (RM-CMM) to enable benchmarking of risk-management

maturity and in turn allow utilities to develop maturity in risk-management for "*optimal, credible and defensible decision making*". The RM-CMM was developed from reviews of water sector risk-management practice and CMM methodologies, scoping interviews, expert panel involvement and workshops with water suppliers. The expert panel and feedback from suppliers verified and validated the model. It was designed to measure and improve risk-management processes, allowing continuous improvement through 'small evolutionary steps', to reach higher maturity levels. A range of potential applications were highlighted, including: self assessment or external evaluation; use by managerial and technical staff as a reference model; and evaluation of third parties risk management maturity prior to selection.

Macgillivray *et al.* (2007a) identified eleven processes: Strategic risk planning; establishing risk acceptance criteria; risk analysis; risk-based decision making and review; risk response; risk monitoring; integrating risk management; supply chain risk management; change risk management; education and training in risk management and risk knowledge management. Organisations were measured on a 5-level maturity hierarchy from initial (1) to optimising (5) based on a number of key attributes that characterise process maturity: scope; integration; verification and validation; feedback and organisational learning; stakeholder engagement; competence; resources and, documentation and reporting. Culture was considered as an attribute but not included in the study as it was argued that culture is difficult to define and that culture change is a *consequence* of process improvement, not a prerequisite. However, as previously mentioned, the uptake of new practices and performance are affected by culture (Johnson, 1992).

In order to aid scoring, guideline statements that describe each process at each maturity level, in relation to the key attributes were developed. Process descriptions were also developed to outline the practices required to increase to the next maturity level. Assessments were made by analysis of self-assessment questionnaires, interviews and documents by an external reviewer (MacGillivray et al., 2007b). This provided an in-depth exploration of risk-management capability but such investigations can be costly and require significant time and resources to complete. Smaller organisations with limited resources may be discouraged from undertaking such an exercise.

Following identification of some limitations of the RM-CMM, mainly its prescriptive nature, the model was subsequently revised to a more descriptive form (MacGillivray, 2006). This model included two processes that consider preventative risk management, using foresight to prevent future mishaps (MacGillivray, 2006); (i) risk analysis and (ii) risk based decision making, made up of associated practices as shown in Figure 2.7. Maturity levels were characterised around these practices and the attributes that reflected maturity of implementation: procedures; roles and responsibilities; initiation criteria; resource management; input data management; output data management; verification; validation; organisational learning; stakeholder engagement and competence. The revised model was tested at one utility, using interviews and document analysis to allow the author to make a judgement about maturity. The benefits of the model were identified as the potential for facilitating a progressive change in risk management approach from one that is reactive, with outcome based approaches to one that is proactive (MacGillivray, 2006).
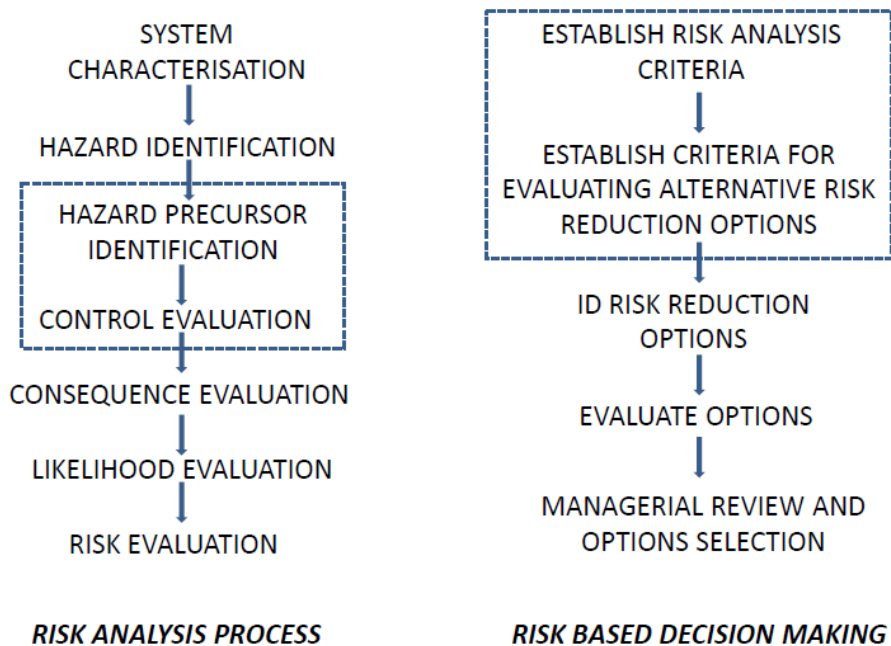
Figure 2.7 Processes from revised RM-CMM (MacGillivray, 2006)
Those practices within dashed box are considered key rather than critical by MacGillivray (2006).

Business Risk Management Maturity Model: In the production of its business risk management maturity model, the International Association for Contract and

Commercial Management (IACCM) attempted to provide a means for organisations to assess the adequacy of their risk management approach, compare approaches with best practice and give an accepted benchmark (IACCM, 2003). The model defined four levels (to prevent the choosing of 'middle ground') of maturity: (i) novice, (ii) competent, (iii) proficient and (iv) expert. Four key attributes were associated with risk management maturity: (i) culture, (ii) process, (iii) experience and (iv) application, each separated into a number of diagnostic characteristics used in the assessment questionnaire. The model aimed to identify maturity and set levels for improvement (Table 2.5).

Table 2.5 IACCM Business RM maturity Model (IACCM, 2003)

Maturity				
Attribute	**Novice**	**Competent**	**Proficient**	**Expert**
Culture	Risk averse, lack of awareness, strategy and commitment	Patchy, inconsistent. Some understanding & awareness, cautious approach	Prepared to take appropriate risk. Understanding of benefits, strategy mapped into implementation	Proactive, intuitive understanding, belief and full commitment to be the best
Process	Where present tend to be inefficient and informal, ad-hoc	Inconsistent. No learning from experience. Standard approach/generic	Consistent approach but scalable. Tailored to specific needs	Adaptive, proactively developed. Fit for purpose. Best of breed,
Experience	None; nothing relevant	Basic competence	Proficient, formal qualifications	Extensive experience, leading qualifications. Externally recognised high competence
Application	Not used	Inconsistent – major projects only. Process driven. Inadequate resource	Consistently applied. Adequately resourced	Proactively resourced. Across entire business. Flexible. Measured for improvement.

Aquality: Donlon et al. (2006) discuss the development of '*Aquality',* a benchmarking tool aligned to the Australian Framework for Drinking Water Quality (Chapter 2.1.3). The 'measures' used aim to give further clarification by providing examples of best-practice that can be used to develop action plans. Like the CMM, continuous improvement would occur due to the directing of resources to areas of weakness, in a prioritised manner due to the weighting of different processes in terms of importance.

Consideration to different utility and supplier types (within Australia) was given when developing the measures, such as size, responsibilities and regulatory arrangements.

Scoring within Aquality is based on four criteria, two of which assess capability and two execution. Execution is limited by the capability score (a supplier cannot execute a process if it is not first capable). Scoring is weighted depending on importance of activities and guidance given on how capacity scores constrain execution scores. Each of the four areas are scored on a five-point scale (similar to those in the CMM, initial to optimised). These scores are then used to give an overall score for each of the 12 elements of the framework. Guidance is given on the scoring of measures, including how scores impact on one another, helping to reduce subjectivity when scoring, allow comparisons to be made and also to make it a useful self-assessment tool, without the need for external support. One criticism of the CMM is that it is overly bureaucratic, this problem was considered by the developers of Aquality, acknowledging that *"Too little detail results in shallow implementation of the Australian Drinking Water Guidelines framework, while too much detail can give rise to bureaucratic processes overly focused on documentation at the expense of actual operational improvements"* (Donlon et al 2006).

The system is intended to cover the 'source-to-tap' approach yet it is understood that one organisation is unlikely to have sole control over the whole supply chain. Therefore, Aquality states that the areas to be included need to be made clear from the outset and assessment can be done by a two-step system either by (i) the supplier assesses its performance and its perceptions of other stakeholders, then the external agencies check this assessment or (ii) the supplier assesses its performance, and the assessment is then undertaken from the external agencies perspective. Aquality is commercially available to Australian water suppliers as web-based software, and is subject to review every 3-5 years to ensure that best practice experiences are maintained. Profiles are generated by the system graphically, as well as a report detailing the results of each measure and an action plan. Although specific to Australia, the ADWG framework is closely linked to the water safety plan approach and could relatively easily be adapted for worldwide use.

The People CMM: As the human element of water quality risk management has been discussed previously in this review, a search for benchmarking methodologies that looked at human elements of capability ensued. Most notable was the 'People Capability Maturity Model' (P-CMM), developed by the SEI (Curtis et al., 2001). The P-CMM is intended to be a 'roadmap for implementing workforce practices that continuously improve the capability of an organisations workforce' (Curtis et al., 2001), based on best practice in human resources, knowledge management and organisational development. As the organisation matures through the various levels, workforce practices increasingly align with the organisations business objectives. The benefits of the P-CMM are argued that working through the levels will create a 'culture of excellence' (Curtis et al., 2001) and that as workforce capability increases then so does readiness for performing critical business activities, the likely results from performing these activities and the potential for benefiting from investments in process improvement or advanced technology. The model is made up of 5 maturity layers. Process areas constitute a set of goals that are essential in achieving a component of workforce capability and practices are described that help satisfy these goals. Figure 2.8 describes the P-CMM maturity levels and associated process areas.

Maturity Level	Focus	Process areas
5 Optimizing	Continuously improve and align personal, workgroup, and organizational capability	Continuous Workforce Innovation Organizational Performance Alignment Continuous Capability Improvement
4 Predictable	Empower and integrate workforce competencies and manage performance quantitatively	Mentoring Organizational Capability Management Quantitative Performance Management Competency-Based Assets Empowered Workgroups Competency Integration
3 Defined	Develop workforce competencies and workgroups, and align with business strategy and objectives	Participatory Culture Workgroup Development Competency-Based Practices Career Development Competency Development Workforce Planning Competency Analysis
2 Managed	Managers take responsibility for managing and developing their people	Compensation Training and Development Performance Management Work Environment Communication and Coordination Staffing
1 Initial	Workforce practices applied inconsistently	

Figure 2.8 P-CMM process areas (Curtis et al. 2001)

According to the model, level 1 organisations are inconsistent in performing practices, they are characterised by a displacement of responsibility, ritualistic practices and an emotionally detached workforce. In contrast, at level 5, the whole organisation is focused on continual improvement through analysis of work and making process enhancements both at an individual, group and organisational level. Level 5 organisations continually evaluate lessons learned and learn from best practice, with a culture in which individuals strive to improve their own capability and contributes to improvements in performance at all levels of activity.

A wide range of benchmarking activities are currently undertaken within the water sector. With regard to the aims of the Bonn Charter, an RM-CMM has been described that could be adapted for use in determining maturity in WSP implementation, although the method described is limited in its current form for use within utilities, as it is dependent on external assessment through interviews and only focuses on the risk management part of the Bonn Charter. Some criticisms of benchmarking activities and CMMs have been discussed, but if these limitations are realised and the exercise is viewed as a tool to assist in improvement, rather than being the answer in itself, such activities can be of benefit in continual improvement. Table 2.6 outlines some related CMM and benchmarking tools, in consideration of their suitability as a Bonn Charter self assessment tool. Although certain elements of some of the tools were suitable, no one tool was sufficient in this context, through limitations in content and assessment style. The main issue is that, although some of these tools consider organisational culture to a small extent, none are thorough enough. For example, MacGillivray considered culture as an attribute but did not include it in the RM-CMM as it was felt that culture was 'difficult to define and that culture change is a consequence of process improvement, not a prerequisite'. However, other authors acknowledge that the uptake of new practices and performance are affected by culture (Johnson, 1992). These tools may however, prove useful in development of the BC-CMA.

Table 2.6 Existing tools that could be related to Bonn Charter

Tool	Focus	Scoring/ levels	Assessment	Content suitability[4]	Limitations
RM-CMM - INITIAL	Risk Management	1 (initial) to 5 (optimising)	External. Based on sub processes and attributes	1, 2 and 4.	Culture not considered; relies on external assessment
RM-CMM - REVISED	Risk Management	1 (initial) to 5 (optimising)	External. Based on sub processes and attributes	1 and 2.	Culture not considered; not self assessment
Aquality	Australian Drinking Water Guidelines	5 levels	Self/external. Based on capability: development & documentation & implementation: coverage & frequency	1, 2 and 4. Culture to some degree.	Too intensive, culture not considered in enough detail.
IACCM	Risk Management	Four levels: Novice, competent, proficient and expert	External.	1. Culture to some degree.	Not broad enough focus, not self assessment
People CMM	Human Resources	1 (initial) to 5 (optimising)	External. Maturity level defined by which areas in structure column are achieved.	4.	Focus solely HR; not self assessment

2.5.2   Cultural assessment

A pre-requisite of this research was to develop an assessment tool with a focus on organisational culture. Therefore, consideration was given to methods of cultural assessment.

Fletcher and Jones (1992) describes the development of a 'Cultural Audit' as a response to the concern that a malfunctioning culture could lead to poor quality work and underachievement. Four cultural types were identified: (i) Homogeneous vs. Heterogeneous; (ii) Enriched vs. Managed; (iii) Developing vs. Stationary and (iv) Balanced vs. Dissonant. The structure of the tool took into account aspects such as motivation, goals, stress and support, and aimed to measure individual differences by asking for respondents perceptions of: their own situation (M score); others' situations

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[4] *Suitability of content to be applied to Bonn Charter implementation, numbers 1-5 refer to Bonn Charter responsibilities.*

(O score) and, their ideal situation (I score). Analysis was based on around 200 response elements within sections and subscales grouped into (i) causes of problems (e.g. 'work demands'); (ii) outcomes (e.g. 'performance') and (iii) moderator (e.g. 'personality'). Each question was assessed on a 5 point scale. Fletcher and Jones (1992) highlighted that there was no ideal culture in agreement with Hofstede et al. (1990), and different culture types would work well in different situations. They noted that what was important were the differences between M and O scores and M and I scores, (the 'misfit' scores). This is an important consideration to take into account; one cannot pre-determine what the 'correct' culture would be, particularly for a wide range of supplier types. The downfall of this type of assessment was that it was large and complex, generating a huge amount of data that the organisation may find difficult to utilise.

Parker et al. (2006) built on the work of Westrum (2004) and Reason (1998) to propose a framework for understanding the development of organisational safety culture. This included abstract organisational aspects such as 'who causes accidents in the eyes of management', 'how do safety meetings feel', and concrete aspects such as audits, reviews and contractor management. Initially determined through interviews, the resulting framework was converted into a brochure for use in safety meetings to understand organisational culture. The framework consisted of five cultural typologies: pathological; reactive; calculative; proactive; and generative. These typologies could be related, i.e. used in parallel, with the five maturity levels outlined in CMMs (Table 2.7).

Hofstede et al. (1990) described a study of organisational culture, to determine if culture could be measured quantitatively, involving three phases: (i) in depth interviews; (ii) standardised surveys; and (iii) questionnaires followed by personal interviews. Surveys were structured around three 'value' (need for security; work centrality and need for authority) and six 'practice' items (process vs. results; employee vs. job; parochial vs. professional; open vs. closed; loose vs. tight and normative vs. pragmatic). Scoring was on a five point semantic differential scale with regard to agreement to pre-coded statements.

Leadership is an important consideration when discussing organisational culture, and as such it should feature in the BC-CMA. However, the BC-CMA will not be a leadership

survey. There is a wealth of leadership assessments available either on the internet[5], to purchase, or via external assessments. The design of these may have some influence on BC-CMA (many based on five point semantic differential scales), but the purpose of these surveys are more akin to personality assessments, for example Myers-Briggs (www.myersbriggs.org) type assessments of individuals rather than organisational culture. Whilst assessing individual personalities of leaders could prove useful in determining organisational culture, it is outside the scope of this tool, and there are already many assessments available for this purpose. We can however assess whether exemplary leadership is present within the utility by determining if such aspects are present, for example the 'five practices of exemplary leadership' of Kouzes and Posner (2002).

How the organisation learns, a defining feature of maturity, is also a cultural item. MacGillivray (2007a) outlined how learning was present at each maturity level (Table 2.7), based on the work by Argyris and Schon (1978), open loop learning at level three; single loop at level four and double and triple loop learning at level five. However, in the context of this research it was decided to differentiate these levels more by considering open loop learning an attribute at level two, single loop at level three, double loop at level four and triple loop at level five to make the jump from level four to five more even (Table 2.7). Organisational culture therefore can be assessed to a certain degree through self assessment. Consideration will be given to the above mentioned models and assessments in the design of the BC-CMA.

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[5] For example: www.chartcourse.com; www.humanmetrics.com;
http://crs.uvm.edu/gopher/nerl/personal/Assess/b.html

Table 2.7 Cultural typologies and maturity levels

Level	Cultural (from Westrum, 2004, Reason, 1998 and Parker et al., 2006).	CMM (MacGillivray and Pollard, 2008)	Learning types
1	**Pathological:** Information is hidden, messengers are 'shot', responsibilities are shirked, bridging is discouraged, failure is covered up, new ideas are actively crushed.	**Ad hoc**: Process ad hoc and chaotic. Success depends on individual effort and these successes are not repeatable from project to project.	When mistakes are made they do not learn – failures are repeated as well as success.
2	**Reactive:** (in terms of safety culture) Safety is important, a lot is done every time there is an accident.	**Repeatable**: Basic project management established to track cost, schedule and functionality. Able to repeat earlier successes on projects with similar applications.	**Open Loop:** Efficiency and quality of processes are variable, stemming from limitations in their verification, validation and feedback mechanisms. These limitations restrict organisations' ability to track and therefore control their processes.
3	**Calculative/Bureaucratic:** Information may be ignored, messengers are tolerated, responsibility is compartmentalised, bridging is allowed but neglected, organisation is just and merciful, new ideas create problems.	**Defined:** Management and engineering activities documented, standardised and integrated into standard processes for the organisation.	**Single Loop:** Emphasis is on improving techniques for executing processes, within the constraints of established process strategies. Learning is directed towards making existing process strategies more effective. Single-loop learning tends to be present in organisations where goals, values, frameworks and strategies are taken for granted. Lack of capacity for deeper learning hampers ability to make informed risk management decisions in rapidly uncertain contexts.
4	**Proactive:** (in terms of safety culture) Tries to anticipate safety problems before they arise.	**Controlled:** Detailed measures of process and product quality are collected. Processes and products are quantitatively understood and controlled.	**Double loop[6]:** Questioning the norms, values and assumptions underlying the design of risk management processes, typically found in organisations where information is continually developed through a broad range of channels. Information openly shared, communicated and used to publicly test assumptions and beliefs.
5	**Generative:** Information is actively sought, messengers are trained, responsibilities are shared, bridging is rewarded, failure causes enquiry, new ideas are welcomed.	**Adaptive**: Continuous process improvement enabled by quantitative feedback from the process and form piloting innovative ideas and technologies.	**Triple Loop:** Questioning and revising broader organisational structures and practices to optimise the capability of processes. The core enablers are an understanding of how human and organisational behaviour influence process capability, and flexibility.

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[6] *In the RM-CMM, Double and triple loop learning was considered characteristic of a level 5 organisation; single loop level 4, and open loop level 3. In order to distinguish the lower levels more, it was decided here to separate double and triple loop learning to the structure above.*

Investigating the cultural influences in incident causation and risk management with regard to safety culture in examples from the steel industry and medical profession, van Vuuren (2000) developed a risk management tool for classifying organisational factors of safety related incidents, termed a 'taxonomy of organisational failure'. The taxonomy was developed in an iterative, explanation building manner, initially from the literature, comparing with case studies, revising as appropriate and repeating this as necessary. The final taxonomy comprised of three main categories with related subcategories:

i. **Structure:** Task demands; responsibilities; skills and knowledge; working procedures; supervision.
ii. **Strategy and goals:** Management priorities.
iii. **Safety culture:** Norms and rules for dealing with risks; safety attributes; reflexivity on safety practice.

Such an approach could conceivably be adapted for use in developing a taxonomy of cultural factors that contribute to sustainable WSP implementation.

2.6 Methodological approaches

2.6.1 Theoretical aspects of social sciences methodology

Neuman (2003) describes three main approaches to social science research: positivism; interpretive social science (ISS); and critical social science (CSS). In practice researchers may not stick to one approach, although will focus mainly on one. The positivist approach is that used by the natural sciences, and was developed for use in sociology by Emile Durkheim (1895) as an "*organised method for combining deductive logic with precise empirical observations of individual behaviour in order to discover and confirm a set of probabilistic causal laws that can be used to predict general patterns of human activity*" (Neuman, 2003). Quantitative data is preferred, generated through methods such as experiments, surveys and statistics. The goal of the researcher is to remain detached, neutral and objective.

Criticisms of the positivist approach are that it falsely represents human social action and fails to deal with the meanings of real people, leading to the development of anti-positivist strategies such as hermaneutics, contructionism, ethnomethodology, cognitive, idealist, phenomenological, subjectivist, and qualitative sociology, collectively termed

the 'interpretive social sciences' which can be traced to the sociologist Max Weber (Neuman, 2003). Rabinow and Sullivan (1988) give a good introduction to the development of ISS stating that ISS aims to examine the meaning embedded within text and to study meaningful social interaction. Qualitative methods are preferred with ISS, through methods such as observation and field research. ISS is sensitive to context and a goal is to achieve an empathetic understanding.

A third approach is that of the critical social sciences (CSS), including versions such as dialectical materialism, class analysis and structuralism, that can be traced to Karl Marx and Sigmund Freud (Neuman, 2003). CSS researchers claim that ISS is too subjective and relativist. Neuman (2003) described CSS as *"a critical process of inquiry that goes beyond surface illusions to uncover the real structures in the material world in order to help people change conditions and build a better world for themselves",* in other words, it aims not to be detached or neutral and actively influences the subjects. Neuman (2003) highlights that historical-comparative methods are favoured due to the emphasis on change, but few full time researchers adopt CSS, instead it is more often used by community action groups, political organisations and social movements.

To develop a deeper understanding through abstract explanations, empathetic understanding is needed. The research design must therefore be flexible, iterative and continuous (Rubin and Rubin, 2004). Using qualitative methods, it is impractical to think that the researcher can remain completely detached, neutral and objective as is the goal in positivist research (Neuman, 2003). This would actually be undesirable, as Schein (2004) noted: *"It would be impossible and undesirable to present any cultural analysis with total objectivity because one's emotional reactions and biases are also primary data to be analysed and understood".* This research is therefore based more in the interpretive and critical social sciences, which aim to *"analyse socially meaningful actions via direct detailed observation within natural settings, using varied methods and is concerned with achieving an empathetic understanding and interpretation of culture"* (Neuman, 2003).

2.6.2 *Theoretical aspects of case study approach*

Case studies allow an in depth examination into many features of a few cases, which can be individuals, groups, organisations, movements, events or geographical units

generating detailed, varied and extensive data (Neuman, 2003). Yin (1981) highlighted that the case study approach should be viewed as a research strategy and not a method in itself; a strategy that may draw on several types of evidence and different data collection methods (e.g. ethnography, surveys.). Although there is a strong favour towards qualitative data, case studies can use qualitative and/or quantitative data and are not restricted to a particular type of data collection method (Yin, 1981). Stake (1995) and Yin (2009) stress that there are at least six sources of evidence that can be used to collect data when conducting a case study:

1. **Documents** (e.g. letters, agendas, newspaper articles).
2. **Archival records** (e.g. organisational records, survey data).
3. **Interviews** (e.g. semi-structured, focused, open ended).
4. **Direct observation** (unobtrusive observation during field research).
5. **Participant observation** (researcher becomes an active participant when observing).
6. **Physical artefacts** (e.g. tools, instruments or other physical evidence obtained).

According to Yin (2003), the case study approach represents "*an empirical enquiry that in explanatory, exploratory and descriptive contexts, can contribute to knowledge of individual, group, social, political and related phenomena*". George and Bennet (2005) highlight the strengths of a case study approach: its high conceptual validity; use in driving new hypotheses and in modelling and assessing complex causal relations. Single cases can be used where the case is a critical case in a well rounded theory; an extreme or unique case; a representative or typical case; cases and phenomena previously inaccessible to inquiry or in studying the same case at different points in time (Yin, 2009). Looking at multiple cases however, can add literal or theoretical replication and increase reliability.

Social research can be explanatory, exploratory or descriptive in nature. Hart (2001) offers some distinctions: Exploratory research focuses on the how, what, when and where and are often small scale and informal in structure in order to provide a better understanding, and examine the feasibility of further study. Descriptive research focuses on the how and what, tending toward small scale qualitative research in order to understand a social phenomenon to provide an empirical basis for valid argument.

Explanatory research focuses on the why and are often larger scale and based on qualitative data, aiming to explain the cause of a phenomenon, suggesting reasons for events and making recommendations for change. Case studies therefore lend themselves more to explanatory research (Yin, 2009).

It is important to perform a pilot case study to test and finalise the case study protocol that will be used and can also increase reliability (Neuman, 2003). Yin (2009) stipulates that the pilot test is not a pre-test, but the pilot test helps to develop relevant lines of questioning and provide conceptual clarification, occurring before selection of specific plans for data collection or final determination of the theoretical propositions, therefore, the pilot study will usually take more time. The pilot case scope will be broader and less focused than the final data collection plan, and can provide information about logistical and methodological issues as well as serving to narrow the scope of subsequent studies (Yin, 2009). As the scope of a pilot case differs from that of the final cases, they may be selected based on different criteria such as convenience, access and/or proximity (Yin, 2009).

2.6.3   Qualitative and quantitative data

Qualitative data, based on ethnography and field research was preferred for this study. Organisational culture and commitment to WSPs are not objects that can be quantitatively described, as they are concerned with human beliefs, experiences, attitudes, behaviours and interactions, and therefore qualitative methods are most appropriate. Qualitative research defined by Glaser and Strauss (1967) is "*any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification*". Qualitative data therefore usually takes the form of words rather than numbers and is a source of "*well grounded, rich descriptions and explanations of processes in identifiable local contexts*" (Miles and Huberman, 1994). It provides in-depth information generated from interviews, direct observation and written documents (Trochim and Donnely, 2007). Qualitative approaches include:

- **Ethnography/Field research:** study of whole cultures within the field using methods such as participant observation and in-depth interviews.

- **Phenomenology**: Emphasises respondent's subjective experiences and views, i.e. trying to understand how the world appears to others (Trochim and Donnely, 2007).
- **Grounded theory:** Developed by Glaser and Strauss (1967), develops a theory about the phenomena of interest that is grounded or rooted in observation.
- **Historical-comparative research:** Examines aspects of social life in a past historical era or across different cultures (Neuman, 2003).

However, quantitative methods should also be considered. Quantitative data is data measured on a numerical scale, often associated with positivist approaches. Quantitative approaches include: experimental research where independent variables are manipulated to measure effect on the dependent variable; statistical surveys; content analysis to produce data such as word frequencies, column inches, times counts and keyword frequencies; and existing statistics and secondary analysis from pre-existing statistical documents and publications (Krippendorf and Judd, 1991). A comparison of qualitative and quantitative approaches is shown in Table 2.8.

Table 2.8 Quantitative research vs. qualitative research (adapted from Neuman, 2003; Trochim and Donnely, 2007)

QUANTITATIVE RESEARCH	QUALITATIVE RESEARCH
- Tests hypotheses that the researcher begins with - Concepts are in the form of distinct variables - Measures are systematically created before data collection and are standardised - Theory is largely causal and it is often deductive - Procedures are standard, and replication assumed - Analysis proceeds by using statistics, tables, or charts and discussing how what they show relates to hypotheses. - Easier to make generalisations - Strength in control and local rigour, aim for objectivity - Data in the form of numbers	- Capture and discover meaning once the researcher becomes immersed in the data - Concepts are in the form of themes, motifs, generalisations and taxonomies mainly developed during data collection - Measures are created in an ad hoc manner and are specific to the individual setting or researcher - Data are in the form of words and images from documents, observations and transcripts - Theory can be causal or non-causal and is often inductive - Used to generate new theories and hypotheses and achieve a deep understanding of issues - Analysis proceeds by extracting themes or generalisations from evidence and organising data to present a coherent, consistent picture - Generates highly detailed data but more at risk from subjectivity and bias - Data in the form of words, actions, sounds, symbols, visual images, numbers.

Whilst qualitative and quantitative data differ, they can complement each other, and researchers do not have to restrict themselves to one type (Patton, 1990; Miles and Huberman, 1994; Yin, 2009). Qualitative approaches may therefore be useful in generating supplementary information in this study. For example, qualitative approaches can be used to gain a general sense of a phenomenon to develop theories, then quantitative approaches can be used to test these further.

2.6.4 Inductive versus deductive reasoning

The research described in this thesis mainly took an inductive approach that is, developing theory and hypotheses from observation, as used in approaches such as grounded theory (Chapter 3.1). Inductive approaches are more associated with methods such as interviews and ethnographical research, beginning with specific observations and building up to broader themes (Blaikie, 1993; Trochim and Donnely, 2007). In contrast, deductive approaches work from the more general to the more specific, developing a theory or hypothesis first, and then searching for evidence to prove, or disprove this, usually associated with quantitative methods such as experiments and surveys for example (Blaikie, 1993; Trochim and Donnely, 2007). The two approaches are given in Figure 2.9.
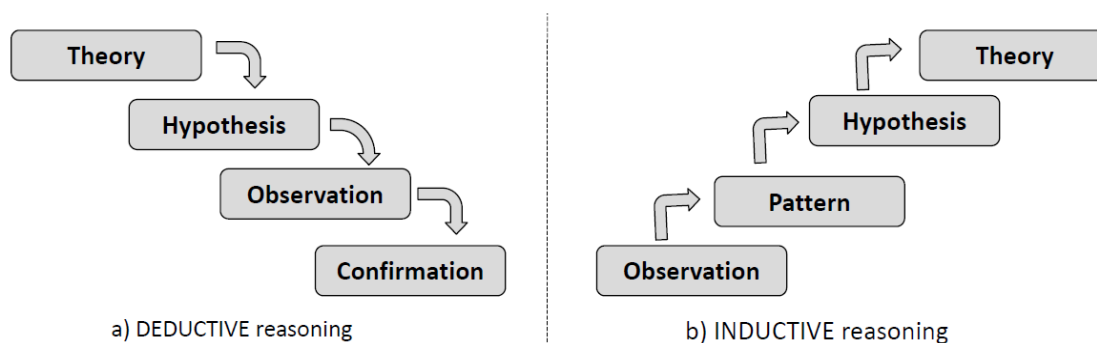
Figure 2.9 Inductive and deductive approaches (adapted from Trochim and Donnely, 2007)

However, in reality, much social science research combines inductive and deductive elements at different stages in the research process (Blaikie, 1993; Glaser, 1998; Trochim and Donnely, 2007). Inspection of the diagrams in Figure 2.9, show that the two approaches can be easily combined to form a cycle (Figure 2.10).
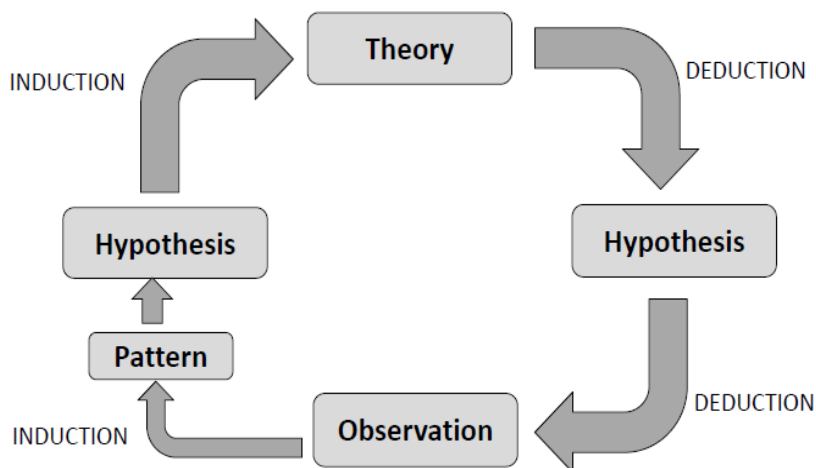
Figure 2.10 Combining inductive and deductive approaches

Combining approaches can help to overcome potential shortcomings of each, such as reservations about making broad statements based on a small number of observations in the inductive approach (see discussion on generalisation in Section 3.3.1).

2.6.5 Deciphering culture

Section 2.3.1 discusses some of the frameworks of organisational culture that can be used in assessment. In terms of methodology, Schein (2004) offers some guidance on 'deciphering culture' in terms of organisational culture and leadership. Assessing organisational culture will have some important challenges and issues to deal with when considering methodological approaches. Schein offers some issues to be aware of when assessing culture:

- There may not be one single set of assumptions formed.

- Subgroups may exist with different assumptions.

- Culture is continually evolving.

Schein identified that culture can be studied in a variety of ways, depending on the purpose of the investigation and the degree of involvement of the researcher to the organisation or members of the organisation with the research. Schein argues that for academic research and theory building, as was the case in this research, the researcher is an outsider, who must gain entry into and develop a relationship with the organisation in question, and so this research required field research, rather than desk based telephone interviews for example. In the research described in this thesis, the researcher had high

involvement, being in the field with time to devote to the organisations being studied, as such qualitative methods are most applicable. Schein identifies different methods depending on the level of subject involvement, such as ethnography, observation and content analysis for minimal subject involvement; interviews for partial subject involvement and clinical research for maximal subject involvement. Clinical research can be thought of in terms of case studies, but the theory argues that the defining feature of clinical research is that the data comes voluntarily from the organisation, ideally because they initiated the research themselves. However, in the context of this thesis, it is the researcher that initiated the research, particularly in cases that are not members of the Bonn Network. Schein states that in such cases, real cultural data will not emerge unless the subject feels there is something to gain, and will be helped by the research. It was therefore important to the researcher in this case, that reports and suggestions that arose from the research would be provided to the organisations following the field work (so as not to influence results during data collection) in order for them to learn from the experience, and make them aware from the outset of the importance of the research.

2.7 Conclusions and application to this research

A research interest in risk analysis tools and risk management frameworks within the water sector has been developed (MacGillivray et al., 2006; MacGillivray and Pollard, 2008; Pollard, 2008). These are a necessary but insufficient basis for improved vigilance on the ground. Recent studies confirm that the organisational infrastructure of risk champions, risk management committees and risk registers are also insufficient, in isolation, as one utility manager noted (Pollard et al., 2007) "*I think that one of the main barriers is convincing senior managers – they have to buy into* [*preventative risk management*]". Organisational commitment to the safe drinking water agenda cannot be taken for granted, but utility managers manage several competing priorities. However, without executive commitment, WSP development may inadvertently become a token gesture and not fulfil its potential. Hellier (2003) noted, in describing the application of HACCP in a water company, that even the best management systems do not deliver safe water alone; well trained people committed to the protection of public health will always be essential. This literature review considered why such

commitment is important, taking into account issues of leadership and organisational culture. It examined why buy-in is so challenging and emphasises the importance of leadership in public health to the delivery of preventative risk management. The fundamental aim of WSPs - the public health imperative – was explored and how this responsibility is expressed in the basic business assumptions of water suppliers. In doing so, reflections were made on other fields such as organisational health and safety and the literature on leadership. Proactive risk-management techniques are widely accepted as the best way of ensuring the safety of drinking water, yet suppliers are still finding implementation challenging, and serious health-related incidents continue to occur. Organisational culture and the basic assumptions of organisations may impact on the level of commitment to water quality and WSPs.

With regard to benchmarking in relation to the Bonn Charter, there is scope for a 'Bonn Charter CMM' to be developed, drawing on the RM-CMM and the people CMM, to develop a more 'cultural' assessment to determine the maturity of organisations wishing to implement the aims of the Bonn Charter, relating to advocacy and commitment to WSPs throughout the organisation as an effective tool in the protection of public health.

3   **<u>METHODOLOGY</u>**

This chapter describes the methods used for the study and discusses why they were chosen above alternatives. The methodological design is outlined, as well as the methods selected for analysis of the data, and validity and reliability. The chapter first outlines why specific methods were chosen (section 3.1); and how the methodology development evolved during pilot studies (section 3.2). The specific methodology and analytic approach is described in sections 3.3 and 3.4, with validity and reliability being discussed in section 3.5. The study employed a case study approach (Yin, 2003) using multiple methods of observation, conversation, interviews and document analysis to generate qualitative data; and was based more in the interpretive and critical social sciences. Data were analysed through cycles of coding in order to elicit results, predominantly with an explanation building goal. Similar analytic methods have been used by Baumgartner (2009) to explore issues of organisational culture and leadership with respect to sustainable development in organisations. The research approach has the benefit of being sufficiently open-ended to elicit a broad set of data on WSP implementation and organisational culture whilst ensuring interview discussions do not stray too far from the research objectives.

3.1 Selection of suitable methodology

The main approach chosen is that of the case study. The case study approach was preferred due to its usefulness in contributing to knowledge relating to individual, group, organisational, social and political phenomena (Yin, 2009). Yin (2009) offers a set of criteria for helping to determine which social science method to use in a given situation (Table 3.1). Use of this table suggests that the case study is most appropriate in this situation. Investigation into the culture of an organisation, asking how and why culture and leadership influence commitment and ultimately Bonn Charter implementation is descriptive in nature. Secondly, during this study the researcher had no control over behavioural events, which depending on the form of the question leaves historical or case study methods. However, access is available to the organisations being studied, which enables direct observation and interviewing of key informants that would

not be available to a historian –contemporary events are being considered, and therefore a case study is the most applicable.

Table 3.1 Selection of methods, (Yin, 2009).

METHOD	Form of Question	Control of behavioural events?	Focus on contemporary events?
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival analysis	Who, what, where, how many, how much?	No	Yes/No
History	How, why?	No	No
Case study	How, why?	No	Yes

The main body of research is explanatory in nature (case study), however there are exploratory elements (pilot case study) and descriptive elements (initial survey). Key analytic strategies include coding as a process for categorising and describing data; memoing as a process for recording thoughts and ideas of the researcher and integrative diagrams and sessions as a way of pulling together detail, and making sense of the data with respect to the emerging theory. Through several iterations of this process the researcher can approach a conceptually dense theory, a predominantly inductive approach (Trochim and Donnely, 2007). One may draw here on the grounded theory approach, defined by Strauss and Corbin (1998) as "*a qualitative research method that uses a systematic set of procedures to develop an inductively derived theory about a phenomenon*". This means to build theory 'grounded' in evidence. Eisenhardt (1989) outlines approaches for building theory from case study research and the combination of a grounded theory approach, that one must start with a research question to guide the research. However, one must avoid, as much as possible, the development of preconceived theories and hypotheses, although recognising that it is impossible to achieve an entirely 'clean slate' in reality (Eisenhardt, 1989). Grounded theory is an iterative process based on the following aspects: codes; concepts; categories and theory (Figure 3.1; Strauss and Corbin, 1998).

CODES: Categorising and describing data

Memos/integrative and sorting sessions

CONCEPTS: Grouping of similar content/making comparisons

Memos/integrative and sorting sessions

CATEGORIES: Broad groups of concepts, foundations for theory development

Memos/integrative and sorting sessions

THEORY: Explanations of the subject of research
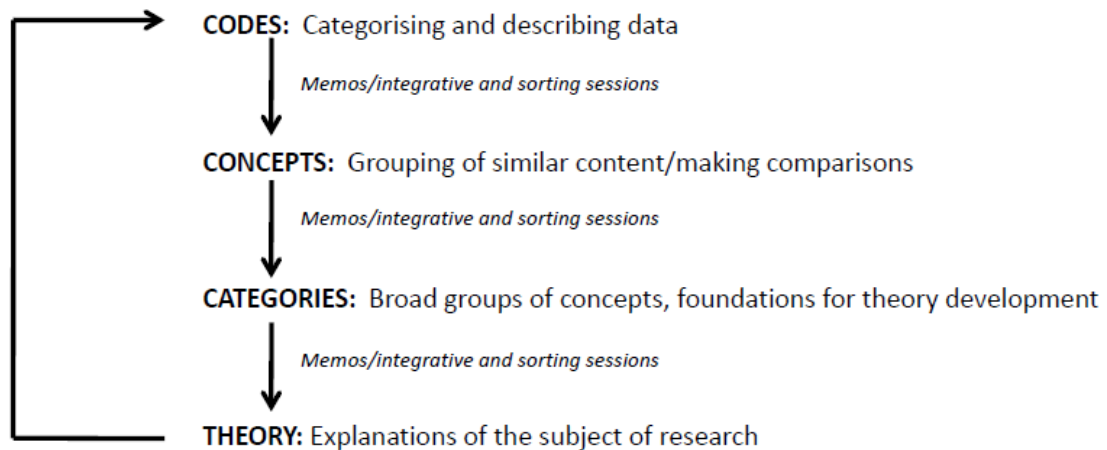
Figure 3.1 Iterative aspect of grounded theory approach used in this study

Whilst the grounded theory approach requires that prior knowledge and theory should be avoided, founders of the grounded theory approach have acknowledged that inductive and deductive approaches can be used in combination (Glaser, 1998). Eisenhardt (1989) summarises the strengths of building theory from case studies:

- Increases the likelihood of generating novel theory through constant juxtaposition of contradictory or paradoxical evidence, leading to reduced researcher bias.
- Emergent theory is likely to be testable with constructs that can be readily measured and hypotheses that can be proven false.
- Resultant theory is likely to be empirically valid because theory building is intimately linked with evidence.

In the context of this study, a 'pure' grounded theory approach is not feasible, or indeed desirable, as a certain amount of prior understanding (although not pre-determined theory or hypothesis) relating to the research arena (in this case WSP development) is needed to guide the research and prevent divergence off topic, but we can still develop theory from the case studies using such an approach as defined by Eisenhardt (1989).

3.2 Evolution of methodology

3.2.1 Pilot case study

The aims of the pilot study were:

- To trial methodology and assessment techniques.

- To develop case study protocol.

- To solidify case study questions.

- To determine how the Bonn Charter was being achieved and develop ideas for tool development.

3.2.2 Selection of pilot and methods

The pilot case (Supplier P) was chosen from Australasia because this is one of the places where the WSP approach was first developed, and was performed in July 2008. The pilot case was a member of the Bonn Network, which allowed for easier access to the organisation, and potentially more forthcoming with information. The scope of the case study was broad – to test methods intended to be used in the field such as semi-structured interview, observation and document analysis, interview questions, the questions asked of the study as a whole as well as the logistical implications. The main supplier visited was a large, public corporatised utility, serving approximately 3 million consumers. In addition there were visits to two other suppliers and various stakeholders in order to gain an understanding of the subject in a wider context, with individuals and groups instrumental in the development of WSPs. Within Supplier P, organisational culture and how the Bonn Charter aims were achieved were investigated.

Prior to the field visit, an initial interview schedule was developed based on literature review and preliminary surveys of water suppliers. Questions were mainly focused around the responsibilities outlined in the Bonn Charter, how the organisation achieved each step in the WSP process and general issues of WSP management and buy-in. Questions were also developed for interviews with stakeholders (such as regulators, governments and health authorities) as well as end users.

3.2.3 Methodology evolution as a result of the pilot

From the pilot study it was clear that the interview schedule developed was too broad and too long, and the questions too prescriptive. Questions focused too much on determining how the organisation met each step in the WSP methodology, and this would not produce enough novelty in terms of research, other than simply documenting WSP methodologies. In conjunction with continued review of the literature (Chapter 2), and interviews with employees, it was found that a focus on organisational culture

and its influence on WSP implementation would provide important and interesting insights not challenged before. The following section outlines the main lessons learned and changes made in terms of methodological approach from the pilot study.

a) *Narrowing of scope*

The original scope, as expected of a pilot, was too broad, determining how each step of the WSP was addressed, as well as looking at organisational culture, Bonn Charter adoption and surveying end users. This did not allow enough in-depth investigation. As such the scope was narrowed to the relationship between organisational culture and WSP implementation, and it was felt that research with end users although interesting was outside the scope of this research.

b) *Focus on culture and determination of key focal points*

Key focal points of interest included: company drivers, WSP blockers and drivers; managerial commitment and leadership; organisational commitment; and motivation.

c) *Development of interview schedule*

The original interview schedule was too broad, long and prescriptive, not allowing for elaboration of key elements of discussion. A new semi-structured interview schedule focusing on cultural aspects was developed (as in case study protocol, Appendix A).

d) *Development of interview skills*

The pilot study allowed for development and practice of interview skills, to ensure that further interviews were conducted with prior experience (Section 3.2.3).

e) *Obtain as much inform before visit as possible*

In forming a clearer scope for the research, it was found that much information, particularly in the form of documentation could be sourced before the field visit, to develop a greater prior understanding of the organisation that would make more use of limited field time.

f) *Arrange interviews where possible before field visit*

The pilot study helped to determine what kind of employees and stakeholders to interview during the case studies and highlighted the importance of trying to

arrange a (rough) timetable before the visit. Employees often have hectic schedules booked up far in advance, therefore trying to arrange time to interview key people before the visit will help avoid disappointment.

g) *Remain open and flexible*

Whilst the above point is valid, it is also important to remain as flexible as possible in the field, as opportunities to conduct more 'opportunistic' interviews with previously unidentified respondents may arise.

h) *Development of case study protocol*

The above points allowed for development of the case study protocol to be used in subsequent case studies (Appendix A). Including addressing aspects such as non-disclosure and confidentiality agreements as may be required by individual cases.

3.3 Data collection methodology

A visual interpretation of the methodology is given in Figure 3.2. Narrative data was obtained through semi-structured interviews with open ended questions around key themes, such as feelings about roles and the organisation; commitment of selves, others and managers; and WSP implementation. Relevant documentation pertaining to the Bonn Charter and public health was obtained, including 'grey' literature such as internal reports, policies, procedures, risk assessments, as well as published reports and papers. Where possible the agenda was arranged before travel, with the key contact within the supplier. If the organisation was not a Bonn Network member, they were requested to complete an initial questionnaire to gather background information. Data was supplemented through observation, conversation and the collection of field notes. The following section details case selection; case study design; interview methodology; document analysis and observational methods used.
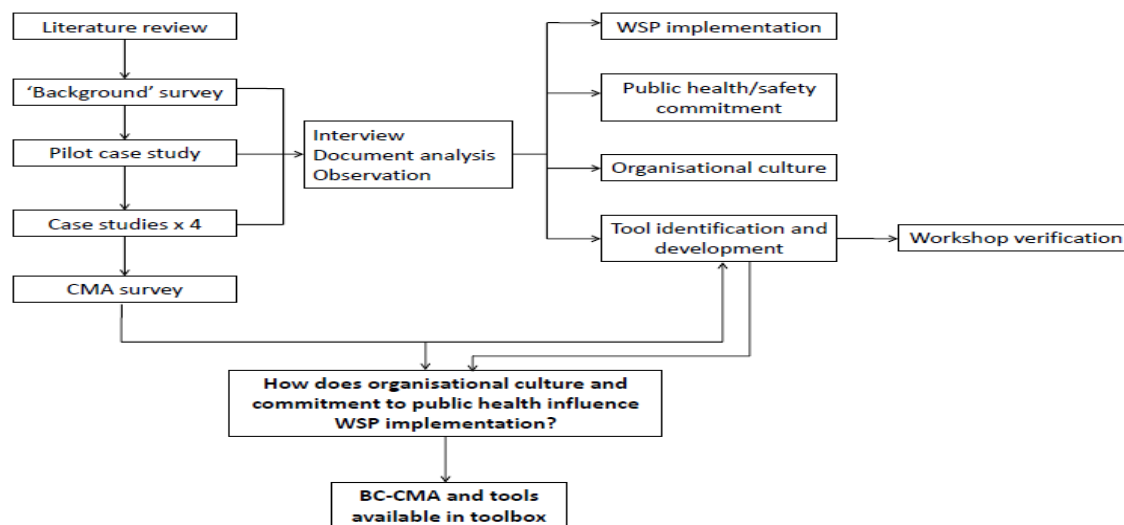
Figure 3.2 Visual interpretation of methodology

3.3.1 Case selection

Initial contact was generally made informally through the IWA, particularly with members of the Bonn Network, to ascertain if the organisation would consider taking part in such a research project. If the organisation was interested, then more detailed information was provided by the research student by email. Where requested, a Non Disclosure Agreement (NDA) was provided, as well as an informed consent agreement (see Appendix A). Where applicable some examples of current outputs were provided to the lead contact. Four contrasting suppliers were studied (Table 3.2): a small public supplier in a developed country (A); a large private utility in a developing country (B); a medium corporatised public utility in a developed country (C) and a holding company and its group of water utilities, two of which were visited in detail (D). All suppliers were responsible for abstraction, treatment and distribution to the consumer, except Supplier D which predominantly consisted of bulk suppliers[7]. The suppliers were investigated in person over an intensive 3-4 week period each. Prior to field research, each supplier completed a structured questionnaire to secure a background understanding of the organisation. When selecting cases, the maximum variation approach was used, maximising the use of information from a small sample. By choosing several cases that differ in dimension we can obtain information about the

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[7] Bulk suppliers abstract and treat raw water, before handing on to a separate retail company that will distribute the treated water to consumers.

significance of various circumstances for case process and outcome (Flyvbjerg, 2006). Random selection was not deemed appropriate due to a lack of time to perform a sufficient number of in-depth case studies to allow generalisation. The ultimate aim of the research is to provide guidance for all types of water supplier, so by picking diverse cases we can make assumptions that fit the whole range of supplier types. A range of different water suppliers were chosen, varying in: size[8] (employee number); private and public management; developed and developing nations and where best-practice of WSPs/risk management is found as well as where there is limited experience in WSP development[9]. Cases were also selected that used English as a first language, or had high levels of English as the researcher did not speak any other languages than English. Approached suppliers needed to agree to the research; and approximately three other suppliers were approached that did not wish to participate, before the final four were chosen. Where water operations were part of a wider organisation, such as a public supply run as part of the council, the term 'supplier' was used to describe just the department that is responsible for water (Table 3.2).

Table 3.2 Case study subjects

	Supplier A	**Supplier B**	**Supplier C**	**Supplier D***
Region	Northern America	S.E. Asia	Northern America	Southern Europe
Ownership	Public	Private	Public corporatised	Private holding with public shareholders and subsidiaries
Approx Employees	15	1,700	350	70 / 180
Approx Consumers	15 000	900,000	330 000	600 000/1.5 million
No. WTPs	1	28	2	1 to 4
No. Interviews	18**	21	19	39
Length of visit	3 weeks	4 weeks	3 weeks	3 weeks
Date of visit	November 2008	May 2009	December 2008	February 2010
WSPs explicit?	Pilot	Yes	No	Yes

* Supplier D refers to a holding company and its subsidiary (public) utilities, two of these utilities were visited in detail during the case study.

** Interview number exceeds employee number because external stakeholders were included, and the small number of employees meant that everyone could be interviewed in the given time.

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[8] Based on IWA classification of size. Small < 50; Medium 50-499 and Large, 500+.
[9] It is hoped that this cross section of suppliers will enable identification of the different challenges experienced by different suppliers in developing and implementing WSPs and other aspects of the Bonn Charter.

Yin (2009) stressed that when performing multiple case studies the aim is not for statistical generalisation as is more commonly recognised in surveys, where an inference is made about a population on the basis of empirical data collected about a sample. Cases should not be likened to sampling units, and thus not chosen on that basis. Instead, cases should be selected 'as a laboratory investigator selects the topic of a new experiment', and therefore multiple cases considered as multiple experiments. Instead of statistical generalisation, we should use an analytic generalisation strategy when performing case studies. This is where a previously developed theory is used as a template to compare with empirical results of the case study. If two or more cases support the same theory, replication can be claimed, if they support the same theory and also do not support rival theories then the results can be claimed even more decisive (Yin, 2009).

3.3.2 Case study design

A multiple-case design is used, allowing a certain amount of replication and therefore robustness to the data. Replication logic (as in experiments), rather than sampling logic (in surveys) is used. This means that the same method is used, and each case is selected to either predict similar results, or contrasting results for a predetermined anticipated reason. This must occur with development of the theoretical framework, which may be modified if findings of individual case studies do not support the original theory. In qualitative research, using a case study approach, method and analysis are a simultaneous and iterative process (Guba and Lincoln, 1981). This iterative, theory building nature means that a flexible research design is essential. New information and discoveries will be made during data collection, and these revelations may need to contribute to altered research designs (Yin, 2009). However, it is important to note that these alterations should not be made lightly, the reasons documented and not compromise the rigour of the study (Yin, 2009). In this case, subtle changes were made to the interview schedule in light of experiences gained in preceding case studies, these are documented in the case study protocol (Appendix A). Each case study was analysed holistically, with the individual organisation constituting the 'case', and also collective case study analysis (Stake, 1995) was performed in order to make generalisations about the subject. Along with a supporting literature review, analysis of different types of supplier will help ensure external validity of the analysis. George and Bennet (2005)

identified that a combination of within case analysis and cross case comparisons was the strongest means of drawing inferences about the topic in question.

There are many different frameworks described in the literature for analysis of culture (Chapter 2.3.1). In this analysis, a combination of the ideas of Johnson (1992), Hofstede et al. (1990) and Schein (2004) was used to describe and analyse the culture as the principles are similar: there are several layers of culture, and we need to understand the underlying, often taken for granted, basic assumptions that form the 'paradigm' in order to make sense of the more visible artefacts. The basic layout of the analysis used Schein's three layers – artefacts, espoused values and beliefs, and underlying basic assumptions. However Johnson's cultural web and Hofstede's organisational factors were used as guides when analysing these three levels (Figure 3.3).

Figure 3.3 Cultural framework used in analysis

It is important when conducting a case study to produce a case study database (Appendices B-D), including two separate collections: data and reports (Yin, 2009). All raw data was kept, including: interview transcripts (recordings were not kept due to confidentiality agreement); documents (electronic where possible); field notes; and survey responses. All interview data for a particular case study was documented in one

hermaneutic unit in Atlas.ti software version 5.2[10]. It was also important to maintain a chain of evidence so that external observers can follow the derivation of evidence (Yin, 2009; Figure 3.4)
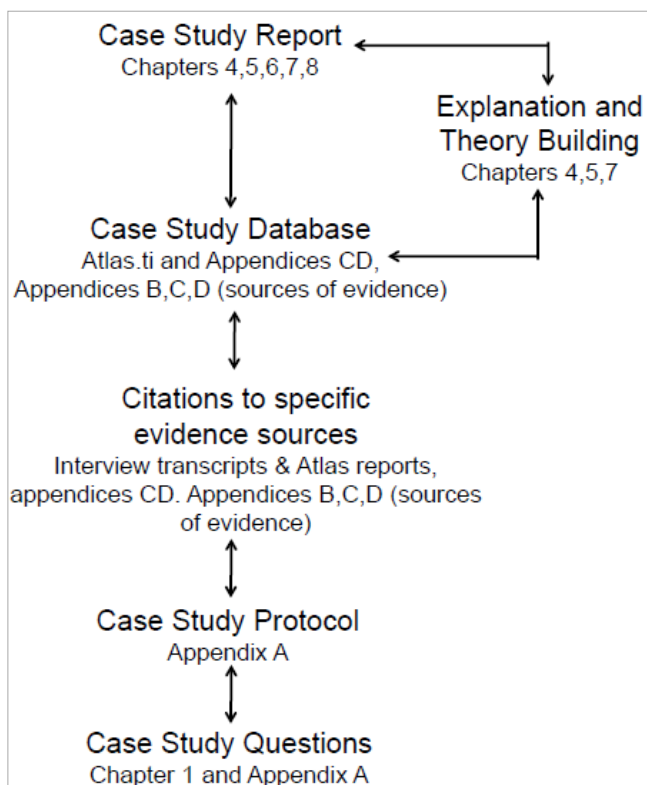
Figure 3.4 Chain of evidence (adapted from Yin, 2009)

3.3.3 Interview methodology

Interview design: Narrative data was obtained through semi-structured interviews with open ended questions around key themes, such as: feelings about roles and the organisation; commitment of selves, others and managers; and WSP implementation. The exploration of common themes enabled comparisons to be drawn between utilities, whilst the flexible nature of semi-structured interviews enabled more in depth investigation of key strands of the discussion. Interviews were recorded with permission and transcribed verbatim by the researcher as soon as possible after the interview, this prevented ambiguity that might arise from using a third party for transcription as well as allowing an initial cycle of analysis during transcription (example interview transcript can be found in Appendix E). Notes were also taken during the interview and interviews

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[10] Atlas.ti is a commercially available qualitative data analysis software that assists in systematic analysis of texts and data, through coding, annotation and memoing.

typically lasted between thirty and sixty minutes. The anonymity of interviewees and the organisation was secured.

The interview schedule is given in the case study protocol (Appendix A), open ended questions were used as opposed to closed or scale items to allow flexibility; in depth exploration; testing limits of respondent's knowledge; establishment of rapport; a truer assessment of what the respondent believes and the production of unexpected answers (Robson, 2002). Questions were sequenced according to the recommendations of Robson (2002), including:

- An introduction by the researcher.
- Easy, non threatening 'warm up' questions to establish rapport (in this case asking interviewees about their role in the organisation).
- Main body of the interview.
- Straightforward 'cool off' questions, and
- Closure.

All interviews were carried out face-to-face. Where possible, individual interviews were carried out, but some instances required the use of group interviews (maximum three participants). Also where possible, interviews were carried out in familiar surroundings for the participant, such as their office, or a meeting room, where privacy could be given to make the interviewee feel more comfortable.

Interviewee selection:

Interviewees were identified by requesting a copy of the organisations organisational structure. Where employee numbers were small (<20), all staff were interviewed. For larger organisations a sample was needed. This sample included a cross section of staff, whose roles relate to the five responsibilities of a water supplier outlined in the Bonn Charter, such as finance; customer service; and human resources. However, the focus was on staff involved in water supply, quality and risk management. Time with top levels of management as well as operational workers was also requested. Where possible, board or council members and key stakeholders such as water quality regulators and health authorities were interviewed. When organising the interviews, awareness was taken that that top managers diaries often fill up far in advance and

therefore it was aimed to organise the trip as far in advance as possible, and to be sensitive to respondents schedules and remain flexible in rearranging appointments.

Individual interviewees were identified on a three part alpha-numeric system depending on the supplier they worked for; whether they were a manager, non-management employee or external stakeholder and numbered according to the order in which they were interviewed in that particular case study, using the key given in Table 3.3. For example if the second person to be interviewed in Supplier A was a manager, then they would be assigned the code AM2; if the fourth interviewee from Supplier D, was an external stakeholder they would be assigned the code DS4 and so on. This allows quotes from individuals to be distinguished from one another yet maintain anonymity.

Table 3.3 Interviewee identification key

Part one	Part two	Part three
P = Pilot case study supplier	**M** = Manager	**1** = First interviewee
A = Supplier A	**E** = Non managerial employee	**2** = Second interviewee
B = Supplier B	**S** = External stakeholder	**3** = Third interviewee
C = Supplier C		**4** = Fourth interviewee
D = Supplier D		....

Interview style: Interviews were conducted using Robson (2002) as a methodological guide. Robson articulates that as an interviewer, one should try and get interviewees to talk freely and openly, recognising that the behaviour of the interviewer may influence the respondents willingness to do so. Key recommendations from this reference include:

- **Listen** more than you speak.
- Ask questions in a **clear**, **straightforward** and non-threatening way.
- **Enjoy** the interview (do not appear bored or scared).
- **Avoid** the following types of question:
  - **Long** or 'double barrelled' questions (can be confusing).
  - Questions involving **jargon** (this is particularly important as some interviewees might not use English as a first language).
  - **Leading** or biased questions (that lead an interviewee to an answer which may not be their particular view).

- Use **probes** to elicit more information from an interviewee (for example, a period of silence, repetition of what the interviewee has said, an enquiring glance).
- Use a pilot study to develop interview style.

3.3.4   Additional sources of data

Initial survey/experience: Prior to field research each utility was asked to complete a short survey to develop an understanding of the research arena. It should also be noted here that the primary researcher has experience in working for a water supplier and development of WSPs.

Document analysis: Where possible, types of documentation needed were identified with the key contact before the visit, these may include: WSPs, risk assessments, policies and procedures relating to risk management and water quality, reports, media reports, memoranda of understanding, regulatory documents, meeting minutes and agendas and research reports. Freely available documentation was collected before the visit (such as that is available on the utility's website and media reports), and other documentation sought during the visit whilst not conducting interviews. Documentation was used to corroborate information provided in interviews and also to guide further investigation.

Observational methods: 'Visual' data was acquired through observation and conversation. A detailed diary of notes and observations, pertaining to the research questions and organisational culture framework, was compiled during the field trip. This was considered supplementary evidence to interview and documentation evidence due to the presence of only one researcher.

3.3.5   Ethical considerations

Whilst there is debate around the merits of identifying or anonymising organisations being studied (Schein, 2004), it was decided from the outset of this research that organisations would not be individually named within outputs of the research, unless specifically requested by the organisation. It was felt that sensitive issues could be uncovered, and that if organisations were to be identified, than valuable data may be withheld, as the research was initiated by the researcher and not the organisation

themselves. By guaranteeing anonymity, more of a relationship could be developed with the organisation and potentially more data uncovered. The same reasoning was used for individual employee anonymity. It was considered that enough relevant background information could be provided whilst still ensuring identities were protected, both of the organisation (for example geographical area and size); and of individuals (for example manager, employee or stakeholder). The ethical policy (appendix M) of Cranfield University was followed; that is that in their research, all staff and students will endeavour to:

- Maintain professional standards including honesty and integrity;
- Properly document all results;
- Evaluate critically all results;
- Attribute honestly the contribution of others;
- Wherever possible report all results openly, bearing in mind the University's commercial considerations and sponsors' needs for confidentiality.

In addition all staff will endeavour to:

- Educate and develop new research workers to an understanding of good research practice;
- Secure and store primary data for an appropriate period of time.

The policy also outlines a number of questions that should be asked, and were asked of the research presented in this thesis:

- Is the action legal?
- Shall I be proud of it?
- Will I feel bad about it?
- Does it comply with the University's values?
- How will it look to my friends and family?
- How will it look in the Media?
- If you know it's wrong don't do it.
- If you're not sure, ask.
- Keep asking until you get an answer that enables you to answer the questions above to your satisfaction.

3.4 Data analysis

Interview transcripts, documents and field notes were analysed using a theoretical proposition strategy, based on the original theoretical propositions that guided the research question (Chapter 1.3). Atlas.ti software was used as an aid, and to store textual data. Atlas.ti enables systematic analysis of texts and data, through coding, annotation and memoing. Coding was guided by the research area: organisational culture and commitment in relation to WSP/Bonn Charter implementation. Analysis draws on grounded theory, in that theory and inferences are developed through the coding and memoing process, and evolve throughout the duration of the project. Coding and concept forming is an iterative process, with several cycles of coding (see Appendix F for code lists and Appendix G for coding example). Beginning with open coding, organising the data into categories and themes, and through each cycle of coding, more themes, concepts, questions and theories will be developed (Neuman, 2003). Analysis was guided by the following aspects:

- Organisational culture.
    - Artefacts.
    - Espoused values and beliefs.
- Organisational/managerial commitment and motivation.
- Underlying basic assumptions and the 'paradigm'.

Yin (2009) describes five analytical techniques for case study analysis, pattern matching; explanation building; time series analysis; logic models and cross cases synthesis. Analysis in this study focuses on explanation building. Logic models and cross case synthesis at a higher level will also be used. Using a theoretical proposition strategy will help focus attention and ignore superfluous data and identify alternative explanations (Figure 3.5). Time series analysis, tracing events over time, was disregarded for this study as time was not considered the most important factor in explaining these phenomena. Pattern matching was disregarded because of its comparing of an empirically based pattern with a predicted one, yet as far as possible the aim is to have as few pre-conceived ideas about the data as possible.
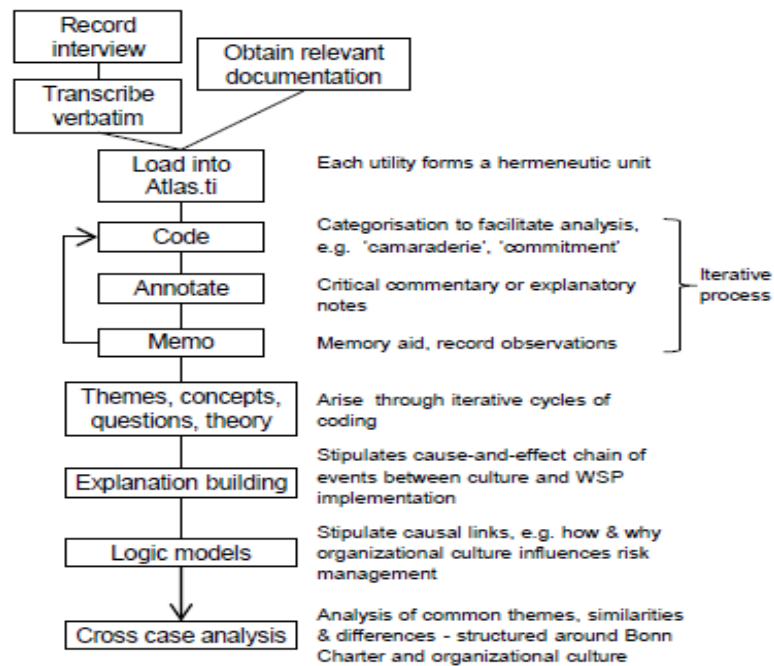
Figure 3.5 Data analysis process

3.4.1 Explanation building

Explanation building was predominantly used in this study. This involves analysis of the case study data to build an explanation about the case. This is done through stipulating a presumed set of causal links about the case – 'how' or 'why' something happened. The process is iterative, making an initial theoretical statement, comparing findings of initial case study, revising statements, and making comparisons with other cases (Yin, 2009). Using this method, it was important to try and ensure the explanations reflect some theoretically significant propositions, for example how and why organisational culture and leadership influences Bonn Charter implementation.

3.4.2 Logic models

Logic models stipulate a complex chain of events in a cause-effect-cause-effect pattern whereby a dependent variable at an earlier stage becomes the independent variable for the next stage (Figure 3.6), aiming to match empirically observed events to theoretically predicted events (Yin, 2009).
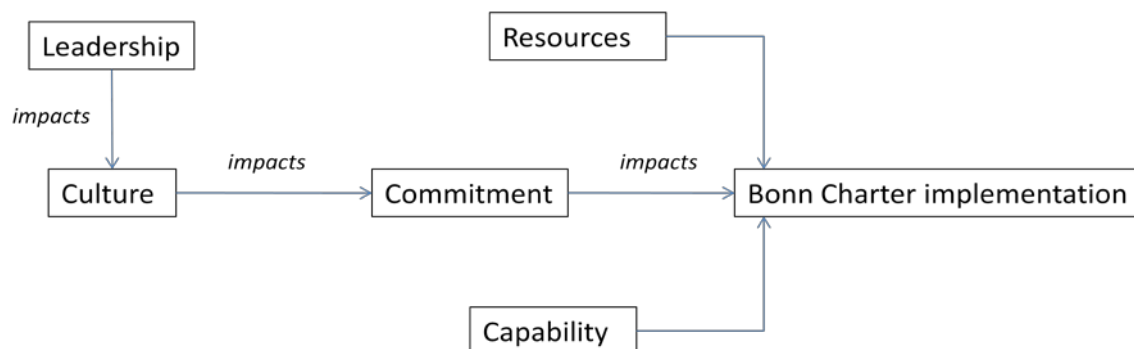
Figure 3.6 Example of simple conceptual logic model

3.4.3   Cross case analysis

Each individual case was treated as a separate study and analysed using the above techniques and the findings aggregated across the series of individual studies (Yin, 2009). In addition, word tables are used to compare data from the individual cases according to a framework of relevant features, Yin (2009) argues that it is important that cross-case patterns will rely on argumentative interpretation rather than numerical tallies as this method is analogous to cross-experiment interpretations.

3.4.4   Questions asked of the case study

When analysing the data, Yin (2009) suggests defining questions to ask of the data on several levels: (1) questions asked of individuals (the interview schedule show in Appendix A); (2) questions asked of the individual case; (3) questions asked of the pattern of findings across multiple cases; (4) questions asked of the entire study and (5) normative questions about policy recommendations and conclusions. Focusing on these questions can also help avoid over-long and irrelevant write-ups (Table 3.4)

Table 3.4 Questions asked in this study, and the corresponding levels described by Yin (2009).

Question	Level (2-5)
How is the Bonn Charter being implemented, explicitly or implicitly?	2
How is WQ risk managed?	2
How & why does culture influence WSP implementation?	2 + 3
How is the public health responsibility of the organisation demonstrated?	2 + 3
Why is the public health responsibility taken for granted/explicit?	2 + 3
How and why do leaders advocate WSP implementation?	2 + 3
Can we make general conclusions about culture and WSP implementation, or is each	4

case individual?	
What cultural attributes support successful WSP implementation?	4 + 5
How can organisations be assisted in developing a supporting organisational culture in terms of WSP implementation?	5
Why is understanding organisational culture and leadership important in terms of WSP implementation?	5

3.5 Potential weaknesses, validity and reliability

3.5.1 Potential weaknesses of the approach and mitigation

It is prudent to consider the limitations of a chosen approach before undertaking a study in order to be mindful of potential errors. Yin (2009) identified some traditional prejudices against the case study approach as a whole, as detailed below, and presented arguments as to how these weaknesses can be avoided.

- *Lack of rigour*

  This study follows the recommendations of Yin (2009) for ensuring rigour and reliability in case study research (see Chapter 3.5.2).

- *Little basis for scientific generalisation*

  Case study analyses are often made on a single case, and attract criticisms of scientific generalisation of the results from more 'traditional' methods using statistical analysis and replication. This study uses multiple cases to try to alleviate this concern, but the numbers are still small. It is therefore more appropriate to explain that using case studies in social science research, the principles of grounded theory are drawn on (Glaser and Strauss, 1967) and the aim is to make generalisations about the theory, not populations. Such methods are used not in theory testing, but theory building and theory elaboration (George and Bennet, 2005; Hamel et al., 1993; Stake, 1995; Yin, 2009).

- *Take too long and result in massive, unreadable documents*

  Case studies are often confused with other research methods such as ethnography or participant-observation which do require lengthy field visits (Yin, 2009). The case study approach uses multiple methods such as interviews and document analysis in addition to methods such as observation and as such

does not take as much time in the field. Some case studies are conducted without a field trip element altogether. Similarly, documentation does not need to be lengthy, if the author remains focused on the research topic and does not lose direction. Stake (1995) supports this, emphasising that case studies must have boundaries; in this case it is important to be focused on commitment and culture in relation to BC implementation. Stake (1995) and Yin (2009) also advocate the use of a case study protocol (Appendix A) that will help maintain focus, particularly where multiple case studies are used. The protocol should include an overview of the project, field procedures, case study questions and a guide for the case study report.

There may also be criticisms of the individual methods used within the case study. Table 3.5 outlines these sources and how these weaknesses were overcome. However, the use of multiple methods within the case study helped counteract individual weaknesses of each method.

Table 3.5 Strengths & weaknesses of sources of evidence (after Yin, 2009).

Source of Evidence	Strengths	Weaknesses	Overcoming weakness in this study
Documentation	-Stable -Unobtrusive -Exact -Broad coverage	-Retrievability (can be difficult to find) -Biased selectivity -Biased reporting -Access (may be deliberately withheld)	Establish rapport with utility being studied, articulate reasons for needing such documentation, articulate what kind of information needed in advance of visit. Try to gain access to intranet in order to select documentation independently. Be mindful of bias.
Archival records	-Same as above -Precise and usually quantitative	-Same as above -Accessibility due to privacy	Confidentiality agreement offered.
Interviews	-Targeted -Insightful	-Bias due to poorly articulated questions -Response bias -Inaccuracies due to poor recall -Reflexivity	Extensive literature review of interview methodology to learn research skills, testing of interview questions in pilot studies. Ensure anonymity. Interview as many respondents as possible and cross-check accounts.
Direct Observation	-Reality -Contextual	-Time consuming -Selectivity (broad coverage difficult without a team of observers) -Reflexivity -Cost (hours needed)	Used as a supplementary, not main source of data due to presence of just one researcher.
Participant observation	-Same as for direct observation -Insightful into interpersonal behaviour and motives	-Same as for direct observation -Bias due to participant-observer's manipulation of events	As above.
Physical artefacts	-Insightful into cultural features -Insightful into technical operations	-Selectivity -Availability	See cultural research framework.

3.5.2   Validity and reliability

Triangulation is obtained through the multi-method case study approach described, by interviewing a range of employees, cross checking these different accounts, cross checking interviewee accounts with documented sources and providing interviewees with an opportunity to comment on drafts of the outputs. In social sciences, there are four methods used to establish the quality of research (Kidder and Judd, 1991), Yin,

(2009) describes the tactics in relation to case study research. Table 3.6 outlines these methods, tactics and how this research achieves validity and reliability. Neuman (2003) defines reliability as 'dependability or consistency' and validity as 'truthfulness', and the aim is to achieve a high degree of reliability and validity.

Table 3.6 Case Study Validity & Reliability (After Kidder and Judd, 1991;Yin, 2009)

Tests		Tactics	Phase	Demonstration in this research
Construct Validity	Identifying correct operational measures for the concept being studied.	-Multiple sources of evidence -Establish chain of evidence -Review draft CS report	-Data collection -Data collection -Composition	Multiple sources of evidence used, interviews (with multiple staff members), documents, conversation, observation, artefacts. Chain of evidence used: literature review, CS questions, protocol, citations to evidence in CS database, database, report. Representatives from case study will have opportunity to review and comment on reports.
Internal Validity	Seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions.	-Pattern matching -Explanation building -Address rival explanations -Use logic models	-Data analysis -Data analysis -Data analysis -Data analysis	Cases selected with intent for explanation building (i.e. on diversity). Rival explanations will be addressed during analysis and logic models used to explain data.
External Validity	Defining the domain in which a study's findings can be generalised.	-Use theory in single-case studies -Use replication logic in multiple case	Research design Research design	Multiple case studies used: replication logic. Cross-case synthesis.
Reliability	Demonstrating that the operations of a study, such as the data collection procedures, can be repeated with the same results.	-Use case study protocols -Develop case study database	Data collection Data collection	See Appendix A for case study protocol. Case study database used in form of Atlas.ti, evidence (transcripts & documents) kept separately from memos, notes and reports.

3.5.3 Potential bias

In Chapter 2.6.1 we learnt that it is impractical for a researcher to remain completely detached, Cohen et al (2007) and Miles and Huberman (1994) identify that there are two

potential sources of bias in this context. Firstly the researcher's influence on the informant and secondly the informant's influence on the researcher. For example, in the context of this research, the author was viewed as a young female foreign representative of a UK university. The researcher was also not an engineer by training, but originally biologist now working in the social sciences and may have caused bias on a number of levels, researching a predominantly male-oriented and engineer based industry; and English not being the first language used in two of the four suppliers visited. The researcher had experience in the UK water industry, having been formerly employed by a UK water company in the field of water quality; risk management and implementing WSPs. However, whilst complete objectivity is impractical (Neuman, 2003) and even undesirable (Schein, 2004), Grinnel and Unrau (2008) summarise some checks and balances that can be used to overcome unnecessary bias. In order to reduce researcher influence on the respondent a number of measures can be taken including: (i) striving to fit into the landscape; (ii) using unobtrusive methods; (iii) being clear about intentions and (iv) doing interviews in an informal, relaxed setting. Therefore during this study time was spent with the suppliers in question in person in order to build a more trusting relationship and the researcher's background in the water industry was emphasised in order to 'fit in'. As well as interviewing, unobtrusive methods of observation were used; the intentions of the researcher were made clear prior to the visit and also with each interviewee, stressing that there was no right or wrong answer to the questions asked. Interviews, where possible were conducted in a setting familiar to the interviewee, for example their own office or staff room, to create a more relaxed setting. To reduce informant influence on the researcher one may (i) avoid the overuse of 'elite' or 'marginal' informants; (ii) co-opting a participant to do some of the interviewing; (iii) using multiple data sources and (iv) staying focused on the research question. During this study, a cross section of interviewees were chosen from all levels within the organisation, little was known about the informants prior to interview so there would be no over reliance on 'elite' or 'marginal' informants. Where English was not the first language, levels of English were however very high, but in those instances where individuals found English more of a challenge, an additional participant was used to assist with the interviewing to avoid miss-communication. Multiple data sources were

used as discussed previously as part of the case-study approach and use of the case study protocol helped to remain focused on the research question.

3.6 Summary

In summary, due to the focus on organisational culture in this study, and therefore the need to discover meaning and generate new theories in order to achieve a deeper understanding of the issues surrounding the effect of organisational culture on WSP implementation, qualitative methods were predominantly used. Semi-structured interviews, document analysis and observational methods using a multiple-case study research strategy generated empirical data to achieve the aims and objectives of this study. Theory is developed rooted in evidence through iterative cycles of coding and memoing in an explanation building analytic approach.

4 CASE STUDY RESULTS

4.1 Introduction

Chapters 4, 5 and 6 describe an evolution of results, from broad descriptions and explanations of the subject in Chapter 4, to a more defined cultural taxonomy in Chapter 5 and development of practical tools in Chapter 6. The outcomes of each chapter feeds into the next (Figure 4.1).
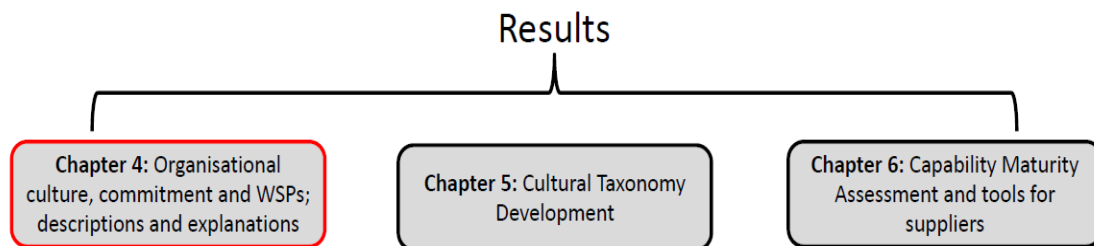
Figure 4.1 Results Chapters

This chapter outlines results obtained from the secondments to four water suppliers (as described in Chapter 3). An overview of the organisational culture is given for each supplier and a description of progress with regard to WSP development. Managerial commitment and leadership; public health protection and organisational commitment to WSPs are also discussed. Appendix B details sources of raw data evidence associated with case study alignment for each element described in this chapter.

4.2 Case overviews

Practical information relating of the range of Suppliers visited (such as size, ownership and WSP development) is given in Table 3.2, Chapter 3. Here, the organisational cultures of each supplier are discussed.

4.2.1 Supplier A

Structurally, Supplier A tended to be hierarchical, with many levels (3-4) of management for such a small supplier. All non-managerial staff had compulsory union membership and relationships between management and staff were sometimes distant and formal, despite managers frequently discussing the value of empowerment: "*The*

more educated, trained and empowered the employee is, the easier my job is" (AM14). Despite this, the structure was notably organic, partly due to its small size. Employees worked well together, taking on secondary roles. Communication tended to be verbal with little use of formal systems, other than personal databases and spreadsheets. Individual personalities often came into play. Being small, there was no specific 'risk team' but also little opportunity for silos to develop. Many partnerships existed with external organisations such as catchment groups, county councils, and community groups. Camaraderie was high amongst staff, "*We are pretty careful, we all look out for each other. These guys are kind of like my brothers*" (AE6), but understaffing was becoming an issue and it was increasingly difficult to attract and retain new staff.

Feelings about the job and organisation were positive. Many felt valued because they considered their job important; they looked after the 'whole city'; had a wide range of skills that were becoming harder to find and were responsible for people's health: "*The water treatment plant job, it is important, you have a lot of responsibility with the health of the community*" (AE8). Employees embraced the fact that work was varied, they enjoyed challenges, their colleagues were good to work with, and they liked the responsibility they were given. Benefits such as pensions and healthcare, job security, and non-monetary rewards for successes were valued. In contrast, some newer staff were less content and felt that the work was boring, and were not as committed to their roles: "*I'd stay working for the city if I could do something more interesting*"' (AE4). This may be due to the fact that historically people have stayed for a long time, and newcomers were rare. As a result there was little in the way of formal induction procedures to make new staff feel part of the team. Some long serving members of staff were discontent with factors such as a lack of financial reward, the way decisions were made, and practical aspects of the job like outdoor work in poor weather. The importance of qualified engineers was espoused by management, with qualified engineers showing outward displays of their status, a ring which showed membership of a professional engineers association (this was also the case in Supplier C). In some cases there was some resentment from other members of staff who felt that their opinions were not valued because they were not engineers themselves, "*If I say that we need to do this or this, because I'm not an engineer, then they'll say well OK, let's do a study, to tell us what we know*" (AE2).

Transparency was considered important. As a government run supplier, council members (who acted as the 'Board') were voted for by residents, with meetings open to the public and televised. However, there was some concern that the council made decisions without sufficient background information and were 'out of touch'. Financially, the water and wastewater business units were self funding, although for large capital projects, grants were sought. Daily meetings occurred with all operations staff to discuss the day's work. Proactively, there were regular checks, maintenance schedules, laminated instructions and parameters at all supplier assets, though a lack of formalised reporting meant it was difficult to capture 'close calls'. There was significant pride taken, with cleanliness considered important: *"To me, that shows the whole system. If you keep that clean, it means you're doing the rest of the job too"* (AE7).

4.2.2 Supplier B

A private company, Supplier B was owned by a parent company, and answered to a board of directors. A condensed, centralised structure had been adopted since privatisation. There was a dedicated water quality team that acted as an auditor to operations through sampling and analysis; *"We are what you call an independent party, we audit the plant, to ensure they do their work properly, to ensure that the water produced complies with the ministry of health standard"* (BM21). A variety of internal cultures existed and sometimes communication was limited between these groups; for example, engineers, scientists, managers, long serving 'pre-privatisation' staff, 'post-privatisation' staff and the parent company. Team work was considered important, if targets were not achieved, it was deemed to be a group failure, not of an individual. Family and friends were frequently mentioned, either when talking about colleagues or customers; *"we are like a family, we've been together for some time and also most of the other heads of department... there is a camaraderie type of feel"* (BM15). Work practices and targets tended to be formalised, with extensive use of control systems such as certifications, audit programmes, committees, monitoring, integrated IT systems and formalised communication procedures. Pride also featured highly, with employees proud of the awards and certifications that the company had received.

Since privatisation there was a move toward targets such as improved efficiency, profitability, customer services and performance. The privatised company was considered more competitive, whilst retaining the relaxed culture of the government. Whereas the government was driven by budget, the private company was considered to be driven by service level: "*Of course, the government section was driven by budget, whereas I think in our sector it is driven by service level, more so, I think governments within a budget, sometimes you will have to sacrifice other things*" (BM8). Previously managers were considered unapproachable whereas now there was more collaboration and discussion between management and employees: "*Previously when we looked at our boss, it was like looking at the king, now we have coffee together and discuss things*" (BM15). Most staff felt that the privatised situation was better, thanks to the actions of management to make the transition easy. Management actively tried to create the desired culture through restructuring, education, communication, hiring of new staff, training, human development and organising group activities: "*The chief operating officers, managers did a lot of brainstorming sessions, developed a lot of courses, developing a customer oriented approach*" (BE10). Privatisation lead to the creation of an internationally certified laboratory and increase in manpower of the water quality department, demonstrating management's commitment to quality and public health. Engineer culture was also highlighted, the holding company wanted to position itself as the '*number one engineering company*' (BE4); yet it was also noted within the utility that there was somewhat of a culture 'clash' between engineers and non engineers: "*The organisation needs to be more co-operative. You see, I'm a chemist, but if you want me to be a lawyer then we have a problem. Chemists and engineers speak a different language*" (BE12).

4.2.3 Supplier C

Supplier C, is a corporatised public supplier, self financing through water rates. Several reorganisations due partly to amalgamations with nearby suppliers and wastewater services have occurred in its history. There was a sense that during the mergers, Supplier C had considered itself the most powerful company, and within the company that trained engineers were superior to non engineers. Local council was the sole shareholder, but had little to do with its day-to-day operation, acting like the 'board' of a private company. A condensed structure was adopted, below General Manager (GM)

there were one or two levels of management above 'front line' workers. As in Supplier A, non-managerial staff automatically belonged to a national union, yet managers mixed with union members during breaks and celebratory events. All interviewees stated that they enjoyed their job and the organisation they worked for; other than a few issues with personnel problems: *"I like it, it's a great job. The GM supports innovation and that's 90% of my role – what are we going to do next?"* (CE9). Many staff had worked for the company for a long period of time. Interviewees also felt that they were provided for in term of resources to do their job effectively.

An informal culture existed, with occasions where formal processes have been abandoned for more informal approaches: *"The continuous improvement team no longer exists after the realisation that instead of the formal team/process that existed at the beginning, there was actually no better way than going out and finding new ways, there was a culture of going out and doing it, rather than a formalised change"* (CM17), although it was recognised that such informality was more of a challenge with increased employee numbers. Security risk and occupational health and safety risk management were valued highly:*"Security risk is taken very seriously here [in Northern America]"* (CM17). Proactive measures such as preventative maintenance and water loss control programmes, were regular activities and the desire to be 'world class' was strong. External consultants and experts were often hired for major projects and there was a focus on human control (with high levels of training) rather than an over-reliance on technology. There was a bonus incentive for staff to achieve and exceed goals, and the supplier also used external benchmarking activities to outline opportunities for improvement. Engineers were again considered highly important, distinguishing themselves from others, but efforts were made to integrate with other staff. Engineers were however keen to highlight their status: *"I'm actually the only engineer in this department, although they have great skills in operating their things, their skills aren't in writing reports"* (CM17).

The GM conducted a twice yearly 'state of the utility' address with all staff, in which the missions and visions were reinforced, and progress discussed. Long service anniversaries, work achievements and special occasions were celebrated. Conferences and events were regularly attended by various members of staff, as learning from others was encouraged. Efforts were made to empower staff, and employees felt that their

opinions and comments were valued. The GM had to re-apply for his job during the mergers, to compete with others, and was prepared to do so in the future suggesting that the GM felt he had no more right to power than others. The GM made great effort to keep in touch with employees and remain approachable, stressing that his 'door was always open' for anyone that wanted to talk. Public relations (PR) and branding was high on the agenda with the company producing t-shirts, glasses, water bottles and mugs for example, displaying its mission statement along with bottled water to help boost trust and image after a local fitness centre publicly stated that bottled water was better for you than tap water in the media.

4.2.4   Supplier D

Supplier D consists of a private holding company and subsidiary companies with public shareholders. The group structure provided support as well as 'friendly' competition which acted as a motivator (if one company was implementing something, the others would not want to be left behind). The organisation is one where formalised procedures, often in the form of quality certifications, were prevalent. It was a professional culture, but despite the high level of formalised procedures, relationships within the organisation tended to be informal, with top management being very approachable to other members of staff. Being private, business diversification and expansion was also high on the agenda with leaders in the organisation keen to seek new business opportunities both in expanding their water operations and also in other areas such as renewable energy. The culture was one of youth, both in terms of the employees and the age of the organisation itself, an organisation that had experienced and contributed to rapid change and continual improvement over the past ten to fifteen years. Employees often espoused that they 'wear the shirt' signifying strong alignment with the culture and commitment to the organisation: *"We have a culture already implemented here in the company, we help each other, we wear the shirt!"* (DM7). Camaraderie was important, all employees worked together to achieve the same objective; a high level of quality and service. Small company size was valued, in that it allowed relationships between staff members to be developed and there was some apprehension over expansion and merging between companies that was intended to produce economies of scale.

There was a feeling that the organisation wanted to be the best, and prove themselves, with concern for their image, and trust amongst the consumer population and their shareholders: "*Because we look at the quality of the product, and we have other certifications for safety, quality and environment. It is a way to show outside that our practices are good practice*" (DM7). This was due to two main factors, that water quality before the company was developed was very poor and there was hesitation from local governments regarding the privatisation of the water supplies. Secondly tourism was high in some regions, and Supplier D felt a need to prove their capability to provide safe, clean drinking water, often by going over and above what they needed to in terms of regulatory requirements, and feeling accountability to the consumer despite being predominantly bulk suppliers[11]. Successes were celebrated and staff generally enjoyed working for the company and felt valued and involved. Training was promoted and recognition was given when achievements were made: "*But I believe we are also very motivated by our work being recognised by the organisation. There are two ways that they do that, by shaking your hand and saying nice job and by letting you earn more money!*" (DM9). Once again, engineering was valued highly, with engineers keen to identify themselves as engineers. It was also highlighted that top managers were trained engineers, rather than 'managers' and this was important to the company: "*He was not a manager, but an engineer, so that was a great thing, it makes a difference that he understands the problem, and that he does not just look at the numbers*" (DM13).

In all four suppliers (A-D), the history of the supplier was widely discussed, including the improvements that had occurred. However, none of the suppliers were past-oriented, and used examples of how things did not work in the past to influence future decisions, tried to be progressive, and encourage people to learn new and better ways of doing things, to ensure continuous improvement. The importance of training was also held very highly in all four suppliers, making training opportunities readily available for all employees, feeling that a well trained workforce was essential for success.

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[11] Bulk suppliers abstract and treat raw water, before handing on to a separate retail company that will distribute the treated water to consumers.

4.2.5   Organisational missions and drivers

Table 4.1 summarises some of the espoused missions and drivers of each supplier. Common to all suppliers was the mission to supply 'quality' water in terms of safety and aesthetic parameters; provision of excellent service and compliance with the regulatory guidelines, driven by competition and a continual improvement desire. Yet not all suppliers explicitly mentioned quality or public health within their mission statements.

Table 4.1 Supplier missions and drivers

Common missions	Quality, safety or cleanliness, of the water; provision of excellent service; competition; continual improvement; regulatory guidelines; aesthetic quality.
Supplier A Specific	Cost; historical failures; reduce customer complaints; workplace safety; security; wanting to have good quality water as a resident and also for family and friends; keeping ahead of a growing population.
Supplier B Specific	'World class'; profit; commercial drivers; customer trust; lack of catchment control; unable to rely on regulatory sampling; quantity; sustainability; public health; environment
Supplier C Specific	'World class'; public health; fiscal responsibility; workplace safety; asset management; environmental stewardship; quantity; proactive; sustainability; security.
Supplier D Specific	Quantity; continuity; sustainability; public health; financial targets; capacity building; confidence/trust; expansion; environment; historically poor water (improvement).

4.3 Water safety plans

4.3.1   What progress have suppliers made in WSP adoption?

Efforts had been made to develop a WSP in **Supplier A**, but had stalled due to a perceived lack of time and resources. A senior member of staff had been made aware of WSPs at a conference, and had become an advocate. Consultants were hired to assist in development and a 'checklist' of hazards was used and workers were asked to rank the hazards they believed posed the highest risk. However senior management disagreed with the responses, believing this to be a result of ineffective communication of the exercise.   At this point, efforts stopped. At the time there was considerable urban growth and with limited staff and resources, all efforts were put into serving new customers, leaving little time for other projects: "*We got started and we got sidetracked, just because this past year and a half have been busier than we've ever seen and we just*

don't have the resources, it just fell off the table. I'm hoping that we can get it running again" (AM16).

Supplier B undertook a WSP pilot project on direction from the parent company. A water treatment plant (WTP) was chosen that would show the greatest improvement. Responsibility was given mainly to one member of staff in the water quality department, and there existed a small committee of three people. Responsible staff had attended a training course in WSPs and used guidance and case studies in development. An awareness project was underway to communicate WSPs to staff but involvement of other staff members in the project was limited. There was an element of uncertainty within the supplier as to how the WSP would be used and whether it would be an improvement on the way water quality was currently managed *"whatever they are doing now is quite OK with regards to water quality, we don't have a high number of violations or anything so to have WSP is OK as long as it doesn't give too much burden at the end of the day"* (BE4).

Supplier C had not embraced WSPs, primarily due to a lack of awareness and promotion of the approach within suppliers and regulatory authorities in the region. Supplier C had therefore not explicitly decided *not* to do WSPs, but due to this lack of awareness and promotion had not been able to give the approach serious consideration: *"I don't fully understand the WSP approach but generally I think we are doing the same kind of thing with the multi barrier approach, so what is the real benefit of us doing it?"* (CM17). When briefed on WSPs, employees felt that risk was managed through other related means, such as the multi barrier approach and a wide range of related practices or 'building blocks' of a WSP that were already undertaken, such as source water protection plans, water quality management plans, system assessments, quality benchmarking activities, and supporting programmes. Even though WSPs were not explicitly a regulatory requirement, employees felt that risk management was inherent within the regulations, requiring source water protection plans, treatment and operations plans and distribution system testing.

Supplier D was first introduced to WSPs in 2003 after the Chief Executive Officer (CEO) of one of its companies attended a conference during which the WSP idea was developed, prior to publication of the 3rd Edition of the WHO drinking water guidelines.

The CEO consulted with a nearby university and began developing WSPs for the company, employing a staff member to do so. Other companies in the group have followed suit, using different approaches, for example HACCP and food certification methodologies in order to guarantee external verification. During the study, the holding company was beginning to develop guidance and assist all companies within the group to implement WSPs in the near future, learning from and developing on the experiences of companies that already use WSPs: *"We are implementing and developing a kind of WSP guideline to help the other companies that we have in our group, because they have few people and money so we help them"* (DE2).

4.3.2 What are the blockers and drivers of WSP adoption?

There were no specific drivers within Supplier C, as the company was not specifically implementing WSPs, but there was the capability. Managers were enthusiastic about new initiatives that would ensure continual improvement. The main blocking feature was a lack of awareness as to what the WSP approach entailed; this could also be due to the fact that there was a lack of WSP implementation in the region. Despite representing a variety of supplier types, there were a number of potential factors that could have acted negatively toward WSP development (here termed 'blockers') and enablers that were common to all cases, summarised in Table 4.2.

Enablers:

- **Enthusiastic management**: Managers within A, B and D initiated the project and provided necessary resources in terms of staff or consultants, as one manager in Supplier A espoused his enthusiasm: *"I went to the conference and got all charged up. At the conference, it was the first time I had been exposed to it and it looked like a really good idea"* (AM16).
- **Incidents**: Past quality related incidents contributed to the drive for WSP development, hoping it would prevent these effects being felt again: *"The main driver was a specific incident where a large volume of water had to be discharged, there was no agreement on whose fault it was... so identifying the potential hazards, the thought sequences and what had to be done for those incidents so that was the main motivation"* (DM19).

- **Accountability**: Accountability to the consumer was used as justification of the WSP, the 'desire to do the right thing' as a manager in Supplier A termed it. As a private company, Supplier B felt particular accountability due to its paying customers and felt that nobody should get sick because of the water; WSPs could help prevent this.

- **Insufficient regulations**: Many employees felt that the regulations were not enough to ensure the safety of consumers and they therefore need to go an extra step (WSPs) to achieve this: *"it is important to have a WQ department to do our own sampling, own testing, because we cannot depend on the ministry of health"* (BE19).

- **Image/competition**: All suppliers to some degree were concerned with image and competition. Be it real competition in the case of private suppliers such as Supplier B, perceived completion with peers in Supplier A or competition within the group in Supplier D. The image of the company was also important, for example in Supplier D, where tourism was high: *"because of the issue of image, because people didn't like the tap water from there, so to prove to them that the water was good, they certified it as a food product"* (DE2).

Other, more supplier specific drives included a desire for **'peace of mind'** that the WSP could provide in Supplier A. Supplier B specifically quoted the revision of the WHO **guidelines** as a driver for implementing WSPs. It would also allow progression, operational improvements and learning opportunities from others though membership of the Bonn Network: *"becoming a member we hope to learn from others, how they conduct their business, in what areas they are lacking. It's more on knowledge sharing"* (BM5). Supplier D had a drive to be pioneers of the approach in the region, to prove if others could do it, so could they: *"people said OK we have ISO 9001, so it's not so difficult to go a little bit farther and the challenge was why not go further, and be a pioneer"* (DS12). A desire to **improve quality** due to historically poor water and therefore to prove themselves acted as a strong driver for WSP implementation: *"But from the start we took something very serious to produce evidence of the improvements and evidence to show that we were doing something better than before"* (DM1). Suppliers B and D also had a **supportive regulator** who were enthusiastic about WSP development: *"But [the role of the Ministry of Health) is more advisory, until our Act*

comes into play then we are really going to focus on WSP there; that will be a legal requirement" (BS2). Supplier D also had a supportive group structure that helped provide momentum for WSP development: *"Of course we are in a group and we can share knowledge between the group. It means that anything is possible"* (DM14).

Potential blockers:

- **Competing priorities:** Private companies such as Suppliers B and D had competing commercial priorities such as an increased interest in new business opportunities that may risk taking the focus away from the core business, and initiatives such as WSPs: "*The main challenge I think is to keep focused on the two main businesses, the drinking water and the wastewater, the other things will be better to optimise the investment that we have already made and to reduce cost, but we should never lose the focus on these two main businesses and that's the danger*" (DM30), younger companies within Supplier D also had more improvements to make and therefore higher priorities on which to spend money. Supplier A acknowledged that increased growth was higher priority.

- **Lack of resources** (time, money or human resource): There was a perceived lack of time, resources and skills in all suppliers, Supplier D found it difficult to attract staff to more remote areas; Supplier A felt the need to employ consultants and a lack of time was the reason the WSP was on hold "*The risk one seemed do die off because we just didn't seem to have the time. Understaffed. We are trying to build up our staff now and get back to where we can actually get back into that*" (AM14).

- **Uncertainty**: Over how to implement the WSP and ineffective guidance was an issue for the suppliers: "*we started looking at the Australian model and I found it frustratingly hard to relate, and it would have probably been better if I had gone down to Australia and learned why. When you are reading everything on paper you are making a whole lot of assumptions*" (AM14)

- **Communication:** In some cases it was felt that communication, both within the organisation and also with stakeholders could be improved, as one respondent noted: "*I think the weakness is communication, because worse than a lack of communication is bad communication*" (DM31).

Specifically, the main issue in Supplier A was that although supported, the project was **not perceived to be urgent** by top management and hence it was difficult to gain momentum: *"The frills of doing extra stuff…. It was purely a manpower issue. I guess if I had personally insisted that it be done, it would have gotten done"* (AM16). Within Supplier B, there was a certain degree of **lack of understanding** and support from within the organisation with many staff reluctant to become involved because they felt it was not their responsibility or that they would not receive formal recognition for doing so. Stakeholders were identified as desired members of the WSP team but had yet to be engaged. Also there were a wide range of initiatives and programmes being implemented, and a fear that this would lead to a certain amount of **'fatigue'** and de-motivation: *"Well the challenge in implementing any programme in this company, which we have a few like six sigma, ISO, lots of things lots of different departments so I think with trying to implement another programme, you come up against objections"* (BE10). Challenges in Supplier D included the fact that smaller companies sometimes didn't see the 'bigger picture', the holistic view that WSPs need: *"Sometimes we are just looking inside and we don't look to the whole system, and we don't see the big picture"* (DE2). It was also felt that companies who were **not certified** found it harder to implement WSPs because of a lack of documented procedures. **Instilling a risk culture** was also found challenging, to get people to think about hazard and risk and that different departments had different cultures which could affect WSP development. *"The culture of our organisation depends on the area in which you are working, we have departments where we have a big innovation capacity... and you have other departments that the way to work is not like that"* (DM30).

Table 4.2 WSP progress, blockers and enablers

	Supplier A	Supplier B	Supplier C	Supplier D
WSP	Explicit project, abandoned/on hold.	Explicit WSP pilot project, not yet complete.	Not explicitly undertaking WSPs	Explicit project, implemented in some subsidiaries for many years
WSP Driver	Top management (believed to be the 'right thing to do' to 'give peace of mind').	Parent company (commercial driver).	Feeling that they already achieve the aims through other means	For continual improvement and to increase trust in the water supply.
Involved	Staff and external consultant; stakeholders.	Staff.	Staff involved in related practices.	Staff, universities, consultants, external auditors (as part of certifications), stakeholders
Blockers	Lack of time and resources; Ineffective communication.	Uncertainty, strong emphasis on end product monitoring, difficulty in establishing a risk based culture.	Lack of awareness of WSP approach; lack of buy in.	Uncertainty over how to help smaller and younger subsidiaries; resources; communication.
Enablers	Supportive senior management, committed staff and incentive (consumer trust).	Support of top management and parent company, committed staff, customer service mentality, wanting to be the 'best'.	Capability – enthusiastic management, committed staff, mindfulness of PH protection, wanting to be the 'best'.	Enthusiastic management; strength and support of group structure; continual improvement mentality,
Other notes	Staff very mindful of operational health and safety when asked about risk.	Uncertainty over reasons why they should do a WSP – risk of tokenism.	Staff very mindful of operational health and safety and security when asked about risk. Capable but lack of awareness.	WSP implementation began before publication of WHO guidelines, proactive in producing guidance in native language to assist others.

4.3.3 WSP benefits

It is important to consider what benefits the WSP brings to the suppliers in question when analysing the success of implementation. Supplier C was not explicitly implementing WSPs and as such could not espouse the benefits of the approach. Suppliers A and B were in the early stages of WSP implementation and most benefits discussed were perceived rather than actual at that stage. The main benefits that **Supplier A** considered the WSP to bring was a more systematic approach to risk management, and peace of mind, to 'guard against the things that make you wake up at night'; *"the way it goes through your whole system and looking for the failure points in*

a kind of a workshop environment and then identifying those points and trying to do something about it makes a lot of sense and although we've sort of done that intuitively we've never done it rigorously" (AM16).

Supplier B perceived that the WSP would benefit both the company and the consumer and would prevent complacency around public health: *"I should also highlight that public health is something that, if things haven't happened, haven't gone wrong for quite some time then people get complacent, so that, when WSPs come into the picture, it is being reviewed annually and it should be the right tool to make sure people are aware"* (BE4). There was also considered to be a benefit to the regulator by making it easier to audit the company: *"I think we are moving to a direction where you want to ensure safe drinking water, if we plan, look at the risk, and have the documentation required it is easier for the authority to audit a WTP"* (BM20). It was hoped that the WSP would help with stakeholder engagement: *"I don't know how to approach them. But at least with the WSP, they can contribute"* (BM21). During a group meeting, employees were asked what benefits the WSP would bring, answers included: less monitoring by people; reduced violations; consumer benefits; risk based maintenance schedules; cost savings; better control; more proactive; reputation benefits (first company in area to implement WSPs) and an increase in customer satisfaction.

Supplier D had been implementing WSPs for the longest amount of time and as a result, benefits could be evaluated, rather than just perceived. These included improved, formalised and documented procedures with better control, and an improved understanding of the system. This also meant that staff were more mindful of quality and safety of the water and were more critical and conscious of the risk: *"this way of doing things they help structure the departments for having quality in their minds"* (DS12). Other members of staff felt that the WSP would help improve stakeholder relationships, both internally, through improved communication and externally: *"The benefits for the future, for myself, in my opinion it will advise us to speak with stakeholders... The WSPs advise us to have protocols and to speak with stakeholders which I think is quite important"* (DM3). Financially, the WSP helped with prioritisation of investment, and also savings and optimisation of cost *"Another benefit was the financial benefit, after a period where investment was large, we are now*

gaining the products of that benefit... after one year of the WSP, we can see a reduction in cost, about 10-15% down" (DE29)*,* such benefits can be valuable when trying to gain the support of top management. Completing the WSP also allowed 'automatic' compliance with other standards *"one of the benefits of the WSP is that some of the procedures makes us automatically comply with the requirements of other standards and that is a huge benefit"* (DM26)*.* In conjunction with certifications, such as the ISO 22000 food certification, WSPs enabled one company to focus on the critical aspects, such as disinfection, enabling a reduction in costs of those aspects that are not critical, *"When we really started to work with the WSP and the ISO 22000 we really focused on what is critical and that is really important because then everyone knows what is critical"* (DM30)*.* Implementation of the WSP provided justification to make changes possible, *"at that time we were limited because we were not the best and we knew there was a lot of things we could do to improve, and we made possible these changes"* (DM14)*.* From a consumer point of view, one member of staff highlighted that the *"main beneficiary of the WSP was the consumer"* (DM18)*,* this was because of the increased confidence in the water supplied and the assurance of safe water. Such improvements have been realised because the WSP has allowed a faster response to early warning systems: *"we have reduced the level of unpredictability; we have a lot of things characterised so our response will be faster and more precise"* (DE25)*.* Figure 4.2 summarises the benefits, both real and perceived of WSP implementation from all suppliers.
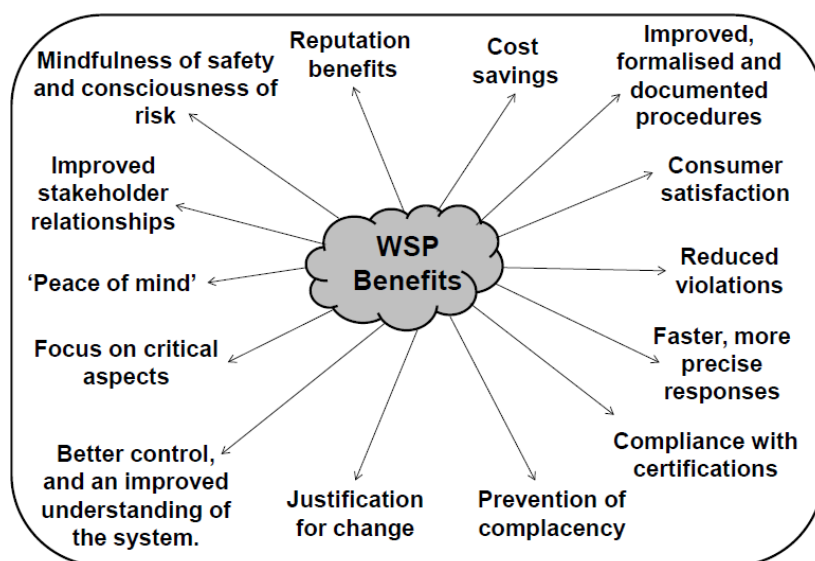
Figure 4.2 WSP benefits

4.4 Managerial commitment and leadership

Supplier A: Managers felt that being a small organisation made risk management easier, because there was less opportunity to 'pass the buck'. If things did go wrong, being so **visible** to the community meant they had to be proactive in preventing issues occurring, as well as wanting to '**do the right thing'** for the community: *"I'd say by the desire to do the right thing and I think that in a smaller community it works better than in a larger one, because really if there's only me, and two others making the decisions then you know who's going to take the flack for it if it doesn't work and we are going to be out there at three in the morning trying to fix it, we're also going to take all the political from it so it's a very direct one on one relationship, if you let something go downhill then you are going to suffer for it"* (AM16). **Training** was seen as a top priority by management to ensure a competent workforce, as was transparency and a continuous improvement culture. Leaders were credited with bringing about positive change in terms of water quality: *"The big push was that the city engineer came to work for the city at that time and he was right into the water quality stuff and he pushes quite a bit for all these new ideas"* (AE1). **Resources** (external expertise and equipment) were forthcoming: *"Equipment wise we are pretty much set. We get what we need without a doubt and even more. There are things we don't need that they give us anyway!"* (AE2). It was considered important to involve front line staff in the risk management approach, as well as engaging **stakeholders**. However, when contemplating **lessons learned**, management acknowledged that more could have been done in effectively communicating this exercise to employees. Unknown to management, in their quest for external expertise, staff felt **undervalued** in their opinions; again, an issue of communication. With **competing drivers** of service provision and completion of other projects, **WSPs were not seen as a priority**, a 'nice to have' rather than essential. This may reflect a risk of **complacency** over water quality, as the supplier did not foresee any major problems with quality, and that they were the best in the region: *"We have all these programmes that we are actually doing ourselves, whereas other municipalities don't do anything, they simply run around putting out fires"* (AM14). There was also a concern that top management were becoming **detached** from day to day activities: *"The guys in city hall, besides the emails they receive, they'll get it and read it but they don't really respond, I think they*

are a bit detached from what goes on here" (AE4). This complacency could be overcome with renewed interest and advocacy by leaders.

Supplier B: Management from the parent company supported the WSP project. Managers actively tried to **create a culture** in which **customer service** and **continuous improvement** were paramount; and accountability and transparency made priority which are important aspects of the Bonn Charter and WSPs*: "During changeover it was a bit of a culture shock... there were lots of activities to help people adopt the company mindset and this helped reduce the culture shock, or made it a 'manageable' shock. Only a few people actually wanted to leave, I think about 99% of the staff stayed"* (BM6). Management tried to instil a drive in the organisation to be **world class** where pride is taken in successful projects. Despite being a developing nation with resource limitations, this was not seen as a blocker to WSP development, and it was acknowledged that it was **leaders** that were needed, not necessarily money: *"I don't think resources should be an issue for anyone, but you have to have a driver [a person] and I believe I am a strong driver in these kind of things, I think my actions influence others, so these people who complain about resources, in actual fact they don't have a driver within the group"* (BM20). **Training** was valued by leaders. However, again, **WSPs were not viewed as a priority**. With **recognition** being important, few staff were given WSP duties in their targets and others were therefore hesitant about becoming involved. The importance of quality and public health was not communicated well to all employees with a resulting perception that it was the responsibility of the water quality department alone and with a risk of **complacency**. There was also **ineffective communication** of the vision or purpose of WSPs, with few understanding their relevance other than because the parent company had requested their implementation *"It just introduced what is the WSP, the ten items of the WSP and I don't remember! I just know that the WSP exists that's all"* (BE16).

Supplier C: Management were **not explicitly committed** to WSPs, feeling that they were already implicitly implementing such an approach and that WSPs could not bring any additional benefits but it was acknowledged that this may be due to a **lack of understanding**: *"I don't fully understand the WSP approach but generally I think we are doing the same kind of thing with the multi barrier approach, so what is the real*

benefit of us doing it? Having said that, I would have said similar about ISO 14001, but since doing it, people now call me an 'ISO evangelist'! I now preach it as the best way!" (CM17). Management were however strongly committed to **continual improvement** and supportive of **innovation**. Employees felt that management did what they said they would do: *"I believe that all levels of management don't just want to talk that they want to walk that too"* (CM4). **Resources** were readily available if justified. The GM and other managers specifically tried to remain approachable, interact on first name terms with staff and celebrate success*: "Well I think, one by making themselves available to staff, so that you make yourselves available to your staff. Two I think it has to do with, well it goes both ways, someone has to feel comfortable enough to ask a question or to approach people on that. But certainly I don't think any of the managers put themselves on a pedestal or that kind of thing"* (CM7). Management also tried to remain **actively involved** in day to day activities, and pay attention to the things that were important to the organisation, as the GM stated: *"I ride shotgun on the action column, to make sure that things get moved along and I think that's a key thing to champion and be active in, making sure people get done what they say they are going to get done"* (CM3), although it was acknowledged that this was becoming harder as the organisation grew.

Supplier D: Employees generally felt that senior management were fully **supportive** of WSP development: *"They gave their full support to the project, we had members from all the departments in the team and we would work directly with the board of directors"* (DM3). The **initial drive** to develop WSPs came from top management: *"The key person was the big boss and we put all the directors around the table maybe three times, and we discussed who does what... and I'm sure this is one of the key factors to have success in implementing WSPs, so put all the high level staff enthusiastic to do the things, otherwise I don't know that it would be very positive"* (DS12). Senior management were also credited with providing the necessary **resources** and environment for staff to be able to implement WSPs effectively: *"The company allows us to do good work and it gives me the materials, the resources that I need to do my work and do my work in the best way... This contributes to our happiness and wellbeing - our welfare"* (DM8). As well as providing resources, it was acknowledged that senior managers were responsible for **developing the organisational culture** that most staff

found supportive and good to work in: *"I should say that the CEO at the time, at the beginning. I have much respect for him, he was very important to the creation of the culture here of wearing the T shirt"* (DE15). Another important aspect of managerial commitment is that managers **are actively involved** in day to day operations, seemed to be prevalent in Supplier D. For example, the CEO would attend audits and visit employees on a regular basis: *"We are able to have this system working very well because we have our CEO, who is unusually involved, even the auditors every year say that. He supports most of the big decisions, he supports us and every improvement we want to make, he tries to make it possible, that is the big difference, he goes to the lab every year and talks to people, it's very different to what I hear in other companies"* (DM22).

Leaders do not have to be senior managers, they can exist at any level of the organisation, but will drive WSP development. In most cases leaders were managerial staff, and their charismatic nature was espoused by other members of staff. For example, in Supplier A the city engineer was credited with instigating change and making great improvements*: "Because the quality wasn't that good at times, that time I think the big push was that [the city engineer] came to work for the city at that time and he was right into the water quality stuff and he pushes quite a bit for all these new ideas"* (AE1); the GM in Supplier C: *"the GM supports what we do, he creates an environment where people who want to lead or do innovative things, they thrive and the support is critical and it's there"* (CE9): and the CEO in Supplier D: *"I would like to mention that the success of the WSP project was down to the CEO he was part of the WSP team"* (DM5). Individual leaders were less talked about in Supplier B, perhaps because of its larger size and more dispersed structure. Strong leadership with respect to WSPs was exhibited by employees in Suppliers B and D who were not members of senior management were given ownership of WSP projects, becoming advocates of the approach and enlisting others.

Kouzes and Posner (2002) identified five 'practices' of exemplary leadership (Chapter 2.3.4). Applying these, we can establish leadership influences on WSP projects (Table 4.3). 'Challenging the process', searching for new opportunities was probably the strongest area in all cases, along with 'encouraging the heart' – all suppliers liked to

celebrate success to a certain degree. 'Enabling others to act' and 'modelling the way' could benefit from more development, to make sure all employees are aware of the project, the reasons for doing it and given sufficient resources to do so. Despite great efforts to create a supporting culture in Suppliers A and B, we can align issues that are blocking success with some of Kotter's leadership errors (Chapter 2.3.4), particularly: (i) not establishing a great enough sense of urgency; (ii) not creating a powerful enough guiding coalition; (iii) lacking a vision or under communicating the vision; (iv) not removing obstacles; (v) not systematically planning for and creating short term wins and (vii) not anchoring changes in corporate culture (examples are shown in Figure 4.3). Supplier D has guarded against these errors in its companies that already implement WSPs, for example, creating powerful coalitions with senior management, having a clear vision for the future of WSPs and the supplier is wary about advertising 'victory' and its successes, despite probably having good reason to: *"Well, my feeling, I don't like a lot of show off! And so we worked inside the company a lot, of course there is one or two meetings with these kind of companies, and this is the only promotion that we did"* (D:14). The challenge will be guarding against these errors when expanding WSPs to all companies.
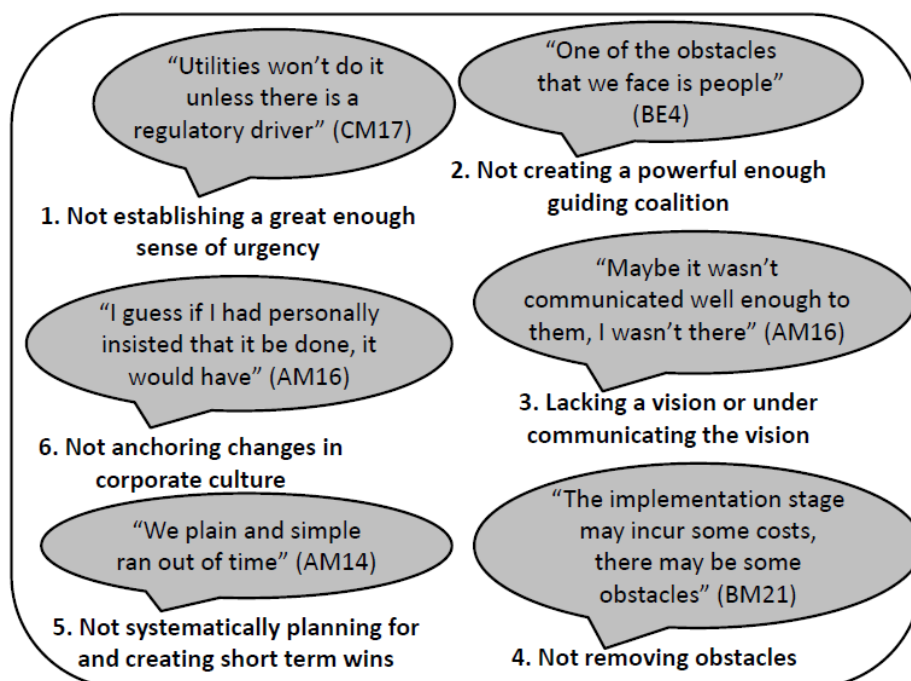
Figure 4.3 Kotter's errors of transformation

Table 4.3 Alignment with leadership practices (based on Kouzes and Posner, 200))

Leadership practices	Supplier A	Supplier B	Supplier C	Supplier D
Model the way - Clarify Values - Align actions with shared values	No formal espousals of public health and quality related values, tends to be assumed, however, shared values of customer service and quality pervade organisation. Could benefit from more clarity and reinforcement.	Mission statements neglect public health and quality values of the organisation. Values and reasons for risk management approach not readily shared, although customer service mentality does pervade organisation. Could benefit from clarification of risk management values.	Public health explicitly mentioned in vision statements, frequently promoted by GM along with other missions and values. WSP approach not explicitly undertaken.	Few formal espousals of public health and quality related values, tends to be assumed, however, shared values of customer service and quality pervade organisation. Could benefit from more clarity and reinforcement.
Inspire a shared vision - Envision the future - Enlist others	Leaders of organisation have clear vision for future, and intend to undertake WSP project yet lack of communication makes enlisting others difficult.	Leaders of organisation have clear vision for future of risk management project, widely communicated to other members of organisation, but as awareness rather than enlistment.	Leaders of organisation have clear vision for future, and widely communicate this to employees and adopt mechanisms to enlist others, although not explicitly for WSP projects.	Leaders of organisation have clear vision for future of WSP projects and expansion. Efforts are made to enlist others, within the organisation as well as external stakeholders and universities.
Challenge the process - Search for opportunities - Experiment & take risks	Opportunities readily sought, hence desire to undertake the project through looking outward for new ideas, expertise sought in the form of consultants. Lessons were learnt from failure of initial project.	Opportunities readily sought, hence desire to undertake the project through looking outward for new ideas, expertise sought through external training programmes and joining network of experts.	Opportunities readily sought, look outward for new ideas, expertise sought in the form of consultants and new ideas are valued. Desire to be 'world class', but lack of WSP adoption.	Opportunities readily sought, hence desire to undertake the project through looking outward for new ideas, expertise sought in the form of consultants and new ideas are valued. Lessons were learnt from reviews of challenges and benefits.
Enable others to act - Foster collaboration - Strengthen others	Self confessed poor communication of risk management activity, resulting in poor understanding and commitment to the project.	Tendency to 'not want to burden others', and as such collaboration is limited, and risk management project limited to a few individuals.	Ownership and involvement enables collaboration within staff of the organisation and external stakeholders, but not for WSP explicitly.	Ownership and involvement enables collaboration within staff of the organisation, group structure allows suppliers to help each other.
Encourage the heart -Recognize contributions - Celebrate values and victories	Celebrations of success. Feeling that employee's contributions were not recognised, resulting in demoralisation. WSP Project did not persist long enough to be able to celebrate values and victories.	Formal recognition is important to employees but few receive such recognition for the project, hence little involvement from others. Caution over celebrating values and victories as still in pilot stage.	Celebrations of success, contributions of employees recognised, innovation valued highly. But not for WSPs explicitly.	Leaders actively make a point of recognising the achievements and contributions of staff, and celebrate successes. Although a reluctance to promote achievements outside the organisation.

4.5 Organisational commitment and motivation

4.5.1 Commitment and motivation to the job

When asked what commitment constituted, a number of responses were offered, and were similar in all suppliers. These included, (i) turning up to work; (ii) quality of work and end product; (iii) willingness to work out of hours and being 'on call'; (iv) camaraderie; (v) focus on customer service; (vi) 'getting the job done'; (vii) enthusiasm to solve problems and interest in the job; (viii) taking pride in work; and (ix) a 'don't quit' culture. Organisational commitment is important for successful implementation of projects such as WSPs, this will require a motivated workforce. During the case studies, mechanisms for motivating staff were explored, common themes of motivation amongst all suppliers included:

- **Accountability**: Being in a small community, Supplier A felt they were in the 'firing line', and therefore felt accountable to its consumers. Supplier B, felt the need to be competitive as a private company, and that if it provided a substandard service it would lose business and that it felt accountable due to its paying customers. This feeling was echoed in all suppliers and helped the necessity to provide clean, safe water provided motivation to do a good job: *"I really enjoy my job. I do find that sometimes it's a little overwhelming, it's like when I first started my mom and dad were like 'so you're like making the water for everybody?' oh my gosh! In other jobs if you make a mistake, it's like 'oh well, start again' whereas if you make a mistake with this job, it's a pretty drastic mistake"* (CE12).

- **Incentives**: Balanced scorecards and targets were used in Suppliers B and C; a bonus scheme in Supplier D and non-monetary rewards in Supplier A to act as motivation. For example, as one employee of Supplier D noted when asked what motivated them: *"For me I think the bonus! Also there may be functions that we have to attend, with suppliers we may need to entertain them at a hotel and that will motivate them to work. The bonus is a very strong factor. The bonus is based on the KPIs and the balanced scorecard"* (BE16).

- **Training**: An emphasis on training and encouragement of training was one way that the organisations tried to motivate: *"One of the ways to motivate the*

personnel is through continuous training, everyone has the liberty to find specific training that they feel will be beneficial and propose that training to the company which most likely will be approved so that is a way to motivate personnel" (DM27).

- **Enjoyable environment**: An environment where people enjoyed their job was very important to the motivation of all interviewees, with many stating that if they didn't enjoy their work they would leave. Some organised events to create and enjoyable work environment *"every year we have family days, sports days and sometimes we have so many events in the company, hopefully we can then change their mentality to be more open to the society, the staff, the customer"* (BM9).

- **Recognition and value:** Receiving recognition for work, including adequate pay and pay progression along with feeling valued were important motivators: *"Give recognition, that is very important, above money, if someone does something and their manager tells them they've done well, then they like that"* (BM15).

- **Importance of job**: Being made aware of the importance of the job that people motivated employees: *"Well I guess number one is the importance of it. Health wise it's probably one of the most important things in our society. I think it motivates the workforce to have those stricter limits, to move to a higher level. It's always good to make yourself a little bit better"* (CM16).

- **Empowerment, ownership and involvement**: Being actively involved in projects helped staff become motivated, even in less skilled positions, the organisation tried to involve them in decision making: *"I think they are interested in the work that they do and the way that they we keep them motivated is to give them ownership of it, and we do that. They are aware of how valuable they are, they are aware that their contribution counts and it has an impact. And they get credit for the good things that they do, and we try to make it enjoyable for them."* (CE9).

- **Benefits**: Material benefits such as wages; pensions and health care: *"We get a good retirement package and they do look after us, in terms of health and things"* (AE5).

- **Celebrations of success:** In all suppliers, celebration of good work helped to motivate: *"I'm also a strong believer in celebrating success, I try real hard to catch people doing something well, versus the other way. And if I see something being done well then I'll name it and celebrate it"* (CM3).

- **Internal relationships**: Developing good relationships with co-workers created a positive, motivating environment: *"Motivation I think is second nature to me and I believe the staff know me, I communicate to all levels of people, I build relationships at all levels... I think I've worked in all departments, so I think I gain the respect of all managers there, I never hold back to assist them in any way I can, the influence comes in that way"* (BM20).

- **Communication and provision of information**: provision of adequate information to staff was seen as a way of motivating: *"It is easy I think, circulation of information is good and this situation is easy to communicate. We have an intranet and we can share all the important documents, for example the mission"* (DM14).

- **Challenge**: Variety in work, finding it 'exciting' and challenges were cited as motivators and prevention of boredom: *"I like my job, I like the fact that I have responsibility for different fields - the lab, cross connections, hydrants"* (AE18).

Other sources of motivation included contributing to the company's profit in Supplier B, and that a change in regulation would mean this motivation was lost: *"Previously we built the objectives saying that if everything is going good then you guys are contributing to the whole profit, but now with the government limiting the licensing regime they will be limiting the amount of profit that we get from the operations, so that may have an impact on the motivation of the staff as well"* (BE4). Strong religious values were also a motivating force: *"Religion is important to us, because we are Muslim, we will be judged by God, we have to answer to him with regards to our actions so we want to do good. We send our staff for training, as well as emotional and spiritual development, so they are not just motivated by money, and therefore they will voluntarily do good"* (BM15). Prior education and training gained before employment with the company was cited as a motivator in Supplier C; *"The people we are hiring now, because they have that two year training, they want to do this, they went to school to do it properly which bodes for them very well, because they come to us with a*

commitment to want to do it right" (CM6). Specifically in Supplier D, it was felt that having a young workforce was self motivating: *"It's easy because here in this company we have a lot of people that are young and very motivated in my opinion, sometimes motivated more than is necessary!"* (DM14).

Despite highly motivated workforces, there were some difficulties in motivating staff. Employees of Supplier A found it de-motivating that it was **difficult to progress** within the company and that their **opinions were sometimes not heard** by management: *"As operators, you know what you need to fix it, what needs to be done but it's not that simple, you have to go through engineers and consultants to prove it, to do your talking for you I guess"* (AE8). In Supplier B, where targets and formal recognition were valued highly, a **lack of recognition** resulted in little motivation for a project. Along with Supplier A, the union system caused some de-motivation in Supplier C, with the feeling that all staff would be rewarded equally, despite level of effort: *"Well, with the Union, it's hard. The organisation has a bonus programme which is, everybody gets a part of it whether they contribute or not, and that doesn't do a lot to motivate a good employee"* (CM16). Supplier D felt that the **global financial crisis** had lead to some de-motivation: "*we are highly motivated for quality but in the world economic crisis, it is difficult for people, they are concerned about the work, it was easier three years ago than now because people are very concerned about the crisis"* (DM30). Another fear was that having achieved so many targets, a **plateau effect** was being seen, and it may become harder to motivate staff.

4.5.2 Employee commitment to WSPs

There was little explicit commitment to the WSP approach by non managerial employees of **Supplier A**, possibly due to the lack of communication or reliance on consultants. As one manager recalled, when asked about the abandonment of the project: "*So maybe that means we are not doing as good a job as we can with the staff, or maybe it [the WSP project] wasn't explained well enough to them. The consultant explained it to them, I wasn't there when he did. That might be part of the reason why it came off the rails"* (AM16). There was however a great deal of commitment to preventative approaches, as one employee acknowledged in his work: *"Now you have a certain job, and you sit down and think about what you need, besides materials and stuff*

you want to think about the different hazards, what could happen and what will happen. You plan for the worst case scenarios" (AE5).

Supplier B exhibited a little more awareness throughout the organisation regarding WSPs. All interviewees had heard of the term 'WSP' and were aware that the organisation was undertaking the project. Outside the small WSP committee and the water quality team however, there was limited involvement and commitment to the project, with some employees sceptical of its benefit or use: *"I have some idea of the so called WSP, I mean I have been to some of the talks but I'm not sure what the actual objective is, because to me we have been doing the thing"* (BM7). There was acknowledgement that more could be done to involve others, and to expand the committee in order to generate more commitment: *"So by having this committee we hope it will grant more formal decisions, so that once decisions have been made, it's actually a total decision from all subsidiaries"* (BE4). **Supplier C** had no explicit organisational commitment to WSPs due to a lack of awareness and buy-in from senior management: *"I think we would say, well what would we gain from doing that [WSPs]. I think department managers have got a good enough handle on their department that they know what the risks are, and we are a cohesive and tight enough group"* (CM17).

Supplier D had the strongest organisational commitment to WSPs explicitly, most members of staff were aware of the project, and could see its benefit. Employees at all levels of the organisation (from management to samplers and works operators) were involved and this involvement lead to increased commitment, for example, one operator had begun representing operators on the WSP team: *"My task is to inform the team some particular situations that haven't been identified previously, and the needs that we have. But it is a two way bridge, I bring in information from the operations to the WSP team and from the WSP team to the personnel"* (DE38).

4.6 Public health protection

Table 4.4 outlines common features of how the public health responsibility of the water suppliers was either made (a) explicit or (b) at risk of being taken for granted, with examples of interview or textual evidence from the case study data. Reasons for public health commitment can be traced to drivers for WSP development (Chapter 4.3.2) and

reasons for commitment (Chapters 4.4 and 4.5). The public health protection responsibility was demonstrated best by the willingness of all suppliers to go over and above what they needed to in terms of regulatory requirements, setting stricter limits and the feeling that the regulations were insufficient in isolation to guarantee safe drinking water. Some factors also could be attributed to why public health was at risk of being taken for granted. Many felt that water quality was good, and most risks had been dealt with. None had experienced a significant public health related incident in the past and all suppliers were above average in their region, and there was relatively little regulatory pressure which could lead to complacency - overworked and understaffed local health authorities were less concerned with water provision and hence conveying a message to the supplier that could lead to complacency: "*Very few and far between. Our last one was a fluoride one in May and it was a false one, it was recorded as a contravention but we knew it wasn't. I'd say once a year and it's usually a very minor thing. If you have a past history of following the rules, then the regulator isn't going to come down on you like a tonne of bricks. And we help them out whenever we can. They actually come to us because we are one of the communities with the type of water that people want to come and see*" (AE2).

Table 4.4 Themes and examples of interview/textual evidence of how public health responsibility is explicit or taken for granted that are common to all Suppliers studied.

a) Interview evidence that supplier is mindful of public health responsibility:

- **Employees perception of missions:** '*To make sure the that we provide clean drinking water so that nobody gets sick*' (**AE18**).
- **Stricter limits than regulation**: '*It is important to have a WQ department to do our own sampling, own testing, because we cannot depend on the ministry of health*' (**BE19**).
- **Proactive approaches:** '*the water is safer because we have a preventative approach and this is the biggest benefit*' (**DM28**).
- *Proactive stakeholder relationships:* '*we have a good working relationship with them, we know who they are, what their job is and we take a step back and so we're all in it together*' (**AM10**).
- **Caution/Fear: '***One angle of our PR campaign is telling people that our water is safe to drink but we'd rather not make it too big... because I'm scared that if you made that general statement then if something did go wrong it would hit us hard*' (**BE4**).
- **Training: "***Training is pretty much as much as they want, there is a good training incentive here, we will pay for anything that will better yourself, or a better employee. It's very progressive here in the support of that*" (**CM4**).
- **Accountability to consumer: '***I think it's also because we are a tourism region and some hotels say don't drink the water on tap and we want to change that we want that people feel safe using the water*' (**D:28**).
- **Provision of resources for quality: '***Equipment wise we are pretty much set. We get what we need without a doubt and even more so*' (**AE2**).
- **Hygienic practice**: "*We flame the tap and then we open the bottle, we can't speak or breath on the bottle! We close it is a soon as possible. The bottle has to be well disinfected*" (**DE32**).
- **Enthusiasm of leader:** '*I think the big push was that [city engineer] came to work for the city at that time and he was right into the water quality stuff and he pushes quite a bit for all these new ideas*' (**AE1**).

b) Interview evidence that public health responsibility is at risk of being taken for granted:

- **Complacency:** '*We have no weaknesses! Um, from a water quality standpoint there is not a lot more we can do really. From time to time we do some optimisation tests, try and improve things*' (**AE2**).
- **Lack of reward/recognition:** '*Some people would not want to be involved because they do not get recognition for it*' (**BE4**).
- **Lack of specific PH training: "***I don't think there is a training course per se about public health, but when you are taking a course, lets say a chlorination workshop, they will touch on that.*" (**CE5**).
- **Few major past events:** "*Because people would say, no we don't have any hazards... It's difficult sometimes because we would have discussions and people would say 'oh we never had that'. So it's good that we have never had a major event but it can happen so we need to see when it happens what are the barriers we have and how we would act*" (**DE11**).
- **WSP not essential/ Competing drivers: "***We didn't finish because we plain and simple ran out of time, everyone got busy with everything else***" (**AM14**).

Tables 4.5-4.8 outline such themes that were unique to each Supplier. It should be noted here that because one point may not be mentioned for a particular supplier, this may not be because it does not exist, but that it was not explicitly discussed or highlighted during data collection. The tables therefore aim to focus on what was readily talked or written about, thus conveying information about their relative importance and is not intended to be an exhaustive list.

Supplier A (Table 4.5) did have a mission statement that to a certain extent mentioned quality, in terms of quality of life for residents. This mission statement covers all of the council's operations, as this was a small council run supply. Awareness and support of the Bonn Charter and WSPs also exhibited Supplier A's mindfulness of its public health responsibility. However, many employees could not remember the WSP project and few interviewees made specific mention of public health. Employees were highly mindful of occupational health and safety risk, often discussing this even when asked about risks and hazards specifically relating to public health. Internally in Supplier A, there were barriers between managerial and union staff which lead to a breakdown in communication and relationships which directly influenced the success of the WSP project '*And I remember when I first got the management job, I was still on call, so I had to run some of the equipment and some of the guys got really mad because there was a manager running the equipment*' (AM17). With limited staff and resources, there were competing drivers, including pandemic influenza plans and service provision for a growing community which were seen as more pressing, and contributed to halting of the WSP project. The public health ethos was at risk of being taken for granted or lost as it becomes increasingly difficult to attract and keep staff.

Table 4.5 Themes and examples of interview/textual evidence of how public health responsibility is explicit or taken for granted that are specific to Supplier A

a) Interview evidence that supplier is mindful of public health responsibility:

- **Safety considered foremost in emergency management documentation:** '*Keeping the water safe is the primary concern whether a power failure occurs unexpectedly or if the power outage is a planned shutdown*'
- **Mission statement:** Includes: Commitment to preserving high quality of life; progressive development and fiscal responsibility.
- **Awareness of WSP/Bonn Charter:** '*I went to the conference and got all charged up... it was the first time I had been exposed to it and it looked like a really good idea*' **(AM16).**

b) Interview evidence that public health responsibility is at risk of being taken for granted:

- **Some staff couldn't remember WSP project:** '*Partially. And I can't even remember if I was truly interviewed or not. I can't remember the details. They didn't give us that much information at the time that I can remember*' **(AE2).**
- **Risk and hazard prompts occupational H&S response:** '*I've got to be preaching to the guys all the time, you know - be safe. I remember digging a water break one time and there was 7 ft of frost and the water main was under the frost and I put my head right underneath the wall. But I didn't know any better!*' [*when asked about water quality risk]* **(AM17).**
- **Few interviewees make specific mention to PH unless prompted:** *Guidelines, Historical failures and customer complaints mentioned most for divers for WQ, operational H&S risk often talked about even when asked about public health risk management* **(From field notes).**

Emphasising quality and public health parameters in company targets; a strong focus on monitoring health based parameters and attainment of quality certifications demonstrated the importance of public health to **Supplier B** (Table 4.6), along with awareness and adoption of the Bonn Charter and WSPs. However, there was no mention of public health or safety in the formal mission statements and many staff did not see the direct benefit of WSPs. There was somewhat of a dictatorial relationship between the parent company of Supplier B and the utility, with limited understanding of the reasons for doing WSPs within the supplier. Differing internal cultures and relationships created some blockers to the public health protection ethos and thus WSP buy-in, *'the engineers tend to feel that when they've done their job that's it, and they will say that the customer complaints 'oh that's your job'* (BM11). There was also still an over reliance on end product monitoring as a way of ensuring quality, despite the aim of the WSP to move away from this reactive measure.

Table 4.6 Themes and examples of interview/textual evidence of how public health responsibility is explicit or taken for granted that are specific to Supplier B

a) Interview evidence that supplier is mindful of public health responsibility:

- **Balanced scorecard:** '*Part of the business plan is on quality, you have your KPIs on quality and we set up responsible people in the respective departments to emphasize quality*' (**BM1**).
- **Quality certification:** '*We got ISO certified. This is very important due to the auditing process, there is someone checking it. It is not the certification itself... it is good that it is audited every year, it is a good control mechanism*' (**BM1**).
- **Sampling and analysis**: '*We have one of the highest numbers of sampling points spread out throughout the system, and some of the initiatives that we do are voluntary*' (**BE4**).
- **Awareness of WSP/Bonn Charter:** '*Public health is something that, if things haven't happened, haven't gone wrong for quite some time then people get complacent, so that, when WSPs come into the picture, it is being reviewed annually and it should be the right tool to make sure people are aware*' (**BE4**).

b) Interview evidence that public health responsibility is at risk of being taken for granted:

- **Mission statements:** (no mention of public health or safety) Holding Company: National leader and recognition; preferred global provider of total water solutions; value-added services; meeting and exceeding customer expectations; professionalism; meeting stakeholder needs; environment. Utility: Satisfy customers and stakeholders; quality service; world class.
- **Don't see value of WSPs**: '*I share the same opinion also, whatever they are doing now is quite OK with regards to water quality, we don't have a high number of violations or anything so to have WSP is OK as long as it doesn't give too much burden at the end of the day*' (**BE4**).
- **Not our responsibility:** '*It's [WSP project] more in the quality department. We haven't been involved really at the moment, we are still in the early stage. We just have our own initiatives like I mentioned are our efforts to maintain WQ*' (**BM14**).
- **Rooted in end product monitoring**: '*Internally we have the [WQ] department, we have set up about 900 sampling points and we take regular samples from these sampling points to make sure that we comply*' (**BM5**).

Supplier C (Table 4.7) was proactive in educating the public with regards to water quality and public health, and providing them with detailed information. The public health role was reinforced to new employees, if not in a formalised manner. Once working in the organisation, employees were encouraged to attend training, conferences and seminars, and public health was incorporated into targets in order to keep it at the forefront of people's minds. However, there was a slight indication that quality and public health protection may be becoming taken for granted with some staff unsure of their role in terms of quality. There was limited water quality data analysis to learn from past experiences. Although public health parameters were included in the targets, there was no weighting of this according to importance and some staff felt 'points' could be picked up elsewhere if such targets failed to be achieved.

Table 4.7 Themes and examples of interview/textual evidence of how public health responsibility is explicit or taken for granted that are specific to Supplier C

a) Interview evidence that supplier is mindful of public health responsibility:

- **PR relating to public health and quality:** *"Instead of being a silent service, we should get out there, show them the test results and put it on the website, and then the website came out of that, all these ways of getting that information out to the public"* **(CM3).**
- **Induction procedures:** *"I would do a presentation on their department, and part of my speech was that 'you are not in public works, you are in public health'"* **(CM17).**
- **Attendance on seminars, courses and conferences encouraged:** *"We try to get them to industry seminars, webcasts, conferences. We also provide them with the internet and encourage them to use that for work"* **(CM15).**
- **Inclusion of PH in targets:** *"Well, one thing we have is an incentive to make sure that you don't have bacteria samples come back positive. There's like an award programme where you can get bonuses and it's in a points system, so if you get so many points you get a certain bonus. Money can help you!"* **(CE5).**
- **Pilot plant:** '*Full scale research entails unacceptable risks to public health. A pilot plant is therefore proposed in order to fully evaluate the proposed process modifications*' (From water quality management plan).
- **Vision statement:** *"We will place the highest value on public health"*
- **'Extra curricular' activities:** Involvement in national competitions: *"We go to this competition where the utilities will go against each other and we have a team, we'll have a moderator like ask questions about water treatment and we'll hit the buzzer and answer them, then after so many rounds there's a winner and you get a little trophy and stuff!"* **(CE5).**

b) Interview evidence that public health responsibility is at risk of being taken for granted:

- **Uncertainty over role in quality:** *"Well, I'm not so sure that I'm the guy that is managing water quality, we are the ones that are producing the product"* **(CM15).**
- **Health parameter not seen as priority:** *"The bacteriological measure we haven't been able to adhere to all that well, because of our small systems, but it's say only one of 12 measures, so we may be able to pick it up somewhere else"* **(CM7).**
- **Limited quality data analysis:** *"But we haven't yet set up a structure where someone is sat down looking at the water quality data that comes in and says 'what does this mean', analysing it, looking backwards, looking forwards, so we need to do that better"* **(CM17).**
- **Mission doesn't explicitly mention PH:** World class services for consumers and environment.

Within **Supplier D** (Table 4.8) public health was explicitly mentioned in mission statements and there were well established communications protocols with regard to issues of potential health significance in order to avoid complacency. As in other suppliers, awareness of WSPs and attainment of quality certifications demonstrated commitment to public health. One member of staff even compared water treatment with running a hospital. There was however a fear that the drive for business expansion and creating economies of scale by merging companies would have a detrimental effect: "*Soon there will be a merger process and this is our weakness at the moment, everything we do we have to ask the other companies if they agree or disagree, and at the moment we don't know in the new company what will be the roles of each other, that is the main weakness*" (DM5).

Table 4.8 Themes and examples of interview/textual evidence of how public health responsibility is explicit or taken for granted that are specific to Supplier D

a) Interview evidence that supplier is mindful of public health responsibility:

- **Communications protocols:** "*We have several means of communicating the information, the reports, internal journal, the internet, we have more or less a daily email sent by the communications department saying something out of the usual happened here and so it goes to every employee in the company*" (**DM3**).
- **Awareness of WSP/Bonn Charter:** "*Well I was, aware of the WSPs only from 2004/2005 when the first book came from WHO, but I was aware of the HACCP methodology since University, the application of HACCP to drinking water I was aware of since 1999*" (**DM30**).
- **Analogy with health service:** "*I think in any process you have two ways, you keep it running as a cafe or you keep it running as a hospital... I think with water you have to run it as a hospital, you have to be professional*" (**DM13**).
- **Mission statements:** Public health; environmental health; responsible policies and practices.
- **Quality certification:** "*There are also many benefits [of certification] - the organisation is focused on critical points or critical situations, I am not in it to gain the 'flags' that represent certification, I want a systematised approach to water safety issues, preventing future issues that may affect the quality of the water*" (**DM19**).

b) Interview evidence that public health responsibility is at risk of being taken for granted:

- **Only one employee explicitly mentioned PH when talking about missions:** "*To supply water to people with quality, always regarding the public health as a main target and the same for the wastewater*" (**DM22**).
- **Competing priorities:** "*The problem [for developing WSPs] is in the smaller companies that some of them are also facing other difficulties*" (**DM1**).
- **Holding company mission statement doesn't mention PH:** Economic; financial; technical; social and environmental sustainability.
- **Reliance on monitoring**: "*The quality is managed by ensuring that the plan from the sampling is done*" (**DM9**).

The tables show espousals of commitment to public health protection from employee's perceptions, company missions, targets, feelings of accountability and customer

charters. These were demonstrated by a commitment to fix problems regardless of hours or conditions, intent to implement WSPs and other proactive approaches, setting stricter limits for health parameters and provision of funding for quality initiatives. However, there was evidence that commitment to public health was beginning to be taken for granted, with complacency around quality, employees feeling they do not get due reward, and a perception that WSPs are not essential. When asked about risk, *operational* health and safety (particularly Suppliers A and C) or security (particularly in Supplier C) was often at the forefront of people's minds and not public health risk, despite the suppliers being aware of the research arena. Many mission statements did not explicitly mention public health safety and there were competing drivers such as finance and competition.

In Suppliers A and C wider cultural influences came into play, as managers acknowledged that local peers in the USA and Canada were generally not aware of, or not adopting WSPs. Being privatised, financial targets and business expansion in Suppliers B and D sometimes competed with other targets, such as water quality. Commercial drivers, although valid, could also have a negative effect without effective communication.

4.7 Cultural webs

Considering the information presented in the above sections, we can align some of these cultural elements into the categories presented by Johnson (1992, Chapter 2.3.1): Symbols; power structure; organisational structure; control systems; rituals and routines and stories and outline some of the basic assumptions that form the cultural paradigm of each supplier. **Supplier A** is a culture where community values and customer service rank highly. The supplier wants to be considered one of the best, and significant pride is taken in working there, as protectors of public health, and a feeling that the organisation must prove itself as a small utility. Education and technology are key. There is some distance between management and non management employees, and a feeling that engineers 'know best', with some resentment from non-qualified staff over this. Empowerment is talked about, but could be developed more in practice. **Supplier B** exhibited a culture where formal roles, responsibilities and targets were valued. Continual improvement and knowledge were strived for. Recognition was important,

not only for the organisation as a whole, but for individuals also. Customer service and the community were important, as were profit and image. The organisation was competitive, striving to be considered 'number one'. Within the organisation, people were considered the biggest asset, and religious beliefs were a strong driver for good work.

Supplier C strove to be a 'world class' supplier in terms of service provision, embracing change and searching for innovation. There was much concern over image, and trust within its consumers. The working culture was informal, and transparency and education were held highly. The organisation tried to stay 'one step ahead', proactively dealing with issues before they became a problem. Environmental responsibility was also extremely important to the organisation. **Supplier D** was a young organisation where fresh experience and ideas were valued. There was a feeling that the organisation needed to prove itself to consumers and shareholders. Change and learning were embraced in order to be one of the best, with high levels of optimism. The working culture was professional and quite formalised, but relationships with colleagues informal. Camaraderie was high, with a 'wear the shirt' culture. The cultural webs for each supplier are summarised in Figures 4.4-4.7.
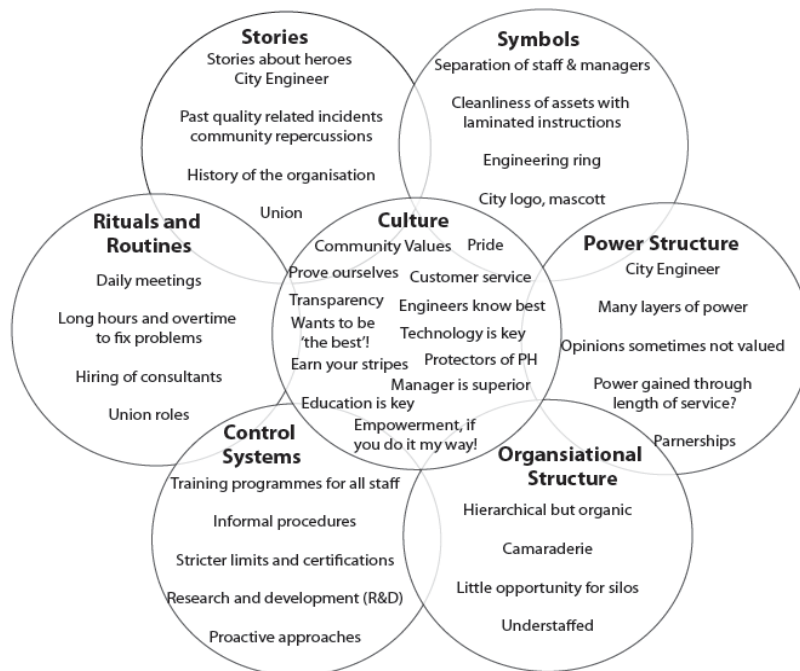
Figure 4.4 Supplier A cultural web (based on Johnson, 1992)
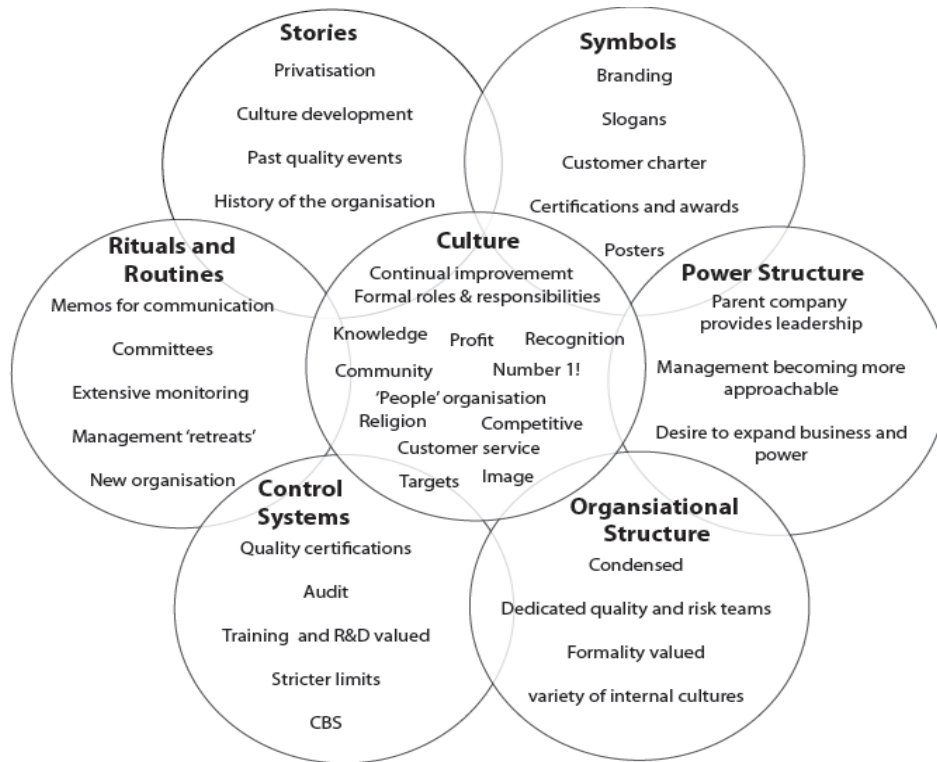
Figure 4.5 Supplier B cultural web (based on Johnson, 1992)
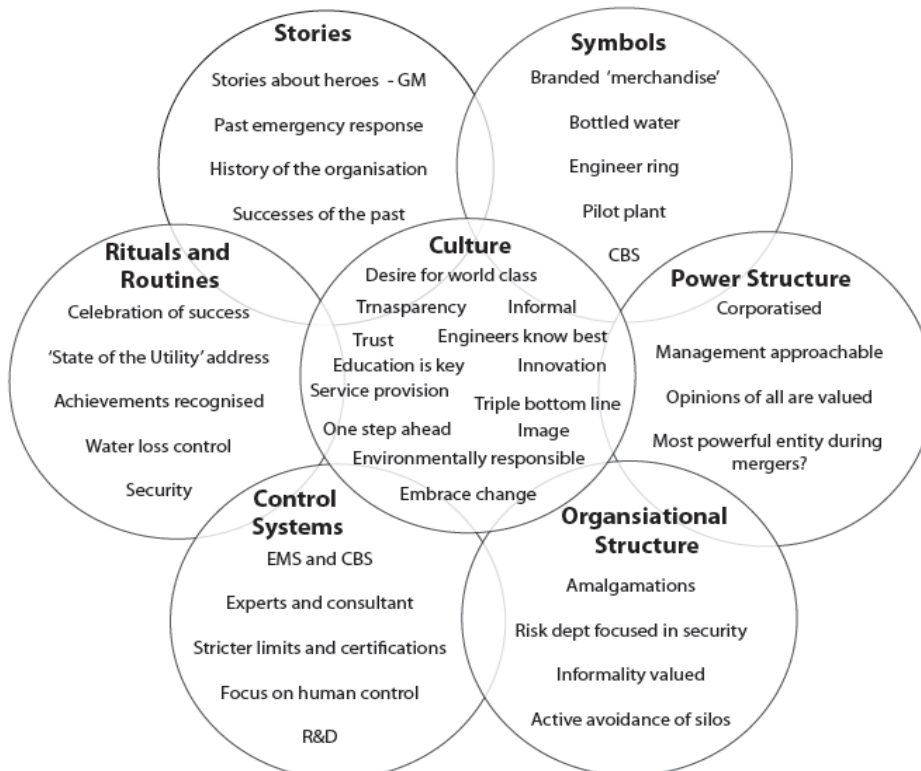
Figure 4.6 Supplier C cultural web (based on Johnson, 1992)
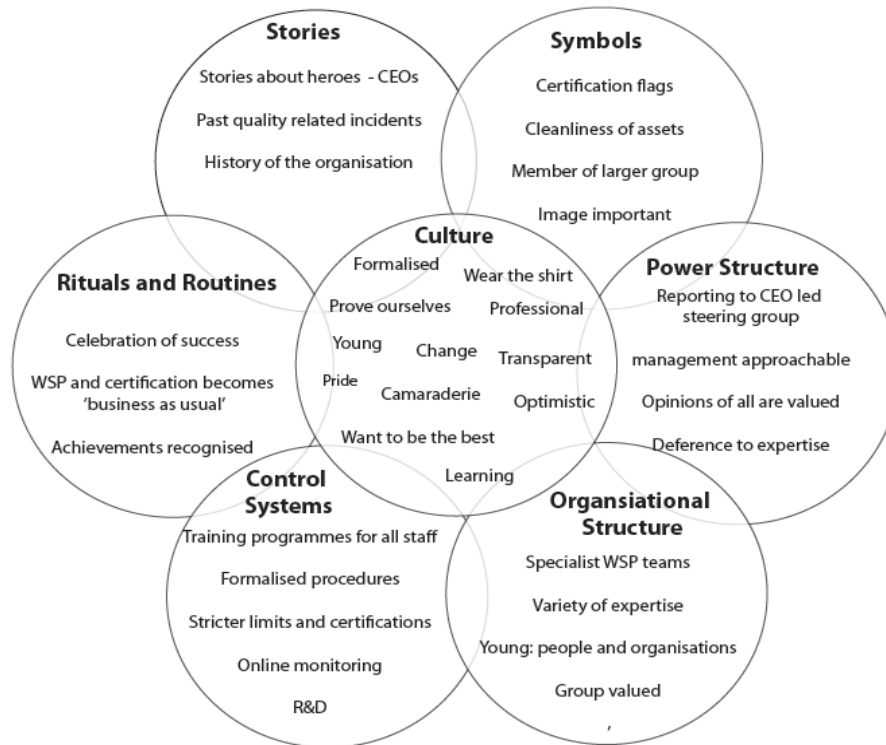
Figure 4.7 Supplier D cultural web (based on Johnson, 1992)

4.8 How does it all fit together?

In summary, four water suppliers were studied, each with varied organisational cultures; there were some common missions such as water quality; safety and cleanliness of the water; excellent service; competition; continual improvement; regulatory compliance and aesthetic quality. Progress and buy in to WSPs also varied greatly, ranging from Supplier C who did not buy-in to the approach and was not explicitly implementing them, to Supplier D, who exhibited the greatest degree of internalisation and implementation. The reasons for this varied, with different enabling and blocking features in each supplier. However there were some common features. Enablers, such as enthusiastic management; not wanting to experience water quality incidents; a feeling of accountability; insufficient regulatory requirements; competition and a concern for the organisation's image were common to all suppliers. Common blocking features included having competing priorities; a lack of skills and resources; uncertainty over how to implement and a lack of communication both within the organisation and with external stakeholders. Figure 4.8 summarises the relationship between leadership, organisational culture and WSP commitment in suppliers A-D, and the positive and potentially negative aspects associated.

Leadership (A)

+ High level WSP buy-in   - Communication breakdown
+ Desire to do the right thing   - Management / staff barriers
+ Community orientated
+ Enthusiasm & optimism
+ Training provision
+ Resource provision

Leadership (B)

+ Parent company support   - Recognition driven
+ Active culture management   - WSPs not seen as priority
+ Desire for world class service - Lack of clear WSP driver
+ Training provision
+ Seek external support

Organisational Culture (A)

(+) Level of service is important - pride
(+) Accountable to community - transparent
(+) Staff camaraderie – informal & organic
(+) Good stakeholder partnerships
(+) Education & training is key
(+) Focus on operational H&S – transferrable skill
(+) Proactive
        (-) Water quality is acceptable – complacent?
        (-) Tension between management & union
        (-) Un-qualified staff feel undervalued

Organisational Culture (B)

(+) Customer satisfaction – transparent accountability
(+) Ambitious: world class, competitive & continually improving
(+) Target compliant
(+) Training & certification incentives
(+) Profit & efficiency driven
(+) Accountable to colleagues
(+) Image important
        (-) Water quality is acceptable – complacent?
        (-) Tension between old & new staff
        (-) Strict targets hinder new development?

WSP commitment rationale (A)

+ Colleague accountability   - Opinions not valued
+ Quality water for community   - Lack of communication
+ Celebrations of success   - Competing priorities
+ Empowerment & appreciation   - Lack of time & resources
+ Community transparent accountability
+ Career progression - training

WSP commitment rationale (B)

+ Targets linked to bonuses   - No recognition= no commitment
+ Committee decisions   - Lack of WSP awareness
+ Knowledge exchange   - Water quality complacency
+ Empowerment & recognition   -Competing priorities
+ Customer charter /   - Few past incidents
accountability
+ Career progression - PDRs

Figure 4.8 Relationship between leadership, organisational culture and WSP commitment in Suppliers A-B

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Figure 4.9 Relationship between leadership, organisational culture and WSP commitment in Suppliers C-D

Benefits ranged from perceived benefits in those suppliers still in the early stages to real demonstrated benefits in those that were more advanced and included reputation benefits; cost savings; improved, formalised and documented procedures; customer satisfaction; reduced violations; a faster and more precise response; compliance with certifications; prevention of complacency; justification for change; better control with an improved understanding of the system; focus on critical aspects; providing peace of mind; improved stakeholder relationships and mindfulness of safety and consciousness of risk.

Managerial commitment and leadership traits were present within all suppliers to a certain extent, but more work could be done in this area to ensure successful and sustainable WSP implementation, such as being more explicit in 'modelling the way' and being more forthcoming in enabling others to act. Issues that may be preventing WSP implementation reaching its full potential included some of Kotter's (1995) leadership errors, (i) not establishing a great enough sense of urgency; (ii) not creating a powerful enough guiding coalition; (iii) lacking a vision or under communicating the vision; (iv) not removing obstacles; (v) not systematically planning for and creating short term wins and (vii) not anchoring changes in corporate culture.

Organisational commitment is also important and commitment to the job and the organisation was generated through motivating factors such as feeling accountable; incentives; training; an enjoyable work environment; recognition; feeling the importance of the job; empowerment and ownership; benefits; celebrations of success; internal relationships; effective communication and feeling challenge within one's work. However the most limiting factor appeared to be organisational commitment to WSPs explicitly amongst the suppliers. Managers and leaders could address this problem using the above factors such as giving staff recognition for their involvement in WSPs; effective communication of the approach; providing sufficient training and celebrating success.

Commitment to public health protection was demonstrated by a commitment to fix problems regardless of hours or conditions, intent to implement WSPs and other proactive approaches, setting stricter limits for health parameters and provision of funding for quality initiatives. However, there was evidence that public health was at

risk of being taken for granted, with complacency around quality, employees feeling they do not get due reward, and perception that WSPs are not essential. Many mission statements did not explicitly mention public health safety and there were competing drivers such as finance and competition. When asked about risk, *operational* health and safety or security was often at the forefront of people's minds and not public health risk.

5   CULTURAL TAXONOMY DEVELOPMENT
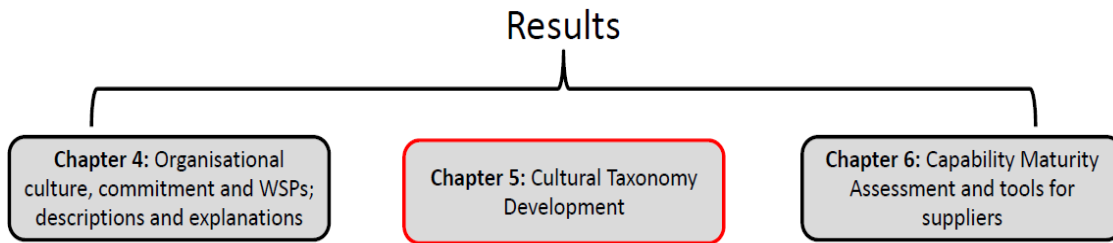
5.1 Introduction

During iterative cycles of analysis of the case study results and inspired by work on safety culture taxonomies (van Vuuren, 2000; Parker et al., 2006) it was clear that a number of supportive 'cultural attributes' could be identified to help consolidate the area of interest: organisational culture and its influence on WSP implementation. Using literature (WSP guidance, WSP case studies and safety culture literature), and further analysis of empirical evidence, a taxonomy of cultural attributes that may constitute an organisational culture which will support successful WSP implementation was developed.

5.2 Taxonomy design

Based on the methods described by van Vuuren (2000), Chapter 2.5.2, a 'theoretical' list of cultural attributes was developed through the analysis of literature and put to test during empirical studies with the four water suppliers visited, and the list modified as appropriate. Since the publication of the 3rd Edition of the Drinking Water Guidelines (WHO, 2004a), which fist mentioned WSPs, there has been a great deal of WSP guidance and case studies written. Therefore, the first step in the methodology of taxonomy design was to distil an initial list of cultural attributes from the relevant literature. Whilst little of the guidance or case studies explicitly talks about organisational culture, much of the lessons learned or advice given could be translated into corresponding cultural attributes. For example, if a document talks of the need for adequate financial and human resources to be made available for the project, then we can infer that senior members of staff need to be committed and buy-into WSPs as a

means of ensuring quality for necessary resources to be deployed. The literature that was reviewed to develop a theoretical taxonomy is detailed in Table 5.1.

Table 5.1Literature used in developing theoretical taxonomy

AUTHOR	TITLE	DOCUMENT TYPE
1 Bartram et al. (2009)	Water Safety Plan Manual: Step-by-step risk management for drinking-water suppliers	Guidance
2 IWA (2004)	The Bonn Charter for Safe Drinking Water	Guidance
3 NHMRC (2004)	Australian Drinking Water Guidelines. Chapters 2 and 3: Framework for Management of Drinking Water Quality.	Guidance
4 Godfrey and Howard (2004)	Water Safety Plans (WSP) for urban piped water supplies in developing countries	Guidance
5 Bath et al. (2007)	Development of water safety plans in the provision of safe drinking water in Western Australia	Case study
6 Gunnarsdottir and Gissurarson (2008)	HACCP and water safety plans in Icelandic water supply: Preliminary evaluation of experience	Case study
7 Tibatemwa et al. (2004)	Implementing water safety plans: Experiences from Uganda	Case study
8 Viljoen (2010)	The World Health Organisation's water safety plan is much more than just an integrated drinking water quality management plan	Case study
9 WHO, (2004a); Bartram et al., (2009)	Water Safety Plan Manual: Step-by-step risk management for drinking-water suppliers and Guidelines for Drinking Water Quality (case studies within documents)	Case studies
10 Hrudey et al. (2006)	Risk management for assuring safe drinking water	Risk culture
11 Mearns et al. (2003)	Safety climate, safety management practice and safety performance in offshore environments	Safety culture
12 Parker et al. (2006)	A framework for understanding the development of organisational safety culture	Safety culture
13 Pidgeon and O'Leary, (2000)	Man-made disasters: why technology and organisations (sometimes) fail	Safety culture
14 PWC (2003)	How effective is your risk culture?	Safety/risk culture
15 Reason (1998)	Achieving a safe culture: Theory and practice	Safety culture
16 von Thaden and Gibbons (2008)	The safety culture indicator scale measurement system (SCISMS)	Safety culture
17 Westrum (2004)	A typology of organisational cultures	Safety culture
18 Pollard et al. (2008a)	Developing a risk management culture – 'Mindfulness' in the international water utility sector	Risk culture guidance

5.3 Theoretical taxonomy

An initial list of 29 attributes were identified from the literature. Many of these were related and could be aggregated, to develop a more manageable taxonomy of twelve (Table 5.2). Declarations of managerial commitment such as endorsement of policy and provision of resources were highlighted in the WSP manual: "*Implementation of the WSP approach requires both financial support and encouragement from senior management*" (Bartram et al., 2009). However, managerial action is also vital, that is senior managers being actively involved, such as being members of a WSP team were combined into one attribute termed 'managerial commitment'. Various attributes were identified from the literature that could be grouped into that of a 'learning culture'; these included a focus on training and education; valuing fresh ideas and experience and the importance of research and development. Effective teamwork and communications as well as an awareness of internal politics were identified, that constituted effective 'internal relationships', a central theme to Parker et al.'s (2006) safety culture framework. Transparency, accountability to the consumer and professionalism were considered important in the literature and grouped under the heading 'accountability', best highlighted by the Bonn Charter (IWA, 2004) which places special importance on transparent operations and communication. The success of preventative measures such as WSPs, is often thought to require effective reporting of things such as close calls, Hrudey et al. (2006) identifies that that these events can be learnt from and prevent future events occurring, this attribute was termed an 'open reporting culture'. Frequently mentioned in the guidance as well as case studies, was the importance of stakeholder engagement and a focus on the consumer, termed here as 'external relationships'. There were many instances in the literature that could be attributed to a 'continual improvement culture' such as going beyond compliance and having a 'total quality management' mentality within the organisation. On an organisational and employee level, empowerment and involvement of personnel was considered important in the success of WSPs, as well as having buy-in from across the organisation, not just management level employees. As Pollard et al. (2008a) identified, employees should be encouraged to take responsibility, particularly when urgent action is required. Increased involvement should lead to increased commitment (Chapter 2.4.2). WSPs are intended to be a preventative approach, so a 'proactive and preventative' culture is needed, where

there is a long term vision, and where there is an attempt to anticipate problems before they arise. As well as managerial commitment, leadership in terms of WSPs is explicitly needed, where water safety is prioritised and attitudes and culture are changed to create motivation. The final attribute, 'mindfulness' was a term used by Hrudey et al (2006), and in this case used to describe a culture where complacency is avoided and foresight is used to be continually 'mindful' of public health and safety.

There was some debate as to whether there should be a thirteenth attribute added, 'risk culture', or whether this was predetermined by the presence of the other attributes, particularly 'mindfulness'. This is said to be present in high reliability organisations, who exhibit a risk culture (Pollard et al., 2008a) and a proactive and preventative culture. Consideration was given to definitions of risk culture to resolve this.

The Risk Management Association's (RMA) Enterprise Risk Council define risk culture as the "*Tone at the top, shaped by the values, strategies, objectives, beliefs, risk tolerances and attitudes that form how everyone in a financial institution view the trade off between risk and return*" (RMA Enterprise Risk Council, 2007). Here the focus is on financial risk but this can be equated to a definition for public health risk also. Similarly, the International Risk Governance Council define it as a "*set of beliefs, values and practices within an organisation regarding how to address and manage risks. Including, how openly risks can be addressed and information about them shared among a risk community. Risk culture defines an organisation's risk appetite*". In a study by the Economist Intelligence Unit it was found that creating a risk culture is dependent on top management with board level executives conveying a clear message that risk is part of everyone's job, and communication is often weak between risk functions and the broader business (Economist Intelligence Unit, 2009). Farrell and Hoon (2009) describe risk culture as "*the system of values and behaviours present throughout an organisation that shape risk decisions. Risk culture influences the decisions of management and employees, even if they are not consciously weighing risks and benefits*". An effective risk culture relies on a common understanding of the organisation and the business purpose; a feeling of 'doing the right thing'; risk training and empowerment of staff to make educated risk-related decisions to ensure consistent risk behaviour throughout the organisation (Farrell and Hoon, 2009). To add to this, Pollard et al. (2008a) emphasise the importance of stakeholder relationships in

managing risk, particularly relating to public health. From the literature we can therefore infer that a risk culture will require:

- Direction from 'the top'.

- Involvement of all levels.

- Expertise and knowledge through learning and training.

- Effective leadership.

- Communication within the organisation.

- Stakeholder engagement.

- Transparency.

All these aspects are covered within the initial taxonomy, particularly by leadership and advocacy, and mindfulness, and therefore it was decided that a separate attribute, 'risk culture' was not needed as risk culture can be thought of as part of WSP culture as a whole, as the WSP is a risk management approach in its own right.

Table 5.2 Theoretical taxonomy of supportive cultural attributes

Attribute (aggregated)	Attributes (initial)	Description	Key References (See table 5.1)
Managerial commitment	Managerial commitment; managerial action; 'tone at the top'	Needed to support the process, and provide necessary resource. Often quoted in literature and also required in empirical cases. Demonstration of commitment to water safety by those in positions of authority. More than just declarations, must also be action (e.g. representation on WSP team).	**1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18**
Learning culture	Focus on training and education; learning culture; valuing fresh ideas and experience; importance of research and development.	Effective WSP implementation requires a culture that wants to learn from mistakes, past events, outside influences, from training and education, research etc. How the organisation learns; optimal = triple loop. Openness to new ideas.	**1, 2, 3, 5, 7, 8, 11, 12, 13, 14, 15, 16, 17, 18**
Internal relationships	Camaraderie/teamwork; communications; internal 'politics'	Often stakeholder liaison is quoted but internal relationships are just as important, WSP meant to be holistic. Relationships within the organisation - good and open relationships between teams, individuals, management and staff etc; sharing of information.	**1, 3, 4, 5, 8, 10, 11, 12, 13, 16, 17, 18**
Accountability	Transparency; accountability; professionalism	Accountability to the consumer and staff. Feeling of obligation to do the 'right thing' - act in a transparent, accountable and professional manner. Being responsible for actions and willing to	**1, 2, 3, 4, 7, 10, 12, 13, 16, 17, 18**

		explain them.	
Open reporting culture	Just/fair blame culture; reporting close calls	Being honest and open in reporting, suppliers are more open to learning and criticism. A culture where people are comfortable to report near misses. Just, fair blame culture.	**1, 3, 4, 11, 13, 14, 16, 17, 18, 19**
External relationships	Stakeholder engagement; consumer involvement/focus	Effective WSPs need effective stakeholder engagement, including consumers. Strong consumer relations related to accountability.	**1, 2, 3, 4, 6, 8, 18**
Continual improvement culture	Going beyond compliance; continual improvement culture; certifications; total quality management mentality.	To prevent complacency and therefore 'stagnation' of the WSP. An organisation that is not content with things as they are and strives to improve. Going 'above and beyond' what is required by law, continual improvement, certifications, TQM mentality.	**1, 3, 6, 8, 10, 13, 16, 18**
Empowerment	Empowerment; involvement and status of personnel	Involvement and recognition of staff to successfully implement WSP. Recognition for work. Ownership and involvement = higher levels of commitment.	**3, 10, 11, 13, 14, 15, 16, 18**
Organisational commitment	Organisational commitment	Linked to above, managerial commitment is often quoted but also needs strong commitment from the staff, those that will be implementing the WSP.	**1, 4, 8, 10, 11, 12, 16, 17, 18**
Proactive and preventative	Long term vision; anticipating (water quality) problems before they arise	Linked to continual improvement culture, this is the aim of the WSP, to prevent problems occurring in the first place. Long term vision.	**3, 6, 12, 13, 15, 16, 17, 18**
Leadership and advocacy	Leadership; prioritisation of safety; advocacy – changing attitudes and creating motivation	Leaders are important, not necessarily top management but people who are enthusiastic about WSPs and generates this in others. Set and advertise a clear vision.	**1, 7, 11, 15, 18**
Mindfulness	Overcoming complacency; public health and safety imagination (foresight)	As described by (Hrudey et al., 2006)– a preoccupation with what could go wrong (in terms of public health). Avoidance of complacency.	**1, 10, 11, 13, 15, 18**

5.4 Empirical testing of taxonomy

In order to gain empirical data, explicitly for the purpose of designing a cultural taxonomy, a case study approach was used, as described in Chapter 3. The interview data was coded according to the 'theoretical' taxonomy, to evaluate if such attributes were present in real situations, and additional coding was performed to evaluate if there were any empirically derived attributes that could be added to the taxonomy. Appendix

C details sources of raw data evidence associated with case study alignment for each element of the cultural taxonomy.

5.4.1 Case study alignment with attributes

a) Managerial commitment

Chapter 4.3 discusses managerial commitment in detail. In terms of explicit managerial commitment to WSPs, top management drove WSP projects in Suppliers A, B and D. Managers in Supplier A readily supplied resources but were perceived to have limited day to day involvement in operations and the WSP. Commitment was not communicated well to employees. Resources were also made readily available in Supplier B, but again day to day involvement of managers was limited. Managers in Supplier C were highly committed to and actively involved with staff and projects, but there was little buy-in to WSPs explicitly. Supplier D had the highest level of managerial commitment to WSPs, with managers present on the WSP team, and actively involved in day to day operations.

b) Learning culture

All suppliers exhibited a learning culture, where research and development, often in conjunction with external agencies such as universities and research institutes were valued highly. Training and education were also considered important to all suppliers: "*They promote continued learning, I don't think anyone has ever said no to a course, or training that I've wanted to put someone through. They certainly promote going out and looking around, who's doing what, make sure that we're aware of everything that's going on*" (CE9). Within Supplier A, extensive data was collected but analysis was limited due to a lack of manpower. Learning tended to be informal, but effective due to the small number of long serving staff. Supplier B was keen to learn from others and best practice, although there was less evidence of using internal events and incidents to learn from. Supplier C strongly supported innovation and was also eager to learn from best practice, and other 'world class' organisations, but feedback was limited. Learning here tended to be informal, but due to an increasing number of employees, more formal mechanisms were being sought. As in Supplier A, there was extensive data but limited analysis. Supplier C had developed a pilot WTP, so that research regarding system optimisation can be performed without risk to public health. Supplier D placed high

importance on innovation and remained open to new ideas. Past events were learnt from with feedback to improve processes.

c) Internal relationships

Internal relationships were varied, Supplier A for example had distance between union members and management yet had a high degree of camaraderie amongst staff, whereas Suppliers C and D had more informal 'open door' relationships between management and staff, as well as high levels of camaraderie. Supplier B was more formal in its internal communication and relationships. Poor internal communication was recognised as a limiting factor by most suppliers, and it was considered that increased communication would help initiatives such as WSPs: "*I think we have to improve the communication, urgent measures are needed to improve the communication between operators and superiors*" (DE17). Supplier A had daily meetings between management and staff for two-way dialogue of the days tasks; but communication of new initiatives may have been less effective. Supplier B had good, formal mechanisms for top down communication but upward channels needed to be developed, and efforts were being made to instil more of an 'open door' culture. Work colleagues were often referred to as 'friends' or 'family'. Within Supplier C, there was conscious effort to ensure that departments did not become silos, through the use of steering committees for major projects, with representatives from all areas, and also cross training of staff. In Supplier D, a wide range of expertise was represented on WSP teams, and relationships were developed with other utilities in the group, despite communications being identified as a weakness.

d) Accountability

Accountability was present in all suppliers, particularly Supplier A, a small town 'on the front line', and was transparent and open in reporting and the information it provided to consumers, over and above regulatory requirements: "*The response time [for customer queries], we are usually there that day. And I go to other places and it's like 'We'll get there in 3 or 4 days'! So unless there's a major problem why we can't, we are there in a day, but if not then we'll talk to them one on one, and say we'll have someone there tomorrow morning, and we do*" (AM17). Supplier B provided a wide range of communication channels for consumers, and had developed its 'customer charter' outlining its responsibility to consumers, although there was limited reporting of quality

issues to consumers. Supplier C had formal targets for increasing customer satisfaction, and was proactive in reporting to the consumer above regulatory requirements. Supplier D felt accountability to the end consumer even though they were predominantly a bulk supplier.

e) Open reporting culture

Reporting of close calls and near misses was collectively the weakest area. This was generally informal and ad hoc in all suppliers, and could benefit from a more formal mechanism for learning from such events. Supplier A had a drive to implement an open reporting culture and establish mechanisms for reporting of close calls, but at present was informal and the mindset of 'better you tell us or we will find out', suggests 'blame'. Respondents in Supplier B articulated that management did not blame individuals and that if something went wrong then it was a collective problem: "*The top manager sets a culture, that he does not blame one person, if something is not achieved then it is everybody's fault, it is a joint effort*" (BM15), however few events and incidents were investigated in detail. Suppliers C and D tried to instil a 'fair blame' culture, but reporting of close calls was ad hoc and informal, if at all.

f) External relationships

Effective WSPs need effective stakeholder engagement. All suppliers actively tried to engage stakeholders, and were often the proactive partner in such relationships, although not always explicitly for WSPs. Supplier A had a high level of engagement, with catchment protection groups, researchers, regulators, health authorities, contractors and consumers. The main stakeholders engaged by Supplier B were government and consumers. Regular engagement was performed to maintain relationships and keep contact informal. Some stakeholders were identified as desired members of the WSP team but were not actively engaged. It was also sometimes felt that areas such as the raw water catchment were 'not our responsibility' and thus WSPs could not be effectively developed there. The number of stakeholders was a challenge, particularly for Suppliers B and D within the catchment "*One problem though is that there are lots of authorities that have responsibility to the catchment*" (BM15), but this highlights the importance of stakeholder engagement. Supplier C actively sought to engage stakeholders at all stages of the supply chain, including governments, landowners, recreational users, industry, regulators, health authorities and suppliers and contractors

with regular meetings being arranged by the supplier: "*Some of the key things that I try to do and you know I guess the other thing I like to try to do is build relationships, both internal and external to the organisation. I spend a lot of time trying to make connections between the departments, and also other external stakeholders to get more of the breakthrough results that we need to have*" (CM3). Supplier D was involved in helping municipalities, driving stakeholder liaison with health authorities, regulators and catchment authorities.

g) Continual improvement culture

A continual improvement culture existed in each supplier, in order to 'be the best' in public Suppliers A and C. Private Supplier B felt the need to continuously improve to develop business: *"If you don't get better then you just fall back. If you are happy with what you are today then it's as good as saying that you are already dead. If you are not looking forward to better"* (BM1). The continual improvement culture is probably best highlighted by Supplier D, consisting of new water companies that previously had very poor supplies that have made huge improvements in recent years creating a momentum for improvement.

h) Empowerment

In terms of empowerment, involvement and recognition of staff to successfully implement WSP could have been improved in Suppliers A and B. Employees of Supplier A to a certain extent felt they were not listened to, despite managers believing empowerment to be important: "*But I'm not sure, but I think the way to do it, the way I'd like to think we are doing it is by giving the guys more responsibility, insisting that they make some of the decisions themselves and letting them in on the reasons why certain things are done, rather than just say go and do this*" (AM16); however, successes were celebrated and staff given responsibility and training opportunities. In B recognition was important to employees, but few received recognition for WSP specifically, and thus were not prepared to become too involved. Supplier C empowered staff to make their own decisions where appropriate and give ownership and involvement in projects, although not specifically WSPs. Supplier D had a young, empowered workforce, given responsibility and involved in decision making, recognition being given where deserved, for example on attaining qualifications.

i) Organisational commitment

Organisational commitment is described in detail in Chapter 4.4. Within Supplier A, employees were committed to providing a good service and ensuring the safety of water, often working a great deal of overtime to fix problems. There was however low commitment to WSPs, but due to a lack of awareness of the project. Pride was taken in work, and there was a strong desire to get things 'right first time'. Employees in Supplier B were committed where they received recognition and as few received recognition for WSPs, commitment to WSPs needed more development. The organisation is committed to 'be the best' but some staff did not readily recognise their role in providing good, safe drinking water. Supplier C employees were highly committed, once again working long hours to fix problems and also taking part in activities outside of work hours such as national and international competitions. A highly motivated and committed workforce existed in Supplier D, young employees and vast improvements made recently helped generate this enthusiasm.

j) Proactive and preventative

Somewhat linked to a continual improvement culture, all suppliers to a certain extent implemented proactive and preventative measures such as preventative maintenance, backups and early warning systems: "*Focusing on preventative maintenance, we will reduce the number of corrective actions, this is important because corrective actions would most probably imply an interruption in flow of the water so the aim of continuous water would not be achieved*" (DM27). Suppliers B and D explicitly were implementing WSPs, although most successfully in Supplier D, and there was an interest in the approach in Supplier A, demonstrating enthusiasm for proactive approaches.

k) Leadership and advocacy of WSPs

Chapter 4.3 outlines leadership in more detail. Strong leaders were present in all suppliers, but not all were advocates of WSPs. Top managers of Supplier A were considered instrumental in improvements that were made, and was enthusiastic about the WSP approach; but there could have been advancements made in communication with staff. Within Supplier B there was strong leadership and awareness of organisational culture and the impact that leadership has, with an active intention to develop desired culture and manage change. However leadership explicitly in terms of WSPs needed to be developed further, despite acknowledgement that it is leaders, rather

than money that are needed for a successful WSP project. Strong, visionary and charismatic leaders existed in Supplier C, but not specifically for WSPs. Leaders, who were not exclusively managers, in Supplier D were actively involved in WSP projects and promoted new ideas to other members of the group.

l) Mindfulness

There was awareness of the public health responsibility in Supplier A but mindfulness of health and safety risk appeared to be stronger. Other than those working directly in the water quality department in Supplier B, there was limited awareness of public health implications and goals, and there was a heavy reliance on end product monitoring, despite the introduction of WSPs. Even though Supplier C was not explicitly implementing WSPs, mindfulness was particularly prevalent: *"I think it's kind of just always in the back of our minds. I feel there's moments of being overwhelmed, thinking oh my God, I'm basically in charge of everybody in the city, sort of thing, like I have the power to make or break this!"* (CE12). Most staff within Supplier D were aware of what could go wrong, due to having a poor water supply in recent history, there is a risk however that the increased improvements could lead to complacency.

Table 5.3 summarises how each supplier does or does not exhibit the attributes contained within the taxonomy.

Table 5.3 Supplier alignment with theoretical taxonomy

	Supplier A	Supplier B	Supplier C	Supplier D
Managerial commitment (to WSPs)	*	**	*	***
Learning culture	**	***	***	***
Internal relationships	**	*	**	*
Accountability	***	**	**	**
Open reporting culture	*	*	*	*
External relationships	***	**	**	**
Continual improvement culture	**	***	**	***
Empowerment	*	**	**	**
Organisational commitment	**	**	**	***
Proactive and preventative	**	**	**	**
Leadership and advocacy (of WSP)	**	**	**	***
Mindfulness	**	*	***	**

*(*** = Strongest areas; ** = strong areas; *= can improve. Relative within the organisation itself and not a comparison between suppliers)*

5.4.2   Empirically derived cultural attributes

During analysis of the case study results, consideration was given to uncovering additional cultural attributes that could be added to the taxonomy. Two aspects arose that were present in all four suppliers and espoused as a driver for either implementing WSPs or other related, non-enforced initiatives (in the case of Supplier C who were not explicitly adopting WSPs). These two empirically derived attributes were a) 'image and reputation' and b) 'competitiveness'.

Image and reputation

This attribute refers to an organisation that is particularly concerned about its image and reputation. It was often felt that implementing WSP or related initiatives could help improve image and reputation and acted as a strong driver. Supplier D operated in a touristic region and had experienced bad water quality in the past, as such they were very concerned with image: "*Those certifications, since we are a touristic region, are to show to the visitors and the inhabitants that we are a solid company that works well, with expertise and basically it's that*" (DM21). Being in a developing country, Supplier B was keen to communicate that they were on a par with companies in developed countries, this was important in maintaining their image of 'world class'*; "It will be more of a PR approach, you know saying WHO has these standards, WSPs are being implemented in modern countries like the US, Australia, UK and we are also applying it to our operations to make sure that you have a better quality of water 24/7*" (BE4). Supplier C was also concerned in having a world class image: "*we want to be recognised as a world class utility, so conference held in Vienna, London, Paris or Cape Town then our name will come up in conversation... we want to compete on the world stage and we've realised that it is a world stage*" (CM3). Image was also important in public settings, Supplier A was concerned with image and reputation as employees and councillors felt they were 'on the front line' in such a small community: "*Well, as the municipal government, we are in the direct firing line!" (*AS11).

Competitiveness

A competitive culture was also a strong driver in developing WSPs. All suppliers visited felt either real competition in the case of private companies or perceived competition, simply wanting to be the best amongst their peers. It was felt that WSPs would either put them a step ahead, or if others were implementing WSPs, then they did

not want to get left behind. Supplier D for example, was structured as a group of water companies, individual companies did not want to get 'left behind' when others were successfully adopting WSP: *"Because we are a group, they don't want to stay back, if their neighbour did something then they want to do it too because they want to be better than them!"* (DE2). When asked why they strived for continual improvement, Supplier B, a private company, talked of competition: *"We have to play at the highest level, the moment you are not able to do that, that is when you surrender yourself to your opponent"* (BM5). Supplier A, although a small public supplier, liked to consider themselves ahead of their peers: *"Very few communities have as many programmes as we do, for example [the neighbouring community] is very much put out the fire"* (AM14). Supplier C also felt this competition with its neighbours, and the international water sector, as a need to improve: *"[our neighbour] has very similar water to us and a couple of years ago, their THMs were 120, ours are about 80, and today theirs are about 25 because there have been all these process improvements, so people in our company say well darn it, if they can do that, then why can't we? And we want to be the best"* (CM17). Concern was raised however that in suppliers that were striving for 'world class'; practices were at risk of being adopted purely because other 'world class' organisations were doing so rather than questioning it's suitability for the supplier in question: *"If I go to a conference and I find out that a utility are doing something better than us, I'll come back to the GM and say 'we should be doing this', and we'll be doing it"* (CM17). When questioned on this, respondents felt that there were robust safeguards in place to avoid this, such as a committees and executive groups who would ask the necessary questions regarding the appropriateness of a particular practice rather than merely saying yes just because another utility was implementing it. Competitive suppliers, striving for world class may also strive to ensure such questioning and oversight is used.

5.5 Summary

All suppliers, to different extents exhibited attributes of the taxonomy, indicating a cultural capability to successfully implement WSPs. What appears therefore to be lacking in those that are not implementing WSPs or achieving their full potential are a managerial commitment to WSPs; leadership and advocacy in terms of WSPs; increased

mindfulness of public health responsibility and ineffective communication of the exercise. During analysis a further two attributes were added from empirical observations: 'Image and reputation' and 'competitiveness', also present in all four suppliers. A way of measuring alignment is needed, the taxonomy was therefore incorporated into a self assessment tool, the Bonn Charter Capability Maturity Assessment tool (BC-CMA) which is described in the next chapter.

6 ENSURING SAFE DRINKING WATER: CULTURAL ASSESSMENT TOOLS TO ASSIST WATER SUPPLIERS
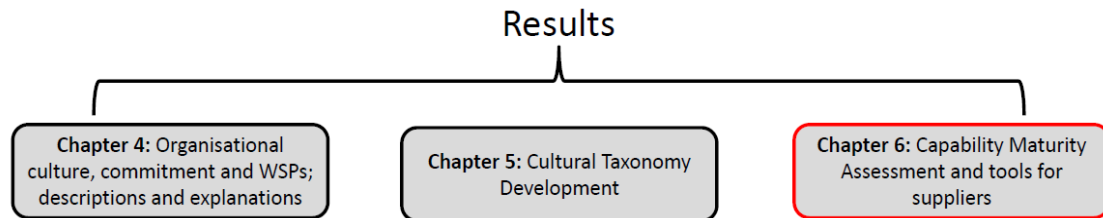
6.1 Introduction

A Bonn Charter 'Capability Maturity Assessment' (BC-CMA) will form part of the Bonn Toolbox (see Chapter 1.1), complementing the toolbox contents, allowing suppliers to assess their current cultural strengths and weaknesses in implementing the Bonn Charter and thus prioritise which specific tools they should consider applying in order to develop cultural maturity. This chapter describes the development and trial of the BC-CMA. The BC-CMA will draw on other benchmarking tools and capability maturity models (CMMs) but will be unique in its specification to the Bonn Charter and WSPs. It is hoped that through periodic application of the BC-CMA tool, Bonn Network members will be able to chart their progress in developing maturity and prioritise the specific areas where most attention is required. The term 'assessment' rather than 'model' was used, to give the tool a more practical feel and to differentiate it from other types of modelling tools that may be provided or used by suppliers. The Chapter first discusses the rationale (6.1.1), development of the structure (6.2), results from case study visits by author judgement (6.3), development of the self assessment tool (6.4) and supporting tool development (6.5).

6.1.1 Rationale

The IWA is developing a toolbox of resources to assist water suppliers achieve safe drinking water by meeting the five responsibilities outlined in The Bonn Charter (Chapter 2.1.2). A requirement of this project was to develop a maturity assessment tool to complement the toolbox. There is a wealth of information and guidance on how to achieve the goals of the Bonn Charter, but often this information is disparate and employees are time constrained. The IWA's 'Bonn Toolbox' aims to consolidate this

information (Pollard et al., 2008b). An area where guidance is currently lacking but is generating research interest is the influence of organisational culture on the success of such initiatives (Chapter 2). Many existing capability maturity models (CMMs) or benchmarking tools involve complex interviews and document analysis by external assessors, which is time consuming; some are country-specific; and others are only focused on limited aspects of the Bonn Charter, for example, exclusively risk management (Chapter 2.5). As such no existing tool was suitable and hence the necessity to develop an assessment tool relating to organisational culture and Bonn Charter implementation: the 'BC-CMA'. In developing the BC-CMA, it was important to ensure that it was:

- Self Assessed.
- Simple to use and understand.
- Applicable to all.
- Guiding; not diagnostic.

6.2 Development of the BC-CMA

Figure 6.1 gives an overview of BC-CMA evolution. Development was initiated with a thorough review of literature relating to water and risk management (Chapter 2) followed by surveys and scoping interviews with water suppliers. The preliminary BC-CMA structure was then created and trialled in field visits and at workshops with network members. Following review of these trials the structure was modified into a self assessment format. Qualitative data was collected during secondments to water utilities using a case study approach and analysed using Atlas.ti software through coding, annotation and memoing as described in the methodology presented in Chapter 3. Each stage of development is discussed in the following sections of this chapter.
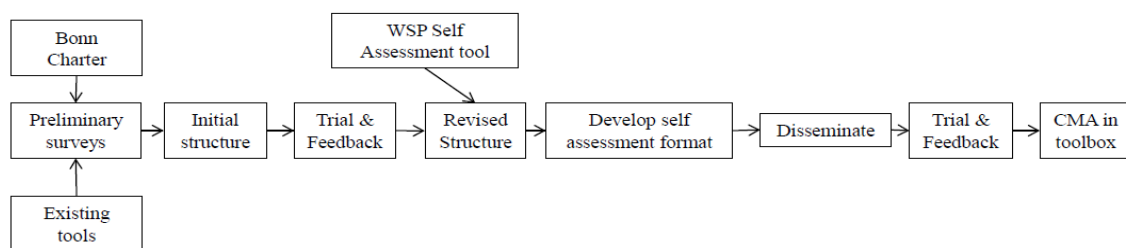
Figure 6.1 Development of the BC-CMA

6.2.1 Review of the literature

A thorough review of the literature was necessary to avoid repetition and to critique existing benchmarking tools and methods of cultural assessment. It was important to establish 'what works and what does not work' in terms of existing tools and to clearly ascertain what organisational culture encompasses in order to suitably focus the BC-CMA questions. The following sections briefly summarise the main findings, a more detailed review is provided in Chapter 2.5.

Existing models and tools: CMMs exist to aid organisations to develop a strategy for improvement, based on assessment of their current maturity level and identification of key process areas where improvements should be focused in a stepwise manner (Paulk et al., 1993). In order to ascend to the next level of maturity, a number of activities must be satisfied. The rationale for increasing maturity corresponds to evidence that higher levels of maturity narrows the gap between targets and actual outcomes; decreases variability of results; decreases costs due to increased productivity and quality and increases process efficiency (Paulk et al., 1993).

Five existing CMMs and benchmarking tools relating to water quality or risk management were reviewed. Results revealed that, although certain elements of some of the tools were suitable as a Bonn Charter self assessment tool, no one tool was sufficient alone. Table 6.1 details the existing tools and their limitations in the given context. The main limitations were in terms of content and assessment method. Although some of these tools considered organisational culture to a small extent, none were thorough enough in this area; and all models required an external assessor for useful data to be generated, which could be a costly and lengthy process.

Table 6.1Critique of five existing CMMs and benchmarking tools

Tool	Reference	Focus	Maturity level	Assessment	Content suitability[1]	Limitations (based on aims of BC-CMA tool)
RM-CMM - INITIAL	Cranfield University (MacGillivray et al., 2007)	Risk Management	1 (initial) to 5 (optimising)	Based on sub processes and attributes. External assessor.	Responsibility 1, 2 and 4. Aimed at water sector.	Culture not explicitly considered; relies on external assessment
RM-CMM - REVISED	Cranfield University (MacGillivray and Pollard, 2008)	Risk Management	1 (initial) to 5 (optimising)	Based on sub processes and attributes. External assessor.	Responsibility 1 and 2. Aimed at water sector.	Culture not explicitly considered; not self assessment
Aquality	WSAA (Donlon et al., 2006)	Australian Drinking Water Guidelines	5 levels	Based on capability: development & documentation & implementation: coverage & frequency. Self assessment/ External assessor.	Responsibility 1, 2 and 4. Culture to some degree. Aimed at water sector.	Too intensive, culture not considered in enough detail. Focused on Australian guidelines.
Business Risk Management Maturity Model	IACCM (IACCM, 2003)	Risk Management	Four levels: Novice, competent, proficient and expert	External assessor.	Responsibility 1. Culture to some degree.	Not broad enough focus, not self assessment. Not specific to water sector.
People CMM	(Curtis et al., 2001)	Human Resources	1 (initial) to 5 (optimising)	Maturity level defined by which areas in structure column are achieved. External assessor.	Responsibility 4.	Focus solely HR; not self assessment. Not specific to water sector.

1 – Suitability of content to be applied to responsibilities of Bonn Charter

Cultural assessments: The aim of the BC-CMA was to create a cultural assessment tool. Therefore, consideration was given to existing methods for assessing culture (Chapter 2.5.2). One interesting piece of work by Parker et al. (2006) built on work developed by Westrum (2004) and Reason (1998) to propose a framework for understanding the development of organisational safety culture. This included abstract organisational aspects such as 'who causes accidents in the eyes of management'; 'how do safety meetings feel' and concrete aspects such as audits, reviews and contractor management. Initially determined through interviews, the resulting framework was converted into a brochure for use in safety meetings to understand organisational culture. The framework consisted of five cultural typologies: pathological; reactive; calculative; proactive and generative. These typologies could be related, i.e. used in parallel, with the five maturity levels outlined in several CMMs (Table 6.2), in order to create a 'cultural' maturity model.

Leadership is an important consideration when discussing organisational culture and although there are a wealth of leadership assessments available, they are often more akin to personality assessments of individuals rather than organisational culture. However, it was useful to assess whether exemplary leadership is present within the utility because it is known to influence organisational culture. Another influencing aspect of organisational culture relates to how the organisation learns. (MacGillivray et al., 2007a) outlined how learning was present at each maturity level (Table 6.2), based on the work by Argyris and Schon (1978). This has been further adapted for this research to make the jump from maturity level four to five more even (Table 6.2).

Literature based cultural taxonomy: Through analysis of the literature, including WSP guidance, case studies and the safety culture literature, a literature based 'taxonomy' of thirteen cultural attributes was developed (Chapter 5). This was not concerned with the assessment of cultural aspects such as 'homogenous vs. heterogeneous' (Fletcher and Jones, 1992) or 'masculinity vs. femininity' (Hofstede, 1980) that could not be considered as 'right or wrong' (see Chapter 2.5.2). Instead the taxonomy focused around measuring a *water safety* culture, of which we can define positive and negative aspects. The resulting taxonomy was used in development of the *revised* BC-CMA.

Table 6.2 Cultural typologies, maturity levels and learning types

Level	Cultural Typology (from Westrum, 2004, Reason, 1998 and Parker et al., 2006).	RM-CMM Maturity Levels (MacGillivray and Pollard, 2008)	Learning types (Modified from McGillivray et al 2007)
1	**Pathological:** Information is hidden, messengers are 'shot', responsibilities are shirked, bridging is discouraged, failure is covered up, new ideas are actively crushed.	**Ad hoc**: Process ad hoc and chaotic. Success depends on individual effort and these successes are not repeatable from project to project.	When mistakes are made they do not learn – failures are repeated as well as success.
2	**Reactive:** (in terms of safety culture) Safety is important, a lot is done every time there is an accident.	**Repeatable**: Basic project management established to track cost, schedule and functionality. Able to repeat earlier successes on projects with similar applications.	**Open Loop:** Efficiency and quality of processes are variable, stemming from limitations in verification, validation and feedback mechanisms, restricting organisations' ability to track and control their processes.
3	**Calculative/Bureaucratic:** Information may be ignored, messengers are tolerated, responsibility is compartmentalised, bridging is allowed but neglected, organisation is just and merciful, new ideas create problems.	**Defined:** Management and engineering activities documented, standardised and integrated into standard processes for the organisation.	**Single Loop:** Emphasis is on improving techniques for executing processes, within constraints of established process strategies. Tends to be present where goals, values, frameworks and strategies are taken for granted. Lack of capacity for deeper learning hampers ability to make informed risk management decisions in rapidly changing and uncertain contexts.
4	**Proactive:** (in terms of safety culture) Tries to anticipate safety problems before they arise.	**Controlled:** Detailed measures of process and product quality are collected. Processes and products are quantitatively understood and controlled.	**Double loop:** Questioning the norms, values and assumptions underlying the design of processes, typically found where information is continually developed through a broad range of channels. Information is openly shared, communicated and used to publicly test assumptions and beliefs.
5	**Generative:** Information is actively sought, messengers are trained, responsibilities are shared, bridging is rewarded, failure causes enquiry, new ideas are welcomed.	**Adaptive**: Continuous process improvement enabled by quantitative feedback from the process and form piloting innovative ideas and technologies.	**Triple Loop:** Questioning and revising broader organisational structures and practices to optimise capability of processes. Core enablers of triple-loop learning are an understanding of how human and organisational behaviour influence process capability, and organisational flexibility.

6.2.2 Preliminary surveys and pilot

In the initial stages of the project, survey responses of IWA members were analysed (Zimmer and Hinkfuss, 2007) and surveys conducted more specifically with Bonn Network members. The IWA member survey looked at areas of background information; water provision; water quality risk management and stakeholder liaison. Fifty two suppliers responded to the questionnaire. In a more targeted survey of Bonn network members, a total of 54 questions were asked, based around four sections (i) basic information of the supplier, such as number of employees, service area and are WSPs being developed; (ii) questions regarding whether the supplier benchmarks its risk management activities; (iii) questions relating to the original RM-CMM developed at Cranfield (MacGillivray et al., 2007a), measured on a 1-5 maturity scale and (iv) questions relating to WSP progress and adoption of the Bonn Charter. Thirteen of the fifteen network members replied. Analysis of responses regarding WSP implementation, such as the challenges they faced, helped influence BC-CMA development. Firstly, there was a huge range of suppliers who participated in the first survey, in terms of size, development and level of WSP implementation. The BC-CMA should therefore aim to cater to all types of piped water supplier[12]. A range of interesting challenges were mentioned which were taken into account when developing the BC-CMA and also supported the need for the BC-CMA. A lack of resources were often mentioned in terms of skills, knowledge and time. As such, the BC-CMA needed to be simple to use and not take up too much time from already busy workloads. Previous CMMs have been lengthy processes involving visits by trained assessors. In order to encourage more suppliers to use the BC-CMA, it was intended to make it a self assessment tool. Lack of finance was also a frequent challenge, by using the BC-CMA as a tool to prioritise workload in developing maturity; this could enable more efficient use of funding. Poor institutional arrangements and challenging organisational cultures were also perceived to be a problem. It was therefore intended to make the BC-CMA more organisational culture in focus, as this is an area where there is little current guidance (Chapter 2). The case study methodology described in section Chapter 3 was used to determine how suppliers were aligned to the Bonn Charter to look for details of

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[12] Small community systems, usually un-piped are covered by the International Small Community Water Supply Network: http://www.who.int/water_sanitation_health/dwq/scwsm_network/en/index.html

best practice. This information then helped in the determination of processes and sub processes to be used in the BC-CMA (Figure 6.2).

6.2.3 Bonn Network workshop 1

A workshop of network members was conducted. Attendees were asked to work in pairs and discuss how they thought they achieved the various aspects of the Bonn Charter's responsibilities of a water supplier; the first two responsibilities (identified in Chapter 2.1.2) were focused on due to time constraints. These responsibilities were split into several 'processes' and the attendees asked to complete a template (Appendix H), and assess on a 0-5 maturity level. Feedback was then requested from the group, and the outputs used in the development of the BC-CMA self assessment format.

Self scoring, as might be expected was high, with an average of around 4 for most of the processes. There were only two instances where a respondent scored themselves with less than 3, indicating that most considered themselves defined, controlled or adaptive in all of the areas. This may be the case, but could not be confirmed without more in depth analysis of the suppliers. This could be an indication that 'over-scoring' was an issue, some comments made in a free text box that there were weaknesses in the current approach, yet a high score, of 4 or 5 was still given (possibly an example of 'level envy' as discussed in Chapter 2.5.1). Responses for 'buy-in' and commitment were generally high level, for example that the board had 'approved' a WSP project, or that everyone was committed to public health and WSPs. Stakeholders were generally identified and communicated with, but active involvement was less common. WSP teams were present in most utilities, with varying areas of expertise. Many had employed staff with WSPs solely as their remit. As expected, most were well developed in terms of WSP completion. Setting of standards was mainly based on regulations and guidelines imposed on them by regulators and governments. Many utilities had implemented ISO quality programmes such as ISO 9001, and 22000. Communication with consumers was undertaken in a variety of ways, such as via websites, telephone, reports, TV, mailouts and direct communication. The development of a WSP self assessment benchmarking tool by IWA and WHO was presented during the workshop (WHO-IWA WSP Water Quality Assurance Tool, in development) influencing BC-CMA development to become

more organisational culture in focus, this also ensured that the BC-CMA was more closely related to the research objectives.

6.2.4   Development of BC-CMA structure, trial and feedback

Based on the literature and initial survey, a trial BC-CMA framework was developed in order to assess water suppliers' alignment and maturity with the Bonn Charter and organisational culture. This framework was then trialled at the four water suppliers described in Chapter 3.3.1. The framework was based purely on the five Bonn Charter responsibilities (Chapter 2.1.2). However, it was subsequently decided that some aspects, such as creating adequate and auditable accounts were not cultural items and the structure was too large in scope to effectively develop a simple-to-use self assessment format and therefore a revised structure was developed.   The revised structure was influenced by the five responsibilities of the Bonn Charter, but from these five, eight smaller 'cultural' elements were extracted (Figure 6.2).

'Process'	'Sub Processes'
Responsibility 1	
Organisational culture	Basic assumptions, Learning, Internal communications, managerial commitment, leadership, organisational commitment, blame culture and close calls, reward.
Team & stakeholder engagement	Team development; ID & engage stakeholders; Define roles, responsibilities and reporting lines
Risk Analysis	System characterization. Hazard ID, Hazard Precursor ID, Control Evaluation, Consequence Evaluation, Likelihood evaluation, risk evaluation
Risk based decision making	Establishing risk acceptance criteria. Establishing criteria for evaluating alternative risk reduction options, ID risk reduction options, Evaluate options, Managerial review & options selection
Responsibility 2	
Setting of standards	Health, consistency, acceptability and trust.
Quality Assurance	Monitoring and corrective actions; audit; consumer satisfaction
Communication & Reporting	Regulators, staff, consumers, stakeholders.
Responsibility 3	
Asset management	Define service objectives, establish asset register, assess asset and service performance, ID appropriate intervention options, Implement efficient operation, maintenance and replacement regimes, monitoring.
Balance between safety & profitability	Balance between safety and profitability, funding for quality
Responsibility 4	
Staff with appropriate training & skills	Value of training, Management, staff
Responsibility 5	
Adequate & Auditable accounts	Transparency

'Element'	'Sub Element'
Cultural Taxonomy	Managerial commitment; Learning culture; Internal relationships; accountability; reporting culture; external relationships; continual improvement culture; empowerment; org. Commitment; proactive; leadership; mindfulness
Stakeholder Engagement	Internal, external, identify, engage, roles, responsibilities & reporting lines, Team development
Risk Analysis	System characterization. Hazard ID, Hazard Precursor ID, Control Evaluation, Consequence Evaluation, Likelihood evaluation, risk evaluation
Risk Based Decision Making	Establishing risk acceptance criteria. Establishing criteria for evaluating alternative risk reduction options, ID risk reduction options, Evaluate options, Managerial review & options selection
Quality Assurance	Setting of standards, Monitoring, Attitudes to audit, value of consumer
Safety & Finance	Balance between safety and profitability, funding for quality
Competence	Value of training, Management, staff
Transparency	Accounts, reporting, communications, regulators, stakeholders, staff, consumers

Figure 6.2 BC-CMA structure evolution

The eight elements formed the revised BC-CMA structure and included (i) Cultural paradigm (based on the cultural 'taxonomy' outlined in Chapter 5); (ii) stakeholder engagement; (iii) risk analysis[13]; (iv) risk based decision making and review[2]; (v) quality assurance; (vi) safety and finance; (vii) competence and (viii) transparency. The sub elements for each are outlined in Table 6.3, along with the rationale for their inclusion, key references and related Bonn Charter responsibility.

Table 6.3 Elements, sub-elements, rationale, references

Element	Sub Elements	Rationale and key influences
1 Cultural Taxonomy (1,2,3,4,5)[14]	Learning; continual improvement; mindfulness; managerial & operational commitment; accountability; proactivity; leadership & advocacy; reporting culture; empowerment; image & competition	Organisational culture acts as a barrier to the uptake of new practices (Johnson, 1992). Empirical evidence gained from case studies. Literature: organisational learning (Argyris and Schon, 1978), organisational culture (Schein, 2004); safety culture (Parker et al., 2006); leadership practices (Kouzes and Pousner, 2002); cultural assessments (Parker et al., 2006).
2 Stakeholder engagement (1,2,3, 5)	Internal, external, identify, engage, roles, responsibilities & reporting lines, team development.	Key point in Bonn Charter (IWA, 2004) and WSP guidance (WHO 2004). Depends on the understanding and management of different organisational cultures to build successful relationships (MacGillivray and Pollard, 2008). Empirical case study data and literature on stakeholder engagement (Gable and Shireman, 2005; Morrison 2003). Questions focus on attitudes toward and perceptions of stakeholder engagement and practical aspects of how stakeholders are identified, engaged and managed.
3 Risk analysis (1)	System characterisation, hazard ID, hazard precursor ID, control evaluation, consequence evaluation, likelihood evaluation, risk evaluation	The Bonn Charter (IWA, 2004) advocates the use of WSPs (WHO 2004). This tool is not a WSP benchmarking tool. Instead, we look at the capability of the organisation to analyse risk. Directly related to improved RM-CMM (MacGillivray and Pollard, 2008), and cultural aspects such as: Incident management (influenced by safety culture (Parker et al., 2006)); close calls and blame culture; attitudes toward risk analysis; review of risk analysis.
4 Risk based decision making (1)	Establishing risk acceptance criteria and criteria for evaluating alternative reduction options, ID and evaluate risk reduction options, managerial review & options selection	As above.
5 Quality assurance (1, 2)	Setting of standards, monitoring, attitudes to audit, value of consumer.	Key feature of Bonn Charter (IWA, 2004) and in verification of WSP (WHO 2004). Focus on organisational culture elements of this such as importance given to health standards and customer

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[13] Taken from MacGillivray
[14] Bracketed numbers indicate the related Bonn Charter responsibilities

responsiveness, effective use of monitoring, attitude to audits. Questions include attitudes to audit (Parker et al., 2006), and the importance given to customer satisfaction.

6 Safety & finance (3)	Balance between safety and profitability, funding for quality	Key feature of Bonn Charter (IWA, 2004) and WSPs (WHO 2004). Increasing financial pressures and competing drivers, therefore important to establish how the organisation perceives the balance between safety and profitability and/or cost. Safety culture assessments (Parker et al., 2006). Questions designed to look at priorities in investment planning, and effective asset management.
7 Competence (4)	Value of training, Management, staff.	Competent staff an essential feature of the Bonn Charter (IWA, 2004) and WSPs (WHO 2004). Value given to people, training and education by the organisation. Range of assessments reviewed consider aspects of training, education and team development and these will be drawn on in development of questions, including (MacGillivray and Pollard, 2008 and Parker et al., 2006).
8 Transparency (2, 5)	Accounts, reporting, communications, regulators, stakeholders, staff, consumers	Essential attribute mentioned in the Bonn Charter (IWA, 2004) in terms of accounts, reporting and communication. Bonn Charter specifically mentions trust of consumers. Transparency and trust are positively correlated, ensuring accountability (Rawlins, 2008). Literature on transparency measurement (Hultman and Axelsson, 2007; Rawlins, 2008). Questions on communication and reporting, drawing on the safety culture assessment (Parker et al., 2006).

Maturity levels were based on the original CMM and RM-CMM maturity hierarchy (MacGillivray and Pollard, 2008), and take its terminology from the RM-CMM: 1 (ad hoc) to 5 (adaptive), an extra level '0' is included to identify non-existent or deliberately negligent practices (Figure 6.3).
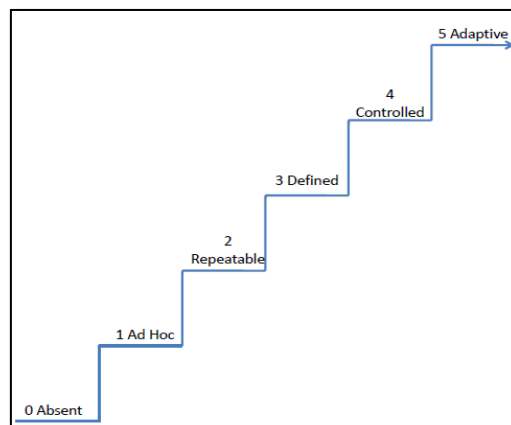
Figure 6.3 Maturity level progression

Using element 1 (cultural taxonomy) as an example, at **level 1** (ad hoc), organisations do not learn from their mistakes. Failures, as well as successes are repeated and failures are covered up. There are no plans for continual improvement. Individuals may feel accountable to the consumer, but this is not widely shared. Work is done at the level of the individual, leadership qualities are lacking to be able to motivate others. Individuals are blamed if something goes wrong, and information is hidden. Much effort goes into 'putting out fires' rather than taking proactive approaches. Managers are superior and do not value the input of employees. The organisation is not concerned with its image or competition.

Organisations at **level 2** (repeatable), 'open loop' learning exists (see Table 6.2). Increasing members of the organisation feel accountable and are aware of public health, but work is still reactive, and reporting of close calls is absent. Successes can be repeated but there is little scope for continual improvement. Employees do as they are told with little involvement in decisions. Managers are committed but leadership qualities are absent. Employees still work at the individual or team level, and rarely mix.

A **level 3** (defined) organisation exhibits 'single loop' learning (see Table 6.2). Reporting is performed, of problems and close calls but is informal. Working together depends on the individuals in question and is varied. Managers are committed and provide resources for defined and standardised procedures. There are upward channels of communication, but the information from subordinates may be ignored. Leadership skills are starting to emerge, along with an awareness of image and competition with peers.

At **level 4** (controlled), organisations ensure 'double loop' learning (Table 6.2). The culture is now proactive, where efforts are made to anticipate problems relating to water quality before they arise. Efforts are made by leaders to ensure that all staff are aware of their public health responsibility, and to motivate employees. Staff are generally aware of what could go wrong in terms of quality and public health and are able to take their own initiative to avoid such instances. There are formal mechanisms for the reporting of close calls, and continual improvement initiatives. Management provide the necessary resources, listen to, and value the opinions of staff. Employees are given responsibility

and involved in decision making. Image of the organisation to its consumers, and trust of the consumer is very important, with methods in place to ensure this is high. The organisation competes with other members of the industry to 'be the best'.

Organisations at **level 5** (adaptive), 'triple loop' learning is displayed (see Table 6.2). Quantitative feedback is used, along with piloting of innovative ideas and technologies to ensure continual improvement. A continual improvement mentality pervades the organisation. Reporting is actively encouraged, and employees feel comfortable in doing so. Silos do not exist and individuals, teams and departments work well together, sharing responsibility and striving toward a common goal that is promoted by leaders. Accountability to the consumer is felt by everyone, and all staff are mindful of their role in providing clean, safe drinking water. Proactive methods are used to ensure that this goal is achieved. Failures are learnt from, and individuals are not blamed. New ideas and innovation are welcomed from all levels of staff and employees are empowered and actively involved in decision making. Image and trust are important and the organisation strives to be the best. The importance of organisational culture is understood and efforts made to ensure that this is supportive. Examples of maturity level descriptions for each of the eight elements can be found in Appendix I.

6.3 Results from case studies

During secondments to four suppliers described in Chapter 3.3.1, an assessment of how each utility currently meets the responsibilities outlined in the Bonn Charter, and it's organisational culture, was performed through semi structured interview, document analysis and observation (Chapter 3) and maturity level based on judgement of the author (Figure 6.4), an example of this judgement is given in Table 6.4 for Supplier A.
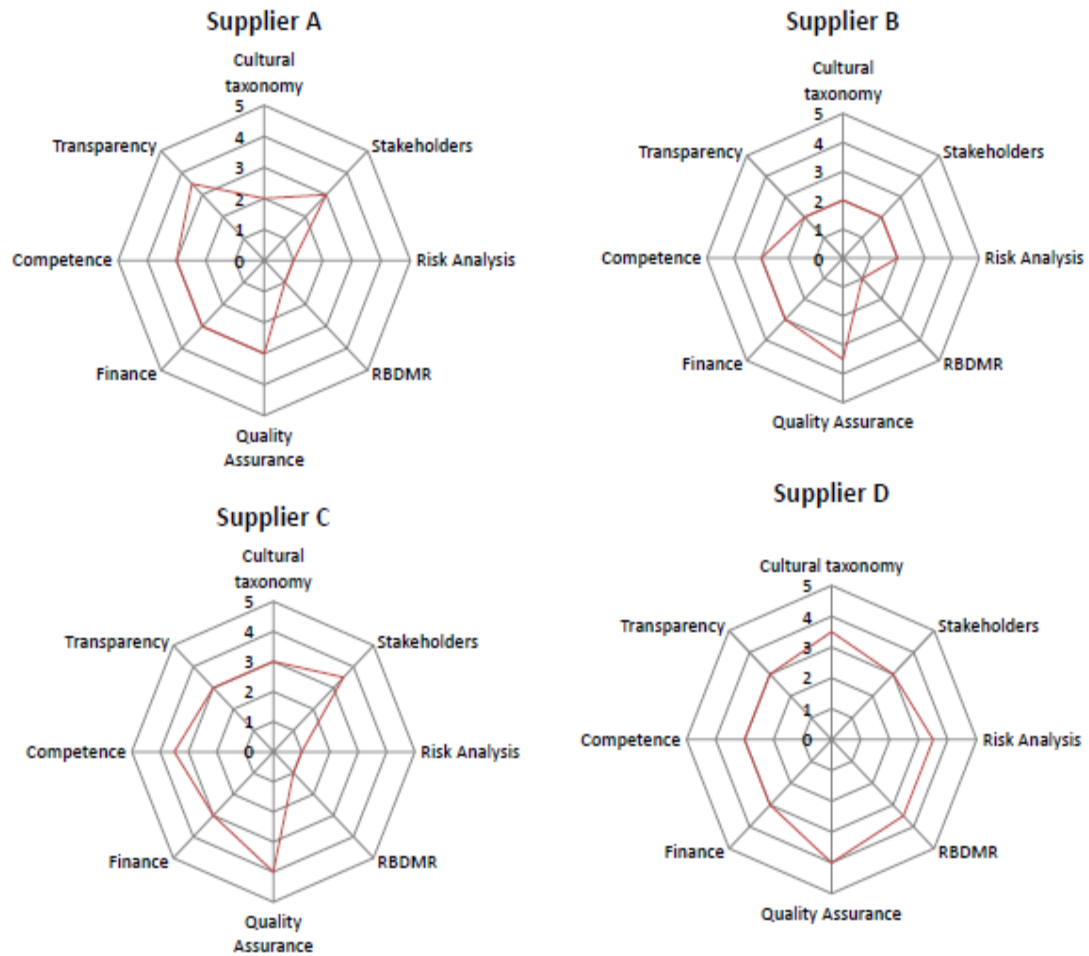
Figure 6.4 Top tier score profiles for Suppliers A, B, C and D

What seems like some discrepancies should be noted here. For example, Supplier C has a fairly high 'cultural taxonomy' score in comparison with others, yet Supplier C was the only one to not consider implementing WSPs, one may therefore expect Supplier C to have the lowest scores. However, it should be remembered that this is a *capability* tool that could be used by a supplier prior to WSP implementation. Therefore, it is considered that Supplier C has a relatively capable culture, but it chose not to implement WSPs, probably due to a lack of information and understanding about the approach. However, should the Supplier decide in the future to implement WSPs, then one would expect them to be relatively successful due to a supportive culture.

Table 6.4Author judgement of maturity example: Supplier A (Suppliers B-D can be found in appendix J)

Element	Supplier A	Level
Cultural Taxonomy	Community values, transparency, camaraderie, get it right first time, earn your stripes, protectors of PH, want to be the best, customer service, prove ourselves, pride, talk of empowerment but managers are superior, technology and education are key, engineers know best, keep control. Barriers between union and management staff. Mission: We are committed to a high quality of life for all citizens, and to facilitate progressive development through responsible leadership. Leadership includes fiscal, environmental, and social responsibilities. Support of research and development from external agencies and hosting of research students. Organisational learning tends to be informal but effective. Few formal mechanisms of documenting and learning from past events, or communication. Daily meeting for two way dialogue and discussion of issues, but workforce feel management do not listen to suggestions. Communication of new initiatives less effective. Drive to implement WSP originated from the top management but abandoned. Managers on call and keep up operator training. Presence on board of water association and helps out local communities. Commitment to WSP low, but due to a lack of awareness. Pride in work and cleanliness of assets. There is a drive to instigate reporting of close calls but this is informal, suggests 'blame'. Benefits for staff such as retirement packages, pensions etc. Good quality of life, non monetary benefits and small celebrations of success.	2
Stakeholder engagement	Very small department, could do more for engagement of staff in other areas of 'city' such as roads etc. High level of stakeholder identification and engagement: Watershed protection groups, researchers, regulators, health authorities, contractors, county and consumers. Level of engagement varies with group. No formal RM programme, so no stakeholders engaged specifically for this purpose. Roles and responsibilities are outlined in communications protocols, reports and bylaws. Attempts have been made to define reporting lines with stakeholders over reporting of incidents, and has been regularly reviewed but appears to be some uncertainty due to infrequent use (few incidents reported, may benefit from regular rehearsals). Other reporting lines tend to be informal.	3
Risk Analysis	No specific team. Utility is very small in terms of employees. When risk management project was started, external consultant was enlisted. There has been no review of potential team members and a concern around time limitations, and no time frame established. Operational staff involved but little buy-in. Chemical, microbiological, physical and radiological water quality hazards are identified in an informal way, mainly through lists of parameters included in the guidelines. No systematic hazard identification is carried out for the various stages of the distribution system. An exercise was carried out to identify hazards in the WTP, using a checklist of hazards from CRC Australia but this exercise was abandoned. Controls mainly within WTP, maintenance schedules and daily checks. Evaluation of the state of mains etc. Maintenance schedules are reviewed, but on an informal basis, based on operator experience. Understanding of the relative consequences of various hazards but no formal consequence or likelihood evaluation. Some risk evaluation processes had been carried out in related fields such as pandemic report. In the WSP type project, the consequence, likelihood and risk evaluation stage had not been reached but a preliminary stage had been conducted where employees were asked to rank the checklist of hazards as to which they perceived to be of highest risk.	1
Risk based decision making	Ad hoc and informal, based more on gut feel than a formal process. Identification of risk reduction options and evaluation of options not performed formally due to absence of risk assessment. In other areas, ad hoc and informal, works due to small size. For major projects, where consultants are employed, it is the role of the consultant to evaluate alternative options in relation to different	1

	objectives such as meeting regulations, public health etc, price tends to come last, so if there are several options all meeting the objectives then price will be reviewed.	
Quality Assurance	Health based targets as dictated by regulator, utility sets stricter guidelines on itself. Informal targets to improve for acceptability. No formal targets for consumer trust/satisfaction, however customer service is high on agenda, and target to respond to customer issues on same day. Awareness of parameters of interest that are not currently stipulated in approval. Constant but informal review. Monitoring at all points in supply chain, (set points in distribution rarely questioned). Notices at the monitoring points detailing limits and corrective actions. Online monitoring via PLC gives alarm if parameters go out of limits. Critical control points and limits are determined based on safety licence to operate, and damage to equipment. Monitoring results are used to change doses/plant operation both via PLC and also manual intervention. Many chemical doses are automated, with calculations based on many variables. Automated shut down and start up procedures. Manual changes are mainly due to experience but efforts are being made to document procedures in a manual. Emergency procedures in operational manual. Most chemical tests are done in house, some are sent to independent lab, three times a year in order to verify the results. Bacteriological tests are sent to a provincial lab, as determined by the regulator. Reliability of alarms tested weekly. Emergency scenario performed once to test alarms and actions. Huge amount of data collected, but not enough manpower to analyse. External auditing carried out by regulator approximately once yearly, no internal auditing due to small size. Management trying to implement an 'Action Form' system used to document consumer enquiries.	3
Safety & finance	Government run utility so are not concerned with profitability, but to have to 'balance the books', cost is not first consideration when choosing contractors. Cost considered as a last option. For smaller items such as equipment purchase, the utility is moving toward a 'mileage' rate as a way to chose. Pricing is approved by council, who are elected by public. Tariffs are relatively high in the area, in order to upgrade and provide quality services. Master plan is a long term plan that prioritises what money should be spent on. Plan shows up constraints within the existing system and also with future planning, taking account of growth. Looks at a 5-10 year horizon as well as a 20/40 year horizon. Tends to use external contractors to do this plan, as it involves high level modelling. Capital budgets used to be granted on a 1 yr basis, now on a 5 yr capital plan, gives a better understanding of how money will be spent.	3
Competence	Training is valued highly by management and used as an incentive for employees. Internal, job specific training for new starters is ad hoc, and usually dependent on other staff members explaining things 'as they go along'. Need for succession planning has been noted but as yet not developed or implemented. No personal development plans and limited opportunity to learn from staff and document how they feel about various issues, management etc. Management keep up to date with operator training to remain in touch with staff. Environment regulator carries out an assessment of the facilities grades it on a 1-4 scale, this will then determine the minimum level of training that is required for operators. Senior management keen on external training courses, attendance on conferences etc.	3
Transparency	Council business is very transparent, public vote, attend meetings and meetings are televised, reported etc. Accounts for the city as a whole, including the water department are audited by an external chartered accountant, in accordance with the accepted principles for local governments. Audit report is presented to Mayor and Council. Sample results submitted to regulator website every month (contraventions reported immediately), customers can view these results and are also if they contact the engineering department. Bacteriological sample results are reported directly to the regulator and health authority. City produces a 'water system' brochure containing info about regulations, how the water is treated, and ways to reduce water use. Utility has a website containing basic consumer information. Formal reporting procedure for regulators. 'Open house' at WTP, particularly if there are problems.	3.5

6.4 Development and trial of self assessment format

6.4.1   Development of self assessment format

Following finalisation of the structure, a simple self assessment format was developed using guidance literature on questionnaire design and attitude measurement (Oppenheim, 1992), and with reference to existing tools described in Chapter 6.2.. Most questions were developed in a way that respondents could choose the statement which best described their situation, for example: *Which statement best describes how do you think the organisation feels about stakeholder liaison?* Or, to determine their level of agreement with a particular statement, for example: *On a scale of 0-5 please indicate your agreement with the following statements (e.g. "Senior management provide adequate resources to do our jobs properly")*. Statements or levels of agreement were measured on a 0-5 or 0-10 scale so that responses could easily be related to the 0-5 maturity levels. Some attitude statements were negative, for example, *"What managers say and do is sometimes different"* and as such were measured inversely. The tool was split into eight elements, with approximately 10 questions per element. A glossary of terms was also developed to accompany the tool along with background information and instructions. The self assessment questionnaire format can be found in Appendix K.

6.4.2   Trial of self assessment format

The self assessment format was made available to 100 IWA member suppliers, online or to print off and return, following an email invitation to complete. The intention was to gain a wider understanding of organisational culture and WSP implementation, as well as test if the tool was useable The response rate however was poor, at 9%. This low response rate could be attributable to problems identified from feedback discussed in the next section (6.4.3). The low response rate meant that statistical analysis could not be performed on the results, instead we can look at the individual responses (Figure 6.5). Generally responses were high, averaging level 4 (controlled). Strongest areas tended to be quality assurance and safety and finance; whilst weaker areas stakeholder engagement and competence, although response rates were too low to make any statistical generalisations. Two of the

nine responses were incomplete, suggesting that respondents found the questionnaire too long, or complex to complete.
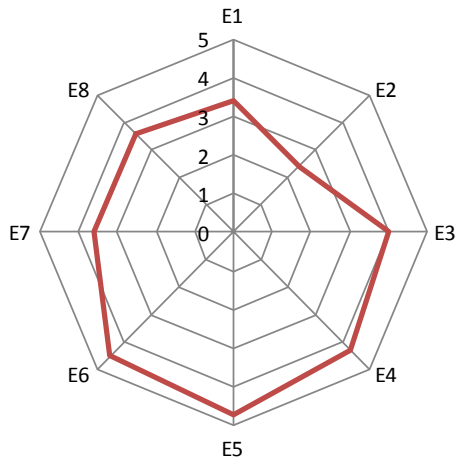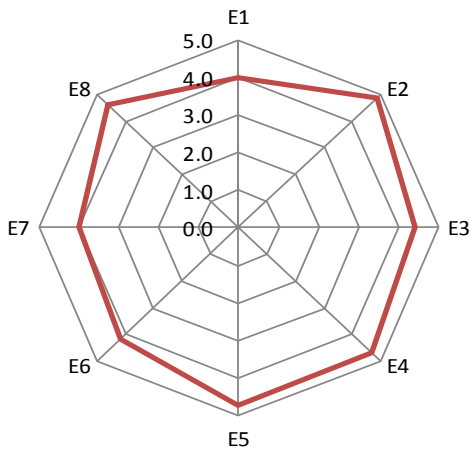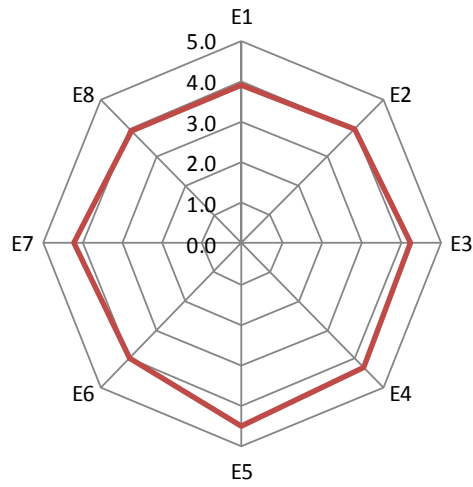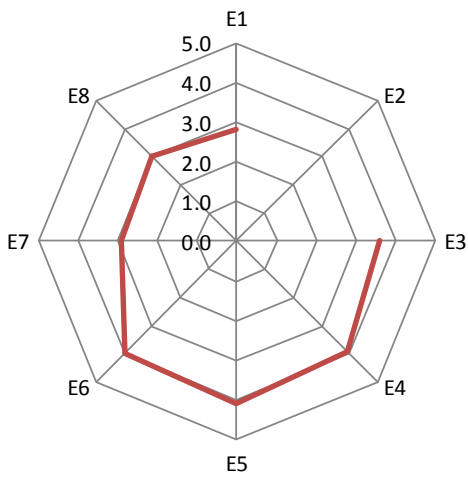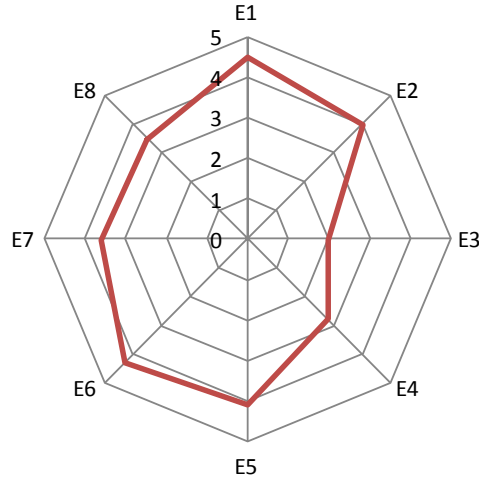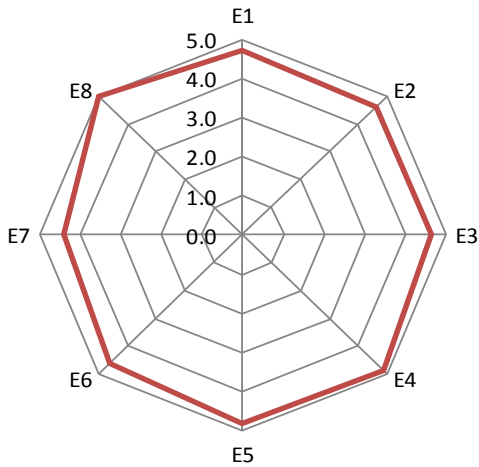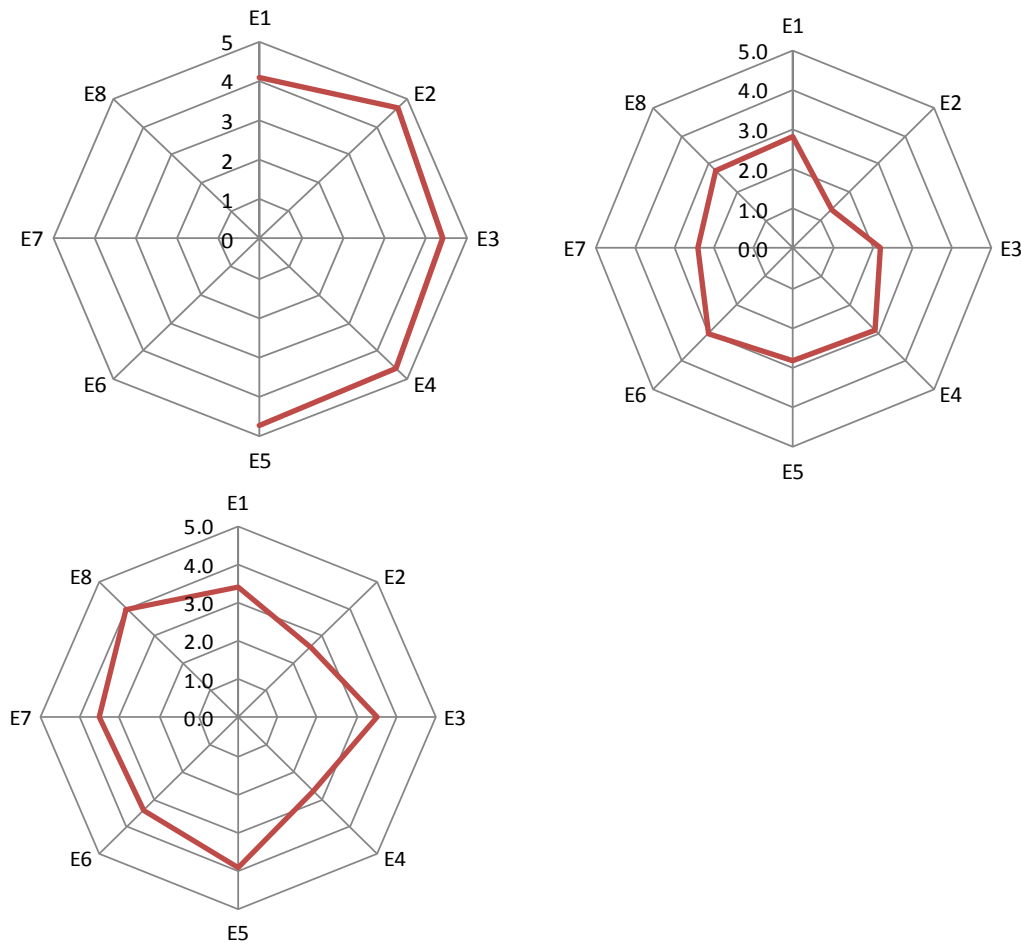
Figure 6.5 CMA survey responses

(E1 = Element 1 (cultural taxonomy); E2 = Element 2 (stakeholder engagement); E3 = Element 3 (risk analysis); E4 = Element 4 (risk based decision making); E5 = Element 5 (quality assurance); E6 = Element 6 (safety and finance); E7 = Element 7 (competence); E8 = Element 8 (transparency).

There were some interesting responses when asked to rank the importance of various aspects in decision making. Overall public health was considered most important followed by regulations; customer service; water quality; reputation; environmental impact; finance and commercial interest. However, one supplier felt that finance was more important than public health. The most important perceived reason for adopting WSPs was to increase public confidence, followed by public health improvement; increased compliance; stakeholder confidence; regulatory requirements; commercial interest and cost savings. The questionnaire also asked suppliers to rank the importance of water quality targets and financial targets on a scale of 1-10 where 10 = of most importance and 1 = not important. On average, water quality scored marginally higher at 9.3 and financial targets at 8.3. Two of the respondents felt these aspects were equal,

both at 10 and two cases considered financial targets more important that water quality targets, at 10 and 8 respectively.

When analysing the results of the survey, it was clear that the questions were long, and some could be considered ambiguous. Assessment of maturity levels was a lengthy and difficult process. The tool therefore needed to be made simpler and easier to use.

6.4.3   Bonn Network workshop 2

The self assessment BC-CMA was presented to members of the Bonn Network at a second workshop, and discussion encouraged to generate feedback. The main points highlighted were that although attempts had been made to make the BC-CMA simple to use as a self assessment tool, the subject of organisational culture is a complex one and it needed to be made simpler still. It was considered to be too long, and time consuming to complete. Another concern was that the language used in the tool was too 'academic' and difficult for users to understand, especially where English was not the first language. Concern was also raised that if a low maturity level was given, then the supplier should not be put off implementing WSPs, as there was a feeling that a WSP developed with low cultural maturity was better than no WSP at all, and that the act of implementing WSPs may in turn develop culture in itself. Suppliers may be put off completing such an assessment for fear of failure. It was acknowledged however that organisational culture is an important area that requires some consideration by those wishing to implement WSPs, but it may not be a priority area of concern for suppliers.

6.4.4   Amendments considering feedback

Table 6.5 summarises the feedback concerns and how these have been addressed. The longer, 'full' version of the BC-CMA was still considered valid by the author and useful to water suppliers wishing to develop their organisational cultures to allow for sustainable and successful WSP implementation. However, following the feedback it was recognised that the full version may be off-putting to suppliers that have not previously considered such factors. Therefore it was proposed to develop a shorter, condensed version based mainly around the 'pure' cultural attributes, namely element 1, the cultural taxonomy. This shorter version could be used by those suppliers who are yet to consider the effect of organisational culture and thus initiate some preliminary work

in this area. If the supplier becomes more interested, and is more advanced in their WSP implementation then they may wish to use the longer version.

The glossary of terms was revised, to include more explanations and the BC-CMA was edited to use simpler language, particularly in the more 'academic' areas of the cultural taxonomy. Organisational culture may be a new area for many suppliers and as such simpler language was used. In view of the concern that suppliers may be 'put off' doing such an assessment for fear that they will reach a low maturity level, or that if a low maturity level is reached then they would be put off WSP implementation, it was decided to provide guidance for completion with the tool. This guidance would explicitly state the purpose of the tool, and that it should not be seen as a barrier to WSP implementation but more as guidance and a prompt to think about organisational culture and how developing it could lead to more successful and sustainable WSP implementation but is not a pre-requisite. A potential weakness of the tool as a self assessment was the lack of external verification and a risk of respondents over scoring due to a desire to be seen in a more positive light 'level envy' as Bach (1994) termed it. However, this weakness can be overcome in several ways including communication: ensuring that the purpose of the tool is well communicated to the respondent, that the results will be for internal use only to assist in improvement measures and that there is no benefit from exaggerating scores. Also, suggesting that the tool is completed by a cross-section of staff, from different levels in the organisation to determine an average maturity level may help.

The low response rate to the online questionnaire was considered to be a result of the above factors: that it was too long, too complex and suppliers were reluctant to identify problems with organisational culture. By addressing these, response rate could have been increased.

Table 6.5Addressing feedback relating to self assessment format

Feedback	Proposal
BC-CMA is too long	Produce a shorter, preliminary assessment format for rapid used, based mainly around element 1, the cultural taxonomy. Keep full version for those who wish to look into this area in more detail.
Language used difficult to understand	Improve glossary to include more terms and more detailed descriptions. Edit BC-CMA to use simpler, less 'academic' language
'Fear of failure'	Be more explicit in guidance to accompany BC-CMA, explain purpose as for internal improvement only and that low maturity should not prevent WSP implementation.
No organisation will be perfect	The tool is intended to encourage continual improvement, as such a level 5 should not be attainable or this may foster complacency. Try to build in responses that require continual improvement into level 5 responses
Low response rate to questionnaire	Addressing the above issues may result in more enthusiasm for completing the BC-CMA.

6.5 Supporting tools

To complement the BC-CMA, a number of organisational culture related tools[15] were developed from existing literature and the research data to form part of the Bonn toolbox, to assist suppliers in considering and developing aspects of organisational culture that may lead to improved and sustainable WSP implementation. Tools (an example can be found in Appendix L) include:

- **Summary of WSP benefits and costs:** A tool summarising the range of benefits and also costs of implementing WSPs, to be used in generating buy-in across the organisation, and provision of the necessary resources.

- **WSP drivers:** Outlining other drivers as well as public health protection, and highlighting the importance of understanding these drivers prior to starting the project and also in communication and awareness programmes in order to help gain buy-in. These other drivers may become more important where a high level of water quality is currently enjoyed and the public health benefits may be less immediately obvious.

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[15] *For the purpose of this toolbox a "tool" is defined as anything that will provide practical help and support to managers and operators involved in any aspect of drinking water quality control. The tools provided by the toolbox will thus include but will not be limited to: Technical and management guidance; procedural checklists; statistical techniques; tips from other practitioners*

- **WSP pilot projects:** Describes the benefits of performing a pilot WSP project, such as gaining support of senior management for wider implementation; demonstrating the benefits without the need for considerable resource; trialling the approach to resolve any glitches and helping gain the support of the organisation as a whole, as well as stakeholders.

- **Senior management commitment:** Highlighting the importance of gaining real, demonstrable managerial commitment. The public health motivator should be clear and a paramount objective, not lost among other, albeit legitimate, drivers such as political or regulatory pressures and financial efficiency.

- **Modifying organisational culture 1: WSP leadership:** A tool to reinforce the importance of leadership. Linked to creating the desired organisational culture, the difference between leadership and management is discussed and the importance of leaders in generating commitment and changing culture.

- **Modifying organisational culture 2: Supportive culture:** Linked to leadership and organisational culture links to WSP, advice to organisations wishing to modify organisational culture to be more supportive of WSP implementation.

- **Resource availability:** Insufficient resources are often quoted as a barrier to WSP implementation. Resources may include staff, finances, time or materials. In addition there is often an uncertainty over how resource intensive a WSP project will be. The amount of resources that are required will vary from case to case.

- **Organisational commitment and motivation:** Commitment of the whole organisation is necessary for effective implementation of WSPs. Staff need to understand their role in water supply and public health protection, and how this can be achieved though implementing WSPs and the principles of the Bonn Charter. Leaders within the organisation have a vital role in securing the motivation and commitment. This document sets out factors which are important in the motivation of staff.

- **Organisational culture (background):** Detailing why consideration of organisational culture is important, in that it can act as a filter to the uptake of new practices, such as WSP, outlines some basic concepts of organisational culture.

- **Water safety 'mindfulness':** A high awareness of hazard and risk, or 'mindfulness' is often attributed to High Reliability Organisations (HROs), those organisations that relatively few accidents compared to their high risk operations. Recent work has suggested that water suppliers may wish to learn from these HROs in order to reduce the chances of water quality incidents occurring, this tool discusses some of these lessons.

6.6 Application of the tools

The BC-CMA described in this chapter is intended to act as a guide, to complement the Bonn Toolbox and allow suppliers to assess their current organisational culture strengths and weaknesses in adopting the Bonn Charter. Through periodic application of the BC-CMA tool, organisations will be able to chart their progress in developing maturity and prioritise the specific areas where most attention is required. The tool is completed by self assessment and will link to suggested tools for improvement in the toolbox. The BC-CMA is not a WSP benchmarking tool, instead the BC-CMA deals with cultural maturity and the capability of an organisation's culture to effectively internalise and implement the goals of the Bonn Charter, including WSPs. Intended to be simple to use, the BC-CMA should help promote thought into organisational culture, an important aspect which acts as a filter to the uptake of new practices (Johnson, 1992) but may be neglected, where suppliers feel that more concrete items such as a lack of resources or time are the main barriers to implementation.

Figure 6.6 shows how the BC-CMA is intended to be used, with two screening questions that should be asked before completing the BC-CMA (which has been developed into an interactive excel based format): (i) Have senior management been introduced to the BC and WSPs? and (ii) Do senior management agree with the principles outlined in the above? On completion of the BC-CMA a score profile will show priority areas for action, on a higher level for each of the eight main elements and a second tier with sub-elements. Respondents will then be directed to a guidance note for each of the eight main elements and then to relevant tools.
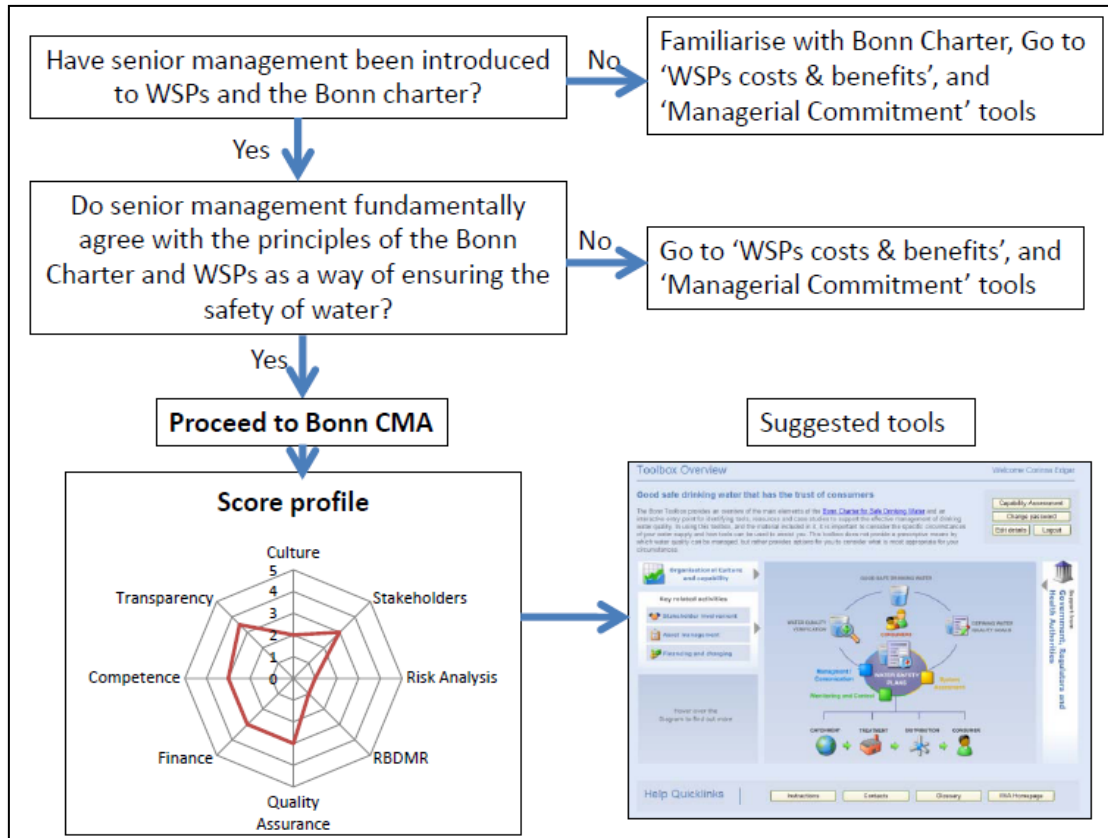
Figure 6.6 Conceptual application of the BC-CMA

Developing organisational culture should not be seen as a pre-requisite to WSP implementation, but rather a concurrent activity, or by those wishing to further improve already developed WSPs. Organisational culture can take many years to develop, and as such should not be seen as a blocker to WSP development, as developing the WSP in itself may act to improve organisational culture, the two are essentially entwined and will help support and improve one another.

6.7 Summary

This chapter outlined the development of a simple self assessment tool to assist water suppliers assess their organisational culture and its influence on WSP development and discussed its potential application. The BC-CMA is intended to prompt water suppliers to think about the important area of organisational culture which may often be neglected. Complementary tools in the Bonn Toolbox will further assist in developing cultural capability and maturity.

7   <u>DISCUSSION</u>

7.1 Introduction

The aim of this chapter is to discuss the results presented in chapters 4, 5 and 6 in relation to the prior literature, and the implications for those wishing to implement WSPs in the global water sector. Firstly, WSP implementation is discussed (Section 7.2), including progress, benefits, drivers and challenges. Then insights from organisational culture are considered (Section 7.3); taxonomy of cultural attributes (Section 7.4) and how a supportive organisational culture can be developed through application of tools (Section 7.5). The central novelty of this work is identification of a number of positive organisational culture attributes that support sustainable WSP implementation; identification of deeper cultural barriers to implementation that may be masked by a perceived lack of time, resources or assistance; reinforcement of the importance of public health protection as a primary motivator, supported by additional 'added value' benefits and drivers and development of tools to assist suppliers in developing their organisational cultures to support WSP adoption. Appendix D details sources of raw data evidence associated with this chapter.

7.2 WSP implementation

7.2.1   Progress

Despite formally being promoted since 2004, as well as some successes, the suppliers studied were experiencing (sometimes significant) challenges in WSP progress, such as a lack of resources, skills and time; uncertainty over how to implement and poor communication (Section 4.3.2). There were however many 'building blocks' of WSPs being implemented already within the suppliers, such as source water protection plans, water quality management plans, system assessments, quality benchmarking activities, and supporting programmes (Section 4.3.1). Sometimes these were not recognised by employees, thinking that WSPs were an entirely new initiative that had to be developed from scratch. Even where it was acknowledged that they were already doing most of it (e.g. Supplier B: "*I'm not sure what the actual objective is, because to me we have been doing the thing*" Chapter 4.5.2), there was more a feeling of 'why are we bothering

doing a WSP?' amongst some staff; and development of a new piece of work by those responsible, rather than trying to integrate existing practices and expertise. The WSP may therefore often be seen as a separate entity rather than an integrated, holistic way of working as it should be. This is a point touched on in the WSP manual (Bartram et al., 2009), acknowledging that many aspects of a WSP are already present in existing good operating practice and that there is no one way to undertake a WSP. Rather, it should fit in with the way the organisation currently operates: *'the WSP approach should be dynamic and practical and not merely another operating procedure'* (Bartram et al., 2009). Yet this was something at risk of occurring in the suppliers visited. This is an area that could benefit from more reinforcement when providing guidance and trying to implement WSPs: that a WSP is more an approach, a mindset and a new way of working rather than a set procedure to be implemented 'by the book'. It is here therefore that the consideration of organisational culture's influence is vital, in an industry grounded in engineering, this may present a challenge (discussed later in Chapter 7.3.4).

Different types of supplier had different levels of implementation, and may not be as one would initially expect. For example, Supplier B was from a developing nation but did not see resources as a barrier, whilst those in developed countries sometimes did. Supplier C was very concerned with continual improvement and adopting 'world class' (Chapter 4.2.3) practices but had little understanding of the WSP approach (Chapter 4.3.1). Organisational cultures and 'softer' issues such as promotion and communication may be highly influential. Espoused challenges such as a lack of time, resources and money (Chapter 4.3.2) may be a reflection of deeper institutional and cultural barriers inhibiting development of WSPs. This is an issue that has been raised in other fields. For example, Taylor (1995) warned that although there were challenges to implementation of ISO 9000 quality certifications in small organisations, care should be taken to ensure that attributing failure to a lack of resources is not in reality an excuse for a lack of resolve. The WSP approach is scalable and adaptable; as the WSP manual states; there is no one way of doing a WSP (Bartram et al., 2009). Those who truly have limited time and resources could still implement a scaled down, or simpler version of a WSP with what they do have, and develop this over time. If the organisation agrees with the method, then a basic WSP is surely better than no WSP at all. Davison et al. (2005) refer to this on several occasions; that the level of sophistication of risk

assessment will be dependent on resources and where resources are truly limited, generic WSPs may be developed. Even simple approaches can bring benefits and may provide an incentive for the deployment of additional resources. Additionally, it is recognised that the WSP approach can itself assist in more effective targeting of potentially limited resources (Bartram et al., 2009; Davison et al., 2005). These are concepts that need to be reinforced in promotion activities.

Suppliers A and C had no functioning WSP (Chapter 4.3.1). Supplier A agreed with the approach and had tried to implement in the past, and Supplier C had not bought into the approach. Wider cultural influences may come into play here. Both were situated in the Northern American continent. Here there tends to be a general focus on security risk, (*"Security risk is taken very seriously here",* Chapter 4.2.3) and managers acknowledged that local peers in the USA and Canada were generally not aware of, or adopting WSPs. Studying multinational companies, Kostova and Roth (2002) noted that institutional environments of subsidiary host countries could affect internalisation and implementation of practices developed by headquarters and so success would be dependent on trust, dependence, and identity with the headquarters. This could be equated to international promoting agencies, and one could therefore hypothesise that powerful agencies such as American Water Works Association (AWWA) and Centre for Disease Control (CDC) in Northern America may mean there is less identification and awareness of comparable agencies such as the IWA and WHO, who are the main promoters of WSPs, and thus less adoption of WSPs. There was also little regulatory driver here for WSP development. Those suppliers that did have WSPs – B and D, also had regulators that were supportive of such an approach (Chapter 4.3.2), although not through enforcement. Supplier C acknowledged that without regulatory pressure, WSPs would not be adopted (Chapter 4.4 *"I think it's because suppliers won't do it unless there is a regulatory driver, there are so many other things that the regulations are making you do")*. Regulators can provide external verification and ensure transparency (Rouse, 2007) and by supporting a WSP development they can add credibility. Under increasing pressures from regulators, if the WSP is not advocated by them, then one could argue that legal requirements would take precedence for these suppliers and WSPs, although possibly supported would not be a priority.

7.2.2   WSP benefits

WSP benefits were diverse (Figure 4.2, Chapter 4.3.3), including institutional benefits such as improved procedures; mindfulness of safety and consciousness of risk; better control; improved understanding of the system; cost savings; faster, more precise responses and compliance with certifications. Cultural benefits included prevention of complacency; providing peace of mind and a focus on critical aspects. Externally, benefits were thought to include improved stakeholder relationships; increased customer satisfaction and reputation benefits. In Chapter 2.4.1, some benefits identified in the current literature were outlined: demonstration of best practice; potential cost savings; improved asset management; quality assurance; refined operating procedures; raising awareness of causal agents and a greater understanding of quality issues; establishing investment priorities; fewer incidents; improved customer responsiveness and a reduction in complaints (Davison et al., 2005; Godfrey and Howard, 2004; Mullenger et al., 2002; Rouse, 2007). There was some correlation between the benefits suggested by the literature reviewed in Chapter 2.4.1 and those perceived and experienced by Suppliers A-D (Chapter 4.3.3): improved procedures; cost savings; improved customer satisfaction and a greater understanding of water quality issues and risks. Some additional benefits highlighted purely from the case studies were automatic compliance with certifications; prevention of complacency; improved stakeholder relations; and the provision of '*peace of mind*', knowing that appropriate measures have been taken to manage risk. Improved asset management and fewer incidents, described in the literature were not mentioned as benefits from the case studies, there may be a number of reasons for this:

- If WSPs are sometimes seen as a separate and independent project (Chapter 4.3.1), rather than holistic, linking with other areas of the business such as investment planning and asset management; employees may not see the link and not see improved asset management as a benefit of WSP implementation.
- Many interviewees did not perceive there to be many risks associated with the water that were not already managed (Chapter 4.6), and thus may not see improved asset management as a benefit.
- There was a certain degree of complacency around water quality (Chapter 4.6) and few past incidents experienced, which may account for why fewer incidents

were not considered a benefit. It may also therefore be difficult to measure a reduction of incidents, and attribute its lack of occurrence to the WSP *per se*. Employees may as a result more readily talk about benefits that can be measured, such as cost savings, improved procedures and increased customer satisfaction.

The primary aim of a WSP is the protection of public health (Bartram et al., 2009; Davison et al., 2005); but as we have seen from the case studies, the reasons for implementing a WSP, and the perceived benefits were diverse. Certainly in areas where a high level of water quality is currently enjoyed, the public health driver may not be the primary one. None of the suppliers perceived water quality to be a major concern. Public health was still important to these suppliers, feeling that the regulations are not sufficient in isolation and that WSPs can give peace of mind, but there was a general feeling that water quality was already good, and safe. As a result, there were other drivers for WSPs (Chapter 4.3.2) and perceived benefits (Chapter 4.3.3) such as improved reputation and image; competitive advantage; cost savings; more efficient ways of working and improved stakeholder relationships. This raises a number of questions. Is a WSP implemented purely as a means to gain competitive advantage, because of a regulatory requirement, or to make cost savings as legitimate and as successful as one implemented solely with the aim of protecting public health? Or is it ideological to think that all WSPs should arise from purely a desire to protect public health, and should a blend of motives matter as long as the end objective is achieved?

This brings us back to a quote highlighted in Chapter 2.4.3 from Hrudey and Hrudey (2004), analysing the causes of water quality incidents in developed countries: "*So many outbreaks appear to have been caused by neglect or complacency that is incompatible with recognising safe, clean drinking water as a top priority in life. No amount of economic rationalisation can make sense of providing mediocre service to the public for something so vitally important*". The authors caution against viewing public health protection as equivalent to other business priorities, such as profit or cost savings. In practice, water utility managers will have a broader view of the objectives of their organisations and the benefits that a risk-based approach could bring. Increasingly, guidance such as the revised WSP manual and Bonn Charter; and

published case studies are beginning to recognise these, such as consumer and stakeholder trust, water acceptability, and cost benefits. However none of the suppliers studied implemented WSPs with the sole primary aim of public health, and all required more work to fully implement. Whilst advertising 'added value' benefits may be helpful in generating buy-in, it is equally important not to lose sight of the main aim: public health, otherwise this may risk getting forgotten, and a true 'WSP culture' not established. The latest edition of the WHO WSP manual (Bartram et al., 2009) acknowledges the issue of complacency within the introduction, noting that nothing should be taken for granted. This critical section should be highlighted to suppliers and at the forefront of the WSP 'ethos' and in the author's view, this section could be expanded further.

7.2.3 WSP blockers and challenges

Some potential blocking features identified by interviewees included lack of resources and skills, as well as more 'cultural' features such as lack of awareness; uncertainty; lack of recognition; complacency; poor internal relationships and communication; competing priorities; and contrasting internal cultures (Chapter 4.3.2). These correlate with those barriers identified by Zimmer and Hinkfuss (2007) in Chapter 2.3.4. Blockers in Suppliers A and C, outweighed drivers. In B and D, drivers outweighed blockers, but there were still some barriers that needed to be overcome. Deeper, institutional and cultural barriers are outlined and discussed in subsequent sections of this chapter.

Managers within suppliers should be aware that challenges to WSP implementation may not purely be physical such as the frequently mentioned lack of resources, be they human, financial or time. Deeper cultural reasons may come into play, and may be more influential than resource provision. The literature presented in Chapter 2.3.3 supports this, outlining that deficits in risk culture are often to blame for failures (International Risk Governance Council, 2009; Kimbrough and Componation, 2009). Poor communication within the organisation; uncertainty over how to implement the approach and competing priorities; conflicting internal cultures between departments; complacency over quality and a lack of recognition for staff working on such projects will have potentially major ramifications. Both suppliers that were actually

implementing WSPs, Supplier B (Chapter 4.2.2) and D (Chapter 4.2.4) were explicitly aware of organisational culture and made efforts to modify and develop it to improve processes. One could hypothesise that an awareness of the effect of organisational culture, and making efforts to change and develop it within an organisation may lead to more successful WSP projects. Leadership directly influences culture (Chapter 2.3.4) and therefore it is only through effective leadership that these blocking features can be removed.

7.2.4 *Internalisation and implementation*

Kostova and Roth (2002) discuss the need for high levels of internalisation (i.e. buy-in to the approach) as well as high levels of implementation. This can help prevent tokenism, doing WSPs simply because of a coercive driver, such as a regulatory requirement and therefore doing the minimum to 'pass' and not achieve the full benefit (Chapter 2.4.2). If we apply the idea to the suppliers studied (Chapter 4.3.1): Supplier A provided an example of 'assent' adoption of WSPs: the organisation believed in its value, but lacked the capability to implement the practice, thus having a high level of internalisation and a low level of implementation. Supplier B was still in the early stages of adoption and work needed to be put into both internalisation and implementation. Supplier C exhibited a low level of internalisation (i.e. buy-in) to WSPs, and a low level of WSP implementation, however a number of WSP 'building blocks' were being effectively implemented without explicitly being termed a WSP. Supplier D appeared to have high levels of internalisation, there was no coercive driver and great efforts were made to implement WSPs because it was believed to be the best approach to use. Some of its large subsidiary companies also had a high level of implementation, with other companies expected to follow suit in the near future.

Where WSPs were being developed, the initial drive came from within the organisation; but sometimes external consultants were used (Supplier A and D). In some cases, external organisations are responsible for initiation of WSP development, such as through regulatory enforcement (e.g. UK case study in Bartram et al., 2009); or development of the actual WSP by aid agencies (e.g. Gregor, 2007); consultants or research institutions (e.g. Mahmud et al., 2007) in conjunction with suppliers. The issue of internalisation and implementation may have important implications here. For

regulators trying to get suppliers to implement WSPs, efforts should not be purely coercive. Consideration should be given to encouraging the suppliers to buy in to the approach and believe it is a beneficial exercise, rather than purely implementing them because they have to. Suppliers B and C had supportive regulators who encouraged implementation but were not coercive. For external implementers who may go to a supplier to initiate WSP development, consideration should be given to its sustainability and what will happen when they leave, as supported by Gregor (2007) researching the development of WSPs by NGOs in the Pacific Islands (Chapter 2.4.3). Just implementing the WSP is not enough, effort should also be put into creating a WSP 'culture' within the organisation that will continue after the external implementer has left.

7.3 Insights from organisational cultures

7.3.1 *Organisational missions and drivers*

From an organisational point of view, there were many missions and drivers of the suppliers as a whole discussed by interviewees including quality and safety of the water; service provision; continual improvement; regulations; financial targets; workplace safety; security; to be 'world class'; environmental stewardship; water quantity; sustainability; business expansion and confidence and trust (Table 4.1, Chapter 4.2.5). This shows that the provision of safe drinking water was not the only mission of water suppliers. Increasingly, privatisation of water utilities is occurring, and whilst this can bring benefits such as improved coverage, quality and regulation (Saleth and Dinar, 2000) and improved service levels as identified by Supplier B (Chapter 4.2.2), it may also bring competing priorities that could be difficult for water suppliers to manage. Indeed, public utilities may also find competing pressures. This was also identified as a potential blocker to WSP implementation (Chapter 4.3.2). Farrell and Hoon (2009) argued that an effective risk culture is dependent on a common understanding of the purpose of the organisation (its basic assumption), and that this may be becoming lost (Chapter 2.3.3). In light of the wide range of competing missions and drivers identified in Chapter 4.2.5, this may be the case in water suppliers. Different teams and departments may have different goals; different visions of the purpose of the organisation; or indeed be trying to juggle many priorities. For example, finance

departments of private organisation may see the purpose to make a profit; water quality departments to ensure safe drinking water; waste water teams to ensure environmental responsibility and so on. This may therefore affect the success and sustainability of WSPs which are intended to be a holistic approach.

Despite employees discussing public health and quality as missions of the organisation, this area was sometimes lacking in formal 'mission' or 'vision statements' of the suppliers, only being explicit in a vision statement of Supplier C, and a mission statement of one of the utilities of Supplier D (Chapter 4.6). Research in other areas has shown that there is often a gap in the perception of missions between managers and non managers (Desmidt and Heene, 2007). One may argue that public health is inherently mentioned within statements of 'social responsibility', 'quality services' or meeting 'consumer expectations', but this may not be sufficient. The Bonn Charter stresses that the main goal of suppliers should be *"good, safe drinking water that has the trust of consumers"* (IWA, 2004). Ireland and Hitt (1992) noted that mission statements can help focus an organisation on *"what really matters, to itself as well as to its stakeholders"*, and a well developed mission statement can help generate commitment throughout the organisation, provide direction and increase performance (Forehand, 2000). But many organisations do not, or poorly develop them; one common error is not considering the needs of stakeholders, and particularly the consumer, and it is challenging to recognise a wide range of stakeholders (Ireland and Hitt, 1992) which could be the case here as the suppliers recognised the challenge associated with engaging a wide variety of stakeholders (Chapter 5.4.1f *"One problem though is that there are lots of authorities that have responsibility"*).

For the modern water company, stakeholders may include governments, regulators, other suppliers, health agencies, consumers, land owners and so on. The public health mission may therefore get lost. If mission statements are a way of establishing direction and performance, neglect of public health aspects could have longer term repercussions that may inadvertently create a message that devalues or de-prioritises initiatives such as WSPs. It is not proposed that other missions and drivers are less important, but perhaps the water safety goal requires renewed visibility in light of newer goals such as financial efficiency, business expansion and environmental protection. With such a wide range

of goals of a modern water supplier, it is leaders who are responsible for making it clear to its employees what its purpose is, and if implementing WSPs, how this fits in.

7.3.2 Past incidents

There was some discrepancy with the effect of past quality related incidents within the suppliers studied. Past incidents and events were sometimes quoted as a driver for implementing WSPs, to avoid such events happening in the future (Chapter 4.3.2). However, the suppliers felt they had experienced few water quality incidents in the past, especially few of public health significance (Chapter 4.6). This may not be as much of a contradiction as it first appears. All suppliers, even those that had functioning WSP projects had some way to go, and experienced challenges in implementation (Chapter 4.3.1). Supplier A's WSP had been postponed; Supplier B had a pilot project but gaining buy-in and involvement from across the organisation was challenging due to uncertainty over the benefit; Supplier C was not implementing WSPs; and Supplier D, although arguably the most advanced still had to implement the approach across its network of utilities. Perhaps therefore, past incidents are a strong driver for WSP implementation, as identified, but due to the fact that the suppliers believed they had experienced few incidents of public health significance, WSPs lacked urgency due to a certain amount of complacency.

This raises a fundamental question of the WSP approach. WSPs are intended to be a proactive, preventative risk management approach. If a supplier needs to have experienced a major incident of public health significance in the past to take them seriously, then would this in turn make them somewhat reactive in nature? This was a concern raised in Chapter 2.3.4, from a quote in Pollard et al. (2007) that showed that leaders paid attention to quality and was concerned that incidents didn't occur in the future, it also highlighted a concern that in order to take risk management seriously, an event of public health significance had to have occurred in the first place. Conway, (2001) acknowledged that through effective leadership, significant safety improvements could be made *"without waiting until a highly public sentinel event forced their hand"* (Chapter 2.3.4). Therefore, successful WSPs can be implemented without experiencing a significant incident, but this will be dependent on effective leadership. Along with WSP promotion, implementers will also need to highlight what could go wrong,

perhaps using published case studies as examples. In doing so, suppliers would be exhibiting 'mindfulness' and attributes of a high reliability organisation (Chapter 2.3.3), "*striving to imagine new scenarios that could occur and protect against these*" (Reason, 1998), and a "*collective preoccupation with the possibility of failure and its root causes*" (Weick and Sutcliffe, 2006). Such aspects were supported by Hrudey et al. (2006) for application in the water sector in order to develop a strong risk management culture and guard against public health incidents (Chapter 2.3.3).

7.3.3   *Formality vs. informality*

There was a range of formality in working practices displayed by the case studies. Whilst relationships between management and staff in Supplier A were quite formal, working practices were informal, with little use of formal systems and processes. This was not however considered to be a problem, the organisation was very small, with only 15 employees and therefore felt that a high degree of formal processes and procedures, or communications mechanisms were not needed (Chapter 4.2.1). This was echoed in Supplier C, often favouring informality over formality in work processes, although acknowledging that this worked well for a smaller company and as it grew in size this was becoming more challenging (Chapter 4.2.3). Supplier B was highly formal in both working relationships and a high degree of targets, formal procedures and processes. Supplier D had formal working practices but fairly informal working relationships. What was clear was that different situations worked best for different organisations, this could be an example of where there is no 'right or wrong' culture (Chapter 2.3.1). Culture change may therefore be more challenging and lengthy in mechanistic cultures. Smaller organisations may find that informality works best (acknowledged by Suppliers A and C, Chapters 4.2.1 and 4.2.3), and that formalising work practices may just create additional and unnecessary paper work; whereas in a larger organisation with many employees spread out over a large geographical area, formal documented work practices and targets may be more necessary. Such differences in formality may be representative of 'formal' mechanistic cultures, which are highly structured, potentially bureaucratic, seek loyalty and obedience and are stable; or less formal 'organic' organisations which are much less structured and therefore more open to change (Burns and Stalker, 1994). Such cultures may however create some varied challenges when implementing WSPs. For example, WSP guidance implied adoption of formal procedures and practices, this

may be challenging for informal cultures, this is supported by the fact that the two suppliers who found implementation most challenging (Supplier A) or were not implementing WSPs (Supplier C, Chapter 4.3.1) were the most informal. Guidance may therefore need to take this into account. However, 'informal' organic organisations may find it easier to change work practices and culture than mechanistic ones. More formal, target dependent organisations may find culture change more challenging and view WSPs as another process to be followed, and neglect instilling the WSP 'culture' within the organisation. This appears to be the case to a certain extent in the most 'formal' and target dependent of the suppliers, Supplier B, who felt that water quality management was OK as it was and although implementing WSPs did not want to burden too many employees (Chapter 4.3.1) and still appeared rooted in end product testing (Chapter 4.6).

7.3.4   *The impact of an engineering culture*

There was a view within the suppliers that trained engineers were superior to those that were not. Non engineers often felt that their opinions were not as valued by those that were, and in some cases engineers themselves made inferences about their superiority (Chapter 4.2). Particularly in Supplier A, employees felt de-motivated that external consultants and engineers were often employed to tell them 'what we already knew', that their opinions did not matter, and it required a trained engineer to make ideas credible (Chapter 4.2.1). Supplier B acknowledged a 'culture clash' between engineers and non engineers (Chapter 4.2.2). Engineers within Suppliers C and D were keen to distinguish themselves as engineers and valued engineers in positions of authority (Chapter 4.2.3).

This raises some interesting points. So far, organisational culture has been considered, and it has been identified that there may be sub-cultures existing within an organisation (Chapter 2.3.1). However, *occupational* cultures also exist. There is a wide body of literature that discusses the culture of engineering. For example, engineers are often considered to be less able to work in teams; poor at communicating with others and put the importance of technology over personal relationships (Bucciarelli and Kuhn, 1997; Robinson and McIlwee, 1991), finding closer identity to their occupation, rather than their organisation (Whalley and Barley, 1997). McIlwee and Robinson (1992) define an

engineering culture through three concepts: (i) an ideology that stresses the centrality of technology and engineers as the producers of this technology; (ii) acquisition of organisational power is the base of engineering success and (iii) an interest in technology and organisational power is required to be interactionally presented in an appropriate form, closely tied to the male gender role. Briefly touched on was the idea of masculine and feminine cultures (Table 2.3, Chapter 2.3.1). Masculine cultures tend to favour assertiveness, competitiveness and ambition, whilst feminine cultures tend to value relationships and quality of life more (Hofstede et al., 1990). This is a culture therefore that focuses on the prestige and status of engineers (for example the engineering 'ring' in Suppliers A and C, Chapter 4.2.1); establishing a work environment that is technically oriented, fascinated with tools and machinery and success based on aggression, competitiveness and technical orientation (McIlwee and Robinson, 1992).

So far the focus has been on the potentially more 'negative' aspects of engineering culture, and some authors have used negative terminology regarding these (such as 'engineer arrogance', Schein, 2004). It is not intended to be overly critical. There are obviously huge benefits in terms of characteristics and skills that engineers bring to organisations. However, there may be some challenges with respect to WSP implementation due to these unique characteristics of engineering culture, learnt through years of training and work. Engineers who find themselves in positions of management may find it challenging to give due consideration to organisational culture and develop the cultural attributes that support WSP implementation identified in Chapter 5 of this study. For example, fostering collaboration, empowering others (who may not be engineers), developing communication and so forth. Such items may conflict with the *basic assumptions* of engineering culture. Engineers may have a different view of a WSP than scientific staff for example; with engineers more focused on the mechanics of treating and physically transporting water and scientific staff more focused on the potential contaminants; microbiology and chemistry of the water. Here communication and understanding is needed, both engineers and non engineers need to focus more on understanding each other's cultures in order to prevent these sub-cultures creating a barrier for WSP implementation:

- Trained engineers are obviously essential, and have acquired vital knowledge and skills during their training, non engineers need to understand their value.

- Non engineer operational staff may however feel de-valued and not as important (Chapter 4.2).

- The issue here is cultural and one of developing internal relationships.

- Engineers need to be more explicit in valuing the opinions of those who are not engineers (but whose day-to-day operation of WTP for example will give them valuable knowledge).

- Communication is key: let non engineers know that their opinions are valued, but explain why consultants are needed. Let staff become more involved in the process, if they feel more valued in their opinions then they will be more committed (Chapter 2.5.2).

7.4 A cultural taxonomy

Chapter 5 described the development of a taxonomy of positive cultural attributes that may support WSP development. Development was based on distilling such items from the WSP guidance, published case studies and safety culture literature. These attributes were then tested during case study visits and additional items identified purely from the empirical evidence. In this section, the resulting list of cultural attributes will be discussed in light of existing wider literature; justification given to their importance; what this means to those implementing WSPs and how such attributes may be developed. How the suppliers exhibited each of the attributes is described in Chapter 5.4.1.

7.4.1 *Managerial commitment*

Managerial commitment is often quoted as important within the guidance but with little detail on how to generate it (Chapter 2.4.1). Declarations of managerial commitment were universal (Chapter 4.4), but what is important is demonstration of this commitment. Statements or sign off of policies and procedures are not sufficient in isolation. There has shown to be a direct correlation between perceived managerial support and employee commitment (Cooper, 2006; Gyekye and Salminen, 2007). Yet there was sometimes a difference in perception in the suppliers visited and sometimes

managerial commitment to WSPs specifically was limited to declarations but without corresponding action, they were seen as a 'nice to have' rather than essential (*"The frills of doing extra stuff"* Chapter 4.3.2).   This may therefore result in decreased commitment from employees.   However, in more general terms, managerial commitment was more developed with provision of adequate resources and training opportunities, although with sometimes a concern that managers were detached from day to day activities.

Godfrey and Howard (2004) describe a decision tree for generating managerial buy-in for WSPs in developing countries. This inspired the development of a more generic process for gaining managerial commitment in all types of suppliers, based on the data presented in Chapter 4. Gaining managerial commitment may come from staff within an organisation, regulators or external promoters of the approach.   If managers are committed, they will have a vital role in ensuring the whole organisation is committed; the literature in safety culture and high reliability organisations supports this – the commitment and actions of leaders will have a direct impact on the commitment of others (Clarke and Ward, 2006; Flin, 2003; Ruchlin et al., 2004).   Indeed, in the company with most developed WSPs, Supplier D, managers were actively involved in the WSP (Chapter 4.3).   A first step in generating managerial commitment would be to understand any reasons for hesitance, for example, in Supplier A, a perceived lack of time and resources (*"We just didn't seem to have the time"* Chapter 4.3.1) and in Supplier C, a lack of understanding and awareness of the approach (*"I don't fully understand the WSP approach,* Chapter 4.3.1). A second step would be to make sure that managers are fully aware of the approach, and all kinds of benefits such as those highlighted in Chapter 4.3.3. If complacency is an issue regarding water quality, it is important to remind managers of what could go wrong in terms of public health and reputation impact. Such lessons may be learned from internal past events, or externally from other suppliers such as those outlined by Hrudey and Hrudey (2004) and reaffirm how the WSP can guard against these. WSP completion may seem like a daunting task, so in gaining managerial commitment it is important to make them aware of any WSP 'building blocks' that are already in place. For many suppliers, the basics of a WSP are already performed, although maybe not explicitly. Once managers buy-in to the approach, they must then understand the influence of organisational culture on the

effectiveness of WSP implementation and empowering and involving staff in the process. Such steps for gaining commitment are summarised in Figure 7.1.
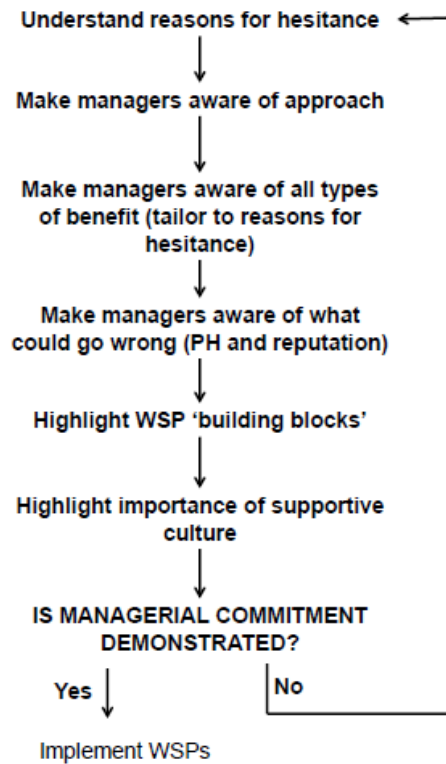
Figure 7.1Generating managerial commitment

7.4.2   Learning culture

Learning was universally important to all suppliers, with a focus on individual education and training, research and development (often with the help of external research institutions) and learning from 'world class' suppliers (Chapter 5.4.1). Despite producing a lot of data, analysis and review of events were limited, due to lack of manpower (Chapter 4.6). This results in little feedback from such information sources to be able to learn from these, particularly in Suppliers A, B and C. Learning types are a defining feature of organisational maturity (Table 2.8, Chapter 2.5.2). Feedback is essential in advancing learning, such as in single loop learning where feedback is used to improve existing processes (Argyris and Schon, 1978). Certain aspects of higher level learning were present in the suppliers, for example the production of information from a wide range of sources such as past experience, research and development, and benchmarking activities, but limited evidence that these were used to test assumptions

and beliefs as required by double loop learning (Argyris and Schon, 1978). For example, Suppliers B and C were particularly concerned with seeking out 'best practice' or what other 'world class' organisations were doing (Chapter 5.4.2). This may raise concerns that practices could be adopted just because these other organisations were doing so, rather than as a result of learning within the organisation. There were also elements of triple loop learning present, where changes are made to cultural elements as a result of questioning and learning, for example organisational structures and practices (Chapter 4.2.2), requiring an understanding of how human and organisational behaviour influence capability (MacGillivray, 2006), essentially an understanding of organisational culture. The suppliers, particularly B ("*there were lots of activities to help people adopt the company mindset and this helped reduce the culture shock, or made it a 'manageable' shock"* Chapter 4.3) and D ("*he was very important to the creation of the culture here of wearing the T shirt"* Chapter 4.4) were very aware of the effect of organisational culture, and tried to determine where changes could be made for the better.

Whilst a commitment to learning was prominent in terms of individual learning, training and research and development for example; more could have been done with regards to organisational learning, questioning current working practices in light of data; past events and benchmarking for example. This could impact WSP development in one of two ways, a lack of an organisational learning culture may hamper WSP development, if the information gained from the approach is not used to make changes within the organisation. However, it could also be argued that where the learning culture is weak, implementation of the WSP may help develop maturity in this area, creating a formal mechanism for feedback and review. Popper and Lipshitz (2000) highlight that an effective learning culture also depends on other aspects such as transparency and accountability and will be greater where there is a high cost of potential error, professionalism and a strong leadership commitment. These are all aspects of culture outlined within the cultural taxonomy and raises the question of whether each element can be considered in isolation.

7.4.3   Internal relationships

In the smaller suppliers visited, small employee numbers were seen as an asset, making risk management easier in Supplier A (Chapter 4.4) and allowing for effective internal relationships in Supplier D (Chapter 4.2.4).   Supplier C was finding increasing employee numbers due to amalgamations a challenge to its preferred culture of informality (Chapter 4.2.3).   This may provide some valuable lessons for larger organisations, to guard against development of silos and encourage working together and develop effective communication channels. The importance of internal relationships should not be underestimated in the success of WSP projects.   As the largest organisation, Supplier B also had more challenge with regard to communication between different departments. One issue identified within Supplier B was the feeling of not wanting to burden others with WSP implementation, who could have had vital input (*"as long as it doesn't give too much burden"* Chapter 4.3.1).

Related to the issue of size and its value in developing internal relationships were that of camaraderie and teamwork; something valued strongly by all suppliers visited.   Work colleagues were often referred to as friends or family and were a strong motivator, not wanting to let work colleagues down, and creating an enjoyable work environment (Chapter 4.5.1). This corresponds to the literature on motivation theory (Chapter 2.4.2). After biological and safety needs in Maslow's hierarchy (Maslow, 1943), 'belongingness' needs are highly important, the need for relationships, friendship and family.   Nohria et al. (2008) also recognises a drive to 'bond', for friendships and fostering collaboration. Such camaraderie and team work is therefore an asset to organisations wishing to implement WSPs, an approach that requires input and involvement from a wide range of expertise.   If such a culture is not present it can be developed and facilitated by leaders.   Camaraderie can help innovation, increase productivity, reduce stress and instil the organisation's mission within employees (Hudson, 2001), all of which will also assist with sustainability of WSP implementation. One can learn lessons of how such camaraderie was developed in Suppliers A-D, such as celebrating success; organising events outside of work (e.g. family days at Supplier B, Chapter 4.5.1); and encouraging team work (e.g. competition entry in Supplier C, Table 4.5d).

7.4.4 Accountability

Accountability and transparency to the consumer is considered vitally important within the literature (Chapter 2.2). The concept of accountability to the consumer arose many times within the results (Chapters 4.3.2; 4.4; 4.6; 4.5.1; 5.4.1) and was a very strong point; manifesting as a desire to go 'above and beyond' what was required by law; a feeling that the regulations were insufficient to ensure public health; considering themselves 'on the front line'; transparency in reporting to consumers, again over and above legal requirements and a customer service focus. All suppliers actively tried to engage the consumer, even Supplier D, who were predominantly bulk suppliers. This accountability was a strong driver for WSPs; Supplier D acknowledged that the main beneficiary of the WSP was the consumer themselves. This links back to the issues raised in developing the public health protection 'ethos' within suppliers, whilst there may be a range of benefits or drivers for WSPs, it is the health of the *consumer* that is the main goal, and the supplier should therefore feel accountable.

7.4.5 Open reporting culture

Related to mindfulness (Chapter 5.4.1l), and a learning culture (Chapter 5.4.1b), reporting of close calls or 'near misses' is considered very important in developing a proactive risk management culture, so that error provoking properties can be removed. This will require an organisation to take the system approach: that is, not blame individuals for errors (or a 'fair blame' culture), but understand that there will be wider system and managerial conditions which will have contributed (Chapter 2.3.3). However, reporting of close calls was weak, and *ad hoc* in all of the suppliers visited (Chapter 5.4.1), with varying degrees of individual 'blame' that may have prevented reporting. If a truly preventative risk management approach is required, then leaders within these organisations will need to implement well defined procedures for employees to be able to identify and report close calls, for these to be learnt from in a systematic way and to feed into the WSP. As Hrudey et al. (2006) stressed for those wishing to create a strong risk management culture, informed vigilance must be promoted and rewarded and close calls must be documented and used to train staff in order to make such events less likely in the future.

7.4.6   External relationships

Engaging stakeholders was considered important by all suppliers, not just in development of WSPs, but in all areas of their work, recognising that by maintaining a strong relationship, things would be easier in times of crisis (Chapters 4.3.2; 4.3.3 and 5.4.1f). In most cases the supplier themselves initiated and drove such relationships, but 'success' often varied with stakeholder group. Whilst Supplier B engaged a wide range of stakeholders on a day to day basis, they were not involved in the WSP, despite being identified as potential members of the team (Chapter 4.3.2). The sheer variety of stakeholder groups, particularly within the catchment was seen as a particular challenge to Suppliers B and D (Chapter 5.4.1f). So whilst engagement with stakeholders was considered important to all, its execution appeared to be a little ad hoc, and success dependent on individuals or groups involved. As few suppliers will have exclusive control over source to tap, engagement of stakeholders is important for WSP development, and is often stressed in the guidance. Whilst it is considered important to develop strong stakeholder relationships for effective WSP implementation (Bartram et al., 2009; Davison et al., 2005; IWA, 2004); some suppliers, particularly B and D, also hoped that the WSP would help develop such relationships (Chapter 4.3.3). Earlier, consideration was given to engineering cultures within an organisation. In Chapter 2.3.2, Guidotti and Ragain (2008) suggested that the main obstacle in working with health care providers is cultural: water professionals are grounded in engineering (driven by precision) and health care providers grounded in medicine (driven by uncertainty) and that successful stakeholder relationships needed to be developed with an understanding of different organisational cultures.

7.4.7   Continual improvement culture

This element is strongly linked to that of learning culture (Chapter 7.4.2), and also mindfulness (Chapter 7.4.12).   All suppliers talked about a continual strive for improvement, including a goal of being 'world class' and a focus on innovation (Chapter 5.4.1g). Yet there was some contradiction in the results, such as a certain degree of complacency over water quality (Chapters 4.3 and 4.5) or a consideration that there was not much to be learnt. Hrudey et al. (2006) maintain that in order to develop mindfulness, a continual improvement culture must pervade the organisation; and the WSP guidance talks about the continual improvement benefits of WSPs (Bartram et al.,

2009). This may be another case where a continual improvement culture will facilitate WSP implementation; but vice versa, development of WSPs may develop the continual improvement culture of the organisation by helping to overcome this complacency and facilitate targeted improvement.

Employees within all suppliers readily talked about the history of their organisations (Chapter 4.1.4), but did not appear past oriented. Past oriented cultures reflect on past glories and successes whilst ignoring future challenges (Schein, 2004), but most organisations when talking about the history, talk about what was wrong, and how they will guard against these errors in the future. Most therefore had a future oriented, continual improvement culture, although spurred on by the problems of the past. For example, past events were often considered a driver for WSP implementation in those that were developing them (Chapter 4.3.2). Future oriented cultures place a high emphasis on vision and ideas (Schein, 2004). As WSP approaches are intended to be proactive, anticipating future challenges and guarding against them, it is important to develop a future oriented culture.

7.4.8 Empowerment

By empowerment, we mean giving ownership to and involving non managerial staff in decision making, and providing recognition for work (Table 5.2, Chapter 5.3). The value of empowerment was explicitly discussed by managers in Supplier A, yet employees felt sometimes undervalued (Chapter 4.2.1). Empowerment with specific regard to WSP development was lacking in Suppliers A-C. The only company that actively involved all levels of staff from a cross section of the organisation in the WSP was Supplier D (Chapter 4.5.2), also the one that had the most developed WSP. Supplier A did consult 'front line' staff, but disregarded their input, did not communicate the task well (Chapter 4.4) and employees could not remember the exercise (Table 4.5d). Supplier B did not want to burden others, and at the time of the visit, the WSP 'team' was very small (Chapter 4.3.1). Supplier C did not implement WSPs at all (Chapter 4.3.1). We might therefore infer from this that involvement of a wide range of levels and departments is valuable in WSP projects. This supports Hrudey et al. (2006) who advocated that operational personnel should understand their role in protecting public health and also be afforded the status, training and remuneration

commensurate with such responsibilities when trying to develop a strong risk management culture (Chapter 2.3.3). If such personnel are given this status, and are dedicated to their role as guardians of public health, then they should therefore be involved in such approaches as the WSP. Empowerment in this sense is closely linked to leadership, two of Kouzes and Posner's (2002) five 'practices' of exemplary leadership are related to supporting and involving others, 'enabling others to act' and 'encouraging the heart'.

The literature (Chapter 2.4.2) has shown that motivation and commitment can be increased through involvement, valuing the input of staff and treating them fairly, by empowering them (Adams, 1963; Herzberg et al., 2004; Maslow, 1943; Nohria et al., 2008). Organisational commitment to WSPs was a weaker area (Chapter 5.4.1), and that in many cases operational level staff had limited involvement in the WSP process, especially where WSPs had been abandoned or experienced challenges (Chapter 4.3.1). Operational staff deal with the system on a day to day basis, and will be the implementers of WSPs. Therefore empowerment, in the form of involving such staff, giving ownership and prestige should be an important consideration for leaders wishing to sustainably implement WSPs.

7.4.9 *Organisational commitment*

The WSP guidance (Bartram et al., 2009; Davison et al., 2005) often talks about managerial commitment but commitment of those doing the work is also essential, and was lacking in those suppliers that were least developed in terms of WSP development (Chapter 4.3.2). Commitment and motivation occurred as a result of: a feeling of accountability; incentives; training; an enjoyable work environment; receiving recognition; a feeling of importance; empowerment; benefits; celebrations of success; internal relationships; effective communication and challenge in ones work. However there were factors that de-motivated staff such as a difficulty to progress; opinions not heard by management; a lack of recognition and reward; the global financial crisis and a plateau effect of motivation following improvements (Chapter 4.5.1).

Meyer and Allen (1991) discuss a three component conceptualisation of organisational commitment and motivation (Chapter 2.4.2). Commitment arises because of: (i)

affective commitment, where there is a positive emotional attachment to the job or organisation and the individual *wants* to be committed; (ii) continuance commitment where there is a high cost of leaving, so the individual feels they have to be committed; and (iii) normative commitment, where the individual feels they have an obligation to the organisation and therefore ought to be committed. These components can be applied to the case study results (Table 7.1).

Table 7.1 Organisational commitment (based on Meyer and Allen, 1991)

Affective	• Employees wanted good quality water themselves, and also for friends and family who lived in the area (A). • Non-monetary benefits, such as celebrations of success, giving staff flexibility in work patterns and giving staff variety in their jobs (A,B,C,D) • Cultural factors such as team support, enjoyment at work, and the feeling that staff were providing a service (A,B,C,D) • Camaraderie, wanting to work well for other team members, pulling one's weight (A,B,C,D) • Empowerment and provision of information (A,B,C,D) • Feeling that they were appreciated by management (A,B,C,D)
Continuance	• Small town feel (A) and Private (B, D), managers would be 'in the firing line' from residents if something went wrong and hence a strong incentive to do the best they could. • Pay progression and opportunities for career progression (A,B,C,D) • Monetary bonuses, such as corporate balanced scorecard award programme (B,C, D).
Normative	• Training and continuing education needed for operator licenses or requirement from supplier (A,B,C,D) • Camaraderie, wanting to work well for other team members, pulling one's weight (A,B,C,D)

Affective commitment to the job and organisation was most prevalent, and thus may be important when considering WSP awareness and advocacy, how to make staff *want* to do WSPs, rather than telling them they *have* to. This is a positive point, Meyer and Herscovitch (2001) identified affective commitment as most effective in generating focal behavior (Chapter 2.4.2). Affective commitment will also be more related to creating a supportive organisational culture, creating an environment where employees want to be committed rather than merely providing monetary incentives for example, allowing for more sustainable commitment. However, in terms of organisational commitment to WSPs specifically, this was an area that was lacking, particularly in Suppliers A, B and C (Chapter 4.5.2). Suppliers may therefore want to relate WSPs to such examples of affective commitment to one's job when promoting them.

7.4.10 Proactive and preventative

In Chapter 7.4.7, the continual improvement attribute was discussed, this is related to a proactive and preventative culture. It was shown that the suppliers were generally future oriented, and by having this foresight, and consideration for future challenges, one would expect implementation of proactive and preventative measures as described in Chapter 5.4.1.

However, despite some proactive measures such as preventative maintenance, without a true risk management culture, an organisation could not be described as proactive. This is a point supported by Hudson (2003) work on applying the lessons of HROs to health care – even with some proactivity, without systematic risk management, an organisation can only be described as reactive, using Westrum's (2004) levels of safety culture (Chapter 2.5.2). A proactive culture, that tries to anticipate safety problems before they arise, appears at level 4 of Parker's levels of safety culture (Parker et al, 2006), and is close to achieving high reliability status (Hudson, 2003). All suppliers would have benefited from advancing their WSPs further, some to a lesser extent than others. When asked about ensuring protection of public health, respondents still to a certain extent felt that end product monitoring helped ensure public health protection, particularly Supplier B, who still appeared rooted in end product testing, proud of the additional volume of samples and sampling points that they used over and above regulatory requirements (Chapter 4.6). More work may be required here to move to a preventative risk based culture, and avoid an over-reliance on end product testing which can still present serious flaws in the process (Hamilton et al., 2006). A proactive and preventative culture is therefore needed to ensure the WSP is not just a token gesture, but WSP implementation can also help develop proactivity.

7.4.11 Leadership and advocacy

In Chapter 2.3.4 we learned that leaders are instrumental in bringing about culture change; this seems to be supported by the case study data (Chapter 4.4). The City Engineer in Supplier A was credited with bringing about positive change in terms of the prioritisation of water quality. Leaders in Supplier B were acknowledged to manage culture change and ease transition from government to private ownership during changeover. Leaders in Supplier D were believed to be instrumental in creating the

culture of 'wearing the shirt' amongst employees. Leaders were therefore capable of instilling change within the suppliers visited, and where WSP implementation was not as successful, this could reflect the importance of the approach as perceived by leaders rather than a 'lack of time or resources', as discussed in Chapter 7.2.1. Indeed, this was acknowledged by leaders themselves in the two suppliers who were yet to have a working WSP, Suppliers A ("*if I personally insisted it would have gotten done*" Chapter 4.3.2) and C (*"I don't fully understand the WSP"* Chapter 4.4).

Chapter 4.4 compared the case study results with Kouzes and Posner's (2002) five practices of exemplary leadership and Kotter's leadership errors (Chapter 2.3.4), in order to understand what positive and negative aspects of leadership were present in each supplier and how these could have impacted WSP implementation. It is therefore important to be mindful of Kotter's errors, and Kouzes and Posner's practices of exemplary leadership and understand the importance of leadership in WSP promotion and implementation activities. Leaders will therefore need to:

- Be aware that the actions of leaders are instrumental in bringing about change.
- If the WSP is believed to be useful, then it should be highlighted as a priority, as demonstrated by Supplier D who began implementation before publication of the WHO guidelines (Chapter 4.3.1).
- A powerful 'guiding coalition' needs to be developed, the WSP team needs to have the necessary authority to be able to implement change (Bartram et al., 2009), recognised as lacking by Supplier B at the time of study (Chapter 4.5.2).
- A clear vision for the WSP, including reasons for implementation is needed and communicated to all staff.
- Assess what is blocking effective WSP development (Chapter 4.3.2), such as a lack of resources or poor communication and resolve these.
- Plan for, and celebrate short term wins to generate motivation, for example, a pilot WSP project at a WTP that will show the greatest improvement, as demonstrated by Supplier B (Chapter 2.4.1).
- Anchor changes in corporate culture: for example, if formal targets and recognition are important, as in Supplier B (Chapter 4.2.2), then ensure that all necessary staff have WSP duties within their targets.

- Ensure that the WSP works for the organisation and do not blindly follow the methods used by others ("*we started looking at the Australian model and I found it frustratingly hard to relate*" Chapter 4.3.2).

7.4.12 Mindfulness (of public health protection)

The term 'mindfulness' was adopted from Hrudey et al. (2006), who applied the work on HRO's by Weick and Sutcliffe (2006) to the water industry. Here the term will refer to overcoming complacency in relation to public health and water quality. As seen in Chapter 4.6, employees tended to be able to espouse water quality and in some cases public health protection as a major goal of the organisation. However, a concern was also highlighted that the public health responsibility was at risk of being taken for granted, such as complacency over the quality of water supplied; competing drivers and a lack of explicit reference to public health within statements of missions or goals (Chapter 4.6). Whilst other goals may be important, Hrudey and Hrudey (2004) warn against viewing public health protection as equivalent to other business priorities, doing so may allow for incidents to occur. It is understood that none of the suppliers would knowingly or deliberately neglect public health. There is however a risk of becoming complacent under normal operating conditions when quality is generally good, under the increasing and competing (albeit legitimate) priorities of modern water suppliers such as latest political, media, regulatory and environmental pressures to manage a wide range of variables such as leakage, drought, bills, flooding and consumer satisfaction, whilst doing so in a cost efficient manner or returning a profit in the case of private companies.

Taking the public health role for granted, or losing sight of it may be hastened by the increasing turnover, and difficulty in finding staff as highlighted by Supplier A (Chapter 4.2.1). Most of the suppliers had benefited from long serving members of staff (Chapter 4.2), but there may be a risk that if and when turnover increases this inherent knowledge will get lost. Whilst most employees are aware of their role in public health protection, there were limited formal espousals of such commitment in mission statements (Chapter 7.3.1), or explicit training in this area (Chapter 4.6). 'Softer', cultural issues were also important in demonstrating commitment to public health and thus may be influential in leadership advocacy of projects such as WSPs. For example, demonstration of caution

when it came to water safety through setting stricter limits than those required by regulation; espoused commitments to health; proactivity; development of stakeholder relationships; focus on training; accountability and awareness and enthusiasm were all considered important (Chapter 4.6).

Particularly in Suppliers A and C, there was a high level of awareness regarding occupational health and safety or security risk (Chapters 4.2.3 and 4.6). This was often at the forefront of people's minds. Even when asked specifically about public health risk, responses were given regarding health and safety risk. Granted, occupational health and safety and security risk are also important, so perhaps these suppliers, if wishing to implement WSPs and develop 'mindfulness', could learn from within the organisation as to how occupational health and safety was promoted and made so prominent in employee's minds, and use such methods when considering public health risk. Supporting this, there are many resources available to organisations wishing to manage health and safety risk and develop safety culture (Chapter 2.3.4). It is important that suppliers do not lose sight of their public health responsibility, even in areas where water quality is good, things still can, and do go wrong (Chapter 2.2). This mindset should be reflected in the WSP, and the WSP, if implemented correctly can help achieve this, and being more explicit in declaring the public health protection role will also help staff understand the reasons for WSP adoption.

7.4.13 Image and reputation; competitiveness

Explicitly derived from the case study data, being concerned about the organisation's image and reputation and competitiveness were important cultural features that prompted adoption of new initiatives and drove a continual improvement culture (Chapter 5.4.2). However, caution must be taken here, image and competitive advantage may be increased even with substandard practice adoption, for example, merely by stating the WSP is being implemented. Staw and Epstein (2000) identified that increased reputation and competitive advantage could be increased in association with popular management techniques, even without a corresponding increase in performance. Tolbert and Zucker (1996) identified three stages for the implementation of a new practice (Chapter 2.3.4), and it was recognised that WSPs could be considered in the 'semi-institutionalisation' stage, where knowledge of the practice is widely diffused but

it has a short history and is not yet permanent, possibly with a 'fad' quality, it may therefore be considered a fashionable approach. Staw and Epstein (2000) warns of 'fashion cycles' in adoption of new procedures, where the goal is for image and competitive advantage therefore there is a risk that new procedures such as WSPs will be adopted whilst they are 'fashionable', but are then dropped in light of new, more 'promising' alternatives. There is a concern that in organisations striving for 'world class' status, practices of other utilities might be adopted without questioning their suitability, either through competition or to increase reputation (Chapter 5.4.1). Such attributes can be supportive but as long as this is demonstrated and not just used for public relations campaigns; as has already been discussed (Chapter 7.2.4), high levels of internalisation as well as implementation are desired. Despite these cautions, concern over reputation and competitiveness can be strong and beneficial attributes, Greyser (1999) identified a number of factors that may be relevant in the discussion of WSP implementation; firstly that credibility or reputation is a central link between company behaviour and public confidence. The Bonn Charter stresses that having the trust of the consumer is essential. Secondly, a good reputation can mean support for the company in times of controversy; therefore one could hypothesise that a supplier with a good reputation will have more support from stakeholders if a water quality event were to happen, which could lead to faster response and a better outcome for the consumer. Thirdly a good reputation can lead to increased organisational commitment, as a result of the pride felt in working for that organisation.

7.5 Developing a supportive WSP culture

This study used a theory building approach. Eisenhardt (1989) identified one of the strengths of building theory from case studies as that emergent theory is likely to be testable with constructs that can be readily measured (Chapter 3.1). This has been demonstrated through development of the 'cultural taxonomy' (Chapter 5) and related tools (Chapter 6), constructs that can be used for further testing of the theories developed in this study. Figure 7.2 shows how use of the data has been focused into practical tools; beginning with broad reviews of the literature, to case study data, solidifying a taxonomy of cultural attributes and using these in development of tools.
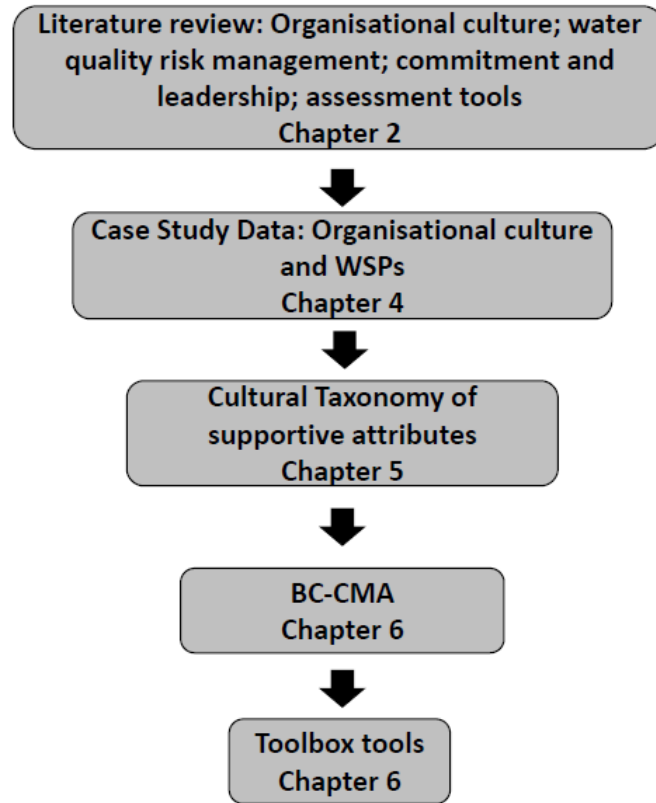
Figure 7.2 Diagram showing narrowing of scope

The results show that organisational culture can have an impact on the success of WSP projects, and this may be an area that is not recognised, or neglected by suppliers. Too often failures of WSP projects may be attributed to a lack of time, human or financial resource (Chapter 7.2.1); not being 'responsible' for a particular part of the supply chain, or a lack of involvement from stakeholders for example (Chapter 5.4.1). In reality, these may be representative of deeper, institutional contradictions to the WSP approach that may not be easily recognisable to those within these organisations. It has been shown that organisational culture can act as a filter to the uptake of new practices (Johnson, 1992); that deeper basic assumptions of organisational culture may be hard to define for members of that culture (Schein, 2004); stakeholder relationships may be challenging due to cultural differences (Guidotti and Ragain, 2008) and organisational culture can be difficult and time consuming to change (Schein, 2004). WSPs are intended to be a holistic way of working, and require a shift in working culture, away from a traditional reliance on end product testing, to a preventative, mindful, risk management culture (Chapter 2.3.5). Guidance is limited in this area and in cultures

grounded in engineering (Chapter 7.3.4), the development of tools such as those described in Chapter 6.5 is essential for suppliers to explore this potentially new area, and help ensure that the WSP approach may be engrained within the culture of the organisation, be sustainable and not forgotten as a 'fad' (Tolbert and Zucker, 1996). Leaders are instrumental in creating and changing culture (Schein, 2004), but they need to be aware of what is limiting WSP development, and what areas they need to work on. Presentation of the cultural taxonomy (Chapter 5) may therefore act as a framework for leaders, and provide some guidance on how to improve organisational culture.

The BC-CMA is not purely a WSP benchmarking tool, instead the BC-CMA deals with cultural maturity and the capability of an organisation's culture to effectively internalise and implement the goals of the Bonn Charter, including WSPs. Such tools, and benchmarking can help develop a continual improvement culture (Rouse, 2007), as recognised by the cultural taxonomy. Intended to be simple to use, the BC-CMA should help promote thought into organisational culture. A weakness of the tool is the lack of external verification and a risk of respondents over-scoring due to a desire to be seen in a more positive light; 'level envy' as Bach (1994) termed it. However, this weakness can be overcome in several ways including communication: ensuring that the purpose of the tool is well communicated to the respondent, that the results will be for internal use only to assist in improvement measures and that there is no benefit from exaggerating scores. Also, suggesting that the tool is completed by a cross-section of staff, from different levels in the organisation to determine an average maturity level may help.

7.6 Summary

WSPs should be viewed as a mindset, a new way of working, rather than purely following a new 'procedure'. Organisational culture is critical and likely will need to be modified to accommodate. This change will take time and leaders are instrumental. Leaders must however guard against common errors and ensure motivation and enthusiasm of employees. Managerial commitment is vitally important to the success of initiatives such as WSPs but it should be noted, as Soltani et al. (2005) identified, the effect of managerial commitment does not exist in isolation, and that the success of a

project will be dependent on many elements 'blended and balanced with the existing organisational context', including organisational commitment where empowerment and recognition are proportional to the important job employees do in ensuring public health protection (Hrudey et al., 2006).

Complacency over water quality; not giving staff enough recognition; competing drivers and a general feeling that WSPs were not essential meant that WSP implementation lacked urgency and so were not as successful as they might have been. This complacency could be attributed to the suppliers not experiencing significant incidents in the past; feeling they are above average in the region and wanting to be the 'best'. To protect against tokenism, it may be beneficial to highlight what can go wrong in conjunction with promoting WSPs in order to create the sense of urgency needed and create a 'mindful' culture, rather than viewing WSPs as a 'nice to have'. These observations support Hrudey *et al*'s (2006) comments on the risks associated with complacency, and echoes the work on 'mindfulness' - organisations that have a collective *"preoccupation with the possibility of failure and its root causes, a reluctance to oversimplify, is sensitive to operations, committed to resilience and deferential to expertise"* (Weick and Sutcliffe, 2006). Hrudey et al. (2006) call for recognition of staff, informed vigilance, understanding of the system and public health responsibility, multi barriers, reporting of close calls and an overall continuous improvement mentality which was important to all suppliers. Customer service and competition, be it real or perceived, were prevalent and WSPs assisted in these goals and vice versa; a culture of 'wanting to be the best'.

From this discussion a number of insights have arisen, and theory developed and those wishing to implement WSPs are urged to take into account:

1. There are a number of **positive attributes of organisational culture** that will support sustainable implementation of WSPs. Suppliers wishing to implement WSPs should be aware of the influence of organisational culture and the elements of the cultural taxonomy: (i) managerial commitment; (ii) learning culture; (iii) internal relationships; (iv) accountability; (v) open reporting culture; (vi) external relationships; (vii) continual improvement culture; (viii) empowerment; (ix) organisational commitment; (x) proactive and preventative;

(xi) leadership and advocacy; (xii) mindfulness; (xiii) image, reputation and (xiv) competitiveness. A good, supportive culture will assist in sustainable WSP implementation, but vice versa WSP implementation may help develop culture.

2. Failure to successfully implement WSPs due to a perceived lack of time, resources or assistance may in reality be representative of **deeper, cultural contradictions and barriers**. Such barriers may include differing internal cultures; lack of recognition; poor communication and internal relationships; competing priorities; complacency over quality and formality of work practices. Leaders should be mindful of cultural blockers such as these and make effort to remove them.

3. Protection of **public health should be a primary driver** of WSP implementation and mission of the organisation as a whole. There are many additional benefits and reasons for adopting WSPs and the public health benefits of WSPs may be hard to see, particularly where water quality is currently good. These other 'added value' benefits may in such cases help generate buy in but should not conceal the primary driver of public health protection.

4. Awareness of organisational culture is important and through **effective leadership culture may be modified to ensure sustainable WSP implementation**. Where the drive for WSPs comes from an external agency, suppliers should be encouraged to internalise the approach, to avoid tokenism. A number of tools have therefore been developed to assist leaders in creating such a supportive culture.

8   CONCLUSIONS AND RECOMMENDATIONS

8.1 Introduction

This chapter offers conclusions and contributions to knowledge in relation to the original aims and objectives of the research outlined in Chapter 1 (Chapter 8.2); reiterates the new insights developed and novelty of the research (Chapter 8.3) and critically reviews this research (Chapter 8.4). It also offers suggestions for further research to develop this subject area further (Chapter 8.5) and makes practical recommendations to members of the water industry that are wishing to implement WSPs (Chapter 8.6).

8.2 Conclusions and contribution to knowledge

In making concluding comments, reference is made back to the original aim: to explore the relationship between organisational culture and WSP implementation and how the role of public health protection is perceived throughout the organisations studied. In order to achieve this aim, a number of objectives were defined:

Objective 1: Investigate organisational culture and WSP development in water suppliers of varying size, development and structure to look for examples of best practice or barriers to effective implementation.

Achievement of objective 1 is described in Chapter 4. Important insights generated here are that although WSPs have been promoted since 2004 (Chapter 2.1), the suppliers were still experiencing sometimes significant challenges and uncertainty in implementation (Chapter 7.2.1). In such a technically oriented field, lack of time, resources and assistance may be frequently quoted as reasons for not implementing, or failures in implementation of WSPs. In reality, the research shows that there may be deeper, cultural resistance to change such as a lack of awareness; uncertainty; lack of recognition preventing commitment; complacency over quality; poor internal relationships; competing priorities and contrasting internal cultures. It is therefore important to understand these (Chapter 7.2.3). In a culture dominated by engineering,

this may be a new and challenging area for suppliers to understand and deal with (Chapter 7.3.4).

Objective 2: Develop a taxonomy of positive cultural attributes, test and add to this iteratively during case studies generating empirical data.

Chapter 5 describes the development of a taxonomy of positive cultural attributes as defined in Objective 2. As identified by fulfilment of Objective 1, there are a number of potential organisational cultural barriers to WSP implementation. It is therefore important to understand what positive elements of organisational culture can support sustainable WSP implementation, which have been defined in Chapter 5. In doing so, the notion of a supportive culture has been broken down into discrete, more manageable elements making the subject easier to understand and therefore potentially easier to modify. The taxonomy draws on assumptions of cultural elements outlined in the literature and explicitly tests them within real world settings and also identifies cultural elements explicitly from the case study data. Something not recognised by the current WSP literature is the importance of image and competitiveness (Chapter 7.4.13) to suppliers which tended to correlate with increased interest and adoption of WSP and WSP related activities cases presented. This shows that the suppliers tended to view such activities as a way of increasing reputation and assisting them in becoming 'world class' organisations.

Objective 3: Identify and investigate how the public health role of suppliers is perceived and advocated within these organisations, and other underlying organisational cultural influences that may affect levels of commitment.

Chapters 4 and 5 discuss how the public health role of suppliers is perceived and advocated and also other cultural factors that may affect levels of commitment. The primary aim of a WSP should be the protection of public health (Chapter 2.1.1). Therefore it is important to understand how suppliers perceive their role in public health protection, if they do not consider themselves protectors of PH then how can WSPs be implemented effectively? The data shows that whilst public health is still on the agenda, particularly espoused by individuals, there is a risk that it is becoming taken for granted, particularly by its absence in corporate mission statements, and complacency

over water quality (Chapter 4.6). It was also identified that there were a wide range of drivers and perceived benefits for WSPs (Chapters 4.3.2, 4.3.3 and 7.2.2). In combination with the wide range of missions of the modern water supplier (Chapters 4.2.5 and 7.3.1), the main purpose of the WSP may therefore be at risk of being neglected in favour of other potential benefits of WSP approaches. The research identified what made employees of the suppliers studied committed and motivated, and what acted as de-motivators in their roles (Chapters 4.5.1; 7.4.3 and 7.4.8). Organisational commitment to WSPs was somewhat lacking, and a blocking factor to effective WSP implementation (Chapter 4.5.2). It would therefore be beneficial for leaders to learn from what motivates employees when trying to promote WSPs and generate interest (Chapter 7.4.9)

Objective 4: Develop a 'Bonn Charter Capability Maturity Assessment' that will enable investigation of objectives 1 and 2 and additional tools to assist suppliers in assessing and developing organisational culture that supports Bonn Charter implementation.

Achievement of Objective 4 is presented in Chapter 6. This chapter presents the practical implications of the research, as has been discussed in Objective 1, the notion of organisational culture may be new and challenging to suppliers, so in the development of tools, suppliers can be assisted in developing their organisational culture with respect to WSPs. No existing tool fitted the brief of a self assessment tool to look at cultural maturity with respect to Bonn Charter adoption (Chapter 6.2.1) and therefore a new tool was developed. The taxonomy developed in Chapter 5 also acts as a framework that could be used in further academic study of organisational culture and WSP implementation.

Achieving the above aim and objectives is important because there is a need for risk based approaches such as WSPs to ensure protection of public health, in both developed and developing nations (Chapter 2.2). WSPs are gaining momentum and interest amongst not only water suppliers, but regulators, aid agencies, researchers and consultants and are fast becoming accepted as best practice (Table 2.2, Chapter 2.1). However, implementation of WSPs will often require a new way of working, moving away from a traditional reliance on end product monitoring to a preventative risk

management approach (Chapter 2.3.3), this will therefore likely require a shift in organisational culture (Chapter 2.3.5). Understanding organisational culture barriers and limitations to WSP development, as performed in this research is therefore vitally important in taking steps to ensure sustainable implementation. As WSPs are gaining popularity, a wide range of additional benefits and drivers were recognised in the suppliers studied (Chapters 4.3.2, 4.3.3 and 7.2.2) in addition to the wide range of missions, priorities and functions of modern water suppliers (Chapters 4.2.5; 7.3.1). There is therefore a risk that the primary aim of a WSP, the protection of public health, or indeed the main aim of a water supplier: 'good safe drinking water that has the trust of consumers' (IWA, 2004) may increasingly (although not intentionally) take a back seat, with other drivers such as cost savings taking priority (Chapters 4.3.2; 4.3.3; 4.6; 7.2.2). In understanding culture (Chapters 4 and 5) and developing a culture that avoids complacency (Chapters 5 and 6) in this area, added value benefits can still be important whilst keeping the primary aim, public health protection, at the forefront of employees minds and the main goal of the WSP. To the author's knowledge, this is the first formal evaluation of the role of organisational culture in WSP development; explicitly researching the interaction of organisational culture and WSP implementation. Until recently, work has been focused more on the technical aspects of implementation.

Here it is important to refer back to Chapter 1.6, and restate that a theory building approach has been used, hypothesis and theory are not developed before undertaking the research to be proved or disproved, but arise as a result of the research, providing valuable insights and observations that contribute to knowledge within the subject area. The work is a piece of social sciences research, based mainly on qualitative methods using a case study approach. The work is based more in the interpretive and critical social sciences that aim to analyse socially meaningful actions, based on the richness and depth of data that are provided in qualitative data produced through interviewing people; allowing an empathetic understanding and interpretation of culture (Chapter 2.6.1; Neuman, 2003).

Analysis has been mainly explanatory in nature, using explanation building approaches to make sense of the data and to generate new theory; via a combination of inductive (theory building) and deductive (theory testing) reasoning (Chapter 2.6.4). In this type

of research therefore, a hypotheses and theory are not developed prior to the research but rather arise through analysis of the data. Using multiple case studies as presented in this work, the aim was not for statistical generalisation as would be the case with positivist research, but for *analytic* generalisation where theory that has arisen in analysis of previous case studies is used as a template to compare with results of subsequent cases and so on – a theory *building* approach (Chapter 3.3.1).

8.3 Summary of novelty

The novelty of this research project as concluded in the previous section can be briefly summarised as:

- To our knowledge, this is the **first formal evaluation of the role of organisational culture in WSP development**. It explicitly researches the interaction of organisational culture and WSP implementation. Until recently, work has been focused on more technical aspects of implementation.

- It identifies deeper, **cultural barriers to effective WSP development** that should be an important consideration to WSP promoters striving for sustainable implementation.

- The research identifies and empirically tests a **taxonomy of positive organisational culture attributes** that contribute to successful WSP implementation (including: managerial commitment; learning culture; internal relationships; accountability; transparency; external relationships; continual improvement culture; empowerment; organisational commitment; proactivity; leadership and advocacy and mindfulness). It also adds two empirically derived attributes: Image and competitiveness.

- It identifies that in relation to a wide range of organisational missions, there are also a wide range of drivers for undertaking WSP projects and a wide range of perceived benefits. **There is a risk that the primary aim of WSPs (protection of public health) and of a water supplier (good safe drinking water) are beginning to be taken for granted** or other drivers take over. It is important to ensure that the public health motivator remains the primary one, supported by other 'added value' benefits.

- Practically, the research describes the **development of new tools** and a 'capability maturity assessment' to make suppliers aware of the subject of organisational culture and assist in developing a supportive culture.

8.4 Critical review

The scope of social science research, using qualitative methods and theory building methodologies can become enormous, and remaining focused is essential to avoid neglecting detail and producing long and unmanageable research projects and outputs (Chapter 3.5.1). It is however important to understand the limitations of the research undertaken. A number of topics arose when critically reviewing the work presented in this thesis.

Firstly, throughout the research there has been a focus on whether the existence of a supportive, or 'good' culture will in turn enable development of a 'good' and sustainable WSP. One could argue that the opposite could also be true, that implementation of WSPs in itself could develop organisational culture. This was an assumption that MacGillivray et al. (2007a) took, disregarding culture as an attribute in development of the RM-CMM; maintaining that culture change was a *consequence* of process improvement and not a prerequisite. However, other scholars disagree; Johnson (1992) for example believes that the uptake of new practices and performance are affected by organisational culture; and therefore by modifying culture, performance and uptake may be modified. One could hypothesise therefore that both cases could be true, and a culture modification exist in both directions (Figure 8.1), that culture influences WSPs and vice versa WSPs influences culture.
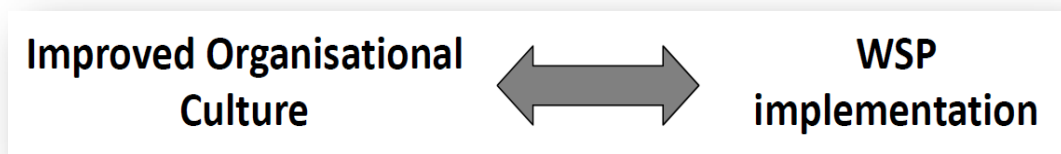
Figure 8.1 Relationship between organisational culture modification and WSP implementation

Secondly, one may argue that the insights discussed in this work are just an example of 'good' organisational culture, applicable to any kind of practice adoption, not specific to WSPs. Undoubtedly, such attributes will not be solely applicable to WSPs, and will likely deliver additional benefits, for implementation of other initiatives. If the WSP approach is intended to be truly holistic and involve a cross section of staff, departments and include a variety of processes (Chapter 7.2.1), then the generality of cultural benefits should be an asset. However, this study is unique in that such cultural elements have been investigated with specific reference to WSP implementation, and certain aspects discussed have particular relevance to WSPs such as the perception of past incidents (Chapter 7.3.2); formality of working practices (Chapter 7.3.3); different internal cultures (Chapter 7.3.4); and perception of public health protection (Chapter 7.4.12). Successful implementation of WSPs, perhaps more than most practices, will require a culture shift (Chapter 7.2.1) and as a result insights of supportive organisational cultures are particularly vital here. What is especially relevant is an awareness of culture, so that those wishing to, can tailor promotion and implementation appropriately so that it works in that given organisational culture.

Thirdly, the influence of national cultures have not been considered in this research. It was recognised that the national culture of a country or region would influence organisational cultures being studied and therefore it has been studied implicitly (Chapter 2.3.1). To explicitly study such differences in detail would have made the scope too broad, and duplicated research being undertaken in related work[16] and may also be an interesting topic for future research.

Finally, in relation to the taxonomy of supportive cultural elements, one may question whether these elements can be considered in isolation, or are they all intertwined, for example in Chapter 7.4.2, consideration was given to the work of (Popper and Lipshitz (2000) who identified that an effective learning culture also depended on other aspects such as transparency and accountability. Many aspects of the cultural taxonomy are closely linked, such as a proactive and preventative culture, and a continual improvement mentality. It is not implied that each element is unique and independent,

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[16] A related research project is being undertaken also in relation to the Bonn Network: 'Sustainable implementation of risk management systems in developing countries – the influence of culture', Yahya Omar.

they will be linked. However breaking a 'supportive' culture into discrete elements will make culture change and development more manageable, and easier to understand. It should be made clear that due to the relationship between the elements, one area should not be neglected in the hope that others will compensate.

8.5 Suggestions for further research

In light of the critical review (Chapter 8.3), and reflection of the work presented in this thesis, a number of suggestions for further research have been identified, in order to develop this subject area further:

- Investigation into whether implementation of WSPs modifies organisational culture (as questioned in Chapter 8.3) using similar methods described in this thesis to allow comparison with the results described. This will help to determine if efforts should be made to modify organisational culture before undertaking a WSP project, or if this can be done concurrently with similar effectiveness; thus further determining the usefulness of the BC-CMA.

- The cultural taxonomy provides testable constructs that can be used to further test the cultural taxonomy as suggested in methodology described by Eisenhardt (1989), in a wider variety of supplier types and levels of WSP implementation. This will allow refinement of the taxonomy to ensure it applies to a wider range of supplier types and potentially identify further empirically derived attributes.

- Further testing and refinement of tools discussed in Chapter 6, in a wider variety of supplier types and levels of WSP implementation. The BC-CMA could be used in more quantitative assessments than those described in this thesis, allowing comparison with a greater number of suppliers, rather than the relatively limited number that in-depth case studies allow. The lessons learned regarding poor response rate should however be considered to ensure a greater number of respondents.

- Investigation into the effect of differing occupational cultures (discussed in Chapter 7.3.4) within an organisation to determine if there are differences in how such cultures perceive WSPs (using occupations as case studies, for example engineers; scientists; operators); and if so, what implications this has

for WSP implementation. Such insights may allow suppliers to see how best to manage such internal cultures and allow for improved internal stakeholder liaison, and therefore improved WSP implementation.

- Investigation into the effect of differing national cultures and WSP implementation, for example using suppliers in different countries owned by a multinational company that is advocating WSPs as a case study to determine if the culture of the country the supplier is situated in has an effect on the way WSPs are implemented. Such insights may help in tailoring WSP communication and promotion activities accordingly.

8.6 Recommendations to the water industry

Finally, in light of the work presented in this thesis, a number of recommendations can be made to those wishing to implement WSPs, either water suppliers themselves, or external agencies promoting WSPs or assisting water suppliers. Primarily, the author urges developers and promoters to consider the subject of organisational culture and how it can impact on effective WSP implementation and realise that WSP implementation may require a shift in organisational culture and be prepared for this. Suppliers should be aware that a perceived lack of time and resources may actually be representative of deeper cultural barriers to development. Developers should recognise that WSP implementation is more than just following a set of instructions, it will require instilling a water safety 'culture' within the organisation; this may be of particular relevance to external implementers that will eventually leave the supplier to its own devices. For organisations wishing to generate executive buy-in, employees may wish to consider the following in an awareness programme:

- Understand the reasons for managerial hesitance.
- Take into account range of drivers and ensure managers are made fully aware of the approach.
- Demonstrate benefits from case studies and/or pilot WSP projects.
- Ensure managers are aware of what could go wrong to avoid complacency and establish a sense of urgency over WSP implementation.

- Understand that improved risk management is likely to lead to reduced violations.

- Highlight WSP "building blocks", such as quality certifications that are already in place.

- Do not neglect long term safety improvements over short term financial gains.

- Value sound risk governance as a strategic business asset in its own right.

- Improved stakeholder confidence flows from good risk management.

- Challenging the beliefs and attitudes of staff will support internalisation as well as implementation.

- Recognise the value of using the WSP approach to inform sound investment planning.

Once 'bought in' to the approach they need to ensure that staff are given appropriate recognition and ownership of the project; address institutional arrangements that may hamper development; ensure staff have the correct skills; establish effective communication lines and be aware of internal cultures; establish effective stakeholder relationships and a continual improvement culture.

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Appendix A   Case study protocol

1. Overview of case study project

1.1 Background

Delivering good, safe drinking water that has the trust of consumers is a key goal of the international water supply sector and the main goal of the Bonn Charter for Safe Drinking Water (IWA, 2004). Being aware of, and mitigating the risks that might compromise this goal are therefore an integral part of water suppliers' planning, management and operation. Water Safety Plans (WSPs), described in the 3rd edition of the WHO guidelines on Drinking Water Quality (WHO, 2004a) and also supported in the Bonn Charter (IWA, 2004), can assist in progress towards this goal.

Following on from the Bonn Charter, the International Water Association (IWA) wished to promote an implementation plan, and seeks to enhance knowledge transfer between suppliers, particularly between those in developing and developed nations. In 2007, the Bonn Network project was initiated with the aim of assisting water suppliers to implement aspects of the Bonn Charter. Thus, the overarching aim of the Bonn Network project and subsequently this research is to assist water suppliers in providing good safe drinking water that has the trust of consumers. The Bonn Network is made up of 15 suppliers from 12 countries; the members will assist in developing tools to support implementation of risk management strategies in relation to improving drinking water quality. The IWA has partnered with Cranfield University to conduct research to support founding network members in their progress toward better risk management, and to develop a 'toolbox' of resources that will enable suppliers to implement the aims of the Bonn Charter.

Work on the project has been split into two main areas: Networking and Knowledge exchange (led by the IWA) and Research and Technical Support (led by Cranfield University). The main areas of work expected by the IWA in terms of research and technical support will be the development of a self assessment model, tool development implementation and dissemination, as well as technical support for web-based

workshops which will be conducted on a quarterly basis to explore aspects of toolbox development with Network members. The research project described in this protocol is part funded by the IWA Bonn Network project,

1.2 Aims and objectives

The Bonn Charter highlights that the primary role of water suppliers is to provide good, safe drinking water. Unsafe water, as many recent outbreaks, not only in the developing world but also in developed countries have shown, have the potential to cause widespread illness and even death. The Bonn Charter advocates the use of WSPs to achieve the aim of supplying good safe drinking water, but have water suppliers lost sight of their public health role? If the supply of safe drinking water is taken for granted, will WSPs ever be a truly implemented, preventative risk management practice incorporated into the day-to-day business of a water supplier or will it result in tokenism? The aim of this research therefore, is to explore how the public health role is promoted throughout organisations and to investigate what makes drinking water quality risk management truly proactive. It will also build on existing work in risk management capability to investigate Bonn Charter implementation capabilities[17] within the international water sector, the underlying business processes within organisations that create a basis for successful risk management and develop tool(s) to assist water providers develop and implement the Bonn Charter, regardless of their size, risk management maturity, or working environment[18].

In order to achieve this aim, a number of objectives need to be reached:

Investigate organisational culture and WSP development in water suppliers of varying size, development and structure to look for examples of best practice or barriers to effective implementation.

Develop a taxonomy of positive cultural attributes, test and add to this iteratively during case studies generating empirical data.

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[17] Including Integrated Water Resource Management, Water Safety Plans (and related techniques such as HACCP), asset management
[18] Political, legislative, social, economic

Identify and investigate how the public health role of suppliers is perceived and advocated within these organisations, and other underlying organisational cultural influences that may affect levels of commitment.

Develop a 'Bonn Charter Capability Maturity Assessment' that will enable investigation of objectives 1 and 2 and additional tools to assist suppliers in assessing and developing organisational culture that supports Bonn Charter implementation.
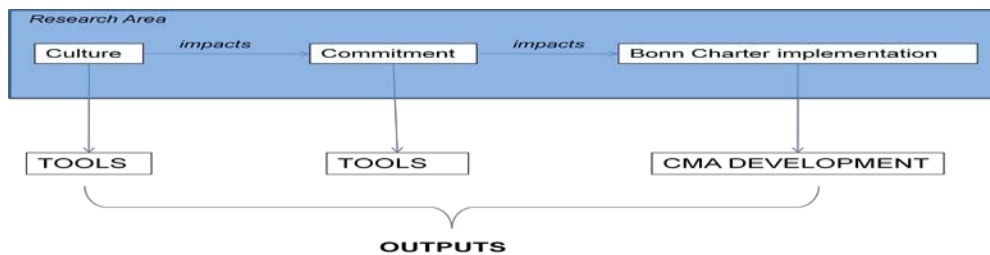
1.3 Purpose of the protocol

The case study protocol is a standardised agenda for the researcher's line of enquiry, particularly useful in multiple case study analyses. It represents a major way of increasing reliability in case study research. Protocols will keep the researcher targeted to the topic of the case study, anticipate problems and provide forethought that will help avoid long term mismatches (Yin, 2009).

2. Field Procedures

2.1 Initial contact

- Initial contact is generally made informally through IWA, particularly with members of the Bonn Network, to ascertain if the organisation would consider taking part in such a research project.
- If the organisation is interested, then more detailed information will be provided by the research student, preferably by email.
- Where requested, an NDA agreement will be provided, as well as an informed consent agreement (see sections 2.4 and 2.5).
- Where applicable provide some examples of current outputs to the lead contact.

Example initial contact letter/email (from student, after initial interest)

Appendix A Case Study Protocol

Dear_____

Many thanks in your interest in taking part in this research.

My name is Edgar Corinna and I am a PhD student of Cranfield University. I would like to spend some time (about 4 weeks) with your organisation to investigate aspects of organisational culture and leadership with respect to WSP development and implementation of the Bonn Charter's responsibilities of a water supplier. This PhD is part of the IWA's 'Bonn Network' project, and the main outcome of this will be a toolbox of resources to assist water providers achieve these goals.

IWA has identified _____ as a potential utility (given your work on WSP) that would be suitable for this study, and hence my email to you.

Logistics

Dates:

Finances: All living expenses covered by University/student.

Resources required:
- Desk space (have own laptop); perhaps internet access if possible.
- Access to key members of staff for interview (allow approx 1hr per interview).
- Access to relevant documentation relating to WSP development and the Bonn Charter responsibilities.
- Site visit(s) if possible to WTP etc.
- Contact with key stakeholders for potential meetings where appropriate.

Purpose of visit

The purpose of this visit will be to investigate aspects of organisational culture and leadership with respect to WSP development and implementation of the Bonn Charter's responsibilities of a water supplier. This PhD is part of the IWA's 'Bonn Network' project, and the main outcome of this will be a toolbox of resources to assist water providers achieve these goals.

It is intended that this research will assist in a greater knowledge of the organisational cultural influences on the success of WSP implementation and public health protection, and the development of tools to enable suppliers to improve in this area. A 'Capability Maturity Assessment' tool will be developed to enable suppliers to measure their current level of maturity and provide resources to help them reach a higher maturity level, resulting in more effective WSP implementation. In order to do this, several secondments will be made to different types of water supplier in order to investigate organisational culture, and its influence in WSP development, and examples of best practice.

Methods of data collection

- Pre-visit 'questionnaire' to gather background information.
- Semi structured 'Interviews' with key members of staff from various levels in the organisation, regarding water quality (management to operational staff).
    - Examples of types of staff members: CEO, senior managers, middle managers, WQ staff, sampling and labs, operations staff, risk managers, HR staff, customer services.
- 'Interviews' are recorded, transcribed and analysed.
- Document collection and analysis (e.g. policies, procedures, manuals, memorandums of understanding, protocols, training materials....)
- Observational studies.

Confidentiality

All interviewees will be kept anonymous. No names of individuals or the utility will be referenced in any outputs (unless utility wishes to be mentioned in a particular output, such as publication of a case study). Confidentiality agreement can be arranged if required. Utility will have the opportunity to review and comment on findings, before anything reaches public domain.

Potential outputs of information

- PhD thesis
- Journal papers
- Case studies/tools for Bonn Toolbox (this will only be through consultation with the utility – please see benefits to utility below).

- Contributions to 'Drinking Water Safety International', newsletter of the Bonn Network

Benefits of visit to utility

- If opportunity arises, potential for paper publication on case study?
- Potential inclusion in 'Drinking Water Safety International' may be a way of communicating examples of best practice to a wider, international audience.
- Potential for contribution to Bonn Toolbox
- Report of findings will be provided to the utility following analysis of data collected during the visit. This may assist the utility in addressing areas of weakness, and focussing on strengths.
- Visit will assist in development of the 'CMA' which will be of benefit to utilities once completed in assessing level of maturity, and implementing methods for improvement.
- Throughout project, comparisons will be drawn between all visits made, and findings disseminated to all parties, providing a form of benchmarking exercise and the opportunity to learn from other utilities throughout the world.

Yours faithfully, Corinna Summerill

2.2 Key contacts

Utility	Name	Position	Email	Phone
Left blank for confidentiality				

2.3 Data collection plan

- Where possible arrange agenda before travel with key contact.

- **Initial questionnaire**: If the organisation is not a Bonn Network member, request completion of the 'initial questionnaire' (filed under 'secondment analysis and interview schedule').

- **Who to interview:** Request a copy of the organisations organisational structure, this will help ascertain which staff members will be key interviewees. Where employee numbers are small (<20), try to interview all staff. For larger

organisations a sample will be needed. Try to include a cross section of staff, whose roles relate to the five responsibilities of a water supplier outlined in the Bonn Charter, such as finance, customer service, human resources etc. however, the focus should be on staff involved in water supply, quality and risk management. Try to book some time with the top manager (CEO, GM, director etc), and top levels of management as well as operational workers. Where possible, speak to board or council members and key stakeholders such as water quality regulators and health authorities. Be aware of the fact that top managers diaries often fill up far in advance and therefore try to organise the trip as far in advance as possible, be sensitive to people's schedules and be flexible in rearranging appointments.

- **How to conduct interviews:** See Rubin and Rubin (2004) for details. Semi-structured, 'guided conversation', see section 3.1 for guide.
  - o Need to address two levels: satisfying line of enquiry and simultaneously put questions across in a nonthreatening, friendly manner.
  - o Use open-ended questions.
  - o Structure of interview: Intro, warm up (non-threatening questions), main body, cool off (straight forward questions to diffuse any tension), closure.
  - o Use appropriate probes to encourage interviewee to 'open up', silent probe, echo probe, 'uh-huh' probe and the 'tell me' probe) (Bernard, 2005).
  - o Ask interviewee if is OK to record the interview and give assurance that the recoding will be destroyed, offer a letter of consent if needed.
  - o Record the interview and take notes, where possible transcribe the interview, verbatim, on the same day.
  - o Be sensitive to novel and unexpected issues in data collection, be a good listener, be adaptive and flexible (Yin, 2009).
  - o Provide interview transcripts for interviewee to review and comment.

- **Documentation**:
  - o Where possible, identify types of documentation needed with key contact before the visit, these may include: WSPs, risk assessments, policies and procedures relating to risk management and water quality, reports, media reports, memoranda of understanding, regulatory documents, meeting minutes & agendas and research reports.
  - o Collect freely available documentation before the visit (i.e. that is available on the utility's website, media reports etc.).
  - o Document searches in the field can be done in 'free-time' when not conducting interviews.

       o Use documentation to corroborate information provided in interviews and also to guide further investigation.

- **Collection of field notes:** A detailed diary of notes and observations, pertaining to the research questions and organisational culture framework, will be compiled during the field trip. This will be considered supplementary evidence to interview and documentation evidence due to the presence of only one researcher. Take photos where appropriate and with permission. Take handwritten notes during the day and type up in evening while events are still fresh in memory.

Principles of data collection (Yin, 2009)

1. **Use multiple sources of evidence**

   See figure 1.

2. **Create a case study database**
   In the event that any external party will be able to access all relevant information pertaining to the case study. Include two separate collections: data and reports. Keep all raw data: interview transcripts (recordings will not be kept due to confidentiality agreement), documents (electronic where possible), field notes, survey responses etc. Keep all interview data for a particular case study in one hermeneutic unit in Atlas, and keep codes/memos etc. Keep any reports in separate file.

3. **Maintain a chain of evidence**
   To allow an external observer to follow the derivation of any evidence from initial research question to ultimate case study conclusions (figure 2).
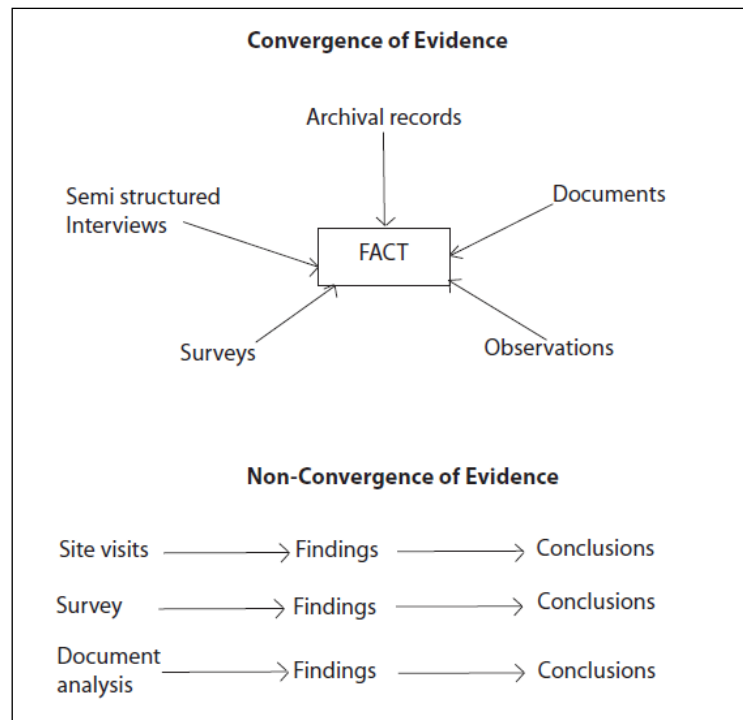
Figure 1. Multiple sources of evidence (Yin, 2009)
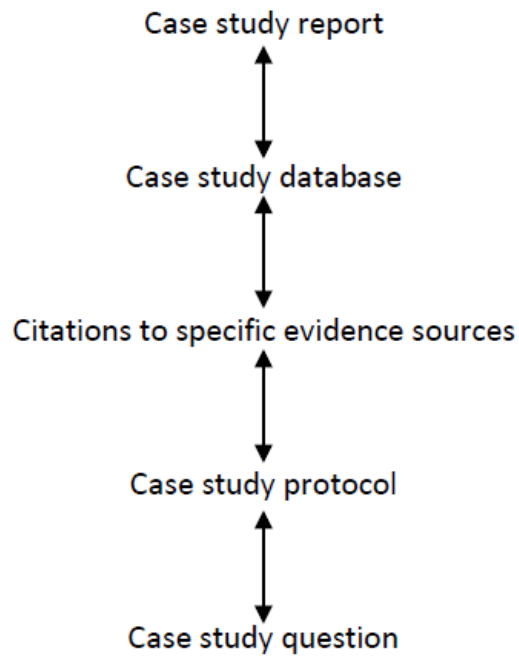
Figure 2. Chain of evidence (Yin, 2009)

2.4 NDA letter (If required)

<div align="right">

Corinna Summerill, PhD Student
Centre for Water Science
Building 52, SAS
Cranfield University
BEDFORDSHIRE
MK43 0AL
January 19, 2011

</div>

Subject: PhD data collection visit; The influence of organisational culture & commitment on WSP implementation.

The Company:

The Researcher: Corinna Summerill

Objectives of the study:

1. Investigate WSP development and implementation of the Bonn Charter and look for examples of best practice or barriers to effective implementation.
2. Identify and investigate how the public health role of the utility is perceived and advocated within these organisations, and other underlying organisational influences (culture, leadership etc.) that may affect levels of commitment and WSP implementation
3. Determine the relationship between objectives 1 and 2: i.e. what is the relationship between commitment to public health protection and the effectiveness of WSP development and implementation.

Qualitative data shall be obtained through the following methods:

- Semi-structured interviews with employees and relevant stakeholders of the company. Interviews will be recorded and notes taken, and then transcribed.
- Analysis of any relevant documentation pertaining to the research objectives.
- Field notes based on observations and conversations.

Research data may be used in several possible outputs:

- Student PhD thesis.
- Journal papers & IWA newsletters.

- Tools or case studies for the Bonn Toolbox.
- Presentations/poster presentations.
- Development of a 'Bonn Charter Capability Maturity Assessment' tool.

Assurance of anonymity:

As the researcher, I understand that I may have access to confidential information about study participants and the company. By signing this statement, I am indicating my understanding of my responsibilities to maintain confidentiality and ensure that the anonymity of individuals is maintained.

- I agree not to divulge, publish, or otherwise make known to unauthorised persons or to the public any information obtained in the course of this research project that could identify the persons who participated in the study.

- I agree not to divulge, publish, or otherwise make known to unauthorised persons or to the public any information obtained in the course of this research project that could identify the company that participated in the study, unless specifically agreed by the company.

- Interview recordings shall not be divulged to anyone other than the researcher. Recordings will be transcribed and transcripts provided to the interviewee for verification. Recordings shall be destroyed at the end of the study. Anonymised transcripts may be held indefinitely.

- The company should make it known to the researcher when any sensitive or confidential information is given or observed during document analysis.

- At the end of the study the company will be provided with additional information and feedback about the findings of the study, and be invited to comment.

Yours Faithfully,

Corinna Summerill

2.5 Consent Form (if required)

I understand that my participation in this project will involve participation in a semi-structured interview relating to the culture of the organisation I work for and will last for approximately 1 hour.

I understand that participation in this study is entirely voluntary and that I can withdraw from the study at any time without giving a reason and without loss of payment (or course credit).

I understand that I am free to ask any questions at any time. I am free to withdraw or discuss my concerns with [*name supervisor*].

[Researcher selects one of the two following paragraphs depending on design]:

I understand that the information provided by me will be held confidentially, such that only the Researcher and [*name(s) of other researchers where applicable*] can trace this information back to me individually. The information will be retained for up to [*state amount of time data will be held*] when it will be deleted/destroyed. I understand that I can ask for the information I provide to be deleted/destroyed at any time and I can have access to the information at any time.

OR IF DATA IS TO BE EVENTUALLY ANONYMISED:

I understand that the information provided by me will be held confidentially, such that only the researcher can trace this information back to me individually. I understand that my data will be anonymised [*state when this will happen, for example at the end of the study or on a specific date*] and that after this point no-one will be able to trace my information back to me. The information will be retained for up to [*state amount of time data will be held*] when it will be deleted/destroyed. I understand that I can ask for the information I provide to be deleted/destroyed at any time up until the data has been anonymised and I can have access to the information up until the data has been anonymised.

I also understand that at the end of the study I will be provided with additional information and feedback about the purpose of the study.

I, _____(NAME) consent to participate in the study conducted by Corinna Summerill, Cranfield University.

Signed:

Date:

3. Questions

3.1 Questions asked of specific interviewees; semi structured interview schedule (level 1 questions)

NOTE: This is a semi structured interview, questions do not have to be asked in order, and order will depend on the flow of the conversation. Additional questions may be asked depending on interesting topics raised, or Bonn Charter relevant topics. Some specific questions may be skipped if the researcher feels they have already been addressed or if time is limited.

Chronologically, the case studies were performed in the following sequence and modified as so, A, C, B, D. The suppliers are not named chronologically as a journal paper was published prior to the thesis, using only two case studies, Suppliers A and B. This naming was kept consistent for the thesis, although another case study had been performed between A and B (Supplier C), to avoid confusion for both the researcher when analysing and those reading the journal paper in addition to the thesis.

Topic A: Commitment to organisation/job

These questions will try to ascertain loyalty, attachment, involvement and identification of the employee with the organisation and their role within the organisation. Such commitment may influence levels of commitment to practices such as WSPs. Questions around missions/values and goals will investigate how prominent public health and water quality are. In this opening section I will not specifically mention that I am

investigating commitment, as this may influence the interviewees to exaggerate their levels of 'commitment'.

1. OPENING question: Ask respondent about role, and how long they have worked at the organisation.

      1a. *Further probe and elaboration on Bonn Charter relevant roles (see 3.3).*

2. Ask respondent what they feel to be the main missions/values/goals of the organisation; how do managers make sure staff are aligned to this?

3. Ask how the respondent feels about the job that they do (If needed, offer suggestions: do you enjoy it? Do you feel valued? Do you think the work you do is important?)

4. Ask how they feel about the organisation that they work for.

5. Ask if they feel comfortable in voicing opinions/make suggestions to management etc.

6. *Further probes/ investigation into key/interesting aspects of the organisational culture that may arise in responses.*

Topic B: Commitment to WSPs (or equivalent) and PH

For staff involved in water production/dist/quality:

Does the company use WSPs? If no, omit questions 12-14

7. What do you feel are the strengths and weaknesses of the way WQ is currently managed?

8. If the organisation is trying to implement a risk based approach: Are there any barriers to implementation?

9. What are the main drivers when managing water quality/ going 'over and above' in terms of quality or making improvements?

10. Has the respondent experienced/heard of a major incident of public health significance?

11. Are there any specific mechanisms for learning from past experiences?

12. How did they first become aware of WSPs/Bonn Charter, and how are they involved?

13. Why did the company decide to implement WSPs?

14. What lessons have been learned? Costs/benefits/challenges; how do they see the future of WSPs?

15. Have they heard of: WSPs/WHO/Bonn Charter/IWA? And ask what they think of them if they have heard.

> *If the respondent has heard of WSPs etc, but the organisation is not implementing a risk based approach, ask why.*

16. If respondents are unaware of WSP/not implementing WSPs, ask how they think they currently proactively manage WQ risk

17. Ask respondents what kind of training they receive; do they receive any specific public health related training?

For supporting role staff (e.g. finance, HR)

18. See section 3.3 and table 1.

19. Have they heard about WSPs?

20. How do they think their role is directly or indirectly involved in the supply of good safe drinking water that has the trust of consumers?

Topic C: Perceptions of commitment

These questions will be more explicit in asking about commitment.

21. Ask: What does 'commitment' mean to you? (in terms of employees being committed to an organisation or work practice).

22. Ask what motivates them/how does management motivate?

23. How committed do they think their leaders are in WSPs (or equivalent) as a means of ensuring WQ?

> ***Possible probes:***

How do they (or don't they) demonstrate this?

Do you think this is enough?

What actions do you think would demonstrate more commitment?

24. How committed do they think their peers are?

25. (If the respondent manages a team) How committed do they think their staff are? How do they try to generate commitment from and motivate staff?

26. Do they feel they are provided with enough resources to do their job effectively?

Additional questions for managers

27. How are staff kept aware of their role in public health protection?

Modifications following Supplier A

Additional question added:

28. How would you describe the culture of the organisation? (Reasons: During case study A, it was felt that explicitly asking this question may generate some interesting data).

Omitted: questions 5 and 15 (IWA and WHO) (reasons: was felt that question 5 was too leading, and asking about awareness of IWA and WHO was not necessary).

Modifications following Supplier C

Questions 3 and 4 merge into question 18 (reasons, these questions appeared to elicit similar answers)

Modifications following Supplier B – None

3.2 Stakeholder interview guide

These are some of the questions that need to be asked (from roles of governments and regulators in Bonn Charter) – but needs to be adapted depending on the stakeholder interviewed and the type of regulatory regime. Possible stakeholders to consider: Governments, regulators, consumer representatives, health authorities.

Government: Roles & responsibilities

- Does the government ensure that institutions and coordination arrangements exist to address water quality risks that may occur from the catchment to the tap?

- Does the government ensure that these institutions are able to secure sufficient resources to undertake their responsibilities? (e.g. creation of mechanisms for funding the installation and maintenance of water collection, treatment and distribution infrastructure?

- Does the government ensure that verification of procedures and water quality outcomes are undertaken with sufficient frequency and that the results are publicly available and transparent?

- Does the government establish general accounting policies that ensure water suppliers maintain adequate and auditable accounts?

- Does the government establish social policies to ensure that all members of society can obtain the services that should be the right of every citizen?

Reg Authorities:

- Does the regulatory regime incorporate health and reliability standards for DW based on the best available scientific evidence and consumer requirements?

- Does the regulatory authority ensure that the process of setting quality & health related standards is transparent and the choices made with regard to the level of risk considered appropriate fully disclosed?

- Does the regulatory authority establish verification systems to assess compliance with drinking water quality standards, DWSOs and to ensure that the results of WQ testing are valid?

- Does the regulator ensure that there is full reporting of compliance results and problems in a way that can be understood by all?

- Power to penalise?

General

- Is the organisation committed to public health protection?
- Is the organisation committed to WSP implementation?
- How does it demonstrate this?
- Why is it committed?

3.3 Questions asked of the individual case

Bonn Charter implementation questions

Document analysis, observation and questions relating to the five 'responsibilities' of a water supplier outlined in the Bonn Charter and below will determine the level of implementation of the Bonn Charter at each utility visited.

The Bonn Charter outlines the following key responsibilities for a water supplier:

1. In conjunction with partners, develop and implement drinking water safety plans (or equivalent), covering catchment to consumer, and regularly verify their implementation and effectiveness using appropriate controls and monitoring.
2. Put in place systems for testing the quality of water supplied including those necessary to meet regulatory requirements and make the compliance results available to the public.
3. Ensure that the full cost of service provision is identified (including the maintenance and replacement of assets) and that appropriate investments are made in the provision of water services, in line with Government established frameworks for financing.
4. Ensure staff with sufficient skills and training are available to those involved in the management of each element of the quality process from catchment to consumer, and
5. Maintain adequate and auditable accounts in line with government requirements.

I will also take into account the 'key principles' mentioned such as an integrated approach, stakeholder partnerships, transparency and honest communication, training etc.

Appendix A Case Study Protocol

Table 1: Bonn Charter detail template

	Detail
Responsibility 1	
Buy-in and commitment	
Stakeholder Engagement	
Team development (WSP)	
Risk Analysis	
Risk based decision making & review	
Responsibility 2	
Setting of standards	
Quality Assurance	
Communication & reporting	
Responsibility 3	
Asset management	
Investment planning	
Pricing	
Responsibility 4	
Staff with appropriate skills & training	
Responsibility 5	
Adequate & auditable accounts	

3.4 Case Study Questions (mental line of enquiry)

Question	Level (2-5)
How is the Bonn Charter being implemented, explicitly or implicitly?	2
How is WQ risk managed?	2
How & why does culture influence BC implementation?	2 + 3
How is the public health responsibility of the organisation demonstrated?	2 + 3

Why is the public health responsibility taken for granted/explicit?	2 + 3
How and why do leaders advocate BC implementation?	2 + 3
Can we make general conclusions about culture and BC implementation, or is each case individual?	4
Can we make general conclusions about culture and BC implementation, or is each case individual?	4
What attributes does a leader need to advocate BC effectively?	4 + 5
How can organisations be assisted in developing a supporting organisational culture in terms of BC implementation?	5
Why is understanding organisational culture and leadership important in terms of BC implementation?	5

(Level 2 = questions asked of the individual case; 3 = questions asked of the pattern of findings across multiple cases; 4 = questions asked of an entire study; 5 = normative questions about policy recommendations and conclusions)

4. Analysis

Use Atlas.ti software to store textual data and assist in coding and memoing.

Strategy: THEORETICAL PROPOSITIONS. Follow theoretical propositions that led to the case study (see aims and objectives section). This will help focus attention and ignore superfluous data and identify alternative explanations.

Analytic Techniques (in order of significance in this study)**:**

- **Explanation Building:** Analyse case study data and build an explanation about the case.

  o Stipulate a presumed set of causal links about the case – 'how' or 'why' something happened.
  o Try to ensure explanations reflect some theoretically significant propositions. i.e. how and why organisational culture and leadership influences BC implementation. Goal is to build a general explanation that fits all cases within the study.
  o Explanation building is ITERATIVE, make an initial theoretical statement (see aims and objectives section), compare findings of initial case study, revise statement, compare other cases etc.

- **Cross-Case Synthesis:** Use word tables to compare cases (see table 1 for example on BC implementation), analyse case studies individually first before

making comparisons and more general inferences, can be used in conjunction with other methods listed here.

- **Logic Models:** Stipulates a complex chain of events in a cause-effect-cause-effect pattern whereby a dependent variable at an earlier stage becomes the independent variable for the next stage. Match empirically observed events to theoretically predicted events (similar to pattern matching.

5. Guide for case study report

5.1 Intended outputs and audiences

- **Thesis**: Thesis committee & peers.
- **IWA newsletters**: Bonn Network members.
- **Journal papers**: Industry and Academics.
- **Tools**: Industry.

5.2 Outline for report

Will depend on the individual output listed above.

Thesis: Classic multiple-case, present each case study as an individual and provide section on cross-case synthesis, using a linear-analytic, comparative or theory-building structure. Individuals and organisations will be kept anonymous for the thesis and journal papers, however it may be in the interest of the organisation to be named in IWA newsletters and tools and therefore consent will be sought in this case. All outputs must be reviewed by the organisations and my peers.

What makes an exemplary case study? (Yin, 2009)

- Significance.
- Completeness.
- Consider alternative perspectives.
- Display sufficient evidence.
- Compose in an engaging manner.

Appendix B   Sources of evidence tables: Suppliers A-D

Supplier A: Sources of evidence

Aspect	Chapter	Source	Detail	Location
Overview and culture -hierarchy -union -manager/staff -informal comms/reports -external -camaraderie -positive job -valued -newcomers rare -discontent -engineers -opinions not valued -transparency -proactivity -pride -community values -customer service -education key	4.2.1 and 4.7	-Atlas report: Supplier A CULTURE; Supplier A UNION; Supplier A STORIES -Atlas report: Supplier A ORGANISATIONAL COMMITMENT; PROACTIVITY; EXTERNAL RELATIONSHIPS -Document A9 (organisational structure); A4 (external partnerships); A1 (transparency); A6 (proactivity) -Supplier A memos: hierarchical (2); union (17); informal communications (5); opinions not valued (13). -Supplier A field notes	-See quote list -See quote list -See Supplier A document list -Supplier A memos: 2,5,13,17 -Union lines 14-16; 92-95; 123-126. Manager/staff lines 92-95; 123-126; 208-210. External partners lines 253-284; Discontent, lines 208-210; transparency lines 151-156; 211-214; Education lines 99.	-Appendices CD: Supplier A raw data: Atlas reports -Appendices CD: Supplier A raw data: Taxonomy quote lists. - Appendices CD: Supplier A document list - Appendices CD: Supplier A memos -Appendices CD: Supplier A raw data: Field notes and survey response
Missions & drivers	4.2.5	-Atlas report: Supplier A DRVIERS; Supplier A MISSIONS -Supplier A memos	-See quote list -Memo 9	-Appendices CD: Supplier A raw data: Atlas reports - Appendices CD: Supplier A memos

Appendix B Sources of evidence: Supplier A-D

WSP progress	4.3.1	-Atlas report: Supplier A WSP -Supplier A field notes	-See quote list -Lines 3-8; 157-178	-Appendices CD: Supplier A raw data: Atlas reports -Appendices CD: Supplier A raw data: Field notes and survey response
WSP blockers & drivers	4.3.2	Atlas report: Supplier A WSP -Supplier A field notes -Supplier A memos	-See quote list -Lines3-8; 9-12; 30-35; 110-111; 127-128; 172 -Memo 3,6,11,14	-Appendices CD: Supplier A raw data: Atlas reports -Appendices CD: Supplier A raw data: Field notes and survey response - Appendices CD: Supplier A memos
WSP benefits	4.3.3	-Atlas report: Supplier A WSP -Supplier A field notes	-See quote list -Lines 162-164; 167-168; 177-178	-Appendices CD: Supplier A raw data: Atlas reports -Appendices CD: Supplier A raw data: Field notes and survey response
Managerial commitment & leadership	4.4	-Atlas reports: Supplier A MANAGERIAL COMMITMENT; LEADERSHIP; ACCOUNTABILITY -Supplier A field notes -Supplier A memos	-See quote list -Lines7-8; 19-23; 44-46; 99; 102-105; 123-126; 225-226; 269-271 -Memo 1,2,10,13,14	-Appendices CD: Supplier A raw data: Taxonomy quote lists. -Appendices CD: Supplier A raw data: Field notes and survey response - Appendices CD: Supplier A memos
Organisational commitment & motivation	4.5.1; 4.5.2	-Atlas report: Supplier A MOTIVATION_DEMOTIVATION; Supplier A WSP -Atlas report: Supplier A ORGANISATIONAL COMMITMENT -Supplier A field notes -Supplier A memos	-See quote list -See quote list -Lines 112-116; 197-200; 234-235 -Memo 7, 13, 14, 17, 18	-Appendices CD: Supplier A raw data: Atlas reports -Appendices CD: Supplier A raw data: Taxonomy quote lists. -Appendices CD: Supplier A raw data: Field notes and survey response Appendices CD: Supplier A memos
Public health responsibility	4.6	-Atlas report: Supplier A MINDFULNESS; Supplier A ACCOUNTABILITY -Supplier A field notes	-See quote list -Lines 50-53; 83-84; 239-241	-Appendices CD: Supplier A raw data: Taxonomy quote lists. -Appendices CD: Supplier A raw data: Field notes and survey response

Appendix B Sources of evidence: Supplier A-D

Supplier B: Sources of evidence

Aspect	Chapter	Source	Detail	Location
Overview and culture -condensed -internal cultures -team work -formal -pride -targets -competitive -collaboration and discussion -culture creation -engineers -continual improvement -recognition -customer service -profit -image -number 1 -religion	4.2.2 and 4.7	-Atlas report: Supplier B CULTURE; Supplier B STORIES AND SYMBOLS -Atlas report: Supplier B COMPETITION; Supplier B IMAGE -Document B3 (organisational structure) -Supplier B field notes -Supplier B memos: internal cultures (5); collaboration and discussion (10); culture creation (11); recognition (1, 12); customer service (7); 'No.1' (2); religion (13)	-See quote list -See quote list -See supplier B document list -Internal cultures Lines 43; 378-382; Formality Lines 85-87; competition lines 176-178; recognition lines 370-371; customer service 346-347; image lines 147; religion lines 352. -Memo 1,2,5,7,10,11,12,13	-Appendices CD: Supplier B raw data: Taxonomy quote lists. -Appendices CD: Supplier B raw data: Taxonomy quote lists. -Appendices CD: Supplier B document list -Appendices CD: Supplier B raw data: Field notes and survey response -Appendices CD: Supplier B memos
Missions & drivers	4.2.5	-Atlas report: Supplier B DRVIERS; Supplier B MISSIONS -Document B1; B4; B5 and B9 -Supplier B field notes -Supplier B memos	-See quote list -See supplier B document list -Lines 8-37; 96-97 -Memo 1,2,7,9	-Appendices CD: Supplier B raw data: Atlas reports -Appendices CD: Supplier B document list -Appendices CD: Supplier B raw data: Field notes and survey response -Appendices CD: Supplier B memos

Appendix B Sources of evidence: Supplier A-D

WSP progress	4.3.1	-Atlas report: Supplier B WSP	-See quote list	-Appendices CD: Supplier B raw data: Atlas reports
		-Document B1; B11	-See supplier B document list	-Appendices CD: Supplier B document list
		-Supplier B field notes	-Lines 39-41; 50-51; 59; 75-82; 169-172; 301-308; 402-407	-Appendices CD: Supplier B raw data: Field notes and survey response
WSP blockers & drivers	4.3.2	-Atlas report: Supplier B WSP	-See quote list	-Appendices CD: Supplier B raw data: Atlas reports
		-Document B1; B4	-See supplier B document list	-Appendices CD: Supplier B document list
		-Supplier B field notes	-Lines78-81; 169-172; 274-276; 331-343; 370-371; 396-401; 407; 409-41	-Appendices CD: Supplier B raw data: Field notes and survey response
		-Supplier B memos	-Memo 4	-Appendices CD: Supplier B memos
WSP benefits	4.3.3	-Atlas report: Supplier B WSP	-See quote list	-Appendices CD: Supplier B raw data: Atlas reports
		-Document B1	-See supplier B document list	-Appendices CD: Supplier B document list
		-Supplier B field notes	-Lines 75-77; 82; 309-319; 321-330	-Appendices CD: Supplier B raw data: Field notes and survey response
Managerial commitment & leadership	4.4	-Atlas reports: Supplier B MANAGERIAL COMMITMENT; LEADERSHIP; ACCOUNTABILITY	-See quote list	-Appendices CD: Supplier B raw data: Taxonomy quote lists.
		-Document B2, B7, B10	-See supplier B document list	-Appendices CD: Supplier B document list
		-Supplier B field notes	-Lines 8-13; 69-71' 365-369; 375-376	-Appendices CD: Supplier B raw data: Field notes and survey response
		-Supplier B memos	-Memo 10, 11	-Appendices CD: Supplier B memos
Organisational commitment & motivation	4.5.1 and 4.5.2	-Atlas report: Supplier B MOTIVATION	-See quote list	-Appendices CD: Supplier B raw data: Atlas reports
		-Atlas report: Supplier B ORGANISATIONAL COMMITMENT	-See quote list	-Appendices CD: Supplier B raw data: Taxonomy quote lists.
		-Supplier B field notes	-Lines 344-349; 350-358; 372-	-Appendices CD: Supplier B raw data:

Appendix B Sources of evidence: Supplier A-D

			374	Field notes and survey response
		-Supplier B memos	-Memo 3, 12, 13	-Appendices CD: Supplier B memos
Public health responsibility	4.6	-Atlas report: Supplier B MINDFULNESS; Supplier A ACCOUNTABILITY -Supplier B field notes	-See quote list -Lines 269; 360-364	-Appendices CD: Supplier B raw data: Taxonomy quote lists. -Appendices CD: Supplier B raw data: Field notes and survey response

Supplier C: Sources of evidence

Aspect	Chapter	Source	Detail	Location
Overview and culture -powerful -trained engineers -condensed structure -enjoys job -resources -informal relationships -security -proactive -consultants -continual improvement -empowerment -PR -Image -world class -innovation -education -transparency -environment	4.2.3 and 4.7	-Atlas report: Supplier C CULTURE; Supplier C STORIES AND SYMBOLS -Atlas report: Supplier C PROACTIVE; Supplier C: EMPOWERMENT; Supplier C IMAGE; Supplier C CONTINUAL IMPROVEMENT -Document C6 (structure); C1, C3 (continual improvement and C1 (transparency) -Supplier C field notes -Supplier C memos: powerful (2); informal relationships (15); security (24); consultants (5); empowerment (8); world class (26); environment (1)	-See quote list -See quote list -See supplier C document list -Engineers lines 393-395; consultants lines 15-16; world class lines 223; environment lines 267-269 -Memos 1,2,5,8,15,24,26	-Appendices CD: Supplier C raw data: Atlas reports -Appendices CD: Supplier C raw data: Taxonomy quote lists. -Appendices CD: Supplier C document list - Appendices CD: Supplier C raw data: Field notes and survey response -Appendices CD: Supplier C memos

Appendix B Sources of evidence: Supplier A-D

Missions & drivers	4.2.5	-Atlas report: Supplier C DRVIERS; Supplier C MISSIONS -Supplier C memos -Document C1, C4 -Supplier C field notes	-See quote list -Memo 13, 26 -See supplier C document list -Lines 3-8; 119; 223; 226-231; 250-252	-Appendices CD: Supplier C raw data: Atlas reports -Appendices CD: Supplier C memos -Appendices CD: Supplier C document list - Appendices CD: Supplier C raw data: Field notes and survey response
WSP progress	4.3.1	-Atlas report: Supplier C WSP VIEWS AND ACTIVITIES -Supplier C memos -Document C2, C9 -Supplier C field notes	-See quote list -Memo 17, 22 -See supplier C document list -Lines 9-13; 338	-Appendices CD: Supplier C raw data: Atlas reports -Appendices CD: Supplier C memos -Appendices CD: Supplier C document list - Appendices CD: Supplier C raw data: Field notes and survey response
WSP blockers & drivers	4.3.2	-Atlas report: Supplier C WSP VIEWS AND ACTIVITIES -Supplier C memos -Supplier C field notes	-See quote list -Memo 12, 20, 29 -Lines 453-479	-Appendices CD: Supplier C raw data: Atlas reports -Appendices CD: Supplier C memos - Appendices CD: Supplier C raw data: Field notes and survey response
Managerial commitment & leadership	4.4	-Atlas reports: Supplier C MANAGERIAL COMMITMENT; LEADERSHIP; ACCOUNTABILITY -Supplier C memos -Supplier C field notes	-See quote list -Memo 8, 11, 15, 16 -Lines 331; 357-358; 408-416; 424-435	-Appendices CD: Supplier C raw data: Taxonomy quote lists. -Appendices CD: Supplier C memos - Appendices CD: Supplier C raw data: Field notes and survey response
Organisational commitment & motivation	4.5.1 and 4.5.2	-Atlas report: Supplier C MOTIVATION -Atlas report: Supplier C ORGANISATIONAL COMMITMENT -Supplier C memos -Document C1 -Supplier C field notes	-See quote list -See quote list -Memo 3,4,9,23,25,28 -See supplier C document list -Lines 120-131; 293-297; 311-	-Appendices CD: Supplier C raw data: Atlas reports -Appendices CD: Supplier C raw data: Taxonomy quote lists. -Appendices CD: Supplier C memos -Appendices CD: Supplier C document list - Appendices CD: Supplier C raw data:

Appendix B Sources of evidence: Supplier A-D

			313	Field notes and survey response
Public health responsibility	4.6	-Atlas report: Supplier C MINDFULNESS; Supplier C ACCOUNTABILITY -Supplier C memos -Supplier C field notes	-See quote list -Memo 1, 24 -Lines 52-57; 80-95; 287-288; 378-379	-Appendices CD: Supplier C raw data: Taxonomy quote lists. -Appendices CD: Supplier C memos - Appendices CD: Supplier C raw data: Field notes and survey response

Supplier D: Sources of evidence

Aspect	Chapter	Source	Detail	Location
Overview and culture -group support -formalised procedures -professional -informal relationships -business expansion -youth -wear the shirt -camaraderie -small size -prove ourselves -image/trust -tourism -celebrate success -valued & involved	4.2.4 and 4.7	-Atlas report: Supplier D CULTURE; Supplier D STORIES AND SYMBOLS -Atlas report: Supplier D IMAGE -Document D12 (organisational structure) -Supplier B field notes -Supplier B memos: group support (5); informal relationships (7); business expansion (1); small size (2); tourism (11); youth (15); change (10)	-See quote list -See quote list - See supplier D document list -Image lines 413; value d and involved lines 339-342; youth lines 2; 146; change lines 21-23 -Memos 1,2,5,7,10,11,15	-Appendices CD: Supplier D raw data: Atlas reports -Appendices CD: Supplier D aw data: Taxonomy quote lists. -Appendices CD: Supplier D document list - Appendices CD: Supplier D raw data: Field notes and survey response -Appendices CD: Supplier D memos

Appendix B Sources of evidence: Supplier A-D

-recognition -change -learning				
Missions & drivers	4.2.5	-Atlas report: Supplier D DRVIERS; Supplier D MISSIONS -Document D2, D6, D10 -Supplier D memos -Supplier D field notes	-See quote list -See supplier D document list -Memo 1, 8, 9, 11 -Lines 124, 148	-Appendices CD: Supplier D raw data: Atlas reports -Appendices CD: Supplier D document list -Appendices CD: Supplier D memos - Appendices CD: Supplier D raw data: Field notes and survey response
WSP progress	4.3.1	-Atlas report: Supplier D WSP -Supplier D memos -Supplier D field notes	-See quote list -Memo 14 -Lines 9-14; 80-84; 92-107; 117; 220-239; 259-334	-Appendices CD: Supplier D raw data: Atlas reports -Appendices CD: Supplier D memos - Appendices CD: Supplier D raw data: Field notes and survey response
WSP blockers & drivers	4.3.2	-Atlas report: Supplier D WSP -Supplier D field notes	-See quote list -Lines 9-12; 92; 116; 238-239; 277; 286-87; 317-318; 321-322	-Appendices CD: Supplier D raw data: Atlas reports - Appendices CD: Supplier D raw data: Field notes and survey response
WSP benefits	4.3.3	-Atlas report: Supplier D WSP -Supplier D memos -Supplier D field notes	-See quote list -Memo 4 -Lines 80-81; 98; 104; 288-290; 304-306; 310-311; 319-320; 328-330; 333-334	-Appendices CD: Supplier D raw data: Atlas report -Appendices CD: Supplier D memos - Appendices CD: Supplier D raw data: Field notes and survey response
Managerial commitment & leadership	4.4	-Atlas reports: Supplier D MANAGERIAL COMMITMENT; LEADERSHIP; ACCOUNTABILITY -Supplier D memos -Supplier D field notes	-See quote list -Memo 6,7,9 -Lines 3; 105; 277; 321-322; 407-408	-Appendices CD: Supplier D raw data: Taxonomy quote lists -Appendices CD: Supplier D memos - Appendices CD: Supplier D raw data: Field notes and survey response
Organisational commitment	4.5.1 and 4.5.2	Atlas report: Supplier D MOTIVATION	-See quote list	-Appendices CD: Supplier D raw data: Atlas reports

& motivation		-Atlas report: Supplier D ORGANISATIONAL COMMITMENT -Supplier D memos -Supplier D field notes	-See quote list -Memo 2,5,9,10,12,15 -Lines 106-107; 339-342	-Appendices CD: Supplier D raw data: Taxonomy quote lists -Appendices CD: Supplier D memos - Appendices CD: Supplier D raw data: Field notes and survey response
Public health responsibility	4.6	-Atlas report: Supplier D MINDFULNESS; Supplier D ACCOUNTABILITY -Supplier D field notes	-See quote list -Lines 58; 100; 160-162; 197-199; 230-232; 411-412	-Appendices CD: Supplier D raw data: Taxonomy quote lists - Appendices CD: Supplier D raw data: Field notes and survey response

Appendix C   **Sources of evidence table: Cultural Taxonomy**

Element	Chapter	Source	Detail	Location
Managerial Commitment	5.4.1 7.4.1	-Atlas quote lists: Supplier A, B, C and D: MANAGERIAL COMMITMENT. -Field notes: Supplier A -Field notes: Supplier B -Field notes: Supplier C -Field notes: Supplier D	-See quote list -Lines 112-114 -Lines 158-159 -Lines 331; 337-358 -Lines 105; 277	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier A, B, C,D, Field notes
Learning Culture	5.4.1 7.4.2	-Atlas quote lists: Supplier A, B, C and D: LEARNING CULTURE. -Document B1 -Field notes: Supplier A -Field notes: Supplier B -Field notes: Supplier C -Field notes: Supplier D	-See quote list -See Supplier B Document list - Lines 19-24; 27; 132-144; 186-196; 218-219 -Lines 78; 230-233; 365-369 -Lines 40-51; 232-234; 300-302 -Lines 2,3,42-47; 82; 118; 133	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier B document list -Appendices CD: Supplier A, B, C,D, Field notes
Internal relationships	5.4.1 7.4.3	-Atlas quote lists: Supplier A, B, C and D: INTERNAL RELATIONSHIPS. -Document C1 -Field notes: Supplier A -Field notes: Supplier B -Field notes: Supplier C -Field notes: Supplier D	-See quote list - See Supplier C Document list -Lines 3-8; 94-95; 123-126 -Lines 85-87; 162; 378-382 -Lines 319-330; 393-395 -Lines241-256; 407	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier C document list -Appendices CD: Supplier A, B, C,D, Field notes
Accountability	5.4.1 7.4.4	-Atlas quote lists: Supplier A, B, C and D: ACCOUNTABILITY. -Document B2, B6 and B8; C14; D14, 15, 16 -Field notes: Supplier A -Field notes: Supplier B -Field notes: Supplier C -Field notes: Supplier D	-See quote list -See Supplier B,C & D Document list -Lines 44-46 -Lines 69-71; 98; 180; 226-228. -Lines 4-8 -Lines 100-103; 160-162	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier B,C,D document list -Appendices CD: Supplier A, B, C,D, Field notes

Appendix C Sources of evidence: cultural taxonomy

Open reporting culture	5.4.1 7.4.5	-Atlas quote lists: Supplier A, B, C and D: OPEN REPORTING CULTURE. -Document A1, A3; C1; C16; C17 -Field notes: Supplier A -Field notes: Supplier C -Field notes: Supplier D	-See quote list -See Supplier A & C Document list -Lines 151-156, 167-168; 211-214; 227-233 -Lines 256-263; 362; 380-382 -Lines 58; 72-73; 389	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier A,C document list -Appendices CD: Supplier A, B, C,D, Field notes
External relationships	5.4.1 7.4.6	-Atlas quote lists: Supplier A, B, C and D: EXTERNAL RELATIONSHIPS. -Document A4 and A5; B1, B2, B4, B6, B10; C13 -Field notes: Supplier A -Field notes: Supplier B -Field notes: Supplier C -Field notes: Supplier D	-See quote list -See Supplier A,B & C Document list -Lines 253-284; 286 -Lines 33; 36; 142-144 -Lines 270-273; 303; 467-471; 489-493 -Lines35-40; 84; 241-56; 399	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier A,B & C document list -Appendices CD: Supplier A, B, C,D, Field notes
Continual improvement	5.4.1 7.4.7	-Atlas quote lists: Supplier A, B, C and D: CONTINUAL IMPROVEMENT. -Document A7; C1, C3; D3 -Field notes: Supplier A -Field notes: Supplier B -Field notes: Supplier C -Field notes: Supplier D	-See quote list -See Supplier A,C & D Document list -Lines 90; 234-235 -Lines 6; 11-13; 61; 67; 96-97 -Lines 10-13; 183-197; 270-273; 350-354; 404-406 -Lines 21-23; 52-56; 328-330	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier A, C, D document list -Appendices CD: Supplier A, B, C,D, Field notes
Empowerment	5.4.1 7.4.8	-Atlas quote lists: Supplier A, B, C and D: EMPOWERMENT. -Field notes: Supplier A -Field notes: Supplier B -Field notes: Supplier C -Field notes: Supplier D	-See quote list -Lines 96-98; 117-118; 197-200 -Lines 372-74 -Lines 4-8; 292 -Lines 2; 145; 339-342	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier A, B, C,D, Field notes
Organisational commitment	5.4.1 7.4.9	-Atlas quote lists: Supplier A, B, C and D: ORGANISATIONAL COMMITMENT.	See quote list	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc.

		-Field notes: Supplier B -Field notes: Supplier C	-Lines 370-371 -Lines 120-150; 230-231; 293-297	-Appendices CD: Supplier A, B, C,D, Field notes
Proactive	5.4.1 7.4.10	-Atlas quote lists: Supplier A, B, C and D: TAXONOMY. -Document A6; C9, C11 -Field notes: Supplier A -Field notes: Supplier B -Field notes: Supplier C -Field notes: Supplier D	-See quote list -See Supplier A & C Document list - Lines 234-235 -Lines 270 -Lines 14; 17-26; 305 -Lines 75-76; 173-75; 183-85	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier A & C document list -Appendices CD: Supplier A, B, C,D, Field notes
Leadership	5.4.1 7.4.11	-Atlas quote list: Supplier A, B, C and D: LEADERSHIP -Field notes: Supplier A -Field notes: Supplier C -Field notes: Supplier D	-See quote list -Lines 99-101; 108; 112-114 -Lines 331 -Lines 3; 277; 407	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier A, B, C,D, Field notes
Mindfulness	5.4.1 7.4.12	-Atlas quote list: Supplier A, B, C and D: MINDFULNESS -Document C1 -Field notes: Supplier A -Field notes: Supplier B -Field notes: Supplier C -Field notes: Supplier D	-See quote list -See Supplier C Document list -Lines 50-53; 83-84; 234-235 -Lines 8-10; 67; 282-295; 360 -Lines 4-8; 287; 424-435 -Lines 100-103	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier C document list -Appendices CD: Supplier A, B, C,D, Field notes
Image	5.4.2 7.4.13	-Atlas quote list: Supplier A, B, C and D: IMAGE -Field notes: Supplier B -Field notes: Supplier C -Field notes: Supplier D	-See quote list -Lines 15-16; 75-77; 174 -Lines 298-299 -Lines 413	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier A, B, C,D, Field notes
Competition	5.4.2 7.4.13	-Atlas quote list: Supplier A, B, C and D: COMPETITION -Field notes: Supplier A -Field notes: Supplier B -Field notes: Supplier C	-See quote list -Lines 242-246 -Lines 14-15; 32; 37; 82; 248-249 -Lines 376-379	-Appendices CD: Supplier A,B,C,D: Taxonomy quote lists etc. -Appendices CD: Supplier A, B, C,D, Field notes

Appendix D   Sources of evidence table: Discussion

Aspect	Chapter	Source	Detail	Location
WSP progress	7.2.1	-See supplier evidence lists A-D, appendix B	-See supplier evidence lists A-D, appendix B	-See supplier evidence lists A-D, appendix B
WSP Benefits	7.2.2	-See supplier evidence lists A-D, appendix B	-See supplier evidence lists A-D, appendix B	-See supplier evidence lists A-D, appendix B
WSP Blockers and challenges	7.2.3	-See supplier evidence lists A-D, appendix B	-See supplier evidence lists A-D, appendix B	-See supplier evidence lists A-D, appendix B
Missions and drivers	7.3.1	-See supplier evidence lists A-D, appendix B	-See supplier evidence lists A-D, appendix B	-See supplier evidence lists A-D, appendix B
Past incidents	7.3.2	-Atlas quote list: Past incident quotes -Supplier A memo 11 -Supplier B field notes -Supplier C memo10 -Supplier C field notes -Supplier D memo 10 -Supplier D field notes	-See quote list -See supplier A memos -Lines 387-389 -See supplier C memos -Lines 270-273 -See supplier D memos -Lines 385-387; 241-256	-Appendices CD: Discussion raw data. -Appendices CD: Supplier A memos -Appendices CD: Supplier B raw data: Field notes and survey response -Appendices CD: Supplier C memos -Appendices CD: Supplier C raw data: Field notes and survey response - Appendices CD: Supplier D memos -Appendices CD: Supplier D raw data: Field notes and survey response
Formality vs. informality	7.3.3	-Atlas quote list: formality quotes -Atlas quote list: INTERNAL RELATIONSHIPS -Supplier A memo 2,5 -Supplier A field notes -Supplier B document B7 -Supplier B memo 3	-See quote list -See quote lists -See supplier A memos -Lines 36-43; 225-233 -See supplier B document list -See supplier B memos	-Appendices CD: Discussion raw data. -Appendices CD: Supplier A,B & C: Taxonomy atlas reports - Appendices CD: Supplier A memos -Appendices CD: Supplier A raw data: Field notes and survey response -Appendices CD: Supplier B document list -Appendices CD: Supplier B memos

Appendix D Sources of evidence: discussion

		-Supplier B field notes	-Lines 78-81; 85-87	-Appendices CD: Supplier B raw data: Field notes and survey response
		-Supplier C field notes	-Lines 362; 404-416	-Appendices CD: Supplier C raw data: Field notes and survey response
		-Supplier D memo 7	-See supplier D memos	- Appendices CD: Supplier D memos
		-Supplier D field notes	-Lines 407-408	-Appendices CD: Supplier D raw data: Field notes and survey response
Engineering culture	7.3.4	-Atlas quote list: Engineer culture quotes	-See quote list	-Appendices CD: Discussion raw data.
		-Supplier A field notes	-Lines 208-210	-Appendices CD: Supplier A raw data: Field notes and survey response
		-Supplier B memo 5	-See supplier B memos	-Appendices CD: Supplier B memos
		-Supplier B field notes	-Lines 296-297; 378-382	-Appendices CD: Supplier B raw data: Field notes and survey response
		-Supplier C field notes	-Lines 355-356; 393-395	-Appendices CD: Supplier C raw data: Field notes and survey response
		-Supplier D memo 3	-See supplier D memos	- Appendices CD: Supplier D memos
		-Supplier D field notes	-Lines 225-226	-Appendices CD: Supplier D raw data: Field notes and survey response
Taxonomy list	7.4.1-7.4.13	-See cultural taxonomy table, appendix C	-See cultural taxonomy table, appendix C	-See cultural taxonomy table, appendix C

Appendix E   Interview transcript example

<u>**Interviewee: AM16**</u>

Researcher: How long have you worked here?

AM16: 28 years.

Researcher: Can you explain to me your role?

AM16: [removed for anonymity]

Researcher: What do you do on a day to day basis?

AM16:   Put out fires! I guess a good percentage of my time is spent dealing with consultants, on the big projects, there are only two engineers in the city, myself and my assistant, so some of that has been kind of offloaded to him. When there's a hiccup, anywhere, so something is going to the mayor, or something has gone sideways then I get involved in that. I spend quite a bit of time on personnel issues that have gone past the supervisor level, so they end up on my desk. A lot of time preparing reports for council and presenting reports to council. I'm the primary interface with council, although **** does some of that for the planning area. Budget takes up a lot of time this time of year. Those are probably the main things.

Researcher: What do you think were the reasons for improvement?

AM16: Well I guess one of the reasons for buying it from the power company was because it was run down and there was grant money that was available to us that wasn't available to them. There had been some studies before we purchased it that sort of outlines what needed to be done. And I don't think we ever really questioned that there wasn't major work required. Replacing the cast iron water mains was driven by the water breaks, I think one year we had 135 breaks and a crew of five people, I mean that's ridiculous. The water treatment upgrades were driven by customer service, because the water was yellow, stunk and stained everyone's laundry. Some of those studies were done by the city at the time of purchase, and others were done by consultants prior to purchase, but I'm not sure who paid for them.

Researcher: What do you feel are the main missions and goals of the organisation?

AM16: There is a mission statement, it's in our strategic plan. In general terms it's to provide a good service to our citizens, to provide a safe community with a high quality of life. We were in a workshop and I think we spent a day and a half trying to sort out what that should say.

Researcher: *Did you agree with it when it was developed?*

AM16: More or less. It talks about progressive, promoting growth, but it also talks about quality of life and maintaining a small town feel and all those things.

Researcher: How do you prioritise different areas of your work?

AM16: Funding is easy, because the water system is funded by the water system, the sewer system is funded by the sewer system, um the building inspections are funded by building inspections. To a certain extent those priorities are set by council when we take our budgets to them, and what I try to do is bring them the issues, and on the operations side if there is no change there are very few issues. Right now for instance I'm trying to talk them into putting a lot more priority onto storm sewer system maintenance and repair which is an area that's been ignored for one reason or another. So what I bring to them is a budget that says here's the status quo, and here's the extra funding that I need and by the way this includes one person and a truck and it's going to cost this much extra money. I then try to give them the reasons and they decide whether or not that funding will be provided. Once they've approved the budget, I suppose I have some flexibility, but I can't really reduce service in one area to increase service in another area that they haven't agreed to fund.

My own time, that's a good question, I guess there's kind of two halves to it, there's, you try and put time to the projects that have the most long term benefit, and at the same time you have to put out the fires, the things that are critical. So you have to try and balance those two and it varies quite a bit. This time of year is budget which is sort of dedicated to all areas but that kind of means that other areas tend to get put on the back burner. Times when there is a major development, we need to negotiate with a big developer, planning takes almost all my resources. The operations side of things, if

things are going well it actually takes very little of my time. It's only when things are kind of sideways. If we have an employee that's causing a bunch of grief of a water break down town in front of the Mayor's house or something.

Researcher: What do you perceive to be the challenges and benefits of small municipal supplies.

AM16: Well I think the challenge is having the expertise to do the work, because we are probably right on the cusp. If we were any smaller we wouldn't be able to manage it properly, particularly as we have a surface water supply. If it was groundwater it would be easier. But frankly we struggle because a lot of the issues that are challenging us are beyond what we are capable of really analysing. Your buddy *** there for instance came up with this NDMA stuff that he found in our water. Well, it's in our water, there are no rules, you really can't tell if its harmful or not, but they think I should do something about it but they don't know what I can do! And so there's an example where even the best people in the province have a hard time figuring out what to do with it. So of course we rely on the consultants, but you also need to have a certain level of expertise to be able to rely on the consultants. The advantage of doing the treatment ourselves is that it is more cost effective in our situation because to run a line all the way to Edmonton would be a ransom of whatever they want at the end of the pipe, and then you'd still have to pay for pumping and distribution and everything else. So that would put us at a disadvantage.

Researcher: What do you think are your strengths and weaknesses

AM16: Well I think we've been fortunate to date that we have been able to put the processes in place that we have needed to provide proper barriers. There are probably some of my colleagues that think we're nuts because they wouldn't touch a water source as bad as we have, but moving a community is a little hard to do. I think with the things that we have in place, processes that we have in place, we are producing good quality water and we should be able to continue to unless the rules change tremendously again, or more. The staffing at the operator level is going to be a challenge, and will continue to be a challenge. We are fortunate that we are a nice place to live so we can use that as an attraction to our retention policy.

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Researcher: *The risk management approach – why did you want to do it?*

AM16: I went to the conference and got all charged up. At the conference, it was the first time I had been exposed to it and it looked like a really good idea, I'm not sure I'd do it exactly the way that HACCP has it set up, but the way it goes through your whole system and looking for the failure points in a kind of a workshop environment and then identifying those points and trying to do something about it makes a lot of sense and although we've sort of done that intuitively we've never done it rigorously. HACCP talks about a single control point and it comes down to the one thing, and I think there's more than one thing.

Researcher: *What can implementing a RM approach offer you?*

AM16: Peace of mind. As someone at the conference said 'what are the things that make you wake up at night'.

Researcher: *What is that?*

AM16: Well, we've been through some of them. When we took the system over from the power company, a little light bulb burnt out and we ran out of water in the city. Because there wasn't a backup alarm system, and that light bulb wasn't on and we didn't know we were getting low on water. We ran ourselves out of water before we knew about it and we had to shut everybody off except for the hospital, we had to, I mean in today's world it would have been a huge news story. Back then it was just the city… we don't want to go through that again!

Researcher: *What steps did you take to implement that approach?*

AM16: We hired a consultant because we didn't have enough time or staff and sometimes those projects work better if you have someone harassing you for the information, if someone forces you to do it! And we got started and we got sidetracked just because this past year and a half have been busier than we've ever seen and we just don't have the resources and it just fell off the table. I'm hoping that we can get it running again.

The province went stupid in the last couple of years, people couldn't hire staff, prices

escalated three times. In the last three years we've added 10km of road, 10km of pipe, 10km of sanitary, 107 new manholes, 13km of storm, 387 manholes and catchbasins, 55 hydrants, 120 valves, 620 new lots and 360 new lots are proposed for this year. Each of those new lots has a development permit, the guys have to install meters, so we just, just to give you an idea, these are the number of registered properties…. We just don't have the staff, and to facilitate this growth everything else stopped.

Researcher: With all that development, why did the RM get dropped? Was it not a good idea to do it before?

AM16: Well nobody told us it was going to happen. All of a sudden it just happened, and you've got people at the counter needing stuff, so we just got overwhelmed. And at the same time as that was all happening council wouldn't give us the staff we asked for. The frills of doing extra stuff…. It was purely a manpower issue. I guess if I had personally insisted that it be done, it would have gotten done. But I got overwhelmed with other things and it just didn't happen.

Researcher: What about your staff - how did they feel about it?

AM16: I'm not sure, when I met with them, the senior people, they seemed to be reasonably keen that it was a good idea. They are generally quite accommodating to my crazy ideas that I come up with. From the results that you had, that I still need back. That was a little disappointing to me because the results that came back weren't real, and that told me that some of the staff don't have a good understanding of what the risks are, they are worried about oil being spilled in the lake rather than a pump that is going to fail. So maybe that means we are not doing as good a job as we can with the staff, or maybe it wasn't explained well enough to them. *** explained it to them, I wasn't there when he did. That might be part of the reason why it came off the rails, so instead of having this basis that we can go right away it meant we had to go right to the beginning again and explain why a nuclear holocaust isn't the kind of accident we are desperately trying to avoid.

Researcher: Have you had any significant past incidents or events?

AM16: Well, when we made the decision to switch on the WTP for the first time, and

we rushed it because the swimming pool was empty for maintenance and we had committed to the guy that when he filled it up it would be clear water not green water, and when we turned on the WTP on Christmas eve and immediately the water main in front of the treatment plant blew out of the ground and we spent the whole of the Christmas holidays trying to fix it and get the WTP back on before we ran out of water. Then we had the whole issue when the work that *** had us do with the gravel aquifer, contaminated the aquifer so then the water is very high in manganese and people are coming in with their laundry all the time, we are just inundated with complaints, and then the water treatment plant comes on line and we tell people there is no manganese anymore and for 6 months people are still getting stained laundry. 100s of complaints, last year *** phones me up and says we're not getting any water in from the lake and it turned out to be frazzle ice on the intake which was something we'd never encountered before and so we went for a day and a half without being able to get water. We've had issues but we've always been able to scrabble and get things done which I guess is what you are supposed to do. I'm worried that someone might dig through the supply line and we might not be able to replace the 24" pipes and clamps on hand, or that we do have them but they've been UV damaged because they've been sitting outside. Or we don't have the right type of gasket, those are the types of things that I'm hoping we will be able to identify in the risk assessment.

Researcher: How do you feel that you learn within the organisation?

AM16: We are slowly moving there, if one of those things happens now then we'd probably, our whole safety management program is all set up on that basis, so whether it's a near miss or a accident there is an investigation and a follow up and a learning process, I guess an education process. I'd like to think that if something like that happened then there would be a formal debrief and a report but I guess I don't have a policy telling me that I absolutely have to do that.

I actually I do, if it was bad enough that it was an emergency, and our emergency measures were activated then there would be all kinds of paperwork follow-up.

Researcher: What are the drivers for managing WQ?

AM16: I guess regulations and customer complaints. I guess there's a third one which is a desire to do the right thing. Microcystin is not listed anywhere in our approval, but we've spent quite a bit of money trying to minimise the risk of microcystin in our system. I'm sure it will be in our next approval!

Researcher: How is risk managed at the moment?

AM16: I'd say by the desire to do the right thing and I think that in a smaller community it works better than in a larger one, because really if there's only me, *** and *** making the decisions then you know who's going to take the flack for it if it doesn't work and we are going to be out there at three in the morning trying to fix it, we're also going to take all the political from it so it's a very direct one on one relationship, between if you let something go downhill then you are going to suffer for it whereas in a bigger place, there are probably lots of people, you know if they don't do their job, it's not them that's going to have to fix it.

Researcher: In terms of the public health responsibility - are the staff are fully aware?

AM16: You ask tough questions! I hope so, um I guess by encouraging them to go to courses, to go to the workshops, and courses. Trying to involve them in decisions, like *** at the WTP is invited to all the meetings on the GAC construction and I guess trying to lead by example.

Researcher: How do they demonstrate their commitment?

AM16: Well probably a couple of things, the quality of their work, how interested they are in what's going on. If they are taking the courses they are offered. If something is happening and it goes on a little bit past 5, whether they stick around to see the end of it. I think it's kind of interesting because the guys can sit around and whine a whole bunch, but if there's a water break they are moving heaven and earth to get it fixed in time so that certainly shows a bunch of commitment, they are staying till 10pm when they might have had plans that night. You know, technically they don't have to, they could tell us to go stuff ourselves.

Researcher: How do you maintain that?

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AM16: That's really tough, and to some extent it's up to the supervisor, but I'm not sure, but I think the way to do it, the way I'd like to think we are doing it is by giving the guys more responsibility, insisting that they make some of the decisions themselves and letting them in on the reasons why certain things are done, rather than just say go and do this. Show them the bigger picture of why it gets done if that makes any sense.

Researcher: How committed are your leaders?

AM16: I think if you asked any one of them they would give you a spiel about how important it is, I guess on the water side, they've let me spend a lot of money and as a result our rates are quite high, and they make those decisions based on advice that I and consultants give them and they pick option A or option B. The way the system is set up in ***, they don't have a whole lot of choice. Because if we are going to meet the approval we have to do some things. That said I think we've gone over and above the approval. Up until a year ago we had a city manager who was a professional engineer that had worked is way through the system and understood how important all this stuff was, we now have a city manager who is a lawyer and he looks at it from quite a different perspective, and it's not so much a common sense perspective as a cover your but perspective which can be used to the same end! It's interesting, if you asked me about sanitary sewers, last year despite all my best efforts we were basically in a situation where we weren't flushing our system and there weren't backups. Just ask ***, he was wild and I think he blamed me, until he sat in on a council meeting and in my mind they had made the wrong decision there, they had put people's homes at risks, not lives, but homes. On the water side there hasn't been a lot of question so I guess that indicates that they are committed or they believe what I say and they have gone with the recommendations for the most part. But a lot of the time I have our approval standing behind me, I don't think that the citizens want a council that aren't providing them with the best water that they can.

Researcher: What do you feel about Public vs. private utilities?

AM16: I think that if you have a progressive council that allows you to do the things you do, then you should definitely be able to do a better job than private. Private sector has to make a profit, so there's a big gap there where you can be inefficient and still be

cheaper than the private sector but what private sector brings to the table is in house expertise that you may have to go outside for as a public utility. I guess in a municipal setting it also allows someone else to be the bad guy, so it's not the city that is increasing the water rate, it's a private company that is increasing the water rate [if the city were supplied by a private company]. And I guess if you can't deal with it as a business, as a municipality then it may be easier to push it over onto the private sector, let them deal with it and be the bad guy. But you tend to lose a lot of control. The city looks after sewer, water, and storm. If you've got a big water break, all the guys are there helping with trucks or whatever. If we have a big snowstorm, the water guys shift over and do snow work, so we've got this big pool of people. If we take the water guys and we privatise them then first of all how is that company going to cope when they have an emergency, where are they going to get those people from, and secondly we've got less people to handle our own emergencies, because we've just taken a third of the guys and privatised them. There's an advantage to having that pool of people, particularly in a small community, where you don't have 100s of employees.

Researcher: How do you envisage risk management looking in the future?

AM16: I guess I envision a chart, a process diagram if you like, from start to finish, source to tap and somehow identify, you know, go through the process, the matrix, identify all the risks and then try to rank the risks based on how likely and what the consequences are. Then pick the top ones and figure out what we can do with them, and turn that into an action plan. I guess if a person does that every year or every two years, then you end up with a new set of action plans and eventually you are making your system more and more robust. I guess, what I would hope is that if there were some really glaring ones then they would pop out like a sore thumb and you could immediately make a plan to do something about it.

Researcher: Is there any mechanism for sharing of information between utilities?

AM16: Um, yes and no. It depends on who's doing the talking. We have a national association that has kind of one representative from each utility, so if you happen to be that one guy, and for me personally when I was on the board, there was an exceptional opportunity to talk to other utilities because I was meeting people from all across the

country, developing all kinds of interesting networks, that's probably how I got involved in this in the first place, so exceedingly so. For [a nearby supplier], who are a member but are not on the board it kind of depends on how much they participate right? There's a newsletter that's sent around, it has some good information in it but unless they're volunteering for people to sit on the committee, there really isn't great interaction and the conferences on the water side, well there's one in *** every year, but it's in *** and then there's a drinking water conference every 2 years and it's all over the place, so unless you can go all over the place then you are probably not networking. There's probably more networking that happens in the regional conferences that is more geared to the operators so it's probably easier to get to those conferences, and easier to network amongst the region. Some of the issues are probably a little more common as well.

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Appendix F   Code list example from Atlas.ti
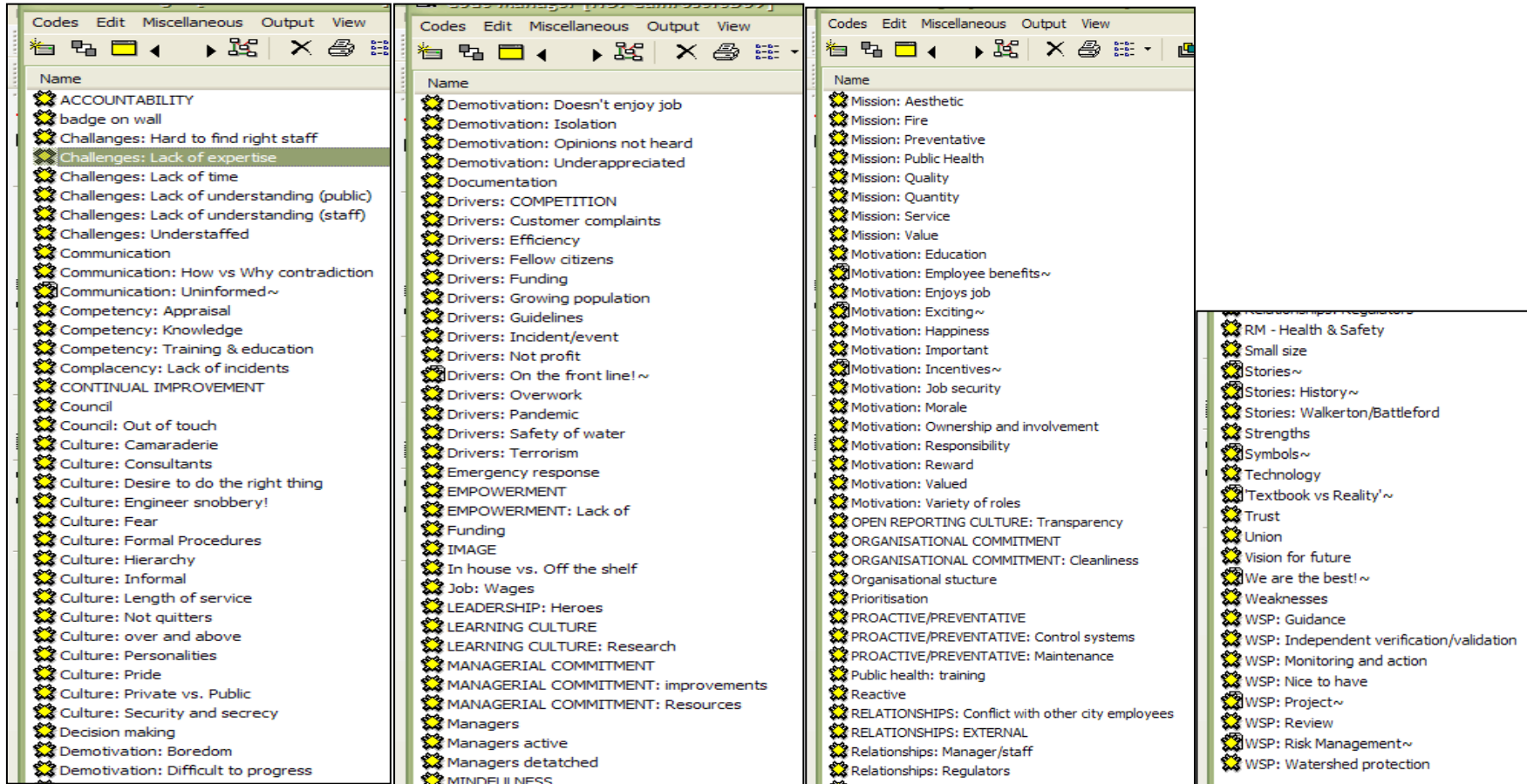
Appendix G   Coding example

File Edit Documents Quotations Codes Memos Networks Views Tools Extras Windows Help

P-Docs P 2: AE2.rtf~ Quotes 15:86 Codes ACCOL Memos Commi

14 *How do you feel about your job?*

15 Oh, my job is great! Its very rewarding because you know what your doing. Helping make clean water, something that you need forever and that's really the job security aspect, we always need clean water! But we are getting to the point where the regulations are getting a lot steeper and you are thinking hmmm!? Because you don't have to be universally trained to do this type of job but you do have to have some sort of knowledge, of water chemistry for example. But, no water plant is the same, some things will work some places and not others so its basically on the job work, making the best you can of your location.

Motivation: Job security Motivation: Enjoys job Motivation: Reward

Competency: Knowledge

16 *What do you feel about the organisation that you work for?*

17 I'm not appreciated. A lot of people aren't appreciated for what they do. And I think it is partly because of the union. If the union wasn't there, yeah some people would get fired but there would be more of an opportunity for the right people to move up. I think they are a little bit behind, because of the ridiculous economic growth that we've had in the last few years, and they still think that is OK that this person earns so much, but housing has gone up 100%! Everything, taxes, fuel, you name it. So yeah, they are a bit behind the time. For some, it would be better without the union, but not for others. So its catch 22.

Union Demotivation: Underappreciated

Council: Out of touch
Managers detatched
Union

18 *Do you think you'll stay here?*

19 I've worked for them for 13 years and I've got another 13 years of my sentence! So we'll play it by ear. Time will tell. Right now we are so understaffed. We are trying to get certified operators, which is almost impossible, because demand is crazy. We try to get people with a certain level of certification. It can be very overwhelming in your first week! We just can't find anybody suitable enough!

Demotivation: Doesn't enjoy job
Challenges: Understaffed Challanges: Hard to find right staff
Challenges: Hard to find right staff

20 *Were you involved in the risk assessment process?*

21 Partially. And I can't even remember if I was truly interviewed or not. I can't remember the details. They didn't give us that much information at the time that I can remember. I really don't remember that much about it.

WSP: Project~ Communication: Uninformed~

22 *What are your strengths and weaknesses about how water quality is managed at present?*

23 We have a city engineer that is very keen on it and will go to no end to make sure that you've got what you need to get the job done. Money is not an issue for the most part whereas with a lot of *** utilities find it very hard to get money for things. It is down to individuals for a large part, because Ted is very keen, he was passed

LEADERSHIP: Heroes
Funding
LEADERSHIP: Heroes

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Appendix H Workshop template

<u>Capability Maturity Self Assessment</u>

Name: _____

Company / Organisation: _____

Things to think about when filling in detail: How are the actions that you describe reviewed and improved? Are the processes applicable to the whole supply chain? Transparency, verification and validation, organisational learning (how you evaluate the process and learn from experience), feedback loops, review of procedures, initiation criteria, data management, scope, integration with other business practices, documentation and reporting.

<u>Scoring</u>

Score	Maturity	Description
0	Incomplete	The organisation is identified by incomplete processes, resulting in criminal or deliberate violation tendencies.
1	Ad Hoc	The organisation is characterised as a learner organisation with complete processes that are not standardised and are largely uncontrolled.
2	Repeatable	The organisation can repeat previous actions but cannot define those actions
3	Defined	Organisation can evaluate what it does and how it goes about it but cannot necessarily act on its analyses. **Open loop learning** (limitations in verification, validation and feedback mechanisms restricting ability to track and control processes)**.**

4	Managed	Organisation can control what it does in the way of processes, determining requirements and ensuring these are met through feedback. **Single loop learning** (Detection and correction of error, i.e. if something goes wrong, the organisation looks for another strategy that will address and work within the governing variables).
5	Optimised	Best Practice, capable of learning and adapting. Uses experience to correct problems and changes the nature of the way it operates. Processes are continual, explicit components of organisational activity forming part of the organisational culture. **Double** (Questioning the governing variables themselves and subject them to critical scrutiny. This may lead to an alteration in the governing variables and thus a shift in the way in which strategies and consequences are framed. I.e. reflection on whether the 'rules' should be changed, not only on whether deviations have occurred and how to correct them) **and Triple loop learning** ('learning how to learn', by reflecting on how we learn in the first place. People would reflect on how they think about the 'rules', not only on whether those rules should be changed)**.**

Responsibility 1: In conjunction with partners, develop and implement drinking water safety plans, covering catchment to consumer, and regularly verify their implementation and effectiveness using appropriate operational controls and monitoring.

	Process	Description	Detail	Score 0-5
1	Buy-in & commitment	How public health protection is viewed & promoted within the organisation. Understanding of culture and being aware of its impact. How committed are senior management to WSP development and PH protection, how do they demonstrate this. How committed is the rest of the organisation; are enough resources allocated to the project?		
2	Stakeholder engagement	Identification and engagement of relevant stakeholders. Definition of roles, responsibilities and reporting lines.		
3	Team development	Identification of size & required expertise; roles & responsibilities; team leader; time frame for completion.		

Appendix H Workshop template and summary

4	Risk Analysis	System Characterisation (document and describe system). Hazard Identification. Control Evaluation. Consequence Evaluation. Likelihood Evaluation. Risk Evaluation. Is this for the whole of the supply chain?		
5	Risk Based decision making	Establishing risk acceptance criteria. Identify and evaluate risk reduction options. Managerial review and option(s) selection. I.e. how do you use the outputs of your risk assessments?		

Responsibility 2: Put in place systems for testing the quality of water supplied including those necessary to meet regulatory requirements and make the results available to the public.

	Process	Description	Detail	Score 0-5
1	Setting of standards/ Health based targets	How are standards/targets set: regulations, specific health targets, availability and reliability, scientific evidence, acceptability, trust...		
2	Quality assurance	Defining monitoring of control measures and corrective actions, internal and external auditing, consumer satisfaction		
3	**Communication**	How are monitoring results communicated to the consumers? How are other quality issues communicated to the consumers? How can the consumers communicate with you?		

<u>Outputs from session</u>

Capability Maturity Assessment tool

Attendees were asked to work in pairs to discuss how they achieved the various aspects of the Bonn Charter's responsibilities of a water supplier; the first two responsibilities were focused on due to time constraints.

These responsibilities were split into several 'processes' and the attendees asked to complete a template, and score on a 0-5 maturity level. Feedback was then requested from the group, and the outputs would help in the development of the CMA self assessment format. Responses for the various sections are given in Table G-1.

Organisation commitment and Buy-in

The second part of this session asked attendees to split into three groups of around 10 people, and discuss aspects of organisational commitment in a focus group session and feedback to the main group. Questions asked included:

- How does your organisation demonstrate commitment to WSPs?
- How do people at different levels of the organisation demonstrate their commitment?
- Is this important? Why?
- Why are you doing/ not doing WSPs?
- Is protection of public health given due priority in your organisation? How?
- What makes WSPs work in your organisation?
- What stops them working?
- Regarding the CMA, what are the most important processes?

Appendix H Workshop template and summary

Table h-1 CMA completion

Responsibility 1	Responses Summary	Av. score
Buy-in and commitment	-[Public health protection] Linked, but limited to water standards. Senior managers demonstrate through recognition of WSP importance. Lower and implementing staff are committed. Insufficient/limited resources supplied. -Public health one of the key issues of the company, training on hygiene every year and also for new employees. Toolbox meetings, induction course for new employees. -Public health a priority issue, translated into fact through ISO 22000 certification. -WQ policy, MoU with department of health, various committees, good WQ structure. -Everyone is engaged to protect the water quality. The term WSP isn't used, but approach is essentially the same. -The public health is the primary goal at the company. We gave the stakeholder's commitment. We have CEO engagement. -WSP approved by the board. Issues discussed as a monthly potable water quality committee – compliance meeting. -WSP approved by board via COO. Potable WQ meeting on a monthly basis; check compliance with WSP. QA/QC compliance meeting. -WQ standards – ministry of health standard is regulated by third party. Well promoted within the organisation, pride in passing standards. Senior management are committed but money is the problem. If a WTW is not meeting standard then it must be closed. Rest of the organisation is committed but minor water supplies receive less money. If there is a problem then the public is advised – normally during/after hurricanes. -We don't have anyone. When we have a problem we talk with public health. Resources – areas we have problems, because we have places very far away. -Company wants to implement WSPs and also from last year, the company is more and more interested in public health protection. -Public health protection concerning a safe water supply is the mission of the company, so all the association knows this is the main objective. The board of directors decide to implement WSP at the company and they nominate the team. The team includes professionals of almost all the departments. -Public health is viewed as a priority. The objective is communicated to workers and stakeholders. The WSP was implemented only 6 years after the company began delivering water. The WSP is fully integrated within the operational areas, and everyone has knowledge of its requirements.	4
Stakeholder engagement	-Partially identified but not engaged. -Early warning system available. Regular contacts with stakeholders, roles and responsibilities are defined. -All the stakeholders are involved, but they have a lot of different interests. Meetings take place once a year with defined improvement actions. -No control on industrial/agricultural activity in the river basin but ongoing actions to improve cooperation and engagement.	4

	-Well defined, good reporting lines. -We give all information to the stakeholders 'clients'. Also the managers of polluters have been contacted to co-operate with the risk assessment. -Contractual agreement on water quality. Monthly feedback and catchment forums. -National forum for all water suppliers and health and environment ministers (every 6 months). Catchment (DoE) – state some problem with enforcement. -Rand water as a bulk supplier. WHO drinking water standards; catchment forums in place. -Challenge, particularly in catchment due to deforestation. WSP dialogue led to communication e.g. landowners and industries. Process is starting with stakeholders. Identified stakeholders by examining upstream use and early warning system now in place. -We have a good relationship with stakeholders, every month we receive a summary of the data analysis. -Stakeholders are identified, although there is not much communication. -Annual meetings with all the stakeholders to identify actions to improve. -The company identified its stakeholders, and communicated with them regularly, within matters of the WSP.	
Team development	-Identified for smaller utilities, time frames are defined but not adhered to. -We need a team for implementing WSP. Risk assessment with team of experts has not been done yet. -Multidisciplinary team with 5 elements for WSP. All personnel have once yearly training in WSP. Project has been completed. Roles and functions are well defined. -Good WQ team and resources, R&D, good WQ drive, management and support. -One full time person. Several staff from operations and maintenance departments. -WSP champion with scientific services. Site champions are at respective operational sites. -WSP committee and ministry of health involved, big task with pilot project... Staff awareness programme. -Champions for WSP and for QA & QC. Operations and scientific staff involved. -Personnel very committed and eager to learn more and improve procedures. -WSP is embedded within water company. WSPs prepared by external consultants with water production staff. One person ultimately responsible who drills down to individual operators. Plan is to prepare WSPs for all facilities, no timescale set, depends on money. -At the moment. We have created the WSP team for implementing WSP with people within the company with expertise. -12 Professionals from different departments for the development and implementation of WSP. Work done with an external consultant. 1.5 year timeframe for completion. -The team was chosen to incorporate different qualifications and expertise areas, but lack some that could not be overcome due to a lack of personnel.	4
Risk Analysis-	-System description well done. Control evaluation half done. Not performed for catchment or service. -Only for the drinking water supply chain. -All the hazards were evaluated for the different sources. Hazards list is analysed every three months. All hazards have causes, consequences and corrective actions identified. Hazard risk is re-evaluated each year, the whole supply chain is covered.	4

	-Good characterisation of system, risk assessment from catchment to tap. The gap is not understanding how detailed do we make it? -We have few processes with the chain completely studied about risks. -We have the whole system characterised and risk assessment and prioritisation. This applies only from the catchment to the service reservoirs. -Risk based on routine analysis. Short, medium and long term risk based assessment of infrastructure. Completed for whole system that the utility is responsible for (not distribution, company is a bulk supplier). -Risk assessment done for pilot in 2003, using 5/5 matrix -Second revision of WSP now in place. 93 flow diagrams, broken down into smaller bits. Hierarchy of hazards in place as a ranked list. Risk informed monitoring; asset management condition assessment; risk assessment for assets. -Fully quantitative risk assessment and use of risk assessment to support decisions. -All carried out for first WSP 'Enterprise risk management' policy is completed, starting implementation (training etc). ERM is embedding risk management principles into the whole of the water company (WSPs is one part of this process). -System characterisation in some companies, but other companies that have lower stage of development we have some problems related with consequence evaluation and so on. -We have started to identify hazards, although we haven't evaluated the risks yet. Catchment management relies on government. We are developing WSP for water treatment works and distribution systems. Buildings networks rely on administration (council) -The risk analysis done includes all the items and was done for all the water supply system (catchment, treatment plant, distribution and consumers). -The system is fully characterised. The hazards are identified and risks are prioritised, through frequency x consequence. We do not do this for the whole supply chain as we do not supply to end users, we supply to municipalities. We try to engage them in WSP but they did not respond favourable to cooperate due to a lack of personnel.	
Risk based decision making	-Risk acceptance criteria not defined. Outputs of risk assessment not used by management. -The output of the risk assessments are implemented in our drinking water sector plan (part of a do, check, act circle). -Risk acceptance criteria is established. Each hazard has the causes identified and control measures are implemented for each case (preventative or corrective). Each year we revise the WSP and risk assessment. -Acceptable risk defined at the ___ level by company management. Outputs of risk assessments considered in management reviews (once per year) and investments adapted accordingly. -After risk assessment we defined some control measures to minimise the risk. As soon as the financial resources were available, some of the control measures not implemented were taken, -The same as the previous question. Our regulator every year audits our system and we need to have everything in order. Adapted our plans to improve the management of the systems, to that we are delivering good water to our consumers -Since a lot of years ago, the philosophy of the company has been 'risk based decision making' although we haven't implementing the WSP yet. Risk acceptance criteria mostly determined in the WTW and reservoirs rather than the distribution network. -The risk assessment (high scores) are presented to the board of directors and support the asset management in order to define	4

	investment. -We established risk acceptance criteria, we implemented measures in order to reduce the risks. The management reviews the WSP annually and whenever a major incident occurs.	
Responsibility 2		
Setting of standards	-Standards based on WHO guidelines -Drinking water law, company quality prescriptions. -Targets were set using two ways. Treated water has own standards developed with the stakeholders in a drinking water product certification. The other standards were established for each hazard/danger based on WHO and other medical sources. -National and international standards and regulations considered as a minimum requirement. Operational limits on treatment steps based on quantitative risk assessment with acceptable risk -Dept. Health protocol feeds into SA water internal protocol. Good scientific backup, well defined, automated systems. -We have good references to follow and we really execute the actions. -According to legal standards; historical data (alarm limits); according to the weakness of the system. -National standards (WHO), results published monthly on internet sites. Monthly external standards. -Ministry of health national standards; in house treatment targets, sampling program. -National standards. Internal monthly publication of monitoring data. Monthly external audit (CSR). Select sample.... -Utility is using national water quality standards and is not in a position to set their own standards. Supply (quantity) targets established through a political process. -Regulations and health targets for specific areas, legislation. -Regulations, specific health targets based on scientific evidence and experience. -Portuguese regulations, WHO recommendations, EPA and Canada guidelines, catchment contamination, treatment limitations.	4.5
Quality assurance	-Control measures of corrective actions are well defined; both internal and external audits carried out once since inception; Consumer complaints well documented. -We have a certified quality control system which is audited frequently. -Control measures were developed for each critical control point including online, monitoring and validation action. System is verified by internal verification (2 per year), internal auditing by external personnel (once per year) and external auditing. -As required by ISO 9001 and ISO 22000. Specific website for consumers. -Regular surveys, improvement plans, gap registers. Regular internal and external auditing. -We have the monitoring of control measures already defined and the corrections action. We have internal auditing yearly and we analyse consumer satisfaction. -Laboratories are ISO 17025 accredited, all sites are ISO 9001 accredited. External water quality audit. Annual external water satisfaction audit. -ISO system, WQ audit (internal), customer survey.	4.5

	-Laboratories are ISO 17025 accredited; all sites ISO9001 accredited (QMS); external audit. -Intensive monitoring and following of actions. Investigations of consumer satisfaction. -We have plans that control the operation of the systems and we identify the problems and then apply the emergency and measures control that are defined in the control plan. Our consumers are the municipalities. -There exists corrective actions, although they are not all written. So one improvement we will do while implementing WSPs will be to document these corrective actions. No auditing of risk management yet, but will come next year. Customer satisfaction surveys. -Results published once yearly in a newspaper and monthly at our website. Provided to the consumers directly by request. Consumers may communicate by phone and email, letter, fax. All these items are implemented. -We did this, we defined measures, we audit. We measure our client satisfaction (every 2 years) and we analyse every month their complaints and monitor their satisfaction through a client	
Communication	**General**: -Websites used for dissemination of information and also as a means for consumers to contact the water supplier. -Local TV, newspapers, local authorities, mail (with bill) direct communications via helpdesk and visits are other ways mentioned of communicating with consumers. -Quality reports on varying frequencies – weekly, monthly, quarterly, annually to consumers and local authorities. -Consumers able to contact utility through helpdesks. **Specific Comments:** -Bad quality issues dealt with quickly; -There is a gap on how other issues are communicated to consumers. good protocol. -Monthly meetings related to quality issues -Summaries every month. It's the public health that communicate with the populations. They don't communicate with us, they communicate with the municipality. -Not much communication of monitoring or other quality issues with consumers, only what is the legal requirement. -Through reports (4 times a year), and we promote meetings with our clients and publish an annual sustainability report. We also report every result to our regulator. We don't supply to consumers, but they can communicate through our website, email and phone.	3.5

Organisational Commitment

Group 1

- CEO supports WSPs by allocating financial and human resources
- WSP commitment in communicated to stakeholders namely through sustainability reports.
- People at different levels of the organisation demonstrate their commitment to WSPs through their contribution in reviewing WSPs.
- WSP is an adequate methodology in risk management in water supply systems.
- Health protection is a mission of the water companies
- WQ indicators have an impact on individual evaluations (performance indicators)
- CEO support makes the WSP work.
- Changes in high level administration staff (personnel changes), and limited finances are barriers to WSP development.

Group 2

Commitment:
- Actually develop and implement WSP (as a continuous process)
- Top level buy-in
    - Resources
    - Sign up
- Act on identified risks
- In UK it secures funding, other countries may help with funding
- Consumer protection law (S.A) all products, a board level issue.
- Bonus link to WQ, and ISO 9001 compliance
- Provision of resources to implement
- Higher level of support
- Public health protection and training/awareness

Why WSPs?
- What goes on elsewhere
- Regulation
- 'right thing to do'
- Champion OR all
- Contractual advantage to private companies (i.e. if they do WSP they might have advantage in winning a contract)

- Time lag (minimum 2-3 years before benefits can be seen)
- Especially if company is already at a high level of WQ compliance

Why Not?
- Lack of technical knowhow
- Priority for funding

Public Health

- ISO 22000 (food safety) certification
- Performance criteria
- At senior management level, important in a different way – perceived risk vs. actual risk

Group 3

- CEO support for WSP in meetings
- Resources to do the job via business case (relatively straightforward)
- Financial penalties for supplying poor quality water
- WQ within personal performance framework (motivation) £ reward
- Executives moving up through ranks means greater commitment?
- Weight of responsibility – fear of getting it wrong!
- Rand – Board level support for WSPs; board level document
- WSPs as a national requirement
- Core corporate goals
- Scottish water – regulatory requirement; financial regulation back up – Regulatory coercion?
- Enthusiasts from within & reallocated resources
- Active transition/desire from compliance to ops. Monitoring
- Lessons learnt, the circumstances that led to say. Walkerton
- Use of introduction/training to reinforce corporate messages – introductory course
- 'Toolbox meetings' – Operational H&S and WQ are standing agenda items

What makes them work?
- Head office team develop WSP, field colleagues to generate WSP schematics and specifications (tell me what to do)
- Funding and priorities especially for smaller utilities and smaller facilities
- Simple message and outputs – corporate governance
- Corporate systems to 'flag up' out of spec (email and backup)
- Make it easy for people to do the right thing – better chance of success
- Reinforcement of senior management, critical (vs complacency),

Summary

CMA session

Self scoring, as expected was very high, with an average of around 4 for most of the processes. There were only two instances where a respondent scored themselves with less than 3, indicating that most respondents considered themselves defined, managed or optimised in all of the areas. Of course, this may be the case, but could not be confirmed without more in depth analysis of the utilities, but there is an indication that 'over-scoring' was an issue, with comments made in the free text box that there were weaknesses in the current approach, yet a high score, of 4 or 5 was still given.

Commitment focus groups

The focus group sessions brought up some interesting discussion, however, as many aspects of commitment and buy-in are part of the organisational culture and basic assumptions of an organisation, it is often difficult for members of an organisation to articulate what commitment within their organisation looks like, as these basic assumptions are often taken for granted.

Despite this, some interesting topics emerged around the subject of organisational commitment to WSPs and public health protection.

- Differences in how countries perceive events that have happened. Some take on board other utility events, others won't take notice unless it happens to themselves.
- Scorecards/performance targets/bonuses linked to WQ helps generate commitment (incentive)
- Corporate inductions include WSP/Public health
- Toolbox meetings (H&S and WQ are agenda items)
- Contractual benefit of doing WSPs (it helps you win a contract?)
- Induction plans and training tools
- High level corporate goals
- Board level support = taking an active interest, standing agenda
- Simplicity works (in developing WSPs)
- Corporate systems that back WSPs up
- Make it easy for people to do the right thing
- Commitment of resources by managers
- Are recommendations actually implemented (demonstration of support)

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- WSP – secures funding
- Consumer protection law in S. Africa helps get board interested
- Incidents both internally and internationally help drive WSPs
- Regulations drive WSP development
- 'Right thing to do'
- WSPs can however be a major time and cost commitment
- Benefits take a long time to materialise, this is particularly a problem where utilities already have a high WQ
- Lack of technical knowhow and funding may limit WSP development
- PH commitment:
    - Certification to ISO 22000
    - Developed countries, Water is not a big PH concern
    - How do you persuade senior management in this case?
    - PH vs. PH (many different perceptions) e.g. at Walkerton, 7 people died, resulting in a public enquiry. If 7 die on the road then it is a good weekend, different levels.

Appendix I   Example maturity levels for each element of BC-CMA

Element 1: Cultural Taxonomy

Level 5 Adaptive	'Triple loop' learning is displayed. Quantitative feedback is used, along with piloting of innovative ideas and technologies to ensure continual improvement. A continual improvement mentality pervades the organisation. Reporting is actively encouraged, and employees feel comfortable in going so. Silos do not exist and individuals, teams and departments work well together, sharing responsibility and striving toward a common goal than is promoted by leaders. Accountability to the consumer is felt by everyone, and all staff are mindful of their role in providing clean, safe drinking water. Proactive methods are used to ensure that this goal is achieved. Failures are learnt from, and individuals are not blamed. New ideas and innovation are welcomed from all levels of staff and employees are empowered and actively involved in decision making. Image and trust are important and the organisation strives to be the best. The importance of organisational culture is understood and efforts made to ensure that this is supportive.
Level 4 Controlled	Organisations ensure 'double loop' learning. The culture is now proactive, where efforts are made to anticipate problems relating to water quality before they arise. Efforts are made by leaders to ensure that all staff are aware of their public health responsibility, and to motivate employees. Staff are generally aware of what could go wrong in terms of quality and public health and are able to take their own initiative to avoid such instances. There are formal mechanisms for the reporting of close calls, and continual improvement initiatives. Management provide the necessary resources and listen to, and value the opinions of staff. Employees are given responsibility and involved in decision making. Image of the organisation to its consumers, and trust of the consumer is very important, with methods in place to ensure this is high. The organisation competes with other members of the industry to 'be the best'
Level 3 Defined	Organisation exhibits 'single loop' learning. Reporting is performed, of problems and close calls but is informal. Working together depends on the individuals in question and is varied. Managers are committed and provide resources for defined and standardised procedures. There are upward channels of communication, but the information from subordinates may be ignored. Leadership skills are starting to emerge, along with an awareness of image and competition with peers.
Level 2 Repeatable	Open loop' learning exists. Increasing members of the organisation feel accountable and are aware of public health, but work is still reactive, and reporting of close calls is absent. Successes can be repeated but there is little scope for continual improvement. Employees do as they are told with little involvement in decisions. Managers are committed but leadership qualities are absent. Employees still work at the individual or team level, and rarely mix.
Level 1 Ad hoc	Organisations do not learn from their mistakes. Failures, as well as successes are repeated and failures are covered up. There are no plans for continual improvement. Individuals may feel accountable to the consumer, but this is not widely shared. Work is done at the level of the individual, leadership qualities are lacking to be able to motivate others. Individuals are blamed if something goes wrong, as such, information is hidden. Much effort goes into 'putting out fires' rather than taking proactive approaches. Managers are superior and do not value the input of employees. The organisation is not concerned with its image or competition.
Level 0 Absent	

Element 2: Stakeholder engagement

Level 5 Adaptive	Relevant stakeholders identified and list reviewed and updated on a regular basis, includes internal as well as external stakeholders. Consumer considered key stakeholder. This is done explicitly for the purpose of WSP. Liaison is regular irrespective of incidents. Understanding of different organisational cultures. Processes in place to learn from other organisations. Information shared openly. Projects undertaken jointly. Commitment from senior managers in respective organisations (high level liaison groups).
Level 4 Controlled	Relevant stakeholders identified and list reviewed and updated on a regular basis, This is done explicitly for the purpose of WSP. Stakeholders work together to achieve an integrated approach, capitalising on synergies and collective knowledge. Regular interaction with well defined reporting lines. Roles and responsibilities documented and reviewed regularly, processes in place for communications procedures, specifically during incidents.
Level 3 Defined	Active process of stakeholder identification, although rarely reviewed, however there may be some difficulties in developing a good working relationship, and cooperation may be limited to one way exchange of information. Roles and responsibilities and reporting lines are defined. Regular liaison meetings may be planned but poorly attended. Good reactive engagement. May be some exceptional relationships but also some not so effective relationships.
Level 2 Repeatable	Stakeholder actively identified although incompletely. Stakeholders engaged on a reactive basis i.e. if there is an incident of PH significance, then health authorities/regulators /consumers will be contacted retrospectively. Reporting lines and protocols defined.
Level 1 Ad hoc	Ad hoc stakeholder identification. Stakeholders engaged on an ad-hoc basis (not actively identified). Some relationships with stakeholders may be productive but this is due to luck, or individuals involved and similar relationships cannot be repeated in other cases. Confusion over communication lines, particularly in times of crisis
Level 0	Stakeholder engagement is absent

Element3: Risk analysis (from MacGillivray)

Level 5 Adaptive	A broad range of mechanisms are in place to capture feedback potentially challenging the validity of the risk analysis process (e.g. benchmarking surveys, professional networks, external peer reviews, mathematical validation of technical methodologies). Norms and assumptions underpinning the design of the risk analysis process are openly questioned, critically evaluated and, where appropriate, revised in light of validation findings (i.e. double loop learning).
Level 4 Controlled	Verification extends beyond rigorous mechanisms to ensure procedural compliance (e.g. sign offs supplemented by in-depth audits) to provide formal quality control of risk analyses (e.g. peer reviews, challenge procedures, external facilitation, Delphi technique, etc.). Root and common causes of errors in the execution of risk analysis (e.g. deficient communication, overly complex procedures, lack of education and training) are identified and resolved. Modifications to the design of the process are identified, evaluated and implemented within periodic and event-driven reviews, but remain largely reactive and externally driven (i.e. mirroring changes to codes, standards, guidelines, etc.).
Level 3 Defined	The critical and key risk analysis practices are explicitly undertaken: system characterisation; hazard identification; hazard precursor identification; control evaluation; consequence evaluation; likelihood evaluation and risk evaluation.
Level 2 Repeatable	The critical risk analysis practices are explicitly undertaken: System characterisation; hazard identification; consequence evaluation; likelihood evaluation and risk evaluation.
Level 1	Critical practices (system characterisation; hazard identification; consequence evaluation;

Ad hoc	likelihood evaluation and risk evaluation) are implicitly or incompletely performed.
Level 0	Risk analysis is absent

Element4: Risk based decision making (From MacGillivray)

Level 5 Adaptive	A broad range of mechanisms are in place to capture feedback potentially challenging the validity of the risk based decision making process (*e.g.* benchmarking surveys, professional networks, external peer reviews, technical validation of decision analysis techniques). Norms and assumptions underpinning the design of the risk based decision making process are openly questioned, critically evaluated and, where appropriate, revised in light of validation findings (*i.e.* double loop learning).
Level 4 Controlled	Verification extends beyond rigorous mechanisms to ensure procedural compliance (*e.g.* sign offs supplemented by in-depth audits) to provide formal quality control of risk based decision making (*e.g.* conflict resolution techniques, peer reviews, challenge procedures, Delphi technique, *etc.*). Root and common causes of errors in the execution of risk based decision making (*e.g.* deficient communication, overly complex procedures, lack of education and training in the application of decision analysis techniques) are identified and resolved. Modifications to the design of the process are identified, evaluated and implemented within periodic and event-driven reviews, but remain largely reactive and externally driven (*i.e.* mirroring changes to codes, standards, guidelines, *etc.*).
Level 3 Defined	The critical and key risk based decision making practices are explicitly undertaken: establish risk acceptance criteria; establish criteria for evaluating alternative risk reduction options; identify risk reduction options; evaluate options and managerial review and options selection.
Level 2 Repeatable	The critical risk based decision making practices are explicitly undertaken: identify risk reduction options; evaluate options; managerial review and options selection.
Level 1 Ad hoc	Critical practices (identify risk reduction options; evaluate options; managerial review and options selection) are implicitly or incompletely performed.
Level 0	Risk based decision making is absent

Element 5: Quality Assurance

Level 5 Adaptive	Validation of the WSP from a variety of sources. Verification may include review of monitoring control measures, microbiological and chemical testing, regular planned review. Full audit system running smoothly with good follow up. Continuous informal search for non-obvious problems with outside help where needed. Fewer audits of hardware and systems and more at the level of behaviours (Parker et al, 2006). Audit welcomed as a positive experience. Customer service orientation and responsiveness pervades the organisation with targets to reduce numbers of complaints. Proactive methods to increase satisfaction. Complaints, enquiries and satisfaction surveys are monitored and fed back into the organisation and used to improve operations.
Level 4 Controlled	Consumer satisfaction measured (WHO). Validation of control measures using external references. Extensive audit program. Management and supervision realize that they are biased and welcome outside help. Audits are seen as positive, if painful (Parker et al, 2006). Complaints and enquiries are monitored and followed up. Consumer satisfaction survey carried out. Targets applied to reduce complaints and increase satisfaction, but some uncertainty. Proactive steps may be taken to inform consumers before planned work etc.
Level 3 Defined	Verification through compliance monitoring. Internal validation of control measures. Regular, scheduled audit program concentrates on known high hazard areas. Happy to audit

	others but being audited is less welcome. Audits structured in terms of management systems (Parker et al, 2006). Numbers of complaints/enquiries are monitored but no targets applied. Calls are followed up reactively but promptly. Customer service taken seriously.
Level 2 Repeatable	Compliance monitoring performed but rarely achieved. Accept being audited as inescapable, especially after serious incidents. No schedule for audits, as they are seen as a punishment (Parker et al, 2006). Lip service paid to consumer satisfaction, there may be a consumer helpline but satisfaction/complaints are not monitored and not followed up on a systematic basis.
Level 1 Ad hoc	Unwilling compliance with statutory inspection requirements. Limited monitoring, no validation of control measures. Audits are mainly financial, WSP/quality audits are unstructured and only occur after major incidents (Parker et al, 2006). Consumer satisfaction not seen as important, consumers may contact the utility but complaints/comments not monitored or followed up.
Level 0	No quality assurance mechanisms

Element 6: Safety and finance

Level 5 Adaptive	Total asset management plan that looks at whole life cost, rather than just initial outlay. Other factors considered important in addition to financial – public health and quality improvements are top priority irrespective of cost. They are in balance and therefore not an issue. Management believe that safety makes money (Parker et al).
Level 4 Controlled	The company tries to make safety top priority while understanding that safety contributes to financial return. The company is quite good at juggling the two. Money still counts (Parker et al).
Level 3 Defined	Critical and Key practices explicitly implemented: Define service objectives, establish asset register, assess asset and service performance, ID appropriate intervention options, Implement efficient operation, maintenance and replacement regimes, monitoring. Safety and profitability are juggled rather than balanced. Line managers know how to say the right things but do not always walk the talk. Safety is seen as a discretionary expenditure (Parker et al).
Level 2 Repeatable	Critical explicitly performed: assess asset and service performance, ID appropriate intervention options, Implement efficient operation, maintenance and replacement regimes. Cost is important but there is some investment in preventative maintenance (Parker et al).
Level 1 Ad hoc	Critical incompletely or implicitly performed Profitability is the only concern, water safety is seen as costing money and the only priority is to avoid extra costs.
Level 0	No understanding of balance between safety and finance.

Element 7: Competence

Level 5 Adaptive	Continuous capability improvement, organisational performance alignment, continuous workforce innovation (PCMM). Issues like attitudes become as important as knowledge and skills. Development is seen as a process rather than an event. Needs are identified and methods of acquiring skills are proposed by the workforce, who are an integral part of the process rather than just passive receivers.
Level 4 Controlled	Competency integration, empowered workgroups, competency based assets, quantitative performance management, organisational capability management, mentoring (PCMM). Leadership fully acknowledges importance of tested skills on the job. Workforce is proud to demonstrate their skills. Training needs start to be identified by the workforce (Parker et al).

Level 3 Defined	The critical and key risk analysis practices are explicitly undertaken. Competency analysis, workforce planning, competency development, career development, competency based practices, workgroup development, participatory culture (PCMM). Competence matrices are present as are lots of standard training courses, acquired knowledge is tested. Some on the job transfer of training (Parker et al)
Level 2 Repeatable	The critical risk analysis practices are explicitly undertaken. Staffing, communication & coordination, work environment, performance management, training & development (PCMM). Training is aimed at the person, often after events/incidents money is made available but training effort diminishes over time (Parker et al).
Level 1 Ad hoc	Critical practices are implicitly or incompletely performed. Workforce practices applied inconsistently (PCMM). Training is seen as a necessary evil and attended when compulsory by law (Parker et al).
Level 0	No workforce practices.

Element 8: Transparency

Level 5 Adaptive	Detailed quality reporting with two way communication lines between consumer, stakeholders and utility. Investigation and analysis driven by a deep understanding of how accidents happen. Real issues identified by aggregating information from a wide range of incidents. Follow up is systematic to check that change occurs and is maintained. Communication via a wide range of media such as website, direct communication, newsletters etc. Open and transparent. Accounts published widely. Welcomes interrogation or reports. Proactive consumer engagement.
Level 4 Controlled	Detailed quality reporting. Incident reporting involves trained investigators with systematic follow up. Reports sent companywide to share information and lessons learned (Parker et al). Active regular consumer communication, consumer communication is valued.
Level 3 Defined	The critical and key risk analysis practices are explicitly undertaken. Quality reporting follows fixed format and supplied to regulator and consumers. Procedures in place for incident reporting producing lots of data and action items but opportunities to address real issues are often missed. Search for causes is limited to level of local workforce (Parker et al). Active regular consumer communication (website, mail shots etc.)
Level 2 Repeatable	The critical risk analysis practices are explicitly undertaken. Reporting is simple and factual supplied to regulator as required by law. No specific consumer reporting. Informal incident reporting system and investigation only aimed at immediate causes with paper trail to show investigation has taken place. Little systematic follow up and previous similar events not considered (Parker et al). Active consumer communication but usually reactive.
Level 1 Ad hoc	There are no reports, but if consumers or regulators request information it will be given. Many incidents are not reported and investigation only takes place after a serious incident. Analysis does not consider human factors or go beyond legal requirement (Parker et al). Ad hoc consumer communication.
Level 0	Deliberate fabrication of reports. No consumer communication.

Appendix J Maturity tables (Suppliers B-D)

Element	Supplier B	Level
Cultural Taxonomy	Organisational culture has potential to support WSP development. Strong desire and pride in being 'the best', successful initiatives and awareness of programmes such as NRW, Knowledge Management, customer charter and info centre suggests that WSPs could be implemented to the same success. Top management is aware of the influence of culture and attempts to direct it. Customer responsiveness, image, religion, family & friends, people, profit, competitive, continual improvement, 'number 1', recognition, targets. Keen to learn from others and from best practice. Less evidence of using internal events and incidents and learn from these. Communication tends to be formal, for example via email 'memos' that have to be signed off by the CEO, or via regular scheduled meetings, good downward mechanisms of communication, upward needs to be developed more although efforts are being made to instil an 'open door' culture. 'Hot topics' such as NRW are widely communicated, efforts being made to make utility aware of WSPs but this is challenging as it is not coming directly from senior management. Management does not blame individuals, that if something is not achieved, it is everybody's fault, a joint effort. However, few events/incidents are investigated in detail. Awareness programmes for senior management from the WSP 'team'– one completed so far, intention for more but as yet managers have been too busy (end of financial year).. Utility paid for membership to the Bonn Network, despite interest coming from parent company. Awareness programme in operation. Support and assistance from parent company – initial desire to implement aims of BC. Strong support for water quality - expansion of department, creation of lab etc, but mindset is still in monitoring rather than risk reduction. Needs development. Awareness programme in operation. Suggests that certain areas needs more ownership and direct involvement in WSP development in order to create buy-in. Organisation is committed to 'be the best' but may not readily recognise their role in providing good, safe drinking water.	2
Stakeholder engagement	Ad hoc engagement of internal stakeholders on some projects but not WSP. External stakeholders engaged regularly, but not specifically for WSPs at present. Regular contact maintained but the structure of that contact is kept informal. Customer care programme, regular face to face meetings, in conjunction with key influencers. Need to engage corporate communications department in WSP. Customer Charter outlines the utilities responsibilities to its customers. Balanced scorecard indicates that department must speak with 6 key stakeholders every month and follow up with a contact report at a regional level and head office deals with state level key influencers. ISO procedures for contacting state government in times of crisis. Development of info centre, allowing various ways for consumers to contact the utility including toll-free phone, email and SMS. Initial team consisted of three people, one of which WQ expert from the utility, other two members from parent company, one of which has wide experience from the utility previously. Team attended 5 day workshop on WSP training for trainers. Has since been reviewed that there needs to be more input, particularly from the utility, and a wider committee has been established with wider areas of expertise. During WSP development,	2

	operations and production staff were involved in the system assessment stage. Pilot WSP outlines desired WSP team, however these were not involved in the pilot, however, pilot used as a learning exercise for future implementation. Informally decided on time frame for completion– anticipated completion of pilot project within 2-3 months, then will report to management before go ahead for wider roll-out.	
Risk Analysis	Extensive documentation for WTP and distribution system, Integrated GIS system for documenting assets and linking to other data. Not specifically for catchment although this has been done implicitly through research projects etc. Hazard identification has been performed for pilot project, however, needs more work. Initially focused on 'checklist' from guidance document. Hazard precursor identification has been performed for pilot project, however, needs more work. Initially focused on 'checklist' from guidance document. Control evaluation has been performed for pilot project, however, needs more work. Pilot WSP tends to document monitoring as control measures, rather than proactive, preventative controls. As a result there is no evaluation of the effectiveness of control measures. Consequence, likelihood and risk evaluation conducted for pilot plant – incomplete. Risk matrix used from case study in guidance document, during pilot, realized that this may need some modification. Risk department of the organisation focuses on business risk but have little involvement or input on WSP at present	2
Risk based decision making	Risk acceptance criteria are established to a certain extent – needs more development. At present risk scores are split into high or low, presume that low are acceptable and high are not acceptable. Specifically in the context of WSPs, risk reduction options, review and selection are not performed at present. A few risk reduction options are presented for high risks. Some has been performed by risk management department, but this is not linked with the WSP.	1
Quality Assurance	Follow MoH standards, which are base on WHO guidelines and reviewed on a regular basis. Daily production band determined by network department, regularly reviewed, WTP has to report if production falls outside of this band. Aim for continuous supply, if this failed (e.g. loss of WTP due to flood) then tankers are deployed. Also sets its own standards and targets, as MoH can be very delayed in responding to failures. Yes, although not extensively documented in WSP. ISO 9001 procedures define corrective actions to take when monitoring of a control measure indicates parameter is outside of desired limits. Still reliance on monitoring and reactive methods rather than as verification of a WSP. Extensive auditing procedures. Internal audit role of Water Quality department to monitor water quality. Internal Audit department and external audits conducted as part of ISO certification: 9001 (quality) and 17025 (lab), annually and re-certification audit every three years. Audit findings are welcomed as a means for improvement and embraced as a useful exercise. Annual customer perception survey, conducted by students with no company branded vehicles etc to ensure impartial. Feeds into tailored consumer information etc. Consumer satisfaction taken very seriously, regular liaison with consumer bodies.	3.5
Safety & finance	Investment planning for capital expenditures on water infrastructure projects initiated by planning department and then approved by regulator. Planning then translated to annual budget numbers and given to finance for compilation for Board's approval of the company's business plan and annual budget. Investment for cash surplus in the bank is through fixed deposits solely done by Finance. Supplier gives proposals for a tariff increase, then scrutinised by regulator. It will also go to the water forum, where consumers get a	3

	change to comment on tariff increases.	
Competence	Training needs identified by HR department and developed and implemented by internal training academy. Range of training available, technical, managerial, soft skills. Some external training providers are needed where necessary. All staff must attend a minimum number of training days per year.	3
Transparency	Financial report subject to external audit, for management and shareholders. Compare actual amounts against budgeted amounts so that remedial actions can be made if needed. Also report on the current period compared to the first quarter of the preceding period to look for changes. Do not report results to consumers or regulator, purely for internal purposes. Compliance monitoring is done by MoH. Does report percentage compliance to consumers. Utility has a website containing detailed information. Reporting to regulator Not extensively, but due to regulatory regime rather than utility per se.	2

Element	Supplier C	
Cultural Taxonomy	Occupational health and safety and environmental management systems are very high on the agenda. Security risk is taken very seriously. World class', trust, education, embrace change, prepare for the future, one step ahead, triple bottom line, providing a service, engineers know best, transparency, innovation, relaxed, environmentally responsible. Hostile to WSP development but lack of understanding. Support of research and development from external agencies and hosting of research students, development of pilot plant. Extensive data is collected but analysis is limited due to lack of manpower. Organisational learning tends to be informal but this is challenging due to increasing workforce. Willing and eager to 'learn best practice'. Good top down communication lines, through 'state of the utility address, staff newsletter etc as well as direct communication between managers and staff. Mechanisms in place for upward communication although not as well utilised. Senior management are very dedicated and committed to their roles and their employees, but do not see the added value of implementing WSPs due to lack of awareness. For other projects, financial resources and support from top management was fairly easy to secure if justification was given, or it was an example of world best practice. Employees appear committed, work long hours to fix breaks, take part in 'extra curricular' activities such as national and international competitions. 'Fair blame' culture, close call reporting is informal if at all. Corporate Balanced Scorecard, non monetary celebrations of successful projects. Informed vigilance is actively rewarded for health and safety but is more informal for quality.	3
Stakeholder engagement	Internal and external stakeholders engaged. Relevant stakeholders are actively sought at all stages in the supply chain. Watershed manager identifies relevant stakeholders within the watershed such as government, landowners, recreational users, industry etc. For the treatment and distribution stages, stakeholders such as regulators, health authorities, suppliers and contractors, people and industries that have the potential to contaminate the distribution system. The public has also been identified as a major stakeholder. Active engagement of stakeholders at all stages in supply chain. Regular tripartite meeting arranged by supplier between health authority, regulator and utility. Roles and responsibilities of various parties outlined in approvals, licences. Bylaws outline roles and	3.5

	responsibilities of the public in terms of cross connection control etc. Dedicated quality team, as well as a water quality committee and a total water quality management committee in development that will include GM. No WSP team. However for other projects considerable time is taken to identify the expertise and the size of the team required. Projects are given timeframes for completion to a certain extent, particularly when it is a regulatory requirement, using external expertise, or for external accreditation such as ISO 14001 or benchmarking. Internal projects that are not a regulatory requirement tend to have less strict timeframes.	1
Risk Analysis	Risk analysis is not formally performed for water quality risk. It is carried out for occupational health and safety, and security risk. Main documentation/flow diagram of system via SCADA system and a schematic of the WTPs. Raw water source description documented in source water protection plan and GIS. No formal basis for review, although source water protection plans should be regularly updated, lack of manpower to do this. 'System assessments' required by regulator to get new licence include a system assessment from source to distribution system. System information included in ERP; locations, GPS, population served, description of dist system and name, title and phone number of persons responsible for implementing the plan etc. Hazard identification/precursor id: Ad Hoc. This is done in some cases on an informal basis, for example through source water protection plans, ISO 14001, leak detection programme. Emergency situations as hazard precursors have been identified in the ERP. On line monitoring of various controls within the WTP. Pilot plant has been installed, in order to look at existing controls and possible improvements (double loop learning?). Consequence, likelihood and risk evaluation: Ad hoc, informal..Elsewhere in the organisation security risk assessment, occupational health and safety and source water protection plans.	1
Risk based decision making	Lack of risk management plan for water quality, corporate risk register focuses on security risk. Risk managed through 'multi barrier approach', and risk management 'inherent within the regulations'.	1
Quality Assurance	CBS actively promoted by the general managers and senior management to all staff. All staff receive a monetary bonus if the critical success factors (CSFs) are achieved. Specific health targets outlined in regulations. Extra targets outlined in CBS, CSFs including bacteriological compliance, public health infractions, regulatory compliance and adherence to objectives of the water quality master plan. Target for satisfaction about service in customer survey, service outages, average call wait time as CSFs. Targets for consistency, acceptability and trust are incorporated in the customer satisfaction target. Regular review of CBS. Extensive monitoring programme throughout supply, treatment and distribution. Monitoring points in distribution system rarely reviewed. Close links with WTP and distribution sampler, WTP is 24 hr manned, and continually monitored, corrective actions tend to be carried out by operators, rather than automated and reliant on knowledge and expertise, rather than formal predetermined procedures. Internal and external auditing is limited in terms of quality, but extensive for H&S and environmental management system, ISO 14001. Do use an externally assessed quality improvement tool, aiming to learn from best practice. Establishment of internal 'QA/QC' department. External lab used to check on internal testing. Board committees to challenge staff recommendations. Consumer satisfaction Annual customer satisfaction survey conducted over the phone by an independent consultant. Seemed to be discrepancy over whether these results were actually feedback into the organisation to make positive changes, felt that it was more a confirmation that they were	4

Element		Level
	doing well.	
Safety & finance	Investment planning based on condition assessment/lifecycle analysis. Delivery and budget are decided on an annual basis, within a five year business planning cycle, annual review and refinement. Regulator sets rates and utility can negotiate on an application basis. Rates are agreed typically for a 3-5 year range. Intention is to include mains replacement as an ongoing cost and take this money out of rates rather than borrow money for such things. Currently undertaking a cost of service study. Rate applications are a public hearing process.	**3**
Competence	There is less competition with other industry, and are perceived as a good employer to work for. Training is encouraged, with a certified operator programme, and funding available for any related training. HR team is finding it more difficult to keep track of training needs and skills since employee numbers nearly doubled. There is currently no formal kind of gap analysis, as when the corporation was smaller it was easier to get the 'big picture'. Workforce are able to identify training needs. Management also attend training courses. Environment regulator carries out an assessment of the facilities and grades it on a 1-4 scale, this will then determine the minimum level of training that is required for operators. Tries to employ staff of a certain level of education, all WTP operators and sampling staff need to have a certain amount of training before employment.	**3.5**
Transparency	The regulator dictates the accounting structure used, and finance department reports to board on a monthly basis; audited statements presented to board and regulator on a yearly basis. Regulator does not audit, but will go into some detail during rate applications and funding approvals. Results are made available to the public as part of an annual water quality report. This is not a regulatory requirement. Boil water advisories are advertised on regulator website as well as the customers affected being told directly. Bacteriological data is sent directly to the regulator, other data is supplied in a monthly report, unless there is a contravention, in which case it is reported immediately. Utility has a website containing detailed consumer information. Formal reporting for regulators, stakeholders, staff and consumers – which is performed voluntarily, not enforced by regulator.	**3**

Element	Supplier D	Level
Cultural Taxonomy	Formalised, 'wear the shirt', prove ourselves, professional, young, change, transparent, pride in working for the company, camaraderie, optimistic, want to be the best, learning. There was a feeling that the organisation needed to prove itself to consumers and shareholders. Change and learning were embraced in order to be one of the best, with high levels of optimism. The working culture was professional and quite formalised, but relationships with colleagues informal. Camaraderie was high, with a 'wear the shirt' culture. High levels of managerial commitment to staff and also WSPs. R&D valued highly with research partnerships with universities common, WSP outputs used to feed back into the organisation. Strong feeling of accountability to consumer even when purely a bulk supplier. Open reporting culture ad hoc, no formal mechanisms for reporting of close calls. Recent rapid advancements provide a momentum for continual improvement culture. Empowered workforce, encourage responsibility, involvement of WTP	**3.5**

	operators in high level WSP meetings for example. Recent poor water quality means that acknowledgement of what could go wrong is fresh in employee's minds but at risk of complacency due to huge advances in recent years.	
Stakeholder engagement	Internal and external stakeholders engaged. Internally from different departments in the organisation, particularly for WSP development, but also within other members of the group structure. External stakeholders include universities, regulator, health authorities, municipalities, catchment groups etc. and such relationships are generally driven by the supplier. Specific WSP teams with membership from wide range of disciplines, and with appropriate authority.	**3.5**
Risk Analysis	System characterisation being carried out, although after taking over from municipalities, this has been a challenge in some cases. Hazard identification, precursor identification and control evaluation undertaken as part of WSP in those subsidiaries that are implementing them, and has been performed for several years and reviewed. Consequence, likelihood and risk evaluation undertaken as part of WSP, although methods used vary between subsidiary company – developed individually with intention of making it tailored to that particular company. Some use food product certification and HACCP in this process. WSP approach used before formal publication of WHO guidelines and supplier assisted regulator in publication of national guidelines. Risk analysis is concentrated mainly on water treatment plant, although attempts made to include catchment stakeholders, and municipalities that run the distribution system and liaise with consumers. Desire to take over distribution role as well to ensure holistic risk management approach. Some subsidiary companies are yet to implement WSP approach but are being assisted by peers and holding company in this process.	**3.5**
Risk based decision making	Related to above, WSPs have been implemented for several years in some subsidiaries allowing establishment of formalised risk acceptance criteria, identification of risk reduction options etc. Senior management are active members of WSP process and options evaluation, review and selection are undertaken systematically. Risk management plans are reviewed on a regular basis and used to feedback into the business. Some subsidiary companies are yet to implement WSP approach but are being assisted by peers and holding company in this process.	**3.5**
Quality Assurance	Extensive external auditing due to high importance placed on quality certifications, environmental certification, food product certifications etc.; external input is therefore valued highly. Stricter limits imposed on self than regulatory guidelines in relation to water quality. HACCP and food product certifications to assure consumers and stakeholders of quality. Laboratories managed in house to ensure high levels of quality control and quality assurance for sampling and analysis. Inspections from regulator. However, employees stressed that it was not the 'badge' of certification that was sought, but the peace of mind, and external verification that it could provide that was essential.	**4**
Safety & finance	Water safety and quality have been top concern due to very recent development of the utilities and prior poor quality. This focus needs to be maintained going forward as 'added value' benefits of WSP such as cost savings are beginning to be realised, there is a risk that focus may move away from quality and toward financial targets. Finances readily available for quality initiatives, monitoring and preventative maintenance.	**2.5**

Competence	Training valued highly, value fresh ideas and new experience. Internal and external training opportunities are sought. Training achievements are celebrated within the organisation. High importance placed on innovation and collaboration with universities. No formal training requirements for operators as in Supplier A and C; trained engineers are valued highly. Challenge to find and attract competent employees in more remote areas of the country in which subsidiary suppliers are located.	**3**
Transparency	Open reporting via regulator and also by individual supplier. Quality data can be viewed on-line and open dialogue and communication lines with third parties, such as municipalities that run the distribution system. Strong feeling of accountability and need to work in a transparent and open manner due to the history of formation of the company and take-over from municipal run systems. Open financial reporting due to government requirements and public shareholders. Close working relationship with the regulator allows for honest and open communication. Group website with extensive information, as well as individual subsidiary websites containing further detail of operations, quality data etc.	**3**

Appendix K   Bonn Charter CMA questions

Element 1: Organisational culture attributes

Organisational culture is a pattern of shared assumptions that a group has learned as it solved problems, which have worked well enough to be considered valid and therefore be taught to new members as the correct way to perceive, think and feel. Organisational culture can act as a barrier or filter to the uptake of new practices.

On the following scale, please indicate your agreement with the following statements:

0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree

1. **Managerial commitment**
   a) Senior management provide adequate resources to do our jobs properly.
   b) Managers do not seem particularly concerned with water quality or public health.
   c) Management are actively involved.
   d) It is sometimes hard to get management to take an interest.
   e) Senior management pay close attention to what we do.
   f) What managers say and do is sometimes different.

2. **Learning culture**
   a) Information is continually developed through a broad range of channels and learned from.
   b) Learning tends to be down to the individual and success is difficult to repeat.
   c) We actively take part in research and development projects.
   d) Feedback is limited and learning is variable.
   e) We learn from experience outside our organisation.
   f) Learning is limited to improving already existing procedures.

3. **Internal relationships**
   a) There is good communication between departments and individuals.
   b) People tend to work in isolation
   c) There is good communication between different levels.
   d) Individuals look after themselves.
   e) There is a feeling of camaraderie.
   f) Management and non management staff do not mix.

4. **Accountability**
   a) We are responsible for protecting the health of our consumers.
   b) The organisation sometimes takes its public health role for granted.
   c) We provide an excellent service for our consumers.
   d) We have no strategy or voiced commitments to public health protection/water quality.
   e) Public health and water quality are important in decision making.
   f) Our consumers are lucky to have the service they do.

5. **Open reporting culture**

a) Employees are not afraid to report close calls, we can learn from these.
b) There are some things that our stakeholders do not need to know.
c) Employees are not afraid to report mistakes.
d) Management blames individuals if things go wrong.
e) The organisation openly reports to its stakeholders, and consumers on many subjects.

f) We only report what we have to by law.

6. **Continual improvement culture**
   a) We always strive to do better.
   b) We aim to achieve our legal responsibilities, to do more is a waste of resources
   c) Feedback is actively used to improve business processes.
   d) We are the top in our class, we cannot improve much more.
   e) We go over and above our legal responsibilities.
   f) Our water is already of a high quality, we do not need to improve

7. **Empowerment**
   a) Recognition is given where deserved (success is celebrated).
   b) Managers rarely listen to staff, or inform them of what is happening. **5**
   c) Staff feel empowered and valued.
   d) Staff are offered little opportunity to development.
   e) Staff are given responsibilities and involved in decision making.
   f) Management seem to know best.

8. **Organisational commitment**
   a) All employees are aware of their role in water quality and public health protection.
   b) Employees are only here for the pay cheque.
   c) Employees are aligned to the values of the organisation.
   d) Employees do the minimum.
   e) Employees give their most to their role.
   f) Employee turnover is high.

9. **Pro-activity**
   a) Takes proactive steps to reduce public health and water quality risk.
   b) We seem to spend most of our time putting out fires.
   c) The organisation has systems in place to manage water quality hazards.
   d) We do a lot after something has gone wrong, but do little to prepare for it.
   e) The organisation has a long term vision.
   f) We do little to manage risk.

10. **Leadership and advocacy**
    a) Leaders motivate other members of the organisation.
    b) When there is a new project, leaders do little to advertise it.
    c) Leaders actively try to create a good working environment.
    d) We lack effective leaders.
    e) The values of our leaders are clear.
    f) Our leaders rarely do what they say they will.

11. **Mindfulness**
    a) All people in the organisation are very aware of what could go wrong and guards against it.
    b) We are at risk of becoming complacent over our performance.

    c) Informed vigilance actively promoted and rewarded.

    d) The organisation tends to work in silos with little communication between departments regarding challenges and limitations.

    e) Fail-safe multi-barriers are actively identified and maintained at a level appropriate to the challenges facing the system. **0**

    f) Staff do what they are told, they are unsure of their role in the wider scheme of things.

12. **Competitiveness, image and reputation**
    a) We have full commitment to be the best with regards to water quality, public health & consumer trust.
    b) We are not concerned with what consumers think of us – we know we provide a good service.
    c) We try to do better than our peer organisations.
    d) There is little effort to increase the company's reputation.
    e) Staff take pride in working for our organisation.
    f) The organisation takes little interest in the work of other water suppliers.

13. **Understanding of culture**
    a) There is an understanding of the culture of the organisation and the impact this has on our activities.
    b) We do not place an emphasis on 'soft' issues such as culture and behaviour.
    c) The organisation has a clearly defined vision.
    d) There is confusion among staff over the missions and goals of the organisation.
    e) Leaders are active in changing culture for the better
    f) The culture of the organisation is not something that can be changed.

Element 2: Stakeholder engagement

Stakeholder engagement refers to relationships developed with people, groups, organisations or systems that affect or can be affected by an organisations actions, for example, catchment organisations, land owners, consumers, regulators.

1. **In which parts of the supply system are stakeholders engaged?**
    a) Catchment
    b) Treatment
    c) Distribution
    d) Consumer
    e) Business wide/strategic level

2. **On a scale of 1-10, how does the organisation view stakeholder liaison?**

    Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

3. **Which statement best describes how do you think the organisation feels about stakeholder liaison? (Choose ONE)**
    a) We do not engage stakeholders.
    b) It is easier to get the job done without the interference of stakeholders, they cannot help us.
    c) Stakeholders can be of assistance when something goes wrong.

    d)   Stakeholders can provide us with information that may or may not prove useful.

    e)   Stakeholder opinions and information are an important consideration in our decision making.

    f)   Stakeholder opinions and information are vitally important and play an active part in our decision making.

4.   Which statement best describes how stakeholders are identified and engaged? (Choose ONE)

    a)   We do not engage with stakeholders.

    b)   We liaise with some stakeholders, on an ad-hoc basis, some relationships work well, others don't, it depends on the individuals involved.

    c)   Some effort is made to identify stakeholders and we liaise with them in the aftermath of an incident for example.

    d)   Stakeholders are actively identified but developing a good working relationship is sometimes challenging, engagement is usually a one way exchange of information.

    e)   Stakeholders are actively identified, we work together to achieve an integrated approach. There is regular, scheduled interaction, information flows both ways.

    f)   Relevant stakeholders identified including internal as well as external stakeholders and consumers. Liaison is regular irrespective of incidents and there is an understanding of different organisational cultures. Processes are in place to learn from other organisations and information shared openly. Projects undertaken jointly. Commitment from senior managers in respective organisations.

5.   How often are stakeholder relationships reviewed? (Choose ONE)

    a)   We do not engage with stakeholders.

    b)   We engage with stakeholders but this is driven by other parties/ we do not review these relationships.

    c)   Rarely/ad hoc.

    d)   Only when an event occurs.

    e)   Often/ad hoc.

    f)   Regularly/scheduled.

6.   Thinking about roles, responsibilities and reporting lines, which statement describes them best? (Choose ONE)

    a)   We do not engage stakeholders.

    b)   There is usually some confusion over communication lines, particularly in times of crisis, individuals may be unaware of their roles and responsibilities.

    c)   Reporting lines and protocols are defined. But roles and responsibilities are less clear.

    d)   Roles, responsibilities and reporting lines are defined. We try to have regular meetings but these don't always materialise.

    e)   Well defined reporting lines and roles and responsibilities are reviewed regularly. We have procedures in place for communications, particularly in times of crisis.

    f)   Everyone is aware of roles, responsibilities and reporting lines, communication is continuous and instigated by both parties.

7.   If you have a WSP, what role do stakeholders play? (Choose ONE)

    a)   We have no WSP.

    b)   None.

    c)   Some provision of information.

    d)   High provision of information.

e) Provide information and assist in decision making.

f) Active members of the WSP team.

Element 3: Risk Analysis

Risk analysis involves the identification and assessment of risk.

1. **Do you have an explicit WSP or water quality risk management project?**

   Y / N / Pilot

2. **Do you undertake risk analysis in other areas of the organisation (e.g. corporate, health and safety, security, environmental etc)?**

   Y / N / Pilot

3. **Which of the following, if any, have you completed (for water quality risk)?** (pick all that apply)

   a) System characterisation   Y / N / Partially

   b) Hazard identification   Y / N / Partially

   c) Hazard precursor identification   Y / N / Partially

   d) Control evaluation   Y / N / Partially

   e) Consequence evaluation   Y / N / Partially

   f) Likelihood evaluation   Y / N / Partially

   g) Risk evaluation   Y / N / Partially

4. **Do you agree, partially agree or disagree with the following statements about how the organisation views water quality risk analysis?** 0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree (please put an 'X' in the appropriate box).

	0	1	2	3	4	5
a) We do not analyse risk						
b) We analyse risk because we have to by law						
c) We analyse risk because we want to prevent problems						
d) Risk analysis is as hoc						
e) Enthusiasm in risk analysis is renewed if there is a problem						
f) Risk analysis is the way we do business						
g) We do not have the expertise or resources to analyse risk						
h) All water quality risks have been addressed						
i) Water quality risks are given appropriate consideration when compared with other risks						

5. **Do you agree, partially agree or disagree with the following statements about how water quality risk analysis is performed in the organisation?** 0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree (please put an 'X' in the appropriate box).

	0	1	2	3	4	5
a) We do not analyse risk						
b) We learn from past incidents and these feed into risk analysis						
c) Risk analyses are peer reviewed						
d) Risk analyses are externally verified						
e) Risk analysis techniques are regularly reviewed and modified as necessary						
f) Risk analyses are reviewed regularly						
g) Risk analysis reviews are driven by events (WQ incidents, changes to regulations etc)						
h) There are standard procedures for analysing risk						
i) A broad range of people are involved in analysing risk						
j) Risk analysis data inputs are identified, stored and collected						
k) Risk analysis outputs are collected, stored and disseminated						

Element 4: Risk Based Decision making, review and options implementation

Risk based decision making and review involves the identification and evaluation of solutions to manage individual risks.

1. **Do you undertake risk based decision making and review for WQ risk?**

   Yes / No / Pilot

2. **Do you undertake risk based decision making and review in other areas of the organisation?**

   Yes / No / Pilot

3. **Which of the following, if any, have you completed?** (pick all that apply)
   a) Established risk acceptance criteria   Y / N / Partially
   b) Established criteria for evaluating alternative risk reduction options Y / N / Partially
   c) Identified risk reduction options   Y / N / Partially
   d) Evaluated risk reduction options   Y / N / Partially
   e) Managerial review and options selection   Y / N / Partially
   f) Implementation of selected options   Y / N / Partially

4. **Do you agree, partially agree or disagree with the following statements considering risk based decision making and review?** 0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree (please put an 'X' in the appropriate box).

Appendix K CMA self assessment questionnaire

	0	1	2	3	4	5
a)We do not assess risk						
b)We do not consider risk reduction options						
c)For each non acceptable risk, we consider a range of risk reduction options						
d)We ensure there is an audit trail when evaluating risk reduction options						
e) Risk reduction options are focused on our values						
f) We forecast the impact of risk reduction options based on our evaluation criteria						
g) Risk reduction options are selected based on the cumulative benefit (e.g. cost, benefit, sustainability…)						
h)Risk reduction options are selected based solely on cost						
i)Evaluation/analysis complements expert knowledge and judgement						
j)Decisions are made solely on opinions						
k)Risk analysis outputs explicitly inform decision making						
l) We have well defined criteria to determine whether we should accept or mitigate risk based on health based targets						
m)If a risk is unacceptable then risk mitigation is implemented immediately						
n)We are often unable to mitigate risk due to a lack of resources						
o)We consider short, medium and long term risk reduction options						
p) Once risk mitigation has been implemented we review our risk analysis and monitor mitigation measures						
q)Our risks are already mitigated						

5. On a scale of 1-10, when making decisions, how important to the organisation is:

a) Customer service   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

b) Reputation   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

c)Finances   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

d) Water quality   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

e)Regulatory compliance   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

f)Environmental protection   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

g)Public Health   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

h)Commercial interest   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

6. If you have a WSP project, how important were the following in the decision to adopt reasons for undertaking it? (rank each aspect, 1 = unimportant, 10 = most important)

a) Improved water quality compliance 1-----2-----3-----4-----5-----6-----7-----8---9----10

b) Improved public health   1-----2-----3-----4-----5-----6-----7-----8---9----10

c) Reduced health risk   1-----2-----3-----4-----5-----6-----7-----8---9----10

d) Improved stakeholder confidence   1-----2-----3-----4-----5-----6-----7-----8---9----10

e) Cost savings   1-----2-----3-----4-----5-----6-----7-----8---9----10

f) Regulatory requirement   1-----2-----3-----4-----5-----6-----7-----8---9----10

g) Improved public confidence   1-----2-----3-----4-----5-----6-----7-----8---9----10

h) Commercial interest   1-----2-----3-----4-----5-----6-----7-----8---9----10

Element 5: Quality Assurance

Quality assurance refers to planned and systematic production processes that provide confidence in a product's (drinking water) suitability for its intended purpose.

1. **Please indicate your agreement with the following statements regarding water quality monitoring** 0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree (please put an 'X' in the appropriate box)**:**

	0	1	2	3	4	5
a) We do not monitor						
b) Monitor the end product						
c) Monitor control measures						
d) Monitor health parameters						
e) Monitor aesthetic parameters e.g. parameters affecting discolouration or water taste/odour						
f) Monitor consistency of final product						
g) Monitor acceptability of water to consumers						
h) Monitor trust of consumers in quality of water						
i) Monitor consumer satisfaction with quality of water						
j) Monitor as required by regulation						
k) Have a risk based monitoring programme (this assesses likelihood of parameters being present in significant quantities and weights the sampling programme to these)						
l) Regularly reviews the monitoring programme						

2. **We have targets for:** (pick all that apply):
   a) Compliance with Regulatory requirements
   b) Health
   c) Consistency of end product
   d) Acceptability of water to consumers
   e) Trust of consumers in the water supplied
   f) Consumer satisfaction with water supplied

g) Reliability of supply (e.g. number of unplanned/planned interruptions)

3. **Which statement best describes how targets are set with regard to water quality and health? (Choose ONE)**
   a) There are no targets
   b) There are guidelines but we are unsure how to interpret or achieve them
   c) There are regulatory requirements and specific health targets that we aim to achieve
   d) We informally set health based targets that are more stringent than regulatory requirements
   e) We explicitly set targets that are more stringent than the regulations. These are reviewed on a regular basis
   f) We continually review and update targets. Feedback mechanisms exist to ensure continuous improvement. Health related targets may be suggested to or queried with regulator. Where regulations are not given, will use research to determine suitable limits

4. **Please indicate your agreement with the following statements on audit of water quality processes and performance with regard to your organisation?** 0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree (please put an 'X' in the appropriate box).

	0	1	2	3	4	5
a) There are no audits						
b) There are regulatory audits						
c) There are audits by external agencies						
d) There are internal audits						
e) Audits are ad hoc						
f) Audits happen when there is a problem						
g) Audits are regular and scheduled						
h) We get audited because we have not done our job properly						
i) Audit concentrates on high hazard areas						
j) When audited we do the minimum needed to 'pass'						
k) When audited we aim to achieve the best score possible						
l) Outside input in the form of audit is welcomed						
m) We can learn and improve from audit						
n) In addition to audit there is a continuous informal search for problems						
o) Audit is positive						

5. **On a scale of 1-10, how does the organisation view audit?**
   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

6. **On a scale of 1-10, how important is customer satisfaction?**
   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

7. **Please indicate your agreement with the following statements regarding consumer satisfaction in your organisation? (Choose ONE)** 0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree (please put an 'X' in the appropriate box).

	0	1	2	3	4	5
a) There are no methods for consumer contact						
b) We do not follow up on consumer contacts						
c) We aim to follow up on important consumer queries						
d) We follow up on consumer queries promptly						
e) We monitor consumer enquiries						
f) We take proactive steps to inform consumers of issues						
g) There are multiple ways that consumers can contact us						
h) We advertise communication methods						
i) We learn from consumer opinion/complaints to improve operations						

Element 6. Balance between safety and financial resources

The way in which water quality and safety is in balanced with financial resources, (provision of adequate finances for operation or investment in new assets). This does not mean that financial returns, charges made to consumers and proper efficiency are unimportant considerations rather that water quality and public health should not be put at risk as a result of the desire for inadequate cost recovery, financial return or unreasonable efficiency.

1. **When making decisions about finance and water safety, please indicate your agreement with the following statements?** 0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree (please put an 'X' in the appropriate box).

	0	1	2	3	4	5
a) Our main immediate concern is financial return or reduce costs						
b) Safety/quality is seen as a discretionary expenditure						
c) Public health and quality improvements are top priority						
d) Money is important but is in balance						
e) Safety/quality makes money and/or avoids unnecessary cost						
f) Water safety/quality is the top concern, but this also contributes to financial return						
g) Financial return/cost and water safety/quality is juggled rather than balanced						
h) Cost and financial return is top concern						
i) We understand the importance of preventative maintenance						

2. **When making asset management, please indicate your agreement with the following statements?** 0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree (please put an 'X' in the appropriate box).

	0	1	2	3	4	5
a) We have no asset management plans						
b) We assess asset and service performance						
c) We identify appropriate intervention options						
d) Efficient operation is implemented						
e) Maintenance and replacement regimes have been established						
f) We monitor asset performance						
g) Whole life cost considered						

3. **How important are financial targets to the organisation?**
   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

4. **How important are water quality targets to the organisation?**
   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

5. **How important are the following when making investments? (Unimportant = 1; Very important = 10)**

a) Regulatory requirements	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**
b) Customer satisfaction	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**
c) Politically sensitive issues	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**
d) Commercial drivers	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**
e) Rate of return	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**
f) Return to stakeholders	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**
g) Personal preference, experience or judgement of management	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**
h) Public health	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**
i) Environmental	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**
j) The cheapest immediate option	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**
k) Whole life cost	**1-----2-----3-----4-----5-----6-----7-----8-----9-----10**

Element 7: Competence

Competence refers to the ability of the organisation to perform a specific task, action or function successfully and will depend on the abilities of staff it employs.

1. **Which statement describes attitudes to training best?** (pick one)
   a) There is no training.
   b) Staff attend compulsory training courses as dictated by law, but these offer little benefit.

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c) Training is focused at the individual. If incidents or events occur then resources are provided for training.

d) There are many standard training courses available, and competence matrices have been developed. Acquired knowledge is tested and there is some on the job transfer of training.

e) There are many standard training courses available, and competence matrices have been developed. Acquired knowledge is tested and there is some on the job transfer of training, in addition, the workforce is proud to demonstrate its skills and begin to identify their own training needs.

f) Development is seen as a process rather than an event. Needs are identified and methods of acquiring skills are proposed by the workforce, who are an integral part of the process rather than just passive receivers.

2. **On the following scale, please indicate your agreement with the following statements** 0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree (please put an 'X' in the appropriate box).

	0	1	2	3	4	5
a) There is no WSP or WQ team						
b) The organisation is too small to have a dedicated team						
c) Structured team is absent, but people are responsible.						
d) There are no formal processes for team development.						
e) WQ team is seen as a 'police force' in ensuring operations comply						
f) There is a dedicated WSP or WQ team.						
g) Roles and responsibilities well defined.						
h) There are a good range of skills and competencies.						
i) The team has appropriate authority						
j) The team reports directly to top management						
k) Stakeholders are active members of the team.						
l) There is continual review of team members and identification of knowledge gaps.						

3. **On the following scale, please indicate your agreement with the following statements regarding human resources in your organisation:** 0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree (please put an 'X' in the appropriate box)

	0	1	2	3	4	5
a) We are adequately staffed in terms of quality and quantity.						
b) The organisation creates a desirable working environment						
c) Individual performance is measured and managed						
d) The organisation understands what competencies are needed and fills these gaps						
e) The organisation understands the importance of succession planning						
f) There are adequate career development opportunities						
g) We have a participatory culture						
h) Employees and work groups are empowered and encouraged to make their own decisions						
i) Staff development is assisted with the use of mentoring						
j) We have a continuous improvement mentality when it comes to staff competency						
k) Issues like attitudes are as important as knowledge and skills						
l) Group performance is measured and managed						

4. **Do you consider the necessary resources** (pick one for each: monetary, human and technical)

   a) Unavailable   Monetary/Human/Technical

   b) Difficult to obtain for proactive measures but available for reactive steps
                        Monetary/Human/Technical

   c) The requisite resources are identified, acquired and deployed
   Monetary/Human/Technical

5. **Is specific risk management training available to staff?** Y / N

6. **Is there** (pick all that apply):
   a) Defined education and training requirements for effective risk management?
   b) Education programmes and/or training opportunities to deliver the above requirements?
   c) Methods for evaluating the effectiveness of risk management training?
   d) Development opportunities to optimise risk management across the organisation?

7. **How important is education and training to the organisation?**

   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

8. **How important is it to employ well educated staff?**

   Unimportant 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Important

Element 8: Transparency

Transparency refers to openness, communication and accountability with staff, stakeholders and also the consumer. For example, open meetings, financial disclosure statements, audits etc.

1. **On a scale of 1-10, how transparent and open do you think the organisations' operations are?**

   Not at all transparent 1-----2-----3-----4-----5-----6-----7-----8-----9-----10 Very Transparent

2. **Which statement best describes communication within the organisation?** (Pick one)
   a) There is no communication between management and staff.
   b) There is a lack of communication from top management, other than telling people not to cause problems.
   c) 'Flavour of the month' topics are communicated but interest diminishes with time.
   d) Management shares a lot of information with workers but there is little opportunity for bottom up communication.
   e) Managers realise that dialogue with the workforce is desirable and a two way communication process is in place although this is not always utilized to its full advantage.
   f) There is a two way process in which management gets more information back than they provide, the process is transparent. There is a feedback mechanism from staff to ensure that commitment is communicated effectively to all.

3. **How do you report on incidents? (Pick one)**
   a) There is no investigation or reporting on incidents.
   b) Many incidents are not reported and investigation only takes place after a serious incident. Analysis does not consider human factors or go beyond legal requirement.
   c) Informal incident reporting system and investigation only aimed at immediate causes with paper trail to show investigation has taken place. Little systematic follow up and previous similar events not considered.
   d) Procedures in place for incident reporting producing lots of data and action items but opportunities to address real issues are often missed. Search for causes is limited to level of local workforce.
   e) Incident reporting involves trained investigators with systematic follow up. Reports sent companywide to share information and lessons learned.
   f) Investigation and analysis driven by a deep understanding of how incidents happen. Real issues identified by aggregating information from a wide range of incidents. Follow up is systematic to check that change occurs and is maintained.

4. **How would you consider the organisations reporting (pick one statement each for quality, financial, consumer reporting)**

	Quality	Financial	Consumer
a) There are no reports			
b) Reporting is ad hoc			
c) Reporting is simple and factual as required by law.			
d) Reporting follows a fixed format and supplied to the necessary audience.			
e) Detailed reporting over and above regulatory requirement, published widely.			

f) Detailed reporting with two way communication between stakeholders, published widely, we welcome interrogation.			

5. **Statements about transparency . Mark on the scales your level of agreement** (0 = Completely disagree; 1 = Mostly disagree; 2 = Slightly disagree; 3 = Slightly agree; 4 = Mostly agree; 5 = Completely agree) with the following statements.

a) **Substantial information: Is information the organisation provides to stakeholders accurate, timely, complete, reliable, comparable, easy to understand, relevant and detailed?**

Accuracy   0-----1-----2-----3-----4-----5

Timeliness   0-----1-----2-----3-----4-----5

Completeness   0-----1-----2-----3-----4-----5

Reliability   0-----1-----2-----3-----4-----5

Comparability   0-----1-----2-----3-----4-----5

Ease of understanding   0-----1-----2-----3-----4-----5

Relevance   0-----1-----2-----3-----4-----5

Detailed   0-----1-----2-----3-----4-----5

b) **Participation: When supplying information, the organisation asks the opinions of stakeholders, understands stakeholders, seeks the necessary information, utilises feedback and involves stakeholders.**

Opinions of stakeholders   0-----1-----2-----3-----4-----5

Understands staff and stakeholders   0-----1-----2-----3-----4-----5

Seeks the necessary information   0-----1-----2-----3-----4-----5

Utilises feedback   0-----1-----2-----3-----4-----5

Involves staff and stakeholders   0-----1-----2-----3-----4-----5

c) **Accountability: The organisation admits mistakes; provides balanced information; is comparable to the industry; open to criticism and is forthcoming with information.**

Admits mistakes   0-----1-----2-----3-----4-----5

Balanced information   0-----1-----2-----3-----4-----5

Comparable to industry   0-----1-----2-----3-----4-----5

Open to criticism   0-----1-----2-----3-----4-----5

Forthcoming   0-----1-----2-----3-----4-----5

d) **Secrecy: The organisation withholds information; blames others; provides unclear information or is slow to inform stakeholders.**

Withholds information   0-----1-----2-----3-----4-----5

Blames others   0-----1-----2-----3-----4-----5

Information is unclear   0-----1-----2-----3-----4-----5

Slow to inform   0-----1-----2-----3-----4-----5

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Appendix L   Bonn Toolbox tool example

Organisational culture and capability	**Water safety 'mindfulness'**	
	Management Guidance	

Information derived from:
   o Literature
   o Research
	Related tools:
	   o Modifying organisational culture 1 and 2.
	   o Senior management commitment
	   o Organisational commitment
	   o Organisational culture attributes.

Important Notes to users:
This document provides information to support improved management of piped drinking water quality by water utilities and other stakeholders. It cannot however be definitive and users must ensure that they assess local factors and particularly take account of any national or regional legislative requirements before use. Where necessary this may also need close collaboration with others. The priority to be given to implementing controls to manage identified water quality risks will depend on a proper prioritisation process by each water supplier.

Summary: A high awareness of hazard and risk, or 'mindfulness' is often attributed to High Reliability Organisations (HROs), those organisations that relatively few accidents compared to their high risk operations, for example nuclear power stations, navy submarines and air traffic control centres. Recent work has suggested that water suppliers may wish to learn from these HROs in order to reduce the chances of water quality incidents occurring.

Detailed information
Leaders within HROs recognise that human error occurs, but also that human variability and an ability to adapt to changing events is an important safeguard. These organisations focus on the system at large, seeking to remove error promoting properties through[1] :

- Establishing of an effective reporting culture.
- Analysing in detail the occurrence of incidents and close calls to uncover the recurrent 'error traps'; and
- Striving to imagine new scenarios that could occur and protect against these.

These features contribute to developing a 'mindful' organisation; one that has a preoccupation with the possibility of failure and its root causes, has a reluctance to oversimplify, is sensitive to operations, committed to resilience and deferential to expertise[2]. Leaders are instrumental in creating this mindful culture. Kotter [3] proposed six tasks that are needed to effect culture change, (i) establish direction; (ii) aligning people; (iii) motivating and inspiring people; (iv) planning and budgeting; (v) organising and staffing; and (vi) controlling and problem solving; of which (Ruchlin et al., 2004)[4] argued the first three were leadership tasks and important in creating a high reliability organisation.

Leaders play a pivotal role in high reliability organisations relating to safety behaviour,

leader influence tactics have a significant effect on individual employee behaviour[5]. Lessons may be learned from these organisations by leaders wishing to influence behaviours relating to public health and safety in the provision of drinking water. Hrudey *et al.*[6] developed these ideas to suggest elements that water utilities may wish to consider when trying to develop mindfulness:

- Informed vigilance actively promoted and rewarded.
- An understanding of the entire system, its challenges and limitations are promoted and actively maintained.
- Effective, real-time treatment process control, based on understanding critical capabilities and limitations of the technology, is the basic operating approach.
- Fail-safe multi-barriers are actively identified and maintained at a level appropriate to the challenges facing the system.
- Close calls (near misses) are documented and used to train staff about how the system responded under stress and to identify what measures are needed to make such events less likely in the future.
- Operators, supervisors, lab personnel and management all understand that they are entrusted with protecting the public's health and are committed to honouring that responsibility above all else.
- Operational personnel are afforded the status, training and remuneration commensurate with their responsibilities as guardians of the public's health.
- Response capability and communication are improved.
- An overall continuous improvement, total quality management mentality pervades the organisation.

Reference for further detailed information:

1. Reason (1998) Achieving a safe culture: theory and practice. *Work and Stress* 12 (3) 293-306.
2. Weick & Sutcliffe (2006) Mindfulness and the Quality of Organisational Attention. *Organisation Science* 17 (4): 514-524
3. Kotter (1990) What leaders Really Do. *Havard Business Review.* 68 [3] 103-111.
4. Ruchlin et al. (2004) The role of leadership in instilling a culture of safety: Lessons from the literature, *Journal of Healthcare Management,* vol. 49, no. 1, pp. 47-58.
5. (Clarke and Ward, 2006) "The role of leader influence tactics and safety climate in engaging employees' safety participation", *Risk Analysis,* vol. 26, no. 5, pp. 1175-1185
6. Hrudey et al. (2006) Risk management for assuring safe drinking water. *Environment International* 32 (8) 948-957.
AwwaRF (2007) *Risk Analysis Strategies for Credible and Defensible Utility Decisions.* American Water Works Association.

Typical resources needed:

Limited financial or material resources are needed. Time and dedication of leaders is needed to effect culture change.

Document creation:

Author	Date
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Cranfield University Ethics Policy

Cranfield recognises that it has an obligation to all its stakeholders to observe and maintain the highest ethical standards. These standards must be upheld in the day-to-day activities of all members of the University*. They embrace the Seven Principles of Public Life (the Nolan Principles) of selflessness, integrity, objectivity, accountability, openness, honesty and leadership. In addition, helping students to acquire a sense of professional and personal ethics in their work is an important part of the educational process the University offers.

The Cranfield University Ethics Policy articulates the general principles that will guide all members of the University in meeting these standards. They ar developed into more specific practices relevant to particular areas of activity (e.g. teaching, research etc) and particular members of the University (e.g. students, staff etc) in the Schools and Administrative Departments.

The Seven Communities

The University serves six (often overlapping) communities and in its daily operation interacts with a seventh, its suppliers. It is the University's responsibilities to these seven communities that form the underlying basis for this code of ethics.

Students

The University seeks to offer a rewarding experience to all its students to support their future careers, on courses clearly described in the University's Prospectuses. Courses are based on the transmission of up-to-date knowledge on fundamentals and their application, informed by the University's work.

Employers

The University seeks to meet the needs of all employers, both as sponsors of students and as employers of graduates. It aims to create graduates who can move smoothly into employment, contribute swiftly to the improved performance of their organisation, and rapidly rise to senior positions.

Research Clients

The University seeks to bring its full capabilities to its research programmes for all clients, in both the public and private sector. It seeks both to generate new knowledge and to apply existing knowledge, wherever in the world that may have been created, to create new insight and opportunities for the clients.

* Members of the University include all officers, staff, students, alumni, members of Court and Council, as defined in Statute II.

Teaching Clients

The University seeks to bring all its knowledge and experience to the design, delivery and assessment of all its teaching programmes. In particular it seeks to produce high quality graduates while giving value for money to all clients of taught programmes, both in the public and private sector in the UK and overseas.

Academic Community

The University seeks to fulfil its responsibility to the wider academic community, both undertaking all its academic work to the highest professional standards, and contributing wherever possible to the development of that community worldwide.

Wider Community

The University seeks to contribute fully to the development of its Local Regions, the UK and Europe, and to be perceived as one of the leading International institutions in each of its chosen fields.

Suppliers

The University seeks to co-operate with all its suppliers. It expects value for money, good service and fair treatment from all its suppliers and recognises its suppliers need for fair terms of trade.

Professional Conduct

All members of the University shall seek to conduct their work in a thoroughly professional manner to the benefit of all the communities that the University seeks to serve. More specifically, they will not claim knowledge, competence or qualifications they do not possess and they will take every precaution to ensure that their views are not subject to misrepresentation, and to immediately take steps to correct any misrepresentations. In their work members will not seek to harm anyone, but where irreconcilable conflicts arise, members will seek to resolve these with integrity. Integrity implies not merely honesty but fair dealing and truthfulness.

Teaching

In its teaching the university will endeavour to:

- Seek to bring all its knowledge to the design, delivery and assessment of all its teaching programmes;
- Describe clearly and appropriately the level and content of all courses;
- Recruit and admit only such students who are believed, by those admitting them, to be appropriately qualified, willing to study diligently, and able to satisfactorily complete, the course;
- Not discriminate on the basis of the student's source of funding, or on the basis of their race, colour, nationality, ethnicity, religious views, sexuality, disability or marital status;
- Assess fairly and honestly all students and maintain honest feedback to students concerning their progress;
- On completion of the course describe honestly and fairly the student's performance on the course.

Research

In their research all staff and students will endeavour to:

- Maintain professional standards including honesty and integrity;
- Properly document all results;
- Evaluate critically all results;
- Attribute honestly the contribution of others;
- Wherever possible report all results openly, bearing in mind the University's commercial considerations and sponsors' needs for confidentiality.

In addition all staff will endeavour to:

- Educate and develop new research workers to an understanding of good research practice;
- Secure and store primary data for an appropriate period of time.

Support Services

In the delivery of all services in support of the work of the University all staff will endeavour to:

- Seek at all times to deliver a prompt quality service;
- Not treat any clients in a way they would not personally wish to be treated by others;
- Give value for money;

- Project at all times a caring image of a University that seeks to help and support.

Consultancy

In its consultancy the university will endeavour to:

- Only offer consultancy and advice within the area of the consultant's knowledge and field of expertise;
- Maintain professional standards including honesty and openness;
- At all times respect client confidentiality, unless expressly permitted by the client to divulge any details;
- Give value for money.

Students

The University would wish to recruit only those students who will:

- Abide by the regulations of the University;
- Observe the University's Codes of Practice and Policy Statements including that on Free Speech;
- Conduct themselves in a manner which neither brings discredit on the University nor harm to its members.

Ethical Quick Test

Is the action legal?
Shall I be proud of it?
Will I feel bad about it?
Does it comply with the University's values?
How will it look to my friends and family?
How will it look in the Media?

If you know it's wrong don't do it.
If you're not sure, ask.
Keep asking until you get an answer that enables you to answer the questions above to your satisfaction.

Implementation of the Code

These fundamental principles should govern the conduct of each member of the University. Whilst the Principles defined above apply to all activities, there are in addition a number of areas where more detailed ethical principles and practices have been set out. These include *inter alia* the University's Financial and Personnel Manuals, the Student Handbook, and for research the relevant UK Research Council publication (e.g. EPSRC's "*Good Practice in Scientific and Engineering Research, 2002-2006*", MRC's "*Good Research Practice 2000*", Wellcome Trust's "*Guidelines on Good*

Research Practice 2005", and the *Joint Code of Practice for Research* issued by the BBSRC, DEFRA, FSA and NERC, April 2003). Each School or Administrative Department must ensure that all members of the University are made aware of both the Code itself and any local amplifications of it.

In the event that any member has any query or concern regarding the Code, or their obligation under it, they should immediately consult either their Head of School or Department, or (for staff) their Personnel Officer, or (for students) their Head of Registry.

Approved Council, December 2000; updated September 2003