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The Impact of Regulation, Ownership Arrangements, and Management Culture on Risk Management Practices within the Water Industry

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Abstract

Although the specifics of water utility ownership, regulation and management culture have been explored in terms of their impact on economic and customer value, there has been little meaningful engagement with their influence on the risk environment and risk management. Using a two phase case study approach as the primary source of information, this thesis asks what are the particular features of regulation, ownership arrangements and management culture which influence risk management, and what are the implications of these relationships in the context of ambitions for resilient organizations? In addressing these queries, the thesis considers the mindful choices and adjustments a utility must make to its risk management strategy to manage strategic tensions between efficiency, risk and delivery of safe drinking water. The case studies expose a tension between the ambition of the water service providers` strategic objectives to provide safe drinking water and the priority that executives place on corporate financial health. This leads to the conclusion that public health risk rankings need re-evaluation in relation to financial risks. There was no evidence to demonstrate that public health risk mitigation had been costed and evaluated against the strategic objectives of the studied organisations. Furthermore, the nature of risk conversations varied within organisations, changing the meaning of risk vertically within the business. A proposed model for the reporting of risk tolerance and risk appetite with respect to mitigating public health risk is the result. Such approaches to risk reporting and costing will support water authorities in meeting corporate aspirations to become 'high reliability' services while retaining the capacity to out-perform financial and service level targets, irrespective of regulation, ownership arrangements or management culture.

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ALLAN, R., JEFFREY, P., CLARKE, M. & POLLARD, S. 2013. The impact of regulation, ownership arrangements and management culture on managing corporate risk within the water industry. Water Policy, 15, 458-478.

ALLAN, R., MAUELSHAGAN, C., LUIS, A. M., JEFFREY, P. and POLLARD, S. 2013. Making risk management stick: reflections on risk governance in water utilities. In U. Borchers, J. Gray and K. C. Thompson (eds.), *Water Contamination Emergencies: Managing the threats,* RSC Publishing, Royal Society of Chemistry, Cambridge, ISBN 978-1-84973-441-7, pp.33-46, DOI:10.1039/9781849737890-00033.

Chapter 1: Context of the Study

The management of risk to protect public health and the environment is arguably the principle purpose of any organisation or institution charged with the provision of water and waste water services (Pollard, 2008). Internationally there is no real consensus on best practise in delivery of drinking water and wastewater services in terms of the ownership arrangements of the service providers. The majority of countries still provide drinking water and wastewater services through municipal public bodies with a growing number engaging the private sector to deliver elements of the service. Very few countries, with the exception of England and Wales, have a fully privatised water industry (Parker 2003, Owen, 2011). Here, privatisation is taken to mean the strategic water assets are owned, operated and maintained by a privately owned organisation. Furthermore there is no consensus internationally on the most effective regulatory regime for protecting customer interests with respect to delivery of drinking water and wastewater services (Section 2.2). The operating environment for business in the water sector is complex (Parker, 2012), with service providers expected to manage aging infrastructure at a time when capital investment funding is limited, decisions need to be evidence based, and company performance is under public and regulatory scrutiny. Water Service providers are expected to manage multi-disciplinary activities from catchment to treatment, treatment to customer and from customer back to the catchments. The end to end process of water supply and wastewater treatment faces an array of threats to operability (and opportunities) which can be usefully described in risk terms. The water companies are also obligated to completely assess, prioritise and manage risks in an environment of competing management objectives. This thesis sets out to better understand the tensions between choices in regulation, ownership

arrangements and management culture; and the influence that this has on risk management.

An understanding of the nature and impact of risk within the water sector can only be attained with reference to the societal role which water services play. Although it is not the intention of this thesis to itemise or delineate all relevant risks[1], a broad overview of the central concerns that drive risk appreciation and management within the sector is warranted. The principal operational driver for any water and wastewater service provider is the delivery of fresh clean drinking water and the removal of wastewater in a safe and responsible manner. The Bonn Charter (2004) is the central statement of ambition here and constitutes a sectoral commitment setting the framework for the basic operational and institutional arrangements necessary for the provision of water and wastewater services, from source to tap. State and contractual performance measures provide operationally relevant targets but the Bonn Charter offers a (globally legitimate) consensus position on the principles of water service delivery. The primary objective of the Charter is to enable provision of good safe drinking water that has the trust of consumers. To achieve this, the service provider must aspire to provide water that is safe to drink, aesthetically pleasing and in sufficient volume at a cost that is considered good value for money. The Charter links this ambition to a consideration of risk, stating that;

'management control systems should be implemented to assess risks at all points throughout water supply systems and to manage such risks.'(p9)

[1] Within the Water Sector risk includes such elements as operational, economic, reputational, supply chain and technical risks. Within these broad risk categories there are sub-sets, for example, within economic risk there will be elements of risk associated with capital investment, operational costs, the cost of unplanned interruptions to supply, etc. This thesis does not intend to map out all relevant risk types.

A risk based approach to quality service delivery is also evident in the World Health Organisation's (WHO) Drinking Water Quality Guidelines, which documents the requirements for the provision of safe drinking water based on a preventative risk management philosophy. The guidelines recommend the development and implementation of water safety plans (WSPs) and a detailed methodology for their development (WHO, 2002).

The WSP approach is designed to assess the risks to the water supply by identifying mitigating actions that prevent raw water pollution from occurring; establishing appropriate treatment processes; and documenting risks to the water supply in distribution that prevent secondary contamination post treatment. These risks might relate to asset condition, financing, technology performance, skills & competencies, or any of a whole host of factors embedded within and without the utility's corporate remit. The principles within the WSP approach are scalable from small rural supplies to larger networks that serve urban centres. The WSP approach provides an important mechanism that enables water companies to take steps towards pro-active adaptive management, as discussed by Davidson and Deere (2005). Other contributions (e.g. Byleved *et al*., (2008)) build on this principle and explore the benefits of using safety plans to inform communication strategies when dealing with public health matters. Yet others, (Hrudey, 2001, Pollard *et al*., 2004, Hrudey *et al*., 2006) provide compelling evidence for the value of the risk management approach which lies at the heart of water safety plans, whilst Summerill *et al*. (2010b) have considered aspects of leadership in risk governance within the water utility sector.

Other recent work on the application of risk management processes in the water sector (MacGillivray *et al*., 2006, 2008) and (Pollard *et al.,*2007; 2009*)* propose benchmarking criteria to aid Water Service providers in successfully managing the challenges of cost reduction and risk mitigation. Consideration is given to other important influencing factors such as competition, leadership and governance that have a role to play in establishing an organisation`s strategy in delivering water and waste water services that meet regulatory objectives (quality, environmental and financial).

1.1 Managing risk within the water sector

As stated above, managing risk is set against the backdrop of a complex operating environment. The water service provider must effectively and efficiently manage a range of assets that vary in terms of age, design and capacity. This is done within a multi-stakeholder, institutional and business context where there is competition for financing between activities which cover operations, capital investment and maintenance. Trade-offs and strategic choices are made by management as they seek to deliver services. At the same time organisations are expected to demonstrate capability in risk management which encompasses appropriate systems, processes, measurement and transparency through reporting.

1.2 Regulation and risk within the water sector

There is general consensus that well designed and implemented regulation can benefit the common good in society (Haines, 2011; Pollard 2008; Gunningham and Sinclair, 2002). However there is little consensus on the optimum regulatory framework for managing risks within the water sector (MacGillivray *et al*, 2008). Water and wastewater

supply services are, in many cases (but not exclusively), regulated by an environmental regulator, drinking water quality regulator and a financial regulator. A tension often exists between the regulatory objectives of the respective bodies which vary with political direction (Haines, 2011). Debate continues as to whether centralised "command and control" regulatory systems should be replaced by a form of self-regulation (Gunningham and Sinclair, 2002). This debate has heightened in recent years as government spending is under increased strain from global economic challenges. This in some way has encouraged politicians to push the management (and cost) of risk back into industry and the water sector is no exception here. As regulation shapes behaviours, it is of interest to identify the impact that changes in regulation have on risk management practises within the water sector. Table 1.1 summaries the percentages of private sector participation in water management; together with regulatory operating systems; and a range of data which informs the characterisation of water management for a selection of countries. The data from the table has been collected from multiple sources (Marques, 2010, Economist, 2010, Owen.D.L, 2011). The table illustrates the variation in ownership arrangements (discussed further in Section 1.3) employed to deliver water service over a wide geographical area containing a broad range of populations. Supporting water supply services are a range of regulatory systems which have been broadly split into centralised, decentralised, sector specific, multi-sectoral, independent and non-independent characteristics. Within these broad categories there are region and country specific variations. For example in Armenia the "multisector regulatory system" called the Public Service Regulatory Committee (PSRC) is interdisciplinary (economic, quality and public service competencies) and covers water, electricity, gas and telecoms. The PSRC is classified as independent from political control

and has autonomy to apply sanctions and enact legislation. In general the PSRC operates financial mechanisms based on an in-year rate of return scheme.

In Italy there is a sector specific regulator, the “Committee for the supervision of the water resources” known as COVIRI. The regulating body sets pricing and monitors the application of laws relating to water. While COVIRI is made up of different stakeholder actors it is controlled directly by the Ministry for the Environment and therefore cannot be classified as independent.

Kenya operates a different regulatory system that is classified as both sector specific and independent. The regulator here is known as the “Water Service Regulatory Body” (WRSB). The WRSB has control over economics, water quality, customer rights and sustainability of the water systems.

In Australia, Canada and the USA generally have devolved regional multi-sectoral regulators that are classified as independent. In each case the regulatory authorities cover: oil, gas, telecoms, water, electricity and, in some provinces, transport. While classified as independent, there is evidence (Chapter 5) that the regulators in Canada come under political pressure to avoid reporting failures (Section 5.5.5) which calls into question the regulators independence and ability to enforce legislation.

In regions such as Central and Eastern Europe and some parts of Asia and Oceania the regulatory model is based on non-independent multi-sectoral regulatory systems which have an increased level of state control. These agencies have structures in place designed to balance the needs of the customers with those of the water service providers. The principles are based around the provision of good drinking water quality and safe sanitation at an affordable price.

Each country specific system has evolved over time and to meet the needs, or perceived needs of the countries` inhabitants. Table 1.1 illustrates that factors such as; number of inhabitants, geography and water consumption per capita do not appear to influence the choices of regulatory (or ownership arrangements) when considering best practise in delivering water services. Table 1.1 also shows a significant variation in customer charges for the selected countries (either as a charge per cubic meter or as an annual fee). Tariff setting does not appear to be directly related to the choice of regulatory model (or ownership arrangements). Given the range of variations exposed in Table 1.1, and of direct relevance to this thesis, it is of interest to examine how the choices in regulatory systems influence risk management approaches (explored in Chapter 5, 6 and 7).

Table 1.1: Ownership Arrangments, Regulation and a range of parameters associated with water management across a selection of countries (Marques, 2010; Economist, 2010; Owen, 2011).

Region	Country	Private Sector Participation		Regulatory Model	Area of country	Population	Population Density	Service Coverage			Number of operators		Volume Water Abstracted	Volume Abstracted for Drinking water	Ave Consumption	Water Losses	Water Services Average Price	Ave Invoice per Customer per Annum	Sectoral Employment
		Water	Wastewater					Water	Wastewater services	Waste Water Treatment	Water	Waste Water							
	Units	%	%	N/A	km^2	x Million	$inhabitants/km^2$	%	%	%	N/A	N/A	Million m^3	Million m^3	Litres per Day per Person	%	$Euro/m^3$	Euro	N/A
Western Europe	Belgium	3	10	Devolved regional regulator	30500	10.5	-	99	82	50	-	-	730	400	106	-	0.79	57	7200
	France	67	47	Sectoral regulator - not independent	543965	64.4	112	99	80	80	75	52	14900	14400	165	-	3	177	Circa 500,000
	Greece	35	38	Multisectoral regulator - not independent	132000	11	84	-	-	-	>1000	>1000	800	600	200	25	-	-	-
	Italy	43	33	Sectoral regulator - not independent	301300	59.4	197	96	84	75	91	91	7600	4500	230	40	1.23	250	64000
	The Netherlands	0	10	Sector Specific independent regulator	41500	16.5	395	100	98	97	10	25	1210	1100	124	10	1.34	177	4900
	Portugal	25	24	Multisectoral regulator - not independent	92300	10.3	111	91	75	66	523	314	862	560	153	35	0.33	130	17500
	Sweden	1	1	Devolved regional regulator	45000	9	-	100	100	-	294	294	900	18	188	22	0.68	-	6000
	United Kingdom	87	90	Sector Specific independent regulator	235000	58.8	408.8	99	96	93	26	11	6307	4790	153	28	2.5	770	38700
Central and Eastern Europe	Armenia	23	0	Multisectoral independent regulator	298000	3.2	101	90	70	0	5	5	588	88	84	85	0.36	-	-
	Czech Republic	71	69	Multisectoral regulator - not independent	78900	10.3	132	92.4	80	75	1211	1211	699	532	100	24	1.8	66	15000
	Kosovo	11	0	Sector Specific independent regulator	10900	2.1	220	74	55	0	7	7	138.8	57	180	59	0.14	108	1500
	Lithuania	0	0	Multisectoral regulator - not independent	65200	3.4	52	77	66	60	300	300	140	98	63	27	1.12	40	6431
	Romania	11	0	Multisectoral regulator - not independent	238391	22	-	70	50	-	2000	2000	900	300	200	-	0.23	-	150000
	Slovak Republic	20	20	Multisectoral regulator - not independent	49000	5.5	111	86	58	55	14	14	325	225	121	32	0.65	-	8740
SubSaharan Africa	Ghana	0	0	Multisectoral independent regulator	238500	23	93	59	7	-	2	1	205	103	20	50	0.43	-	3200
	Kenya	0	0	Sector Specific independent regulator	538400	34.7	59	55	25	20	100	50	-	-	-	60	-	-	-
	Mozambique	3	0	Sector Specific independent regulator	801600	21.4	25	26	4.6	3	220	20	85	42	21	51	-	-	-
	Niger	4	0	Multisectoral independent regulator	1267000	14	11	63	-	-	2	0	43	37	12	-	0.33	-	-
	Tanzania	0	0	Multisectoral independent regulator	945100	38	41	60	3	3	20	10	185	111	14	40	0.28	-	-
	Zambia	0	0	Sector Specific independent regulator	752600	11.7	16	68	34	34	29	29	316	168	110	47	0.25	-	-
Asia and Oceania	Australia	37	12	Devolved regional regulator	7700000	21	-	-	-	-	-	-	19	2	280	12	0.59	341	12000
	Indonesia	5	0	Sectoral regulator - not independent	1900000	234.7	134	18	3	2.3	>320	>320	6600	3300	146	50	0.49	25	3162
	Philippines	13	2	Multisectoral independent regulator	300000	90.5	295	85	72	10	>1600	>1600	4800	2400	133	50	0.22	-	4000
	Singapore	28	0	Multisectoral regulator - not independent	704	4.7	-	100	100	-	1	1	500	215	158	4.5	0.53	-	-
Americas	Beliz	33	33	Multisectoral independent regulator	23000	0.32	13	90	40	40	2	1	65	25	240	38	0.15	-	550
	Brazil	30	21	Devolved regional regulator	8515000	190	-	81	48	48	1350	1350	22650	15400	145	40	0.68	-	-
	Barbados	0	0	Multisectoral independent regulator	431	0.28	647	99	-	-	1	1	42.7	21.4	210	50	0.55	-	-
	Canada	3	6	Devolved regional regulator	9984700	33.3	3.2	85	85	80	9000	9000	5400	4200	343	23	0.72	235	300000
	Chile	96	94	Sectoral regulator - not independent	757000	16.6	21.3	99.8	95.2	81.9	52	50	1451	905	150	38	0.59	225	9570
	Colombia	24	11	Sector Specific independent regulator	1139000	44.4	39	88.3	74.1	25	2886	1071	2329	1188	59	49	0.36	92	18600
	Costa Rica	0	0	Multisectoral independent regulator	51100	4.1	85	98	21	4.5	1800	5	350	175	117	50	0.26	-	3000
	Honduras	7	7	Sector Specific independent regulator	112500	7.5	64	75	36	-	>2000	-	-	-	-	50	0.1	25	-
	Jamaica	0	0	Multisectoral independent regulator	11000	2.7	252	73	30	-	8	4	287	95	132	67	0.75	-	-
	Mexico	13	22	Multisectoral independent regulator	1953000	109	252	89	86	36	10500	250	10300	5100	144	50	0.15	115	96800
	Panama	11	0	Multisectoral independent regulator	75500	3.3	43	86	51	39	11	2	498	290	280	42	0.22	71	2500
	Peru	3	10	Sector Specific independent regulator	1285000	28.7	22	84	76	28	50	50	1264	717	97	42	0.41	60	8000
	Trinidad and Tobago	0	0	Multisectoral independent regulator	5100	1.3	208	92	21	21	1	1	365	160	360	55	0.12	48	2500
	Uruguay	0	0	Multisectoral independent regulator	176200	3.5	19	92	48	-	2	3	320	147	125	54	0.85	171	4360
	USA	15	7	Devolved regional regulator	9800000	303	-	84	95	-	53000	50000	560000	190400	660	-	0.33	312	445000

1.3 Ownership arrangements and risk within the water sector

Internationally there are a range of ownership arrangements for Water Service Providers (Table 1.1). Typically the ownership arrangements are viewed as either “public” or “private”. In fact there are is a range of activities (and services) within the remit of a water service provider that can be delivered with some public and or private sector participation (Owen, 2011). Where public/private partnerships exist there are further distinctions to be made around the commercial operating models which range from leasing of assets to concession contracts (See Section 1.5). For the purposes of this thesis the “ownership arrangements” discussed include:

- Public Sector Ownership (For example Ghana, Uruguay Lithuania (Table1.1)), where the public sector own and operate assets.
- Private Sector Ownership, where private enterprise owns and operates assets (For Example, England (within the UK) and Chile (Table 1.1)).
- Private sector participation (The majority of examples in Table 1.1) which can be sub-categorised into;
    - Private participation that covers less than 10% of the population
    - Private participation that covers between 10% and 50% of the population
    - Private participation that covers greater than 50% of the population
    - Private participation offering full range of corporate services (asset ownership and operation), where the governing institute may hold a majority share in the company
    - Private leasing of assets plus operations including maintenance

- Private sector delivery of infrastructure upgrade and maintenance
- Private sector concession contracts for small asset operation
- Private sector operation of assets

Many countries` water services (for example, Mexico, France and Australia) are not exclusively operating under a single system and may operate a complex combination of leasing, management, operational and maintenance contracts. These contracts can be negotiated and agreed at a regional or federal level (Owen, 2011).

This thesis considers a number of international case studies including the UK, where there are variations in regulation and ownership arrangements for water service providers. In Scotland the water and wastewater services are operated on behalf of the Scottish government (and ultimately the Scottish public) by Scottish Water. This differs from England and Wales where water and wastewater service provision is delivered through a number of privately owned and mutualised organisations. In Northern Ireland water and wastewater services are delivered through a different public ownership arrangement (Parker, 2012). The regulatory arrangements in each country within the UK have similarities that include independent regulation of economics, water quality and the environment. Within the context of the regulatory arrangements there is a requirement to develop a strategic business plan which, in England, Wales and Scotland, feeds into a “regulatory contract” that normally covers a five year period, although this is constantly under review. These strategic plans outline a program of capital investment that is designed to replace aging infrastructure, improve water (and waste water) quality, reduce the impact of operations on the environment and enable some operational cost efficiency. A tension may exist between delivering improvements to

service, economic efficiency and capital investment delivery. In addition to this, private organisations have an obligation to shareholders that ultimately requires a return on investment in the form of a dividend (or other payment mechanism) and increased value of the organisation. Equally, publically owned utilities may not have access to the capital markets and will compete for tax revenue with other public services which may limit the water utilities` ability to deliver critical investment (the variation of income per cubic meter of water produced and per capita is illustrated in Table 1.1). Each choice that the water utility makes with respect to operational arrangements, environmental stewardship and capital investment within the regulatory arrangements will have a unique risk profile.

Section 1.4 Management culture and risk within the water sector

The approach that the individual water utilities take to managing risk will be shaped by the predominant management culture within the institution. Organisations responsible for the planning and delivery of utility services such as energy, transport and water are exposed to a wide array of diverse management cultures. For the water sector, the impact of these influences on the effectiveness and efficiency of service delivery has been a primary concern over at least two decades (Richardson et al., 1992, McGuinness and Thomas, 1997, Bakker, 2003a). However, studies seeking to better understand how ownership arrangements, regulation and management culture influence the operation of utilities have largely focused on the economic and customer value performance of the organisations under review. This is understandable given the broader public debate on the wisdom and benefits of privatised water services. However, somewhat surprisingly and of direct relevance to this thesis, few have considered the impact of regulation,

ownership arrangements and management culture on water utilities` approaches to managing commercial, operational and systemic risk. Risk perception and analysis plays a hugely influential role in decision making within the boundaries of a regulated business (Haines, 2011b) and, given that utility performance (against whatever metrics) is a function of how decision takers deliver results within the confines of what is deemed acceptable, it is unusual that more attention has not been paid to exploring the associated 'risk dynamic' (taken to mean the interplay between risks associated with utility actions and management strategies for coping with those risks).

A management culture driven by a fixation with the efficiency and performance agendas is clear from the findings identified in the literature review (reported in Chapter 2), with remarkably little attention paid to other possible impacts of regulatory and ownership arrangement changes. This is in stark contrast to other literatures, for example those concerned with the evolution of polycentric governance arrangements (Ostrom, 2010) and the influence of regulation on risk perception and management (Haines, 2011) which have recognized and articulated a rich landscape of influences on risk environments and management response preferences. Other relevant contributions have explored benchmarking risk management capability within the international water utility sector (MacGillivray *et al*., 2006, MacGillivray et al., 2007a, MacGillivray et al., 2007b, MacGillivray and Pollard, 2008) and explored operational antecedents of good risk governance in the sector (Hrudey et al., 2006, Summerill *et al*., 2010a, Summerill *et al*., 2010b).

The variations in ownership arrangements, regulation and elements such as revenue (as illustrated in Table 1.1) will drive management culture and therefore attitudes to risk management. The influence of management culture on risk management has not been

fully addressed in previous studies (Chapter 2) and yet the need to deliver sustainable water services for a growing population is a high priority. This thesis offers an opportunity to bring into sharp focus the interplay between the above components and, as a consequence, improve risk management choices for water service provision (Chapters 6 and 7).

1.5 The research landscape

Adam Smith, in 1776, published "*The Wealth of Nations"* which debated the benefits of denationalisation and market reforms that informed the industrial revolution. The merits of a variety of ownership arrangements and the emergence of regulation have been widely debated since and there is little or no common approach to water service provision between, and in some cases within, countries (Ruester and Zschille, 2010; Owen, 2011; Parker, 2012a). Water services have been characterised as having some critical features which make it more difficult to operate fully privatised utilities (Marques, 2010). This includes elements such as economies of scope and scale; water services are considered to be a natural monopoly; water is required for life and social justice must be considered; generally the provision of water services are capital intensive; and the operational environment varies with geography, water use and raw water quality (Marques, 2010). Regulation is an important activity that serves to protect the public interest (and public health) and help guide the direction of the industry to make improvements in terms of services together with delivering economic efficiency (Saal, 2007; Marques, 2010). Studies have identified a tension between achieving economic efficiency and public service obligations (Peda et al., 2013, Pérard, 2009, Ruester and Zschille, 2010).

Since 1973 the UK water industry has undergone radical reform (Parker, 2012). In England and Wales there were a series of step taken which were initiated by the 1973 Water Act and subsequent policy changes that ultimately resulted in the privatisation of the regional water authorities in 1989. Scotland and Northern Ireland were not included in the market reform initiatives and the governing bodies of these home nations chose to deliver water services through public sector arrangements. In many other countries water services also remain in the public sector and many ownership arrangements and regulatory arrangements exits (Owen.D.L, 2011, Ruester and Zschille, 2010, Renzetti and Dupont, 2004, Renzetti and Dupont, 2003) which are designed to offer best value to consumers while protecting public health (Pérard, 2009, Ruester and Zschille, 2010, Peda et al., 2013). In general, the evidence presented in the identified studies suggest that the efficiency of a water service provider is not dependent upon the ownership arrangements. There is little evidence that these studies take into account influences on asset deterioration, capital investment profiles, quality improvements and the underlying risk profiles that the organisations have.

Consideration of these features of water service provision can be articulated as an initial two principle research question:

Do water sector regulation, ownership arrangements and management culture impact on the risk management strategy?

And;

If they do, what impact does this have on the primary objectives (good safe drinking water that has the trust of consumers) of the utilities?

In addressing the principle research questions the investigation asks (i), what are the particular features of regulation, ownership arrangements and management culture that influence the risk dynamic? and (ii) what are the implications of these relationships in the context of ambitions for water service providers? In addressing these queries, consideration has been given to the choices and adjustments a utility may make to its risk management strategy to deliver its regulatory objectives such as public health and environmental protection.

1.6 Aims and objectives

The aim of the research reported here is to expose the inter-relationships between regulation, business ownership arrangements and management culture (in the context of water service provision) and how this interplay influences a water service provider`s approach to risk management. The study builds upon existing research in risk management and governance. The traction that risk management achieves is examined within a variety of organisations exhibiting differing ownership arrangements and management cultures operating under differing regulatory regimes. In order to achieve the aim of the research, the following objectives have been the focus of the project.

- Characterize water service provider performance against the regulatory contract objectives (or other relevant instrument). This uses published annual performance data and other available metrics and data sources where publically available. (Chapter 4 and 5)
- Identify the governance and financing arrangements for water services in each case study context. (Chapter 4 and 5)

- Identify the business priorities and ownership arrangements for each case study. The implications of the variations across the case studies will be considered with respect to approaches in risk management. (Chapters 2, 4 and 5)
- Propose improvements to risk management approaches and reporting. (Chapter 7)

It is recognised that this study addresses a limited number of elements relating to the selected topic. Limitations on time dictate what can be practically achieved within the scope of the project (the limitations of the thesis are discussed in Section 7.3). With this in mind the study may refer to, but will not include formal analysis of:

- Detailed analysis of the improvement rate of efficiency and performance between private and public ownership arrangements.

The research question (Section 1.5) is further refined and developed from the output of the literature review and discussed in Section 2.6. The research agenda requires a multidisciplinary approach to deliver meaningful output. Figure 1.1 represents the principle scientific disciplines employed in the research activity. The core discipline and topic of interest is risk analysis. In particular the water industries approach to risk management choices under a range of conditions. The research agenda developed to explore risk analysis is delivered through methodologies in management science, psychology and social science methodologies in combination. This co-constructed inter-disciplinary approach supports the complex nature of the problem as defined in Chapters 1 and 2. The methodology and interdisciplinary approach is discussed in more detail in Chapter 3.

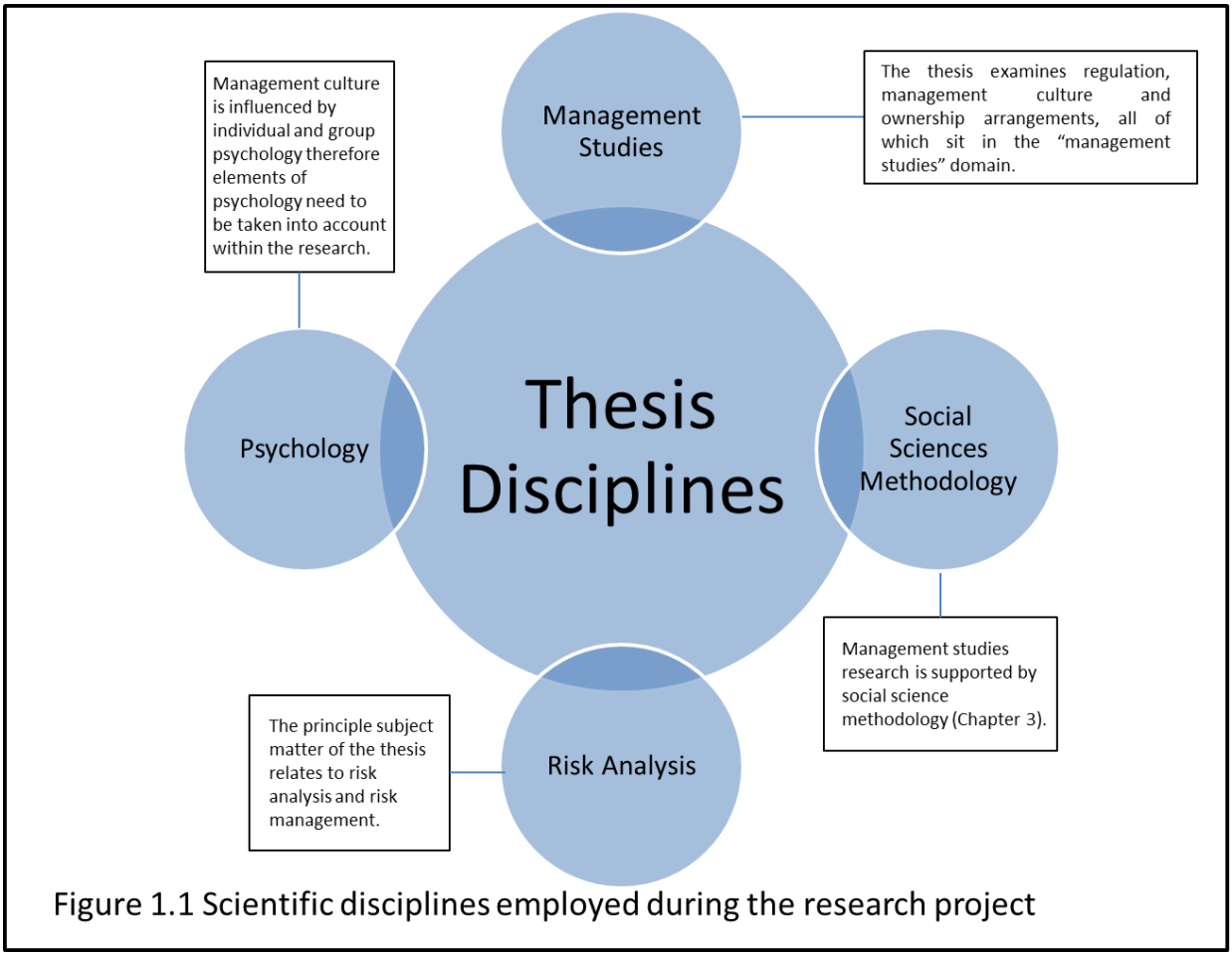


Figure 1.1 Scientific disciplines employed during the research project

1.7 Terminology

In this section, the principle terminology used within the thesis is defined. It is important to be clear on the definitions as used in this thesis as they may deviate from similar terms in other bodies of work.

1.7.1 Regulation

The Oxford English dictionary definition of `regulation` is "*A rule or directive made and maintained by an authority".* In the context of this thesis regulations are rules or instruments designed to control, inform, challenge and influence the behaviours, activities and conduct of water service providers. Within this study the three areas of

operating are the focus for regulation; environmental quality, water quality and economic performance.

1.7.2 Ownership arrangement

The term ownership arrangement describes the local, regional or national models for water utilities in place between the governing bodies, accountable authorities (often referred to as the municipality) and private sector for delivering a product, service or some other commodity. In the context of this thesis the services delivered are the provision of drinking water and removal and treatment of waste water. Ownership arrangements are multi-dimensional in that they vary dependent upon factors such as financing; available resources; cultural preference; politics; geography; population served; objectives of the businesses; services offered; assets owned; assets operated and assets built (Owen, 2011).

Public Ownership Arrangements

For the purposes of this thesis `public ownership arrangements` describes an operating environment where water and waste water services are delivered through assets owned, operated and maintained by a `public body`. Where a `public body` is an organisation whose work is part of the process of government.

Private Ownership Arrangements

Within the context of this thesis `private ownership arrangements` describes an operating environment where water and waste water services are delivered through assets owned, operated and maintained by a `private enterprise`. Where a `private

enterprise` is a business owned and operated by independent individual(s) rather than by a government.

Private Sector Participation

`Private sector participation` covers a wide range of ownership arrangements occupying the space between public ownership arrangements and private ownership arrangements. Private sector participation involves private enterprise delivering a range of aspects of water and waste water services that may include infrastructure investment, operation and maintenance, leasing, concession contracts and ownership of selected assets.

1.7.2 Management culture

Management culture should not be confused with organisational culture. Organisational culture according to Johnson (1992) can be expressed as learned behaviour within an organisation that has evolved through cumulative experience as objectives are delivered in an operating environment influenced by internal and external forces. Normally new entrants into the organisation would take on the some or all of the inherent behaviours that define the organisation. Management culture differs in that it can be characterised as a set of behaviours that have been deliberately encouraged by management with the purpose of delivering the corporate objectives (Easterby-Smith, 2008). In this thesis the management culture is taken to mean "the set of behaviours that the leadership group have instilled in the organisation to deliver regulatory and business objectives".

1.7.4 Risk Tolerance and Appetite

Within risk management processes and governance structures, risk appetite is often mentioned. Indeed the research shows how, within the interview responses elicited

through this study (Chapter 4 and Chapter 5), senior managers and directors frequently refer to risk appetite. Risk appetite can be defined as the amount and type of risk that an organization is prepared to pursue, retain or take responsibility for (ISO, 2009). Although the ISO definition appears to be clear, this contribution highlights in Chapters 4 through 6 that defining the risk appetite for a particular organisation is something that senior managers find difficult to quantify and articulate. Partly this is because there are elements of risk appetite which can be classified as psychological (Slovic, 1995, Slovic *et al*., 2004) and therefore difficult to measure effectively. The psychological elements of risk appetite are important however in this thesis financial risk appetite is considered as it is measurable within the context of the organisations financial limits and thus is easier to quantify than psychological elements. The following section articulates why the measurable financial risks are helpful in defining the risk appetite and tolerance of a business. These measurable elements of finance can be used to set a baseline for risk tolerance and appetite, over which less measurable psychological elements can be layered to build a more holistic view of risk appetite within an organisation.

Any organisation needs a quantum of capital to operate regardless of ownership arrangements. The organisation will have, to a greater or lesser degree, a series of objectives to fulfil within its sphere of operation. Normally businesses would deliver strategic objectives within the limitations of available operating capital. In most cases the delivery of objectives is affected by changing circumstances (changes in energy price, treatment failures, climate change, etc.) and both positive and negative outcomes are manifested during the course of day to day business. The outcomes of actions taken to meet objectives will either contribute to, or reduce stress on the company finances. The amount of risk taken (as a consequence of actions or decisions) may also influence the

stresses placed on the financial position of the organisation. As some point in the lifecycle of the business, risks may manifest themselves in a way that has a catastrophic impact on the finances of the operation meaning the business fails. The point at which financial failure is about to occur can be described as risk tolerance. Theoretically, then the risk appetite should be a smaller quantum of capital than the risk tolerance to avoid financial failure of the business or organisation. Figure 1.2 illustrates the discussion and differences and relationship between risk appetite and tolerance.

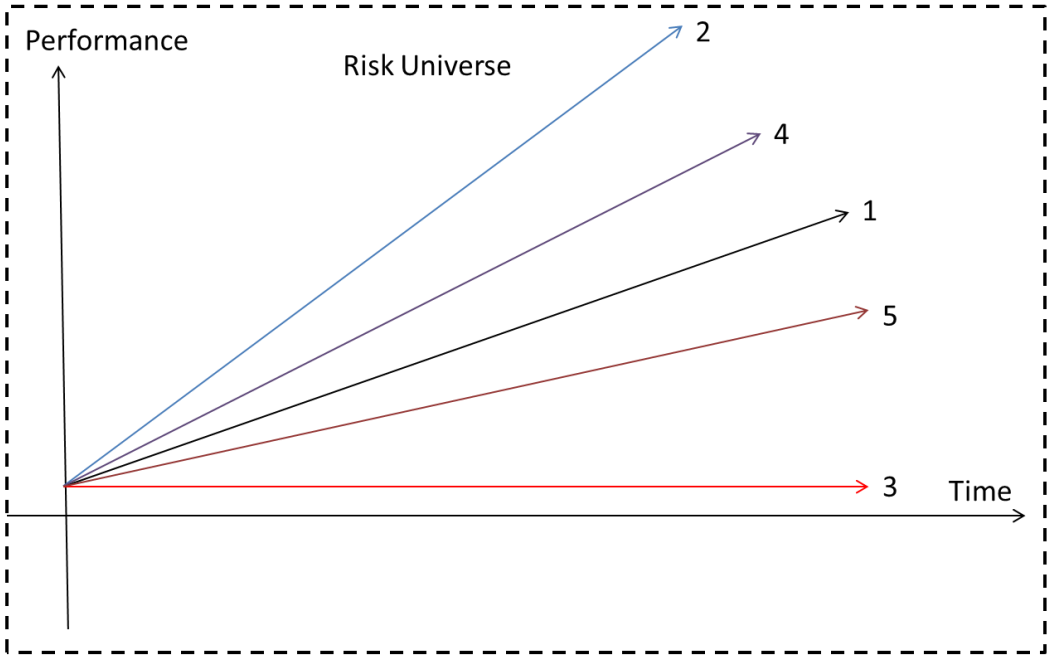


Figure 1.2 Simple representation of risk appetite with respect to company strategic objectives and risk tolerance.

The dotted box represents the total risk that an organisation may encounter. This could be described at the risk universe unique to the fictitious organisation. Line 1 represents the planned improvements to company performance laid out in the strategic business plan. Line 2 represents the upper limit of performance achieved and line 3 is the lowest limit of performance achieved (Figure 1.3). Line 2 could be called out performance

(where the organisation gets to when nothing fails) and Line 3 could be classified as business failure (where the organisation fails to meet any and all objectives) 2 and 3 are at the extreme tolerances of business performance and, for the purposes of this contribution, can be classified as risk tolerance. Lines 4 and 5 represent performance outcomes which sit comfortably within the risk tolerance envelope and represent the organisation`s acceptable performance limits which protect financial and operational sustainability (Figure 1.3). Lines 4 and 5 can be classified as the boundaries of risk appetite. In other words the business in not prepared to take risks that could push performance above Line 5 or below Line 4 (Figure 1.3). For the purposes of this contribution risk appetite will be defined as the willingness to take decisions and actions with uncertain outcomes that an organisation is prepared to take without compromising risk tolerance.

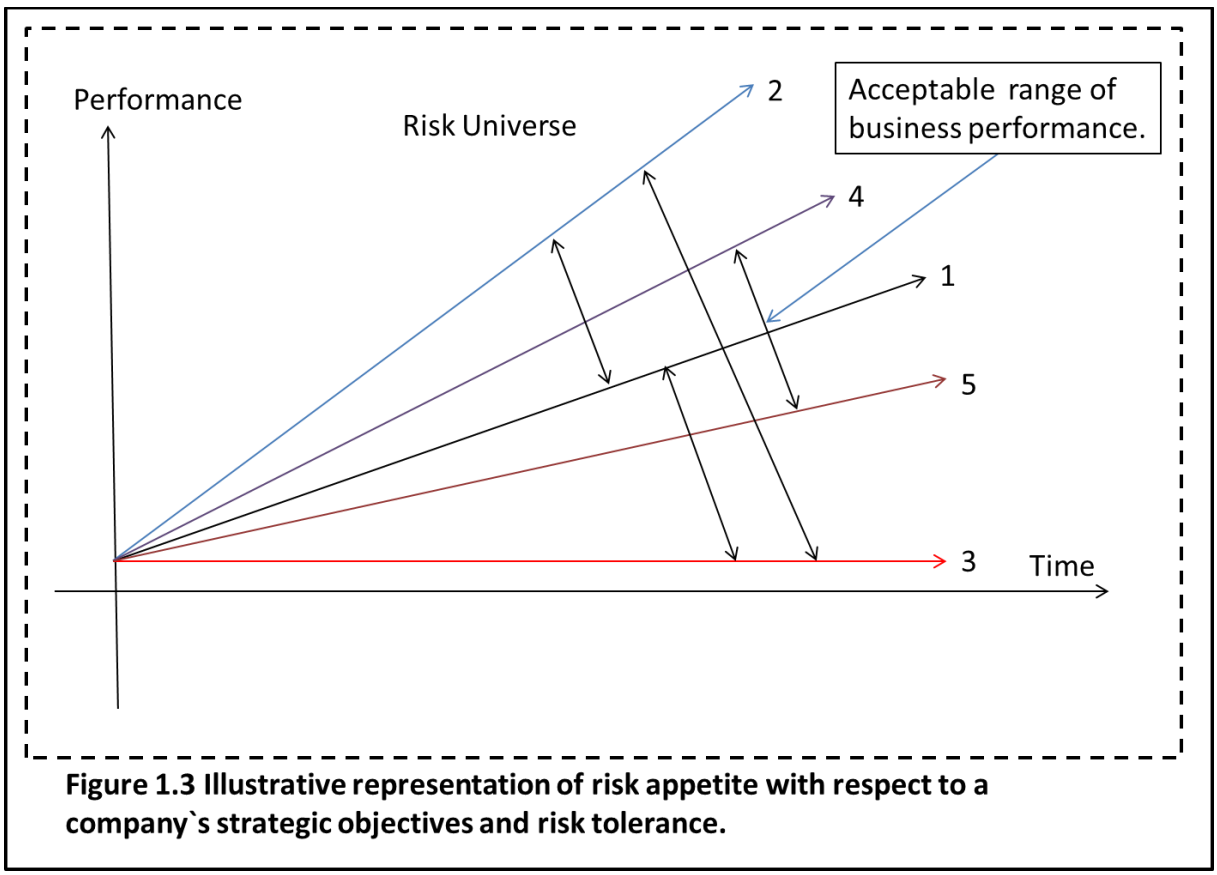


Figure 1.3 Illustrative representation of risk appetite with respect to a company`s strategic objectives and risk tolerance.

All of the assumptions made by the organisation in relation to performance and risk are rooted in future predictions and are very much dependent upon fore-sighting, planning, stakeholder expectations, reliability of historical performance data and trending analysis.

1.7.5 Governance

The internal organisational processes used to manage and monitor both risk and elements of leadership are formally considered and examined in Chapters 2, 4 and 5. These elements and activities could be broadly described as "Governance" which is understood as the act, process, or power of governing, administering or leading. Governance arrangements can be difficult to define and in Chapters 4 and 5 it is explored by some directors and management representatives. The responses given by these actors suggest perceptions of governance (both the process and implementation) vary vertically within the organisations involved in the cases.

1.8 Personal Motivation for conducting the study.

The thesis author has some 23 years experience working in the water industry and related commercial businesses. During that time it had been observed that the water utilities aspired to become a "high reliability" organisations, meaning the sector desired to have an impeccable record in risk management and achieve zero water quality failures, similar to that of other high reliability industries like aerospace, oil and gas and nuclear energy, where failures can have a significant impact on life and/or the environment. Over the years working within the industry, the researcher noted that although the aspiration to be a "high reliability" organisation was there, the water industry in many instances focused on reactive interventions when failures occurred rather than adopting a pro-active management (and leadership) style. The researcher was motivated to explore perceptions

of current operational practices, which, for the most part, conflicted with a desire for risk management maturity, a pervasive risk management culture and a shift to operating a high reliability sector. With this in mind, a number of conversations took place between the researcher and actors within the water industry which suggested that regulation, ownership arrangements and management culture may have a dominant influence on approaches to risk management (Chapter 4 and 5). The researcher was motivated to use the emerging idea as a starting point for development of the research proposal (Chapter 1 and Chapter 2).

1.9 Structure of thesis

Figure 1.4 illustrates the structure of the thesis and highlights the relationships between chapters and the overall development of the research contribution.

Chapter 1, the introduction, has outlined the research question and the reasons for undertaking the research. The chapter develops the thinking around the scope, aims and objectives of the project. It has also set out the definition of adopted terminology and articulated the relevant issues that have been taken into consideration when developing the project themes and framework.

Chapter 2 documents the findings from the review of literature that was carried out to inform the study by interrogating the body of work relating to water service provision and risk. A series of questions were asked of the literature which were designed to identify gaps in the research landscape while challenging current thinking in the maturity of risk management within water service providers operating in differing regulatory environments and under different ownership arrangements. The review itself utilised a number of web based literature databases and explored the body of available work both

vertically and horizontally across different aspects of water management and risk management. The review provides the groundwork for the development of the study framework; finesses the research challenge and question; delineates the knowledge gaps and identifies the leading researchers in the chosen field of study. The review also informed a critique of relevant work relating to interdisciplinary research involving utility ownership arrangements, regulation, risk management, economics and culture.

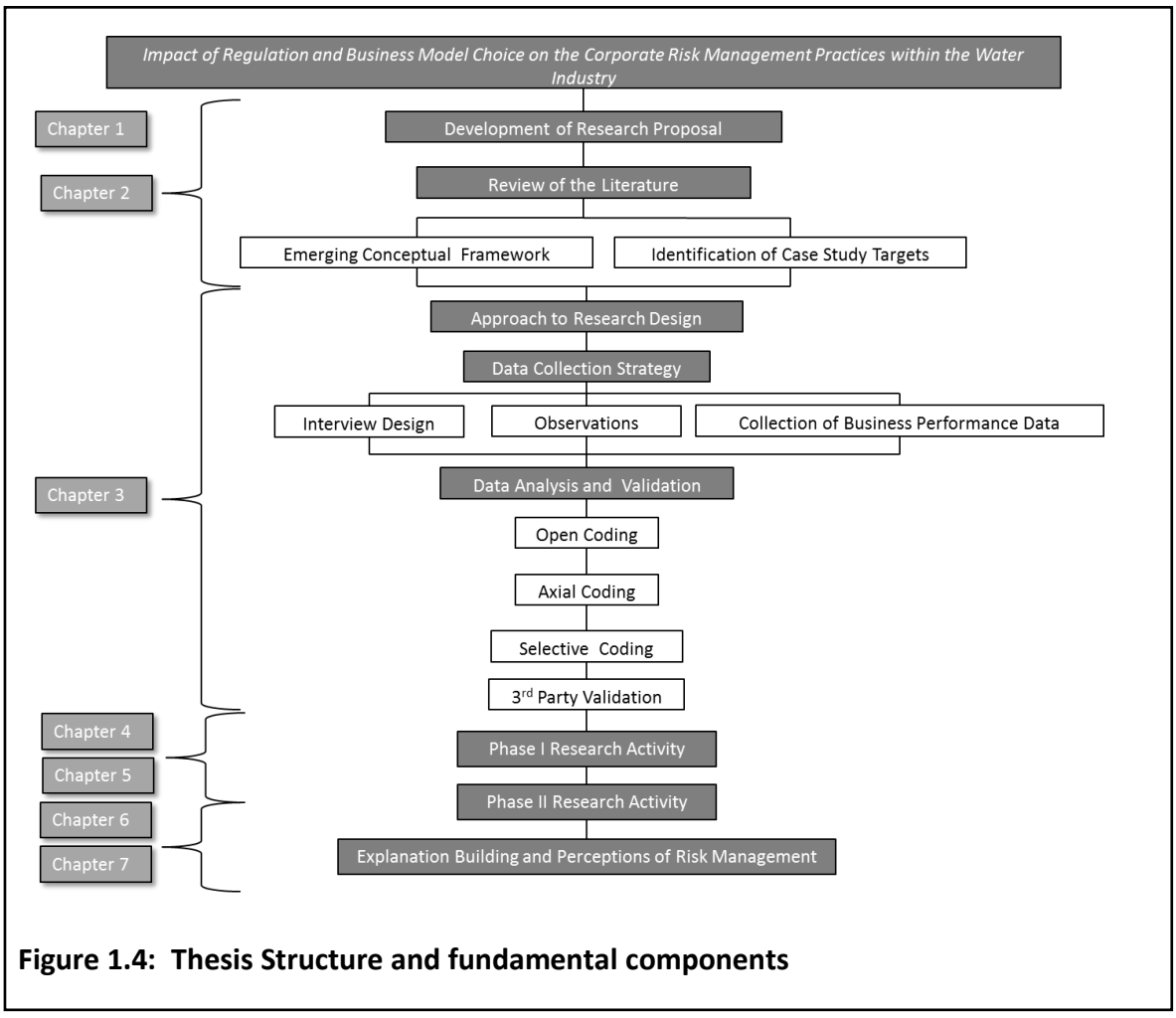


Figure 1.4: Thesis Structure and fundamental components

Chapter 3 builds on the evidence collected in the literature review and informs the design of the final research question and study framework. Having established and refined the principle research question, the chapter then goes on to explain the research approach and methodology. In this case the epistemology of the research approach is

based on constructive realism (Section 3.2) (Easterby-Smith, 2008, Fleetwood, 2005, Miller and Tsang, 2011). The chapter discusses the challenges of case study based data collection and analysis using the approach reported by Yin (2009) and those of computer assisted qualitative data analysis (CAQDAS) using coding methodologies (Neuman, 2003, Corbin, 2008).

Chapter 4 describes the first phase of the research activity and explains the purpose of this exercise. The initial study was designed to deliver a range of outputs that included piloting used to test the researcher's interview technique on a limited number of actors; testing the output and identified research opportunities in the literature review; developing methodology, coding design and analytical process using CAQDAS.

Chapter 5 documents the second phase of research activity which was informed by the evidence collected from the literature review and the output of the first phase case study work. At the core of the research sits case studies that include a range of agencies with varying ownership arrangements governed by a variety of regulatory frameworks. Interviews were conducted with a range of actors operating at different management and operational levels within the chosen water service providers and regulatory offices. As with Chapter 4, the collected data were analysed by CAQDAS and synthesised into a qualitative view of the importance of risk management within the context of the operating model of the organisations examined. The data were subject to a quality control process conducted by an independent analyst to validate the output.

Chapter 6 discusses the research findings and frames this within the context of previous contributors to the field. The chapter considers the findings of both phases of research and discusses the interplay between ownership arrangements and regulation. This

chapter explores variations in meaning and interpretation of “risk” within the context of the organisations` delivery plans and defines some actions that a utility could take to ensure consistency of approach to risk management that support pervasiveness of risk management within their institute.

Chapter 7 offers insights and conclusions on the tensions between water utility ownership arrangements and regulatory frameworks on the safe delivery of water and sanitation services. Some suggestions for improving risk reporting are offered. The chapter reflects on the research journey and highlights the novelty of the work and contribution to knowledge gained from the findings of the project. The final sections consider the implications of the thesis for the management of risk within the water industry and identify further opportunities for research in this topic area.

Chapter 2: Literature Review

The provisional research question reported in Section 1.5 was synthesised from a limited search of the literature, conversations with industry actors and academic staff and personal experience of the researcher (see Section 1.8). The material below reports a more comprehensive literature review drawing on the provisional question to frame an investigation into contributions to knowledge related to this thesis. The literature base was explored both vertically, taken to mean topic specific; and horizontally, taken to mean across topics (Wray, 2011). The topics considered were regulation, ownership arrangements, management culture and risk management in relation to water management and included some literature on risk management in other sectors such as banking where there have been recent systemic failures that could contribute to learning for the water sector. The work of notable researchers (for example David Saal and David Parker) was traced through the development of their thinking. The output of the examination of literature informed the refinement of the research question and the development of a research framework (see Section 2.4 and Figure 2.4).

2.1 Regulation and risk management

Regulation as defined in Section 1.3.1 is "*A rule or directive made and maintained by an authority".* Regulations are enacted to pursue consumer interests (Gunningham, 2011, Haines, 2011b, Baldwin, 2012). Regulations shape water service provision, influencing:

- The economics of operation
- The economics of capital investment and capital maintenance
- Water quality standards that need to be attained
- Environmental standards that need to be attained

- The protection of public health
- Customer charges and affordability of water and wastewater service

Regulators work closely with water service providers to ensure that water services aspire to deliver safe drinking water, safe sanitation that is affordable (Pollard, 2008). Risk management is central to ensuring the water service provider discharges its duties as defined by regulation. Regulation has typically been based on a command and control strategy (Gunningham, 2002) where organisations must comply (command) or be penalised (control). More recently there has been recognition that regulation, in many cases, has adopted a more risk based approach where-by the water service providers are expected to demonstrate an understanding of the risks within their water systems and the supply chain (Gunningham, 2002; Pollard, 2008; Haines, 2011, Baldwin *et.al.,* 2012). New approaches in regulation require water service providers to adopt more formal risk management processes and deliver regulatory targets. The demands on resources are further complicated by Global economics and politics as governments are coming under pressure from financial constraints and the cost of borrowing as well as political pressure to reduce bureaucracy within government systems (Baldwin *et.al*., 2012). The result of this is a move to push the risk management away from the central governing institutes/regulators and towards the water service providers (Gunningham, 2002, Haines, 2011a, Haines, 2011b). The burden for managing risk is then placed on the water service provider, who already has multiple demands on management and leadership time (Section 1.4).

The influence of regulatory priorities on the productivity of water utilities has been highlighted by Abbott and Cohen (2009). They suggest that post-1995 (when financing of English and Welsh water companies was reviewed), changes to the price cap in the UK

helped improve productivity over and above what might have been expected with privatisation *per se*. Utilities face significant financial challenges in acquiring sufficient funding to ensure that water quality, customer service and environmental objectives are met (Rodriguez, 2004, François *et al*., 2008). A tension exists between the general economic interest, public service provision, internal markets, competition and state intervention (Rodriguez, 2004, François *et al.,* 2008). The impact of regulation on risk has been considered (Haines, 2011, 2013) but few contributions seek to understand the interplay between the regulatory demands (water quality, environment and finances) on the choices made for service delivery and the risk management strategies applied (including management culture) which influence the risk and risk management practices within the water service sector.

These contributions on financing and productivity illustrate the constraints that limited, periodic regulatory cycles impose on utility efforts to deliver regulatory obligations. Evidence from a number of detailed studies (MacGillivray *et al.*, 2007a, 2007b) suggest that when faced with an aging infrastructure and limited funds, utilities will prioritise short term interventions before long term mitigation measures (Hrudey *et al*., 2006). Such strategies instil a reactive approach to risk management as resources (human as well as financial and technological) become focused on immediate priorities. In contrast, a more appropriate risk management strategy (Pollard *et al*., 2008) under such circumstances could be characterised by contingency planning although, with little incentive for operators to value more pro-active strategies, even contingency planning will reflect restricted temporal and risk threat horizons.

Another dimension of regulation worthy of consideration in the context of corporate risk management is the role that competition plays. Privatisation theory (Boycko and Shleifer, 1996) suggests that public service approaches to achieving efficiency and quality improvements can be influenced through the introduction of competition. Cubbin and Stern (2004) discuss the role of competition within the utility sectors and observe that in some areas (gas, electricity and telecoms), the positive effects of competition took some time to show and evolved along with regulation. However, for utilities like water, where there is a public service obligation and significant networked infrastructure to deliver services, it is more difficult to establish true competition given the natural monopoly that exists. Stern (2010) examined lessons from the introduction of competition within energy markets and applied the knowledge base to the English and Welsh water sector. Stern points out that the recent Cave review (Cave, 2009) raised the issue of competition. He points to the liberalisation of the telecoms and energy markets as relevant, and postulates that wholesale distribution of water could be opened up to competition in England and Wales, drawing on existing models in other utility sectors. This would require appropriate codes of practise, abstraction controls and consideration of the wider environmental costs to society. By contrast, Scotland has already opened up competition in water services. Sawkins and Reid (2007) looked at concerns that cross-subsidy existed in the water services in Scotland and examined the approach taken to cross subsidisation by the Scottish Executive. They point to the Water Services (Scotland) Act 2005 and the formation of the Water Industry Commission (WIC) that has been tasked with developing an approach to competition in the Scottish water market. The Scottish Executive published a number of statements and reports (Scottish, 2004b, 2004a, 2005b, 2005a) as part of the consultation, concluding that the introduction of retail competition was desirable. Sawkins and Reid (2007) establish a

mechanism for the flow of cross-subsidy but also highlight that more work is required to implement their framework. Competition in the retail markets in Scotland is now established with a number of licensed providers operating. Recently Scottish Water`s retail business Scottish Water Business Stream has seen a loss of contracts worth circa £300m of income which feeds into the wholesales parts of the business and is a component of financing used to maintain operability (including investment). This unpredicted sizable gap in financing will ultimately have an effect on investment, operability and the risk profile within the business.

There is little unambiguous evidence to support conclusions about the effectiveness of competition in public utility services. Water is essential for life and difficult to value. At present, it is typically only the costs of transporting and treating the water that the customer pays for. Opening up water service provision to competition might create incentives to improve performance and efficiency, but may also lead to additional operational risks (MacGillivray *et al.*, 2006). Risk management strategies will need to be adjusted to compensate for any variations in service provision or new entrants to the market (as seen in Scotland). Contracts between delivery partners will need to expose systemic risks and be clear on the owners of such risk (Ruester and Zschille, 2010).

The dynamics exposed by the above discussion are illustrated in Figure 2.1. Regulation sets the ambitions and minimum performance standards that utilities must aspire to, with respect to efficiency, service, drinking water quality and environmental sustainability. Regulation also shapes the strategic operating environment for a utility and influences the relationship between utility, customers, markets, and (increasingly) the natural environment. It also circumscribes a risk agenda in terms of both the character of dominant

risks and the utility's ability to respond to those risks (Macgillivray *et al.,* 2006). As alluded to by Parker (1998), the priorities which an organisation places on competing regulatory objectives within a regulatory contract period will have a direct impact on the company risk profile.

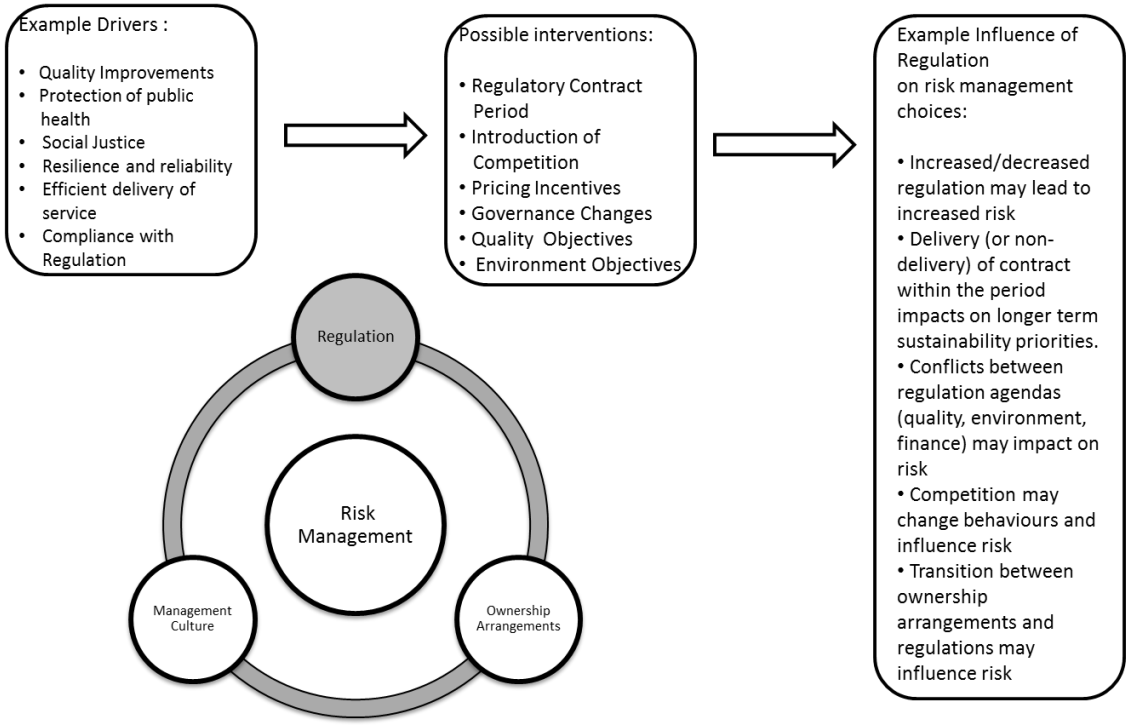


Figure 2.1: The influence of regulation on risk management.

2.2 Ownership arrangements and risk management

The merits of ownership arrangements in delivering efficient water services have been widely debated internationally (Wallsten and Kosec, 2008, Martínez-Espiñeira *et al*., 2009, Bayliss, 2003, García-Rubio *et al*., 2010, McKay, 2003) and improvements to productivity and efficiency were a central consideration in policy decisions made by the UK government that led to privatisation of the water companies in 1989 (Parker, 2012). Emerging evidence suggests that successful privatisation and efficient delivery of service is contingent on a wide range of additional factors. For example, a management culture that drives for efficiency

within the limitations of a regulatory pricing review period and constrained funding availability tends to be characterised by a reactive management approach (Saal *et al*., 2007, Ruester and Zschille, 2010).

The ownership arrangements of utility services vary widely at an international level (Table 1.1) but can be categorised into state ownership (or public ownership arrangements), private ownership, and private sector participation (section 1.7.2). Each ownership model has important consequences for the particular forms of risk experienced by a water service provider (Pollard *et al.,* 2007) and the risk management tools available to them (Macgillivray *et al.,* 2006).

Responsibility and accountability for managing risk is the most obvious implication of utility ownership arrangements with either society or shareholders sharing the burden with the governing institute and/or regulators (Section 2.1). However, both public and private ownership arrangements allocate risk and responsibility across a variety of individuals, institutions, corporate bodies, communities and even generations. Consideration of the ownership arrangements in Table 2.1 invites discussion about how risk is distributed across the social, commercial, and governance landscape. Indeed one might argue that such a discussion would greatly aid understanding of risk management challenges, and advance the development of more integrated approaches.

Table 2.1: Utility ownership arrangements in the water sector (adapted from Ruester and Zschille, 2010)

Ownership arrangements Description	Opportunities	Potential Weakness	Example Countries
Public ownership arrangements and operation.	Full State control.	All financial and operational risk sits with the governing institution.	Scotland, Norway, Netherlands, Uganda, Singapore, America, Germany
Leased assets operated by contractors.	Assets remain State owned.	Operational and some financial risk sit with the contractors.	Germany, France, America, Panama, Australia, Philippines
Cooperation (Partnering) Model with public institution the majority shareholder.	Financial and Operational risks are jointly owned.	Operational and some financial risk sit with the contractors.	Germany, France, America, Panama, Australia, Argentina, Philippines
Contracting out of management activity that includes planning, financing, construction and operation.	Financial and Operational risks are spread across a range of business.	Difficult to co-ordinate and get best value. Some businesses may bid low to win the contract which will lead to budget over spend.	Germany, France, America, Panama, Australia, Argentina, Philippines
Concession model that stops short of full privatisation.	Most of the risk sits with the contractors. There may be sufficient incentive to drive out-performance of the contract. The contract will be better defined and run for longer period, providing stability.	The public institutions will still be fully accounTable for service failures.	Germany, France, America, Australia
Privatisation.	Service provision, financial and operational risk are the responsibility of the private organisation. Efficiency improvements should be achieved.	Little state intervention. Private institution must meet service standards and shareholder demands.	England, Chile

Interdependencies between regulation and ownership arrangements have also been shown to influence corporate risk management. Parker (1999), discussing the regulation of privatised public utilities in the UK, highlights the move from state-owned utilities to private ownership arrangements with governance through state regulation. He reports that the privatisation model developed in the UK in the 1980s is now being used or adapted for use in other countries, introducing the private ownership arrangements of what were traditionally state-run organisations. He argues that privatisation in the UK has provided benefits for consumers and investors with respect to reduced charges, quality improvements and return on investment. He also explains that successful privatisation is reliant on the legitimacy of regulation, effective relationships between the regulator and

regulated body, and an appropriate institutional context. Highlighting examples in Asia, Latin America and Africa, Parker cites evidence of political instability that impact on the legitimacy of regulation and therefore the perceived independence of the institutions and individuals. Risk management practises within a specific jurisdiction will be influenced by local legal and institutional arrangements and have a direct impact on the reliability of service to consumers. For example, with a publically owned utility such as those in Norway, Scotland or the Netherlands, the majority of the infrastructure and financial risk sits with the governing authority (see Table 2.1). As the ownership arrangements move towards the private sector, so the risk is shifted to a greater or lesser degree away from the governing institution. Table 2.1 also highlights a contract management approach adopted in Germany and France where the service providers and contractors hold the balance of operational risk. However, a weakness of this arrangement is that financial benefits to the controlling institution do not always deliver attractive or even sufficient returns on investment (Ruester and Zschille, 2010).

The dynamic between regulation, ownership arrangements and risk management is re-enforced by Ruester and Zschille (2010) in their examination of the German water sector. Germany provides a useful case study because water services are provided by 765 individual suppliers, operated by the state through a range of business models that include municipal, private and public-private partnerships on a regional basis. For public-private partnerships, there is a further subset of ownership arrangements that the authors define as public sector ownership with support from private contracts for various elements of business operation. The diverging objectives of public and private operators can generate very different approaches to managing risk. Although for the private operator, profit is a significant concern, public authorities may prefer to outsource more difficult operations where

environmental factors, age of assets or poor raw water quality (and therefore higher treatment costs) passes on higher cost to the operator and keeps the direct overheads relatively low. Price caps on customer charges and constraints on access to capital for infrastructure investment leads to tension between new design and build infrastructure projects and capital maintenance requirements.

Other studies (Bhattacharyya *et al*., 1995, Shaoul, 1997, Bosworth and Stoneman, 1998, Renzetti and Dupont, 2003, Chenoweth, 2004, Dore et al., 2004, García-Sánchez, 2006, Bel and Warner, 2008) conclude that although private companies *should* be more efficient, evidence suggests this may not necessarily be the case. Renzetti and Dupont (2004) discuss factors that influence the performance of water utilities, highlighting that ownership arrangements are of particular interest. They point out that econometric modelling predicts that private ownership arrangements incentivise a reduction in costs to help achieve maximum benefit for shareholders and customers in the form of reduced charges. However, there is little empirical evidence to confirm this and, of relevance to this contribution, there is no recognition of the impact of these ownership arrangement choices on the risks the water service providers face. The calculations of efficiency within the identified studies do not fully factor in quality enhancements (and asset deterioration as a result of under-investment) which may also influence the risks within the utilities. The authors argue that privatisation needs to be accompanied by the introduction of competition if the move to deliver greater benefit to the customer and shareholder, while recognising that competition and private sector participation could result in less investment in infrastructure which may result in more operational risk. Parker (1999) supports this view by highlighting that where natural monopolies exist (such as water and wastewater service provision), service providers (public or private) will only be motivated to improve performance when

regulation is in place to create the necessary incentives to invest in infrastructure and capital maintenance but there is no acknowledgement that driving down costs will alter the risk profile within the water utility and that this will need to be recognised and managed. Renzetti and Dupont (2010) provide evidence that concurs with Ruester and Zschille (2010) that the specifics of size of operation, cost of treatment, geography, customer base and water resources (quality and quantity) all have an impact on the ability of a water service provider to achieve its performance targets. An additional factor influencing performance is variability in pricing policy and accounting practices that do not take into account the full cost of service provision and therefore may lead to underinvestment that puts operational processes at risk. There is little or no evidence that suggests changes in provision of financing will affect the risk profile. This is in agreement with Saal, Parker and others (Saal and Parker, 2000, Saal and Parker, 2001, Saal and Reid, 2004, Saal *et al.*, 2007) who observe that when privatisation of the water sector was introduced in the UK in 1989, the price cap regulations were relatively unchallenging and resulted in a lower than expected rate of efficiency improvement. It was not until 1995, when the price cap rules were reviewed, that efficiency improvements increased. However, the efficiency gains within the water industry in the UK were not as significant as those secured from earlier privatisations (e.g. gas, telecoms, electricity) due to the water companies` regional monopoly position (lack of competition) and the relatively low initial price cap. At the time the effect of improving efficiency on the risks within the business were not known, however recently water charges in England have increased to accommodate the lack of investment in infrastructure which has led to deterioration of the asset base (increasing operational risk). Saal and Parker conclude that improvements in efficiency post 1995 were due to the changes in regulation rather than privatisation *per se*. The contributions presented in this section major on

efficiency without fully appreciating the influence that the efficiency measures have on the risk profile of the organisation and the influence that ownership arrangements have on management culture.

The studies reviewed indicate that whilst the form of ownership has been explored as a determinant of operational performance, researchers have yet to fully take into account what this means for the management or risk within the organisations (García-Rubio *et al*., 2010, Martínez-Espiñeira *et al*., 2009, McKay, 2003). The review suggests that price cap rules can both limit or enable funding and that access to funding drives infrastructure investment choices. The balance between infrastructure replacement and capital maintenance will shape operational risks that ultimately influence the reliability of services to the customer. Figure 2.2 summarises the discussions in this area. As margins are squeezed in a privatised sector, perhaps as a direct result of more insistent regulation, decisions about prioritising investment and driving efficiency in operational practices will necessarily expose some parts of the business to more risk than would hitherto have been the case. Pollard *et al* (2004) remind us that this tension can only be managed by vigilant organisations irrespective of their particular ownership arrangements or regulatory environment.

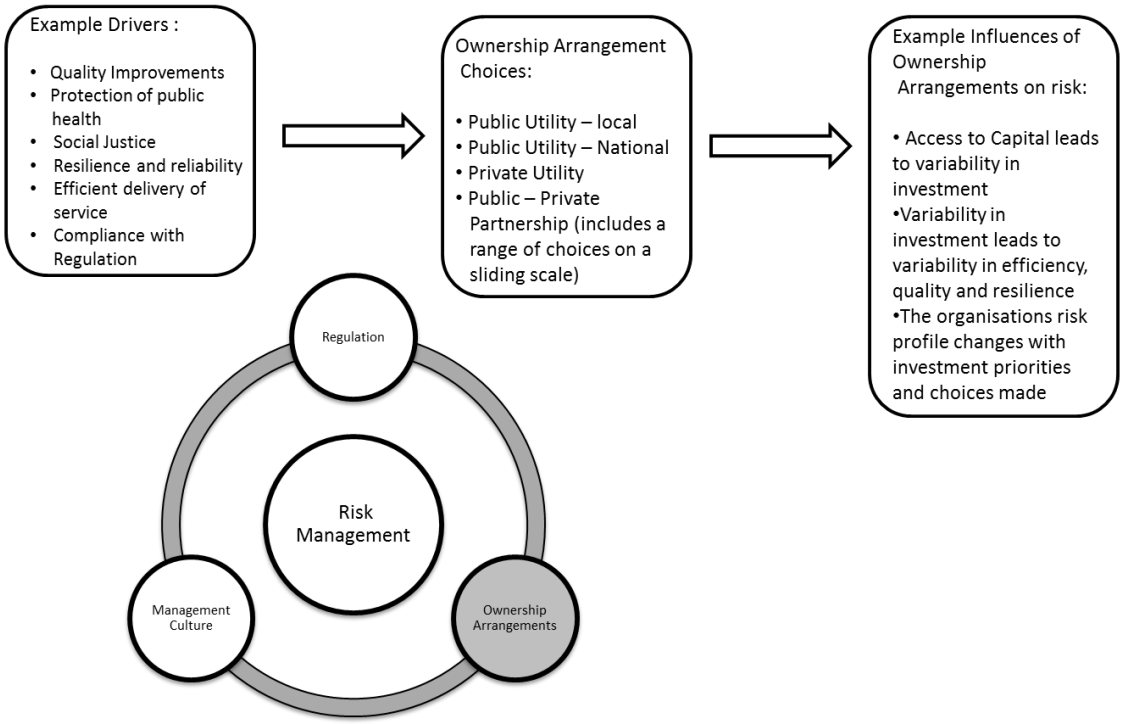


Figure 2.2: The influence of ownership on risk and risk management.

2.3 Management culture and risk management

The dominant management culture and leadership style found within a water utility will shape how the organisation chooses to meet or exceed the targets and objectives set by regulation and other stakeholders. The influence of management culture on business performance and risk has been of growing interest to researchers and commentators since the 1980s with Johnson (1992) developing a framework, known as “the culture web”, that is widely used to demonstrate the links between culture, strategy and management behaviour using components such as norms, values and symbols. Drew and Kendrick (2005) define culture as one of the five pillars of corporate governance (along with leadership, alignment, structure and systems) that are needed for integrated risk management. Both Baumgartner (2009) and Rizak and Hrudey (2007) demonstrate that embedding sustainability and risk management into the culture of an organisation can lead to corporate

success; though both are challenging concepts to drive home within a business, particularly in the face of multiple demands on leadership time. Their contributions are consistent with the view that management culture influences the risk management strategy of the water utility.

As Stacey (1996) explains, organisations tend to desire known outcomes, but in order to be innovative they may need to occupy territory that has less certainty with high degrees of epistemic and stochastic uncertainty. This view is supported by Osborn and Hunt (2007), Tetenbaum (1998) and Tetenbaum and Laurence (2011) who suggest that in today`s operating environment, organisations work within complex adaptive systems that force them into domains of high uncertainty. The tensions inherent in operating as part of a complex system may be minimised by application of the appropriate risk management cultures. These management cultures may then provide a bridging function between uncertainty and risk. Water companies need to become more risk mature (MacGillivray *et al*., 2006, MacGillivray and Pollard, 2008) and look to preventative measures to ensure continuity of both safe drinking water and safe sanitation. Such maturity involves a risk management culture that takes into account data, uncertainty (both stochastic and epistemic), emerging risk, available finance, in addition to the competency of staff and regulatory objectives.

The influence of management culture on risk management strategy and performance has only partially been explored within the water industry. Summerill *et al.* (2010b) considered water safety plans as a move towards a more preventative risk management approach. Organisational culture was shown to play a substantive role in the choices made by utilities with respect to how water safety planning was implemented. The study identified `enabling`

and `blocking` cultural features that impacted the development of consistent water safety plans. The utilities in this study were self-motivated to produce the plans. However, time, resource and communication issues occasionally blocked progress. In contrast, enabling features included strong leadership, continuous improvement, community (and therefore customer) focus, proactive engagement, competition, empowerment and competency of the workforce.

Gigerenzer and fellow researchers (Todd and Gigerenzer, 2003, Hutchinson and Gigerenzer, 2005, Brandstätter *et al*., 2006, Katsikopoulos and Gigerenzer, 2008, Goldstein and Gigerenzer, 2009) offer us insight into the way individuals apply heuristic processes in making decisions with limited data. These works explain how simple heuristic systems have developed that allow fast decision making based on acceptance or rejection of a range of cues within an individual`s or group`s epistemic limits. This might suggest that certain organisations with differing regulatory obligations and ownership arrangements prioritise objectives and targets in a way that legitimises their business strategy. This may be helpful to note when developing an understanding of water service providers` approach to risk management.

Figure 2.3 articulates the impact of management culture on a water utility's approach to risk management. This in turn will have an influence over the resilience and financial stability of the organisation. Hrudey *et al.* (2006), Pollard *et al.* (2004) and Summerill *et al.* (2010a) all emphasise the importance of culture on the adoption of specific risk management strategies and examine why organisations persist with a reactive approach to water quality failures and water safety planning.

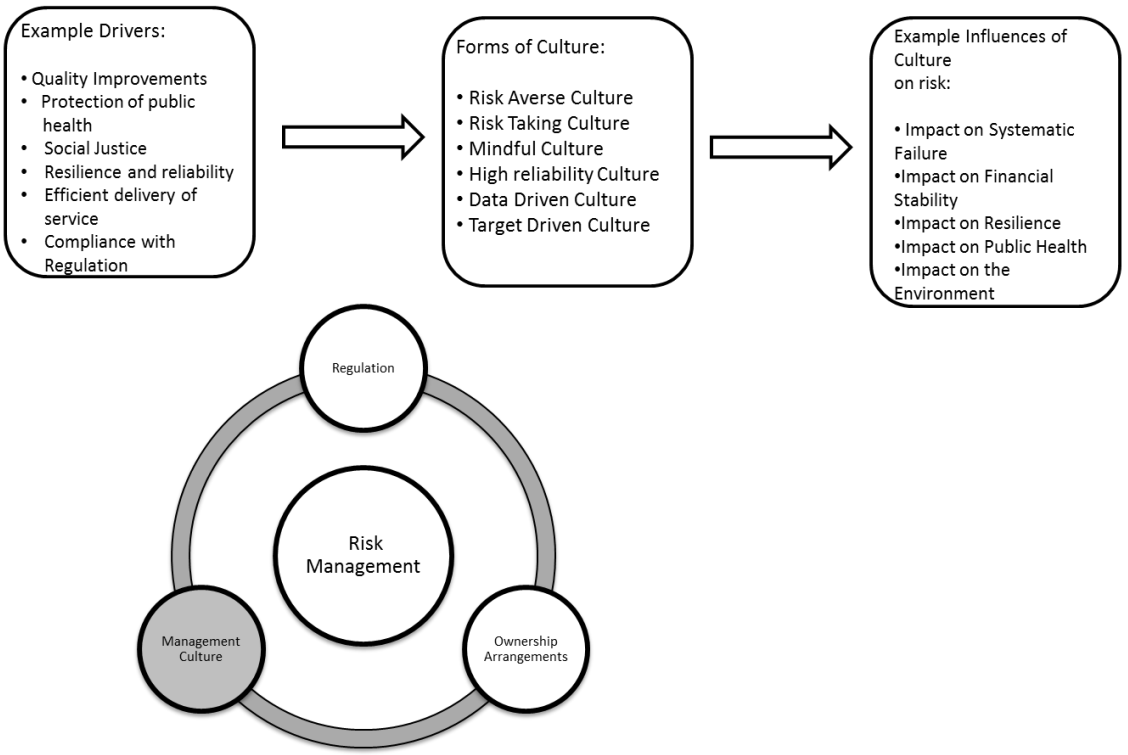


Figure 2.3: The influence of culture on risk and risk management.

2.4 Themes from the literature and their application to this research

The foregoing critique builds upon previous reviews by Walter *et al* (2009) and Bel and Warner (2008) and expands on these works by specifically and explicitly considering regulation, ownership arrangements, and management culture as influences on risk management. The review is summarised in Figure 2.4 as a conceptual framework of these interdependencies. The model illustrates how interventions by regulators or businesses, which are intended to achieve improvements for customers, may have unintended consequences. So, for example, limiting customer charges is beneficial to the customer and should drive innovation and value into the organisation. However, it may also compromise long term quality improvements, sustainability and increase the risk of failing assets. This review has identified that regulation informs priorities such as economic viability, compliance, investment choices, affordability and the protection of public health and the

environment (Section 2.1) all of which will influence approaches to risk management. As a conceptual model of the dynamic between risk management and a significant slice of a utility's operating environment, Figure 2.4 is both descriptive and diagnostic, proposing explanations for shifts in risk management approaches. The extent to which it also supports critical analysis and prognosis can only be confirmed through subsequent deployment through case study research. It does, however, provide a validated (if admittedly rather mechanistic) model for understanding the interaction of regulation, ownership arrangements and management culture on risk management choices.

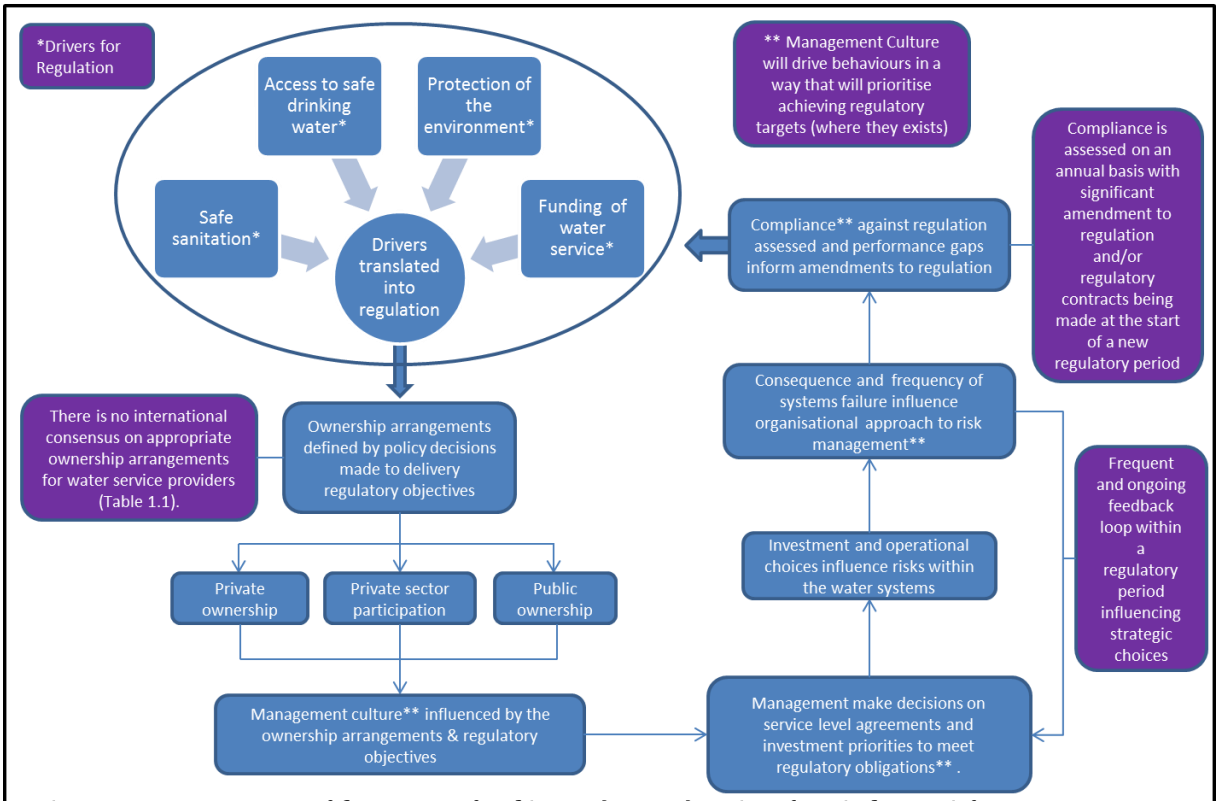


Figure 2.4: Conceptual framework of interdependencies that inform risk management strategy choice.

The foregoing sections have illustrated some examples of regulatory mechanisms (price caps, quality standards, introduction of competition) that influence this framework. A range of ownership arrangements which will be informed by regulation (public ownership

arrangements, privatisation and models described as private sector participation) have been documented and inform the management culture that influences risk management choices. Although the review demonstrates that uncertainty (stochastic and epistemic) incentivises reactive risk management, it also suggests that operating within the time bound limits of a regulatory contract and the availability of capital funding has more of an influence over the balance between reactive risk management (typically under restricted funding conditions) and proactive risk management (where there is adequate access to capital markets).

Water utilities operate within a dynamic business environment and are subject to changes in regulation, objectives and ownership arrangements that will affect the risk profile of the organisation. It is clear from this review that utilities must remain vigilant to change and constantly re-evaluate the appropriateness of risk management strategies in order to manage risk (systemic and corporate) and cost reduction challenges. There is a clear need to better understand how to best craft an organisation`s risk management strategy under different operating conditions, supporting a measured risk management culture. An improved risk management model will support water authorities in meeting the aspirations of the Bonn Charter and becoming “high reliability” services while still out-performing their financial and service level targets.

2.5 Refinement of the research agenda and research question

In order to protect public health and maintain services to its customers, a water provider must ensure the networks it operates are robust to, *inter alia,* changes in population, climate change and water scarcity (Blackmore and Plant, 2008, Wang and Blackmore, 2009). Where risk management enables the organisation to focus on the ability to prevent failures and maintain a stable system, strategies to enhance resilience seek to develop interventions

that support the ability of systems to adapt to change. Hence, risk management regimes that promote resilience will be pro-active rather than reactive, intentionally seeking out and characterising risk within organisational plans and operations as a precursor to building resilience enhancing capacities (Pollard *et al.,* 2009).

Other research supports the need for further work to better understand the challenges a utility faces in embedding risk management practise and making it pervasive through the organisation. Hrudey *et al.* (2006), Pollard *et al.* (2004), Wu *et al.* (2009) and Rogers and Louis (2008) provide supporting evidence that regulation, ownership arrangements and management culture have an influence on how a water utility approaches risk management. Organisations that have developed high reliability systems will manage the tension between systematic risk and cost reduction.

There is evidence of the relationships between regulation and corporate governance installed to oversee risk management which has relevance to the research agenda developed here. Rothstein *et al*. (2006) draw our attention to the emergence of risk (systemic or corporate) as an organising concept for regulation and governance which has led to many debates, particularly with respect to Ulrich Beck`s risk society thesis (1992). Rothstein *et al.* (2006) argue that more recent preoccupations with risk are not driven by changing distributions of real, or imagined ills in society, but rather by changing ills in governance. In fact, the review emphasises that failure has always been a part of governance but more recent pressures on organisations such as greater coherence, transparency and accountability have exposed the limits of governance as a result of this greater awareness of institutional risk. Rothstein *et al.* (2006) conclude by arguing that risk "colonisation" resulting from the dynamics of contemporary governance leads to risk

defining the object, method and rationale of governance. It can be argued that management strategies need to remain agile and under review to take account of new and emerging risks resulting from changes to regulation, ownership arrangements and management culture within a water utility business. Inflexible governance and risk management systems may result in creating further unintended corporate risk.

The literature review has identified a number of interesting features of the interplay between regulation, ownership arrangements, management culture and risk. The main focus of research in this area is around the efficiency of business models employed to deliver water and waste water services. The review noted that few studies have considered the impact of regulation, ownership arrangements, and management culture and efficiency improvements on water utilities` approaches to managing operational and systemic risk. This thesis explores this gap in the research and intends to better understand the approaches to risk management under varying regulatory and ownership arrangements. Chapter 3 expands on the literature review and uses the output to synthesise a framework for the research.

The literature review described in Chapter 2 explored a rich landscape of research that examined regulation and ownership arrangements in the water sector and some other sectors, on risk management. This analysis of previous work revealed that there was a broad range of research on the efficiency of ownership arrangements but that there was a gap in understanding of how management decisions influenced risk management choices within the water utilities. As national and international financing continues to come under cross-sectoral pressures and the desire for efficiency remains a significant political priority; the need to understand the impact of these driver facilitated through mechanisms such as

regulation, ownership arrangements on risk management becomes greater. The consequences of failure to deliver safe drinking water and sanitation can have an immediate and significant impact on public health and the environment. The literature review, in part, has been confirmatory by exposing evidence that regulation, ownership and management culture do have an impact on risk management (Sections 2.1. through 2.5). Having highlighted that such features do have an impact on risk management, the question can be refined to:

> *How do the specifics of regulation, ownership and management culture influence risk management choices for water service providers?*

Chapter 3: Methodology

Chapter 2 exposed a complex and rich landscape of influences and interdependencies rooted in a social context that is not easily quantified or understood. Figure 2.5 highlighted that the delivery of water services is a complex matrix of interactions where management tasked with delivery of the services do so in an environment defined by regulation, limited by economics and influenced by politics. The review exposed a gap in understanding of how variations in regulation and ownership influence management culture and ultimately risk management practise. Chapter 3 defines the general methodology adopted to facilitate the research activity and it should be noted that some elements of methodology were specific to the Phase I and II research activities. The variations in methodology are reported in Sections 4.3 and 5.3 respectively.

In Section 1.6 the research disciplines were briefly described (See Figure 1.1) and it was reported that a multi-disciplinary approach to addressing the research question was being employed. A qualitative approach has been chosen and is based on social sciences methodology to enable a context specific appraisal and deeper understanding of what water industry actors think and believe about risk management practise with respect to regulation and ownership arrangements. The adopted qualitative approach is based on rigorous and established techniques (Silverman, 2013a) that enable the researcher to analyse and present the data in an objective way. This is discussed in detail in Section 3.4.

Chapter 3 goes on to explain the approach to data analysis using computer assisted qualitative data analysis systems (CAQDAS) and in particular describes the methodology of code development and theory building (Silverman, 2011). During this phase of the analysis it was important to independently validate the analysis (Blaikie, 2000, Easterby-Smith, 2008,

Creswell, 2009, Silverman, 2011) and this is discussed in Section 3.4.6. During the data collection and analysis phases it was noted that the researcher was working within one of the institutes included in the study and this could influence the interpretation of the results. This possible bias is considered in some detail in Section 3.3.4. A critical perspective on theory and method development is used to;

- Understand, identify and apply a robust approach to data gathering and interpretation.
- Identify and secure the collaboration of appropriate candidate organisations for the case studies.
- Develop and execute interviews with selected respondents.
- Examine and critique accessible company data including business plans, compliance reports and quality performance reports.
- Analyse and Interpret the available evidence (interviews and documents) using a qualitative methodology.

Chapter 3 explains the approach taken to two phases of fieldwork which build on the output of previous activities, Phase I building on the literature review and Phase II informed by Phase I and the literature review. The development of each phase uses the core methodological principles described in Chapter 3 but there are elements of the method adapted to support the phase specific requirements defined by the outputs of the previous research activities and the agenda set for the respective phase. The phase specific methodology is described in Section 4.3 for Phase I and Section 5.3 for Phase II.

3.1 A Constructive Realist approach to qualitative analysis

Within the context of the research agenda, this project examines the interplay between regulation, ownership arrangements together with actors who`s actions (and behaviours) collectively define the management culture (Partington, 2002) within the organisations examined as case studies. This thesis operates in the domain of management studies and the interactions between groups and individuals can be classified as social in nature (Blaikie, 2000, Partington, 2002, Easterby-Smith, 2008, Silverman, 2013a). Management research can be described as concerned with the production and legitimisation of forms of knowledge associated with the practise of management (Partington, 2002). Like other research disciplines it involves observation, reflection, conjecture and testing theories and models that advance knowledge and best practise in management applications. In the Social Sciences and management research, methodology is defined by reference to epistemological perspectives that inform the interpretation and validation of data which supports theory construction (Blaikie, 1993, Blaikie, 2000, Easterby-Smith, 2008).

Neuman (2003) suggests three principle approaches to Social Science research. These are positivism, interpretive social science (ISS) and critical social science (CSS). In many cases researchers adopt one approach but elements of the other philosophies may be used to a greater or lesser extent as the study evolves. In summary, the positivist approach is that which is generally associated with the natural sciences and is built around data, experiment and statistical validation. With Positivism, the researcher is an objective, neutral observer who remains detached from that which they are observing. ISS by contrast, is based on qualitative methods (field study and observation) that examine meaning embedded in text and takes into account social interactions and context in an empathetic way. To compare,

CSS suggest that meaning about reality is generated by individuals and groups rather than reality being both real and apprehendable (as with positivism). Neuman (2003) points out that:

"The CSS researchers conduct studies to critique and transform social relationships by revealing the underlying sources of social control, power relations and in-equality". Pg 109 Neuman (2003)

By identifying and defining revealing underlying sources of social control, inter-relationships and the interplay; the CSS researcher empowers people, and in particular, individuals or groups that are less powerful or marginalised. In general the CSS researcher would define social sciences as " critical process that goes beyond the 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" (Neuman, 2003). The CSS approach is appropriate for this study as it supports the investigation of motives and the impact of power groups and individuals within the interacting organisations (in this case, Regulators, Directors and Senior Management, etc)(Ackroyd, 2000, Easterby-Smith, 2008). Constructionism sets an orientation towards social reality that assumes beliefs and meaning are constructed by individuals or groups which fundamentally shape what reality is for them (Neuman, 2003; Blaikie,2010; Silverman, 2013). The research activity is centred on understanding how features of the water sector (Regulation and ownership arrangements) inform management culture (in part, the reality) and these influence approaches to risk management. The research activity is constructed around open questions which allow participants to express their reality within the research framework (Figure 2.6).

3.2 Building a conceptual framework

The literature review (Chapter 2) defines a complex landscape of interactions in the context of water regulation and ownership arrangements (Figure 2.6). These organisation to organisation relationships are interwoven at various points by equally complex social relationships between the actors within organisations at various levels of management and in operations (Partington, 2002, Easterby-Smith, 2008). With such a rich and diverse set of parameters it is desirable to develop a conceptual framework for the research which provides a focus to the methodology, field work, data collection and interpretation; enabling the project to be delivered to a convincing academic standard within available time scales (Blaikie, 2000, Corbin, 2008).

The conceptual framework (Figure 2.6) is not designed to be interpreted as defining the full complexity of interactions between regulators, water service providers and the individuals within these organisations (For example the agreement of regulatory contracts and the delivery of regulatory targets set against such contracts (Section 2.2 and Figure 2.3)). It offers an informative guide (or aide memoire) to the possible influences over attitudes and decision making when considering approaches to risk management and elements of interaction between regulators, utilities and individuals. The framework has informed the development of the fieldwork documented in Chapters 3, 4 and 5.

3.3 Producing the field work agenda

As discussed in Chapter 1, this research is an enquiry into how the interplay of regulation and ownership arrangements and management culture influences the risk management application. Study design informs development of a legitimate methodology that develops and enables collection and analysis of data. Section 3.1 discussed general approaches to

qualitative analysis and explained the range of research philosophies available, suggesting the CSS approach is appropriate for this study. Section 3.3 outlines the development of the field work agenda through the development of a research strategy which is based on a CSS approach.

3.3.1 Research Strategy

In this section the concepts of enquiry logic are explored more deeply to enable the development of data gathering and analysis. This in turn informs the field work agenda.

The methodological perspectives outlined by Blaikie (1993, 2000) and Easterby-Smith (2008) can be categorised by four principles of logical enquiry (Table 3.1); inductive, deductive, abductive and reductive. Inductive enquiry aims to establish universal generalisations that explain observable patterns and is based on a positivist epistemology that assumes knowledge is derived from controlled experimentation and data analysis. Deductive enquiry aims to test theories in order to prove or disprove them and is based on a critical rationalist epistemology that suggests that knowledge is never proven and observations are limited. Abductive enquiry sets out to understand the world through observation and describe social actors` motivations, accounts and experience. The epistemological position is based around interpertivism which recognises that knowledge is derived from meaning and interpretation of everyday interaction. Finally, reductive enquiry aims to explain observed phenomena with respect to the structure and mechanics that define reality. This is based on realism as an epistemological position that suggests that knowledge is gained by modelling mechanisms, structures and systems that define reality. This study uses a combination of inductive and deductive approaches and recognises that the researcher had been

embedded into that which will be observed. This can be described as a realist approach (Easterby-Smith, 2008, Bhaskar, 2008).

Table 3.1: Four research strategies and their logical approach (modified from Blaikie (1993).

Forms of Reasoning	Inductive	Deductive	Retroductive	Abductive
Aim	Establishes universal generalisations used to explain patterns.	Tests theories to eliminate false ones and corroborate remaining ones.	Discovery of underlying mechanisms that explain observed patterns and regularities.	Describes and understands social interaction from the perspective of the social actors.
Starting Point	Accumulate observations and data. Producing generalisation.	Identifies regularities to be explained. Construct of theory and deduction of hypothesis.	Documents and models regularities. Development of a hypothetical model of a mechanism.	Discovery of common lay concepts, meaning and motives. Production of technical accounts from lay accounts.
End Point	Use generalisations to develop laws and patterns that help explain further observation.	Testing of hypothesis by matching to data.	Determine mechanism by observation and experiment.	Develop theory and test iteratively.

3.3.2 Research strategy choice

The thesis is concerned with the development of ideas and theories that explain features and interactions between actors within regulation and water utilities in an attempt to better understand and define the influence such features and interactions have on risk management application within the water sector. This ambition is strongly aligned to the inductive research strategy of “theory-hypothesis-observation-confirmation”. In addition,

there are elements of the research that require an answer as to why things happen which is more aligned to the deductive approach of “observation-pattern-hypothesis-theory”. This interaction is depicted in Figure 3.1. Both strategies can be used in tandem (Blaikie, 2000) and may help to overcome weaknesses in adopting a single approach research strategy. Figure 3.2 depicts the re-enforcing cyclic effect when combining inductive and deductive research strategies (Blaikie, 2000, Creswell, 2009). In summary, the primary strategy for the research is based on induction but supported by including deduction in the process at the appropriate points.

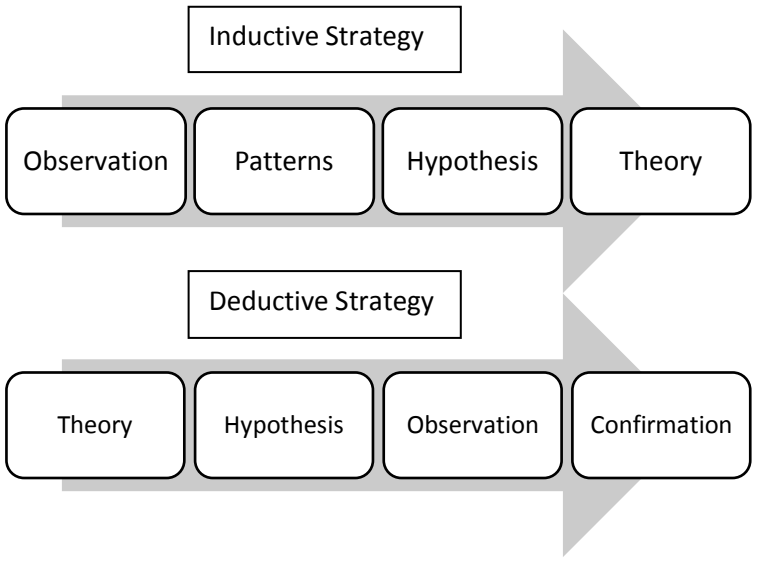


Figure 3.1: Inductive and Deductive Research Strategies (Easterby-Smith, 2008)

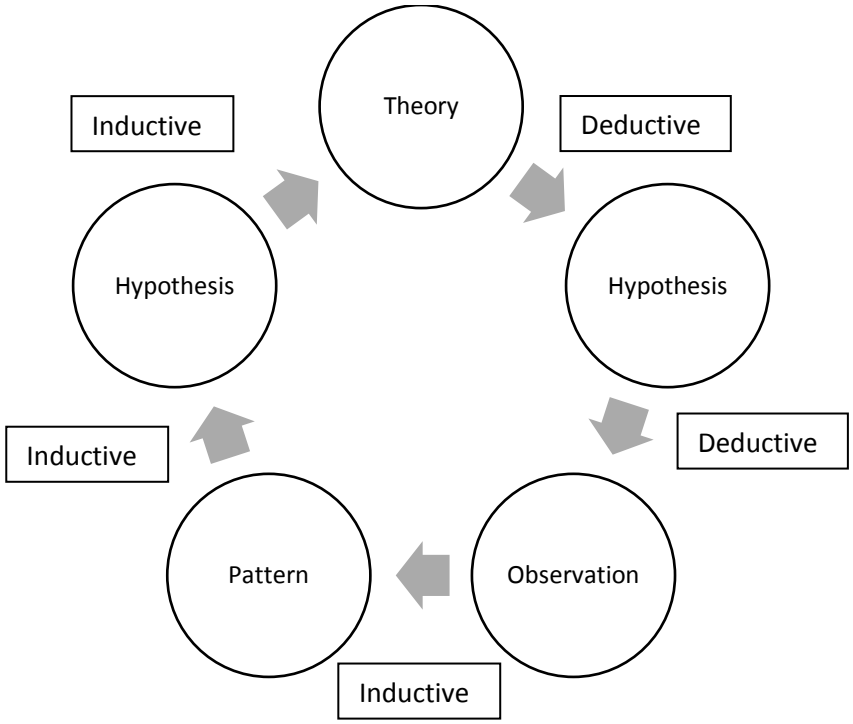


Figure 3.2: The cycle of inductive/deductive research strategies (adapted from Blaikie, 2000 and Neuman, 2003)

3.3.3 The researcher`s relationship with the study subjects

Blaikie (1993,2000) points out that consideration should be given to the relationship between the researcher and researched to identify and address any possible bias. Consideration of bias is important when establishing the stance (and inter-relationship) that the researcher has with his research cases, as it can influence the outcome of a number of aspects of the research activity, such as data gathering, interpretation and analysis of the data. For example, in this research study, the researcher was working for one of the organisations involved in the research, for part of the duration of the study. The researcher had pre-existing relationships with the actors interviewed within the organisation and was very familiar with the processes and systems operated by the business. A conscious choice

was made by the researcher between being an “outsider”, observing the social situation at a distance or an “insider” immersed in the social world of the research subjects. The research was conducted from the position of insider with the researcher immersed and engaged with the research cases from one of the case study organisations.

Having established the researcher`s position as an insider (for part of the study), it was also important to define the researcher as an “expert” or “learner”. The expert position is armed with relevant knowledge, theory, concepts, and tools that inform the further development of knowledge, compared to that of the learner who aims to set aside existing social scientific knowledge in an attempt to help the research cases conceptualize and understand the social world in which they are immersed. In this case the researcher can be classified as a learner as he sets aside existing knowledge of risk management to better understand the influence of regulation, ownership arrangements and management culture have on risk management practise. This means that the researcher can be thought of as an “insider learner”. The implication of this is that there is requirement for a degree immersion in the case study organisations which opens the researcher up to influence by the case study organisations and, equally, the researcher could influence the case study organisations. The nature of the immersive interaction between researchers and case study organisation could lead to potential bias.

The potential bias within the research activity was managed by applying a consistent approach to interview structure and data analysis that was challenged by the supervisory team and at the periodic reviews throughout the duration of the project. In Phase II, the output of the interviews across case study Cases were reviewed by an independent researcher to verify the coding structure (Section 3.9).

3.4 The case study approach

In the preceding chapters and sections the study has been defined as social in nature and based on a constructive realism epistemology. In Section 3.3.3 the researcher has declared an “insider learner” stance and in Section 3.3.2 the research approach has been justified as a combination of inductive and deductive strategies. In this Section (3.4) the process for data collection is discussed and described. A number of researchers, for example, Blaikie (2000), Neuman(2003), Creswell(2009) and Yin (2009) suggest a range of methodologies that can be used to collect data in the social sciences domain. Yin (2009) offers a set of criteria which can be used as an aid to selecting an appropriate social science method for a given set of circumstances (Table 3.2). The data collection is based on interviews, company data and other reports. Other data collection methods such as surveys and close question interviews where considered but the open interview approach was preferred as it gave the actors more freedom to express their views unconstrained, which added to the richness and diversity of responses.

Table 3.2: Selection of social science methodologies (Yin, 2009)

Method	Question Type	Control over Research Parameters (Behaviour, environment, social Setting, etc)	Focus on contemporary Events
Experimentation	How, Why	Yes	Yes
Surveys	How Much, How Many, Who, What, Where	No	Yes
Analysis of Archive Materials	How Much, How Many, Who, What, Where	No	Yes and No
The Study of Historical events	How, Why	No	No
Case Studies	How, Why	No	Yes

There is little control that the researcher has over the operating environment of the organisations which provide the focus for the study and there is no control over the social environment or behaviours. Furthermore the research is concerned with contemporary events and how these impact on long term outcomes for the water industry. Given this, the study will be employing case study methodology advocated by, for example, Easterby-Smith (2008), Blaikie (2000), Silverman (2013) and others.

3.4.1 The Data

Yin (2009) describes the types of evidence and data that are required to be collected in order to develop a robust and legitimate case study output. These include elements such as archive records, interviews (open ended, focused and structured), observations, and other documentary evidence.

The study is built upon multiple case studies. Gathered evidence includes company reports, strategic plans (where these exist), regulatory documents, risk management procedures (and reports), structured and open interview questions and observations by the researcher (Yin, 2009). Much of the evidence, for example, company reports, strategic plans and regulations are available through company websites, government websites and national archives. Risk management processes were accessible for some, but not all case studies and confidentiality agreements needed to be signed for access to some data, particularly reports that contained information on reported risks within organisations. Financial information was provided directly by some case study cases, some were obtained through company websites and some were not accessible. Where information was unobtainable, for example Section 5.4.3 (where a short written response was provided), the discussions were limited but based on the available evidence. The data gathering exercise was aided by the fact that the researcher held a senior position within one of the organisations and had access to actors and reports more readily than a researcher that is out-with the organisation. The researcher had very good working relationships with actors in most of the other case study organisations (including regulators) which made access to data (including interviews with executives) perhaps more straight forward than would normally be the case for this type of investigative work (Easterby-Smith, 2008; Partington, 2002). Although this is the primary

method of research, it is noted that the there are elements of experimentation and these modified during the two phases of research activity (Section 4.3 and 5.3).

3.4.2 Design of Phase I

The research activity was conducted in two phases with Phase I designed to verify the output of the literature review learning and assess the effectiveness of the interview techniques used and the construction of the questions designed.

The purpose of Phase I (Section 3.5) was to:

- Verify the observations made in the literature review (Chapter 2)
- Test the researcher`s competence in developing interview questions and executing interviews
- Gather a set of data to inform selection and development of a more detailed set of case studies under Phase II

The researcher worked within the utility and had open access to a range of actors at senior management level, together with regulatory officers. At this stage in the study the focus was on the interplay between regulation and ownership arrangements on the management culture and how this influenced risk management. It was practical and reasonable (recognising time limitations and availability of senior managers and directors) to target those actors within the organisation who had accountability for managing risk. The regulators views are important, providing an independent position on how risk management was implemented within the organisation.

3.4.3 Design of Phase II

Phase II builds on Phase I and is centred on acquiring the necessary data to address the research question (Section 2.5). There were a number of questions that needed to be addressed when developing the design of Phase II that included:

- *What information is needed to address the research question?*

The information required to address the research question is contained within each case study as documented evidence and additional material is held by actors within the organisations as; experience, process application, management culture and technical competence.

- *Where is the information located?*

The information resides within the organisations, in the public domain and with the case study actors.

- *How will the researcher gain access to the information?*

The researcher gained access to the data by engaging with the actors who agreed to be participants in the case study interviews. Some of the participants supplied supplementary documentation, for example, financial reports, risk registers, performance reports. The researcher gained additional documented evidence from company websites, regulators and government websites.

- *How will the information be extracted and analysed?*

The information collected was collated as a project within a CAQDAS system and coded as described in Section 3.5 through 3.11.

- *How many interviews are enough to address the research agenda?*

The number of interviews required to deliver enough data to validate a study has been widely debated (Mason, 2010, Baker, 2012). Valid qualitative studies have been based on as few as one interview with the mean number of interviews in a study conducted by Mason (2010) being 31 (based on a review of 560 studies). With such variation in sample size it is worth considering the principle of saturation (Glaser and Strauss, 1967) where collection of further data does not necessarily delivery new meaningful insights on the topic of study. In the case of this thesis, saturation was considered along with the objectives of the study and access to the required actors. The total number of recorded interviews was 29 which are within a reasonable target range for a qualitative study. A further 17 informal conversations took place which added to the richness of the analysis (Table 3.5).

Five case studies where selected (Section 5.3) which provided a number of variations in regulation, ownership arrangements and management culture. The case studies had differing geographies and in one case (Case C) operated across a number of countries and therefore regulatory systems. The selection process is described in Section 5.3.1. As with Phase I, the output of the Phase II research activity was generated and analysed using the methodology described in Sections 3.5 through 3.11. The actors interviewed within each case study were anonymised with the numbers of interviews for each case listed in Table 5.3 and a key for actor identification given in Table 5.9.

3.5 Design of data collection

Figure 3.3 is a visual representation of the research journey milestones. The first step taken was to deliver a research proposal which identified a potential gap in research for the topic of interest (Chapter 1). The proposal was further developed and expanded in the literature

review (Chapter 2). In turn the literature review informed the research question and the proposed analytical methodology (Chapter 3). The research activity was then broken down into two phases of case study work.

The second phase of multiple case study work was undertaken once Phase I was completed (Sections 3.4.2 and 3.4.3). Multiple case studies should be carefully considered and approached as one would approach empirical laboratory research which is built from multiple experiments (Neuman, 2003; Creswell, 2009; Yin, 2009). In other words each case study should be considered as an individual experiment, adopting a strategy where the observations from one case study are used to inform the agenda for subsequent enquiry. In this way, rich and meaningful qualitative evidence that informs the study objectives is synthesised.

The project needed to be mindful of the potential for bias and of the validity of interpretation so as to ensure a credible scientific contribution could be made. Recent commentary on qualitative studies (Silverman, 2005, Silverman, 2013a) has highlighted concerns over the application of established social science methodologies and perhaps over use of these techniques (Silverman, 2013b) which is a legitimate observation. These challenges to the appropriate use of qualitative methods have been given careful consideration when selecting the methodology for Phase I and Phase II.

The appropriate application of social science methodology was determined by examining existing literature on social science methodology and acquiring an understanding of when and how such methodologies can be usefully deployed in qualitative studies. Evidence, for example interview transcripts, were analysed using CAQDAS and employed established methodologies for qualitative interpretation (Easterby-Smith, 2008, Silverman, 2011,

Neuman, 2003, Blaikie, 1993). Similarly, for the construction of coding systems, methodology was used that was adapted from literature on the application of CAQDAS (Friese, 2012, Saldana.J, 2009, Lewins. A, 2007). A verification exercise was conducted (see Section 3.10.4) that, to a degree, acted as a quality control on the process of coding. The rigour applied to the application of selected methods should mitigate concerns over the application of the chosen data gathering and analysis process.

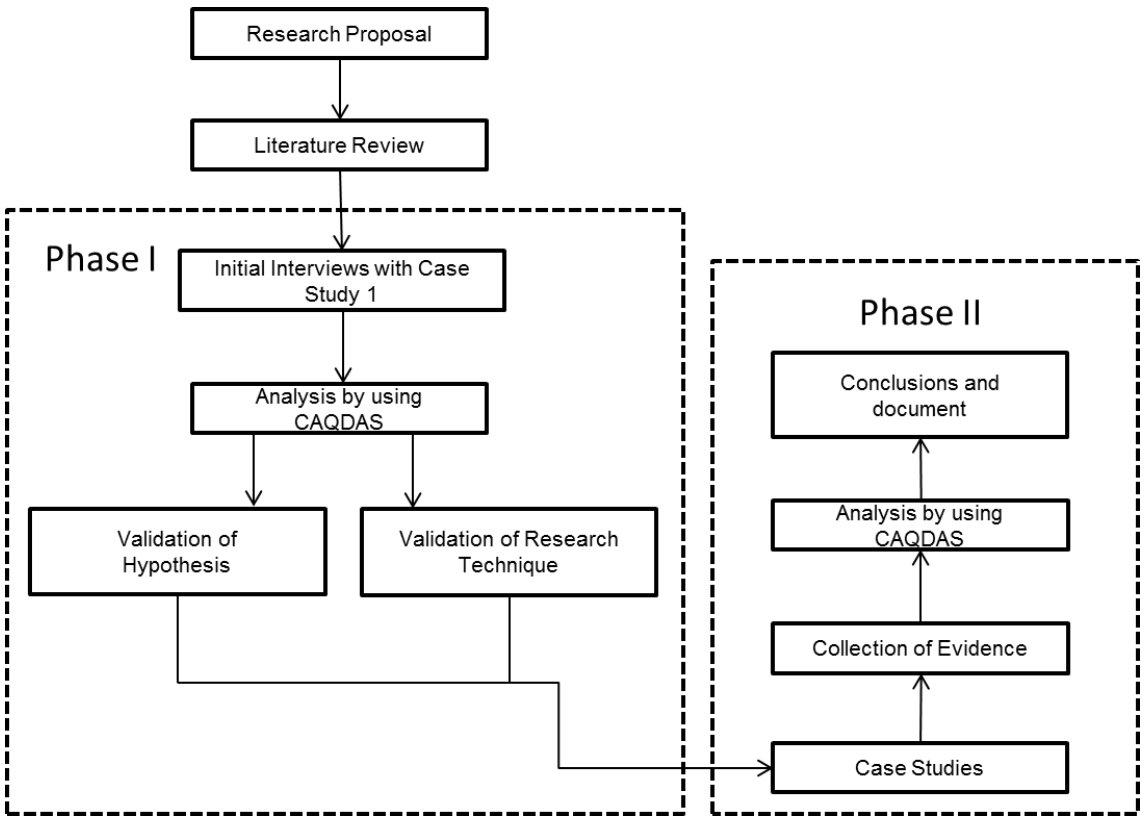


Figure 3.3: Data Collection and analysis process

3.6 Interview survey methodology and approach to question design

Foddy (2003) observes that the use of verbal data has become dominant in Social Science studies. Sliverman (2013) also highlights that the use of interviews in case study work appears to be overused or used inappropriately. Interviews are, however, a cost-efficient way of exposing and recording behaviours and opinion. Foddy (2003) together with Kvale and Brinkmann (2009) explain the usefulness of good interviews while emphasising the limitations and unintended results or bias that the interviewer can impose on the interview situation. Interviews form the backbone of this study and it is therefore important to make mindful choices in the construction of questions and the execution of the interviews to elicit as rich a response as possible from the limited time available with the interviewees.

Foddy (2003) explains that all questions are open to interpretation and explains that answers will be open to influence from the interviewer`s behaviour (for example, style in asking questions, beliefs, relationship with interviewee and knowledge of subject) as well as how the interviewee interprets the question in relation to memory recall, experience, attitudes, beliefs, etc. In general terms information is exchanged between interviewer and interviewee in a cyclical process of encoding and decoding the language used in questioning and answers given. Every exchange is open to miss-interpretation, influence and bias.

The interview questions for both sets of case studies (Phases I and II of the research agenda) were designed as open, semi-structured questions, taking into account the sensitivity around interpretation of the wording used in each question. The semi-structured interviews with open ended questions are listed in Table 3.3.

The questions were constructed around the central themes identified in the literature review (Chapter 2). The use of a standard set of open questions allowed for a range of

opinions to be expressed within the selected group of actors. The questions were slightly modified for the interviews conducted with the regulator to reflect the accountabilities they have with respect to the water sector regulation. A total of five interviews were conducted during Phase I. Each interview lasted approximately forty five minutes and was fully transcribed for analysis. The transcriptions were kept confidential, in-line with the ethics requirements (Appendix I). Respondents signed a consent form and were made aware that the information they provided would be anonymised but may form part of a publication (Appendix I).

Phase I interviews were transcribed and analysed using CAQDAS (Friese, 2012, Saldana.J, 2009) and the output of the analysis, along with the literature review output, was used to modify the questions for Phase II of the study. Table 3.4 lists the questions used during Phase II.

Each interview (for both phases of the research agenda) was a conversation which used the questions listed in either Tables 3.3 or 3.4. Supplementary questions were asked during the course of the conversation to develop and expand on interesting features of the answers given. The supplementary questions varied from respondent to respondent dependent upon the answers given and how these were decoded by the researcher. This iterative process is represented in Figure 3.4. The Phase II interviews varied in duration from around 25 minutes to one and a half hours with the average being circa 50 minutes. The shorter interviews were given by interviewees that were lower in the organisational structure and/or who had limited experience of risk management and regulation. Their responses are included and still valid as they offer an understanding of the importance allocated to risk management and the pervasiveness of risk management within the organisations. In one of

the case study targets, the organisation of interest (from Portugal), did not give interviews but provided two written responses, one answering the questions in Phase II (Table 3.4) and the other relating to other questions that they felt relevant. The responses, while limited, were still valid in the context of the study as they gave an insight into what an organisation was prepared to share with third parties on the subject of risks. The documents are unique within the study and have been included in Appendix III. The responses were analysed using CAQDAS and coding methodologies consistent with the other interview transcripts.

Table 3.3: Interview questions developed for Phase I case study and validation exercise, based on literature review output.

Question	Motivation	Primary Question	Origin of Question (lit Rev or Prof insight)	Expected response Director	Expected response GM	Expected response Manager	Expected response Regulator
1	Validate Organisational approach to regulation.	Can you describe how Scottish Water`s ambitions and activities are shaped by regulatory objectives?	Literature Review and Professional Insight: In the UK there is evidence in the business plans that water companies focus on meeting or out performing the regulatory contract. Paying less attention to longer term objectives.	Will vary but the key concern for directors is access to funding while out performing the regulatory contract.	Outperformance of the regulatory contract is essential. This will include financial and operational objectives.	Compliance with regulation cannot be compromised.	Compliance with regulation cannot be compromised.
2	Validate Organisations understanding of Ownership and Performance.	Does the form of ownership of the business influence its potential for success within the current regulatory environment?	Literature Review: It would appear that privatisation does not lead to greater efficiency. Performance is linked to a range of factors that include complexity of treatment, abstraction, networks, etc.	The general view would be that there are advantages and disadvantages of both. I would expect that access to capital markets is the main driver and therefore they would favour privatisation over public ownership models.	This will be mixed as the GMs have a range of experience in the public and private sectors. I would expect personal experience would influence the answers.	This is likely to be a personal judgement based on personal experience and political views.	The regulator will give an unbiased opinion on the advantages and disadvantages of both but will be reluctant to give a personal view.
3	Validate Understanding of Risk strategy within the organisation.	What are the major risks faced by Scottish Water in delivering its objectives?	Literature Review: Evidence suggests that although water companies understand risk, it is not yet embedded in the organisations culture sufficiently to meet the requirements of, for example, the Bonn Charter.	The directors are likely to discuss the corporate process. They may give a view on the effectiveness of the strategy.	The GMs will be aware of the risk management strategy and policy. They may give examples of risks that they have escalated through the process. They may have a view on the effectiveness of the current system.	The manager will be clearer on the mechanics of the organisations risk management system. They should be able to comment on the effectiveness of operation.	The regulator will know of the risk strategy but may feel that it is not yet embedded into the culture. This will be supported by evidence gathered during site audits.
4	Determine the priority of risk within the context of achieving the business objectives.	Thinking about your area of responsibility, can you provide a couple of examples of how risk is charicterised and managed when delivering your business objectives?	Literature Review and Professional Insight: Water companies appear to put the task before leadership or risk. For example, there is evidence to suggest that outsourcing is used as a way of mitigating risk.	The directors will be in a position to give good examples of risk mitigation measures that do not compromise delivery of out performance.	The GMs may be able to give good examples of risk mitigation for their particular areas. Some will give examples of longer term (greater than 5 years) interventions.	The manager should be able to give some specific detailed examples of risk management initiatives for their area of responsibility.	The regulator may express concern that the business objectives are priorities to the detriment of managing operational risk and the protection of public health.
5	Establish the importance of governance within the organisation.	To what extent are governance structures and processes within Scottish Water appropriate for managing the types of risk that the business faces?	Literature Review: The recent banking crisis is driving business towards introducing more governance, evidence points to greater governance leading to the generation of additional risk.	The directors will be able to describe the organisations approach to governance.	The GMs will give a similar response to the directors. They may indicate that there are too many governance groups within the organisation.	The manager should be able to give examples of governance activity but this may be more specific to their area of accountability.	The regulator will be clear on the governance processes of the organisation but may question the necessity of some of the activities.

Table 3.4: Open questions developed for the Phase II case study work (based on phase one output and literature review).

Question	Motivation	Primary Question	Origin of Question (lit Rev or Prof insight)	Expected response Director	Expected response GM	Expected response Manager	Expected response Regulator
1	Understand and validate the business priorities of the organisations (regulators and service providers) to see if there is alignment.	What Drivers Influence the Business Priorities in your Organisation?	Literature Review and output from the phase 1 interviews. The principle drivers may include access to funding, delivering regulatroy objectives and improvements to customer service.	Will vary but the key concern for directors is access to funding while out performing the regulatory contract.	Outperformance of the regulatory contract is essential. This will include financial and operational objectives.	Compliance with regulation cannot be compromised.	Compliance with regulation cannot be compromised.
2	Gain insight and understanding into what competing tensions are present and how this may influence decision making.	What Tensions do you feel exist between the various drivers and to what extent do these impact on sustainable busines practise?	Literature Review and output of phase one interview process. Tensions appear between financing, quality and service. Each regulatory body and water provider will put a different weighting on each of the factors.	The general view would be that there are advantages and disadvantages of both. I would expect that access to capital markets is the main driver as it enables quality and service imporvements.	This will be mixed as the GMs have a range of roles and responsibilities within the organisation. Their answers will be aligned to their areas of responsibility.	This is likely to be a personal judgement based on personal experience and accountability.	The regulator will be able to articulate most of the tensions and may favour delivery of the regulatory objectives that they are accountable for.
3	Validate Understanding of the risks that the orgnisation faces.	What are the key areas of risk with which youthink the organisation sould be most concerned?	Literature Review: Evidence suggests that although water companies understand risk, it is not yet embedded in the organisations culture sufficiently to meet the requirements of, for example, the Bonn Charter. This is supported by the output of phase one.	The directors are likely to discuss the corporate process. They may give a view on the effectiveness of the strategy.	The GMs will be aware of the risk management strategy and policy. They may give examples of risks that they have escalated through the process. They may have a view on the effectiveness of the current system.	The manager will be clearer on the mechanics of the organisations risk management system. They should be able to comment on the effectiveness of operation.	The regulator will know of the risk strategy but may feel that it is not yet embedded into the culture. This will be supported by evidence gathered during site audits.
4	Determine the priority of risk within the context of achieving the business objectives.	How do the performance objectives and the fundng model of the organisation meet the regulatory priorities?	Literature Review and output pf phase one. Decision makers tend to be aware of risks but are still required to make decisions which may be counter to the risk mitigation measures.	The directors will be in a position to give good examples of risk mitigation measures that do not compromise delivery of out performance.	The GMs may be able to give good examples of risk mitigation for their particular areas. Some will give examples of longer term (greater than 5 years) interventions.	The manager should be able to give some specific detailed examples of risk management initiatives for their area of responsibility.	The regulator may express concern that the business objectives are priorities to the detriment of managing operational risk and the protection of public health.
5	Establish the importance of governance within the organisation.	Is there an appropriate risk management culture in the organisation and what improvements, if any, would you like to see with respect to managing risk?	Literature Review and output of phase one interview process suggests that organisations will have base risk management in place but this is not as mature as would be expected.	The directors will be able to describe the organisations approach to governance.	The GMs will give a similar response to the directors. They may indicate that there are too many governance groups within the organisation.	The manager should be able to give examples of governance activity but this may be more specific to their area of accountability.	The regulator will be clear on the governance processes of the organisation but may question the necessity of some of the activities.
6	Deterimine how organisations approach long termstratgey and planning.	How do you percieve your organisation`s remit and role changing in future?	Literature Review and Phase One output suggests that utilities will focus on short term planning horizons such as annual or five year blocks.	The directors will be in a position to give good examples of risk mitigation measures that do not compromise delivery of out performance.	The GMs may be able to give good examples of risk mitigation for their particular areas. Some will give examples of longer term (greater than 5 years) interventions.	The manager should be able to give some specific detailed examples of risk management initiatives for their area of responsibility.	The regulator may express concern that the business objectives are priorities to the detriment of managing operational risk and the protection of public health.
7	Establish and understanding of how effective the actors think their risk management processes are embedded within the business.	How pervasive do you think risk management is within your organisation?	Literature Review, personal experience and the output of phase one suggests that in some cases risk management does not gain traction through out the organisation.	The directors will believe that the risk management processes in place are effective for the most part but could be imporved.	The GMs will give a similar response to the directors. They may indicate that there are too many unproductive meetings within the organisation.	The manager should be able to give examples of risk managment activity but this may be more specific to their area of accountability.	The regulator will not necessarily be clear on water companies risk management processes and how well embedded these are.

3.7 Collection of documented performance data

Case study work should not just be a series of interviews (Silverman, 2013b, Neuman, 2003) used to assess the qualitative nature of an organisation or a set of cultural features of a group. Information from a wider range of sources can significantly enrich the project output (Creswell, 2009, Yin, 2009). In many cases data is publically available for water companies. In the United Kingdom, water quality data, asset information, financial performance and investment profiles are easily accessible through either the relevant regulators` web sites and/or the water service providers` web sites. The data can also be obtained through freedom of information requests or simply by contacting the organisation of interest and seeking permission to access the data for research purposes. Some data linked to the non-UK cases was a little more difficult to access, however a similar process of accessing data through publically available routes and/or direct contact was applied.

3.8 Ethical considerations and confidentiality

It was agreed at the outset of the project that the actors and organisations taking part would be anonymised within the outputs of the study. It was important to elicit open and honest responses from the interviewees in a safe environment where they could express opinion and sensitivities without concern of being identified. In doing this it was hoped that the interview outputs would be richer, more expressive and have more depth than if the interviews were formally documented within the body of the report. The richness of answers is key to enhancing the quality of the analysis (Silverman, 2013b) and legitimising the qualitative research approach.

By ensuring anonymity, the relationship between interviewer and interviewee can be improved (Creswell, 2009, Brinkmann.S, 2009) resulting in the potential for deeper and more meaningful conversation that uncovers opinion and deeper levels of understanding. With this in mind, enough general information on the organisations involved in the study has been included (for example, in Table 5.2) where the assessment of organisations is geographically based. Interviewees` general role titles have been used and a unique reference number allocated to protect their identity (Table 5.9).

The research ethics policy of Cranfield University was followed (Appendix I) with a particular emphasis on the following:

- Being open and honest with potential respondents;
- Ensuring respondents understood what would happen to the information they provided;
- Ensuring respondents understood their right to withdraw from the study at any time;
- Producing contact details so that respondents could raise queiries subsequent to interviews.

When considering the project as a whole and the ethics agreements (Appendix I), the Cranfield policy requires that the project and supporting activities are legal, are aligned to the University`s values, will produce an output that is valid and enhance reputation. A proposal for ethical approval for the study was submitted and approved by the Cranfield Science and Engineering Research Ethics Committee (Appendix I).

3.9 Considerations of bias within the sample set and influence on responses.

As discussed in Section 3.3.3, in this project the researcher can be classified as an "insider-learner" (Blaikie, 1993, 2000). At the start of the project the researcher had some knowledge of risk management issues and extensive knowledge of the water industry, with some 14 years experience in water sciences, water and wastewater quality and operations. The researcher was also embedded in one of the case study organisations for part of the duration of the project. With this in mind, close attention was paid to the method choice, interview technique, approach to data analysis, etc, (See Section 3.4, 3.5 and 3.6), with a recognition of, and sensitivity to the bias that the researcher could bring to the study. A number of checks and validations have been used to identify influences and bias of the researcher. The first practical step was to conduct Phase I of the research activity to test the researcher`s ability to design open questions and a credible interview technique. The output of the initial five interview transcripts were analysed using CAQDAS and the output was discussed, reviewed and tested within the research team (principle researcher and supervisory staff). The outcome of the review confirmed that the researcher`s interview technique was satisfactory, based on the conversational style of interview technique suggested by the transcript text (and recordings) together with the richness of the interviewee responses. The coding methodology appeared appropriate and consensus was reached on the adequacy of the interpretation of the interviews, allowing the researcher to proceed to Phase II of the research activity.

The Phase II activity output (data collection, interview transcripts and coding exercise) was reviewed by an independent, post-doctoral researcher, who holds a PhD in social

sciences to validate the coding system. This validation exercise is discussed in Section 3.10.4. The validation exercise highlighted that the coding system and the way that it had been applied by the 3rd party researcher was similar to that of the principle researcher. While this is not a definitive validation exercise in quantitative terms it demonstrates that the analytical techniques are replicable with broadly similar outcomes.

3.10 Approach to data analysis

Recorded interviews were transcribed by the principle researcher with support from professional administration staff. Some interviewees, principally operational staff, declined to be recorded. In cases where transcripts are not available, field notes were used as aid memoires to the answers given at the interviews. All interviews and analysis were supplemented by observations and ad-hoc conversations during interactions with industry actors (Table 3.5). These interactions included water company staff, regulators and other stakeholders including water users. Observations included interactions between senior management and regulators engaging in conversation about such topic areas as compliance with regulation; interactions between senior managers during management meetings, discussing, for example, elements of business performance, governance issues and compliance; conversations between managers and operational staff discussing actions resulting from incidents (where an incident is a failure of the water treatment process which may result in harm to the public). All of the conversations add richness to the qualitative analysis and the understanding of organisation management culture. The analysis of the

interviews was carried out using CAQDAS (Section 9.9) and (Friese, 2012; Lewins.A, 2007).

Table 3.6: Ad-hoc conversations which provided supplementary qualitative data

Participant	Case Study	Date	General Subject Area
Director	A	06/02/12	Ownership Arrangements
Regulator	A	16/02/12	Regulation
Manager	A	03/02/12	Risk Management
Manager	A	07/03/12	Risk Management
Operator	A	23/02/12	Risk Management
Operator	A	08/03/12	Regulation
Operator	A	08/03/12	Risk Management
Director	B	03/04/12	Risk Management
Manager	B	12/04/12	Regulation
Operator	B	05/04/12	Risk Management
Operator	B	05/04/12	Risk Management
Director	C	01/02/12	Ownership Arrangements
Director	C	09/02/12	Ownership Arrangements
Director	C	17/02/12	Risk Management
Operator	C	22/03/12	Risk Management
Operator	C	29/03/12	Regulation
Operator	C	05/04/12	Regulation

3.10.1 Coding and the strategy for code construction

Coding structures need to be mindful of the framework that the project is working within the data analysis process. The coding process needs to be defined but flexible enough to be adjusted to avoid constraining the richness of the qualitative analysis. The process of coding is cyclical and more detail is built during each revision of the interview scripts. The adopted coding sequence follows that proposed by Neuman

(2003) and Saldana (2009). The initial review involved open coding which is a process that enables the researcher to locate themes and develop codes in an attempt to condense large volumes of raw data into themes. The second phase of coding is known as axial coding and focuses on re-analysing the data using the preliminary codes and emerging concepts from the open coding exercise. The principal objective is to review and examine the initial codes that lead to organisation of ideas and themes that develop an axis of primary concepts. The final step in the coding process involves scanning all the data and previous developed codes for cases that demonstrate the emerging themes; this is known as selective coding. Each project document was analysed using this approach. Throughout the three phases of coding the inductive and deductive strategies (Section 3.3.2) were applied which underpinned the cyclic nature of coding. The initial open coding exercise was more weighted to the inductive elements of the strategy, where observation from the interviews were translated into coding and patterns which informed thinking (Figure 3.2). The ideas forming from the open coding then informed the axial coding which incorporated more deductive strategy. The selective coding element of the analysis incorporated both inductive and deductive elements (Figure 3.1).

From the three phases of coding analysis conducted in CAQDAS a range of open codes were established, examples of which are listed in Table 3.6. These codes, with other similar logical codes, were applied to each interview and have helped develop the analysis documented in Chapter 4 and 5. Figure 3.4 is a screen shot demonstrating how the open codes listed in Table 3.6 have been applied to the transcripts of the interviews (Friese, 2012, Saldana.J, 2009).

Table 3.6 Selected codes identified during Phase I open coding exercise.

Code	Sub-code	Definition
Regulation	Collaborative	Used when there is an indication of regulators and organisations working together.
	Objectives	Used when business, ministerial or regulatory objectives are mentioned.
Ownership	Political	Used when there is reference to interaction with political entities.
	Incentives	Used when incentives to meet objectives are mentioned.
	Shareholders	Used when shareholders are mentioned.
	Funding	Used when economics, OPEX, CAPEX and funding mechanisms are mentioned.
Governance	Process	Used when processes are mentioned.
	Decision Making	Used when decision making and delegation are mentioned.
	Accountability	Used when ownership or risk and decisions are mentioned.
Risk Management	Economic	Used when the economics of risk management is mentioned
	Political	Used when risk management within a political context is mentioned.
	Public Heath	Used when public health management is mentioned.

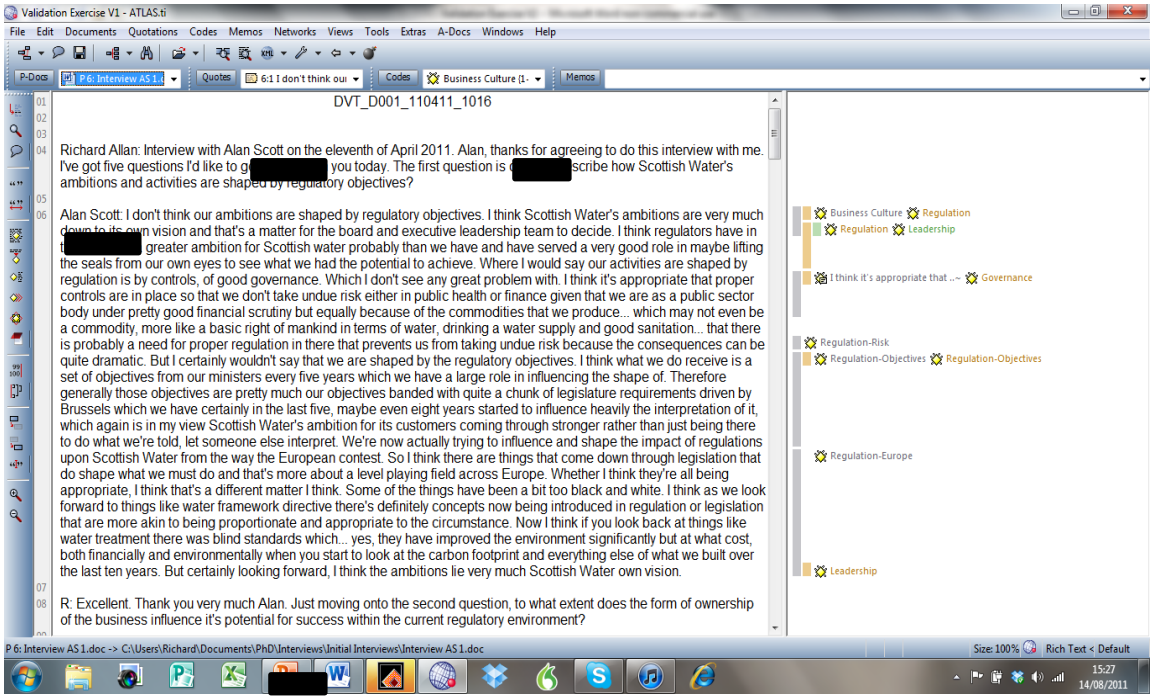


Figure 3.4 : Example of application of codes to transcript text.

Data analysed for Phase II of the study was conducted using the same techniques as Phase I. The output of Phase I informed the open questions developed for Phase II and the coding strategy during the analysis. Appendix II lists the codes developed in each phase of the research. The codes in phase one, while informative, were developed into a more descriptive set of codes during the analysis of the Phase II data based in the cyclical nature of the inductive and deductive strategy (Figure 3.2). The descriptive codes better reflected the nature of the responses given by the participants in the Phase II case Studies (Chapter 5).

3.10.2 Developing the coding networks and inter-relationships

As well as developing a code structure, the inter-relationships between interviewees was considered as part of the analysis. During the analysis the actors were grouped by role, by country and by organisation. Connections were made within countries between service providers and regulators. By creating a range of sub-families it was possible to view the data through multiple lenses to gain a deeper, richer analysis and understanding of the common themes, experiences and tensions that exist within the sample group. The document families were grouped in ways that enabled vertical and horizontal comparisons to be made within the data that facilitated a more complete and detailed analysis.

3.10.3 Capturing data using field notes and analytical memos

In Section 3.6 and 3.10 it was highlighted that some interviewees, while happy to be interviewed did not agreed to be recorded. Ethical considerations mean that the preference not to be recorded needed to be honoured. Where recordings (and transcripts) were not generated, field notes were taken. The output of the field notes (a form of transcript)were included in the analysis. Other forms of notes were developed throughout the research activity, these notes can be referred to as analytical memos (Saldana, 2009). These analytical memos are of importance as they capture the researchers thinking and document observations, emerging themes and help support theory building. The whole analytical process can be described as one of noticing, collecting and thinking. Figure 3.5 is a simple representation of the cyclical nature of the analytical process.

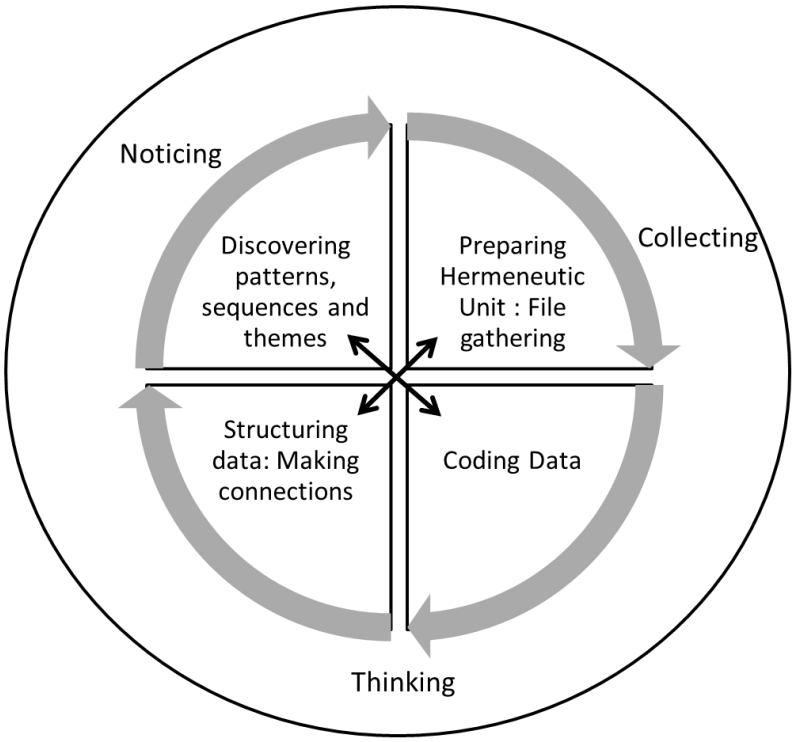


Figure 3.5 Noticing, collecting and thinking. A simple representation of the analytical process used in CAQDAS. (Based on Saldana, 2009 and Friese, 2012)

"Noticing things" in the context of this thesis can be described as a process of finding interesting things within the data when reading and reviewing transcripts, documents, field notes, audio files, etc. During this process analytical memos can be generated, notes made or documents marked up. The process would generally be considered as a pre-coding phase around connecting ideas, themes and observations that will aid the coding process. Noticing things can be done alone, reflecting on the data collected, or through discussion with colleagues and other researchers which may lead to further observation about the data set under review. Either way the principle objective is to notice elements within the data that further advance thinking and ultimately, the analysis of the data.

"Collecting things" is a complementary process to noticing things and is about gathering evidence, where evidence can be described as documents, interviews, surveys, analytical memos codes, code families, etc. The collected evidence is brought together in the project specific HU (Friese, 2012; Saldana, 2009). Collecting data is not a one off activity but part of the iterative process described in Figure 3.6. As more relevant things are noticed, new evidence may emerge which gets added to the HU.

The final part of the cycle is "Thinking" about the evidence and data collected, making connections and structuring the data in a way that enables theory building, generation of concepts, building of emerging patterns and trends. New data and evidence may emerge which requires further thinking and analysis, leading to modification of theories and concepts. The cyclical process can be repeated any number of times through the qualitative CAQDAS process to build rigour and confidence into the output.

3.10.4 Independent validation of data analysis

The study is based on qualitative analysis principles as described earlier in Chapter 3. Analysis of qualitative data is subjective and interpretation is dependent upon the epistemology and ontology of the researcher (Neuman, 2003, Easterby-Smith, 2008, Creswell, 2009). Given that a set of qualitative data can be analysed in different ways dependant on the epistemological position taken by the researcher, it is desirable to validate the analytical approach and coding structure through an independent mechanism. Here the analytical process has been challenged by the supervisory team

in the initial phases of the researched and a review conducted by an independent post-doctoral researcher competent in qualitative research methodologies.

A selection of transcripts were chosen from multiple organisations and roles (listed in Table 5.3) and submitted to the independent reviewer. A copy of the codes developed by the principle researcher was submitted with the data. The reviewer then attempted to code the transcripts using the codes submitted. The re-coded transcripts were saved as PDF documents and sent back to the principle researcher for comparison. Figures 3.6 a and b depict screenshots from the original transcript and a portion of the same section generated during the validation exercise. The limitations of the scaling of the two different document management programs means that the CAQDAS screen shot reveals more of the interview transcript compared to that of the PDF reader. The independent validation exercise supported and verified the researchers approach to the coding process by demonstrating that a qualified third party could apply the same analytical technique and independently replicate broadly the same outcome from the data set. It is recognised that the exercise is limited to a secondary qualitative perspective and should be interpreted within that context.

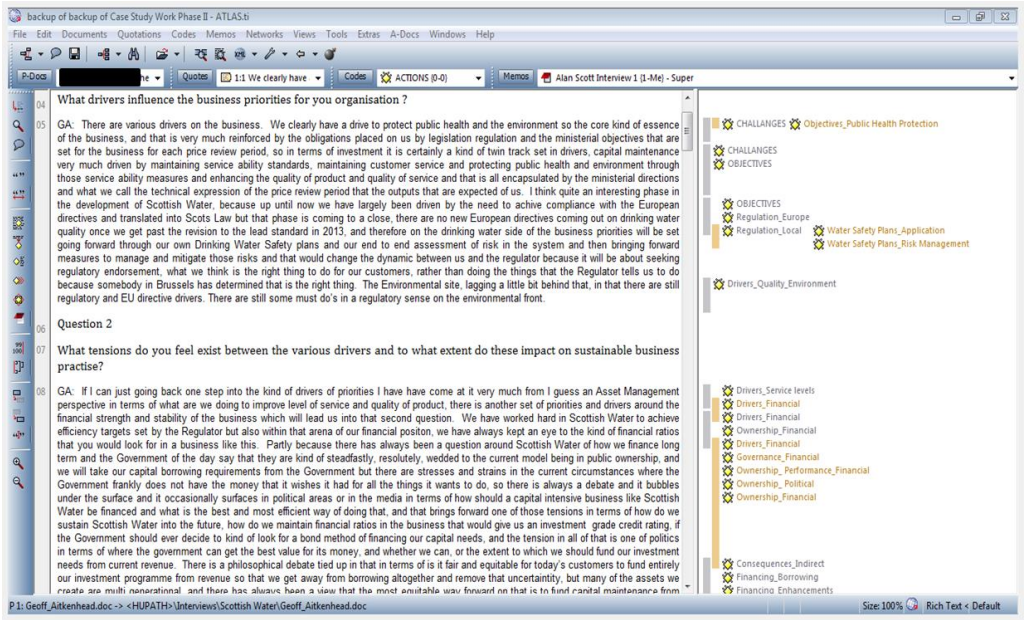


Figure 3.6a Screen shot of a coded section of an interview transcript from Atlas.ti

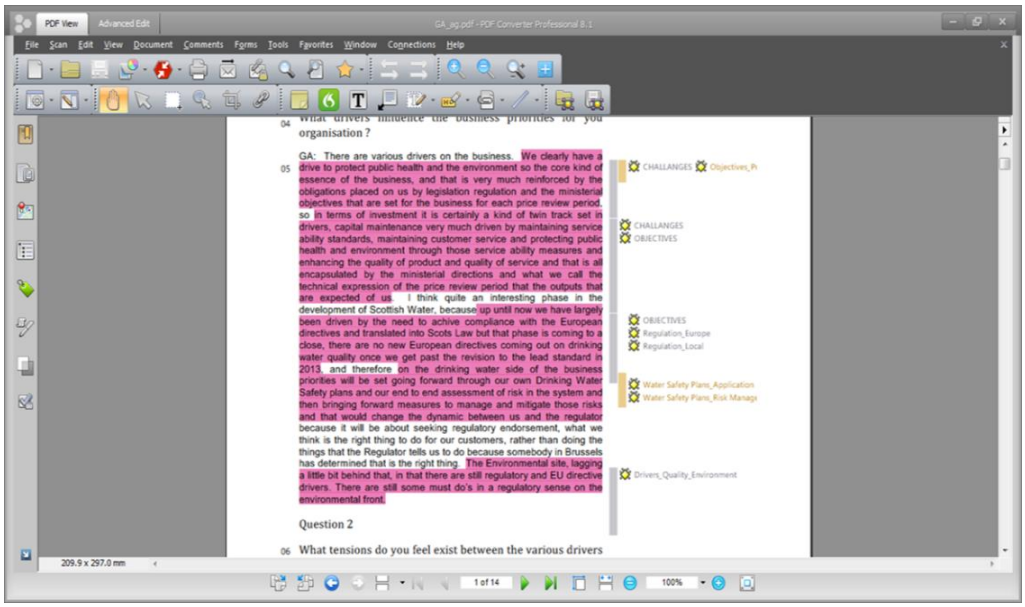


Figure 3.6b Screen shot of a sub-section of an interview transcript (the same as in Figure 3.6a) from the validation exercise.

3.11 Reporting of Results

The qualitative analysis is reported in Chapter 4 and 5. In Chapter 4 the data is presented as coded sections of quoted text for each of the groups of actors. The code frequencies for a number of codes are presented along with example quotes in Table 4.3 which is a summary table for Phase I. Discussions of the data for each area of interest are structured in a similar way to aid the flow of the discussion. Each section is broken down into:

- The Regulator`s Response
- The Directors` Response
- The Managers` Response
- Comments

Phase II generated much more coded data and it was of interest to investigate and analyse the variation of responses between groups of actors (for example Section 5.5.2). It was also of interest to establish the response of all actors against specific codes to see if there were commonalities or substantive differences of views (for example Section 5.5.3). In order to facilitate a deeper understanding of the data, the frequency of coding was presented in tabulated form (see Table 5.11) and as a series of histograms (for example, Figure 5.4 and 5.5).

3.12 Summary

The research is focused on establishing a deeper and richer understanding of the approach taken to risk management within water service providers that operate within different regulations, ownership arrangements and management cultures. The

nature of the study supports the adoption of a qualitative approach to the research (Sections 3.1 through 3.3). Chapter 3 has discussed the qualitative methodology used in the research and has addressed emerging concerns about the overuse and/or incorrect application of qualitative analysis in social and management studies. The data was collected through semi-structured interviews, analysed and coded using CAQDAS. A sub-set of interview transcripts were further analysed by an independent third party post-doctoral researcher as a validation mechanism designed to challenge the principle researcher`s approach. Using interviews, document analysis and a multiple-case study approach has allowed a qualitative strategy that has supported an improvement in understanding of what influences organisational approaches to risk management application in the water sector. As the study progressed the methodology used was modified based on the context of the case studies and the findings in Phase I. The adapted phase specific methodologies are covered in Sections 4.3 and 5.3.

Chapter 4: Results – Phase I

Chapters 3 through to 6 describe the delivery of the research agenda from development of the researcher`s approach to qualitative methodology, interview technique and analysis using CAQDAS. The chapters contribute to the development of a deeper appreciation of some of the factors which influence risk management across a range of ownership arrangements and regulatory systems. Each chapter builds on the output of the preceding chapters leading to observations, suggestions and conclusions discussed in Chapter 7.

4.1 Purpose of Phase I

Phase I of the research activity was designed to address a number of considerations. The primary objective was to test the output and observations of the literature review while further informing the development and refinement of the research question. The secondary objectives were to develop, test and improve the researcher's ability to conduct qualitative research (using a limited set of actors and documents) before a more substantive multiple case study exercise was undertaken. The practical, systematic approach and methodology adopted in Phase I was modified for Phase II, taking into account learning gained. The phase specific modifications to the methodology described in Chapter 3 are documented at the beginning of Chapter 4 (Section 4.3) and Chapter 5 (Section 5.3).

4.2 Scope of Phase I

The initial phase of research activity involved five principle actors operating in two organisations. The first was a water and wastewater service provider (water company) and the second organisation was the water quality regulator who monitored the water company`s operational performance with respect to drinking water quality. Phase I included a review of the water company`s business plan together with annual performance reports which documented the actual out-put of the organisation compared to that predicted in the strategic business plan. The regulators independent reports on the water quality performance were also included in the investigation.

4.3 Phase I specific methodology

The case study in Phase I was constructed using data gathered from senior managers, directors and regulators (Section 4.2). The ownership arrangements and regulatory framework which the case study operates within are one set of conditions of interest within this study. The utility is a publically owned business which differs in ownership arrangements compared to other parts of the United Kingdom (Table 4.1). England and Wales water utilities were privatised in 1989, with Welsh Water adopting an operating model based on mutualisation. Northern Ireland has similarities in ownership arrangements to the case study water service provider. All of the water service providers are regulated using comparable statutory instruments across finance, water quality and environment disciplines. Table 4.1 lists the ownership arrangements of the water service providers in the UK together with the regulators.

Table 4.1: Operational Arrangements of UK water service providers.

UK Region	Ownership arrangements	Environment Regulator	Water Quality Regulator	Financial and Service Regulator
Scotland	Public Ownership arrangements	Scottish Environment Protection Agency	Drinking Water Quality Regulator (DWQR)	Water Industry Commission
Northern Ireland	Public Ownership arrangements	Northern Ireland Environment Protection Agency	Drinking Water Inspectorate (Northern Ireland)	The Utility Regulator – Electricity, Gas and Water
England	Private Ownership arrangements	Environment Agency	Drinking Water Inspectorate (DWI)	OFWAT
Wales	Mutualisation	Environment Agency	Drinking Water Inspectorate (DWI)	OFWAT

At the time of writing, the case study was the fourth largest water service provider in the UK and served circa 5 million customers covering approximately one third of the land mass of the UK. The organisation operates 268 water treatment works along with networks and distribution. The annual operational budget was in the order of £278m (covering water and waste water operations) and the capital investment plan identified close to £500m of improvement projects and capital maintenance per annum. The utility operates over a wide range of assets and geographies which include very small rural supplies and islands through to large urban centres. More detail on this utility is documented in Section 5.4.1. The case study organisation was selected because it provided one variation relevant to this thesis. The principle methodology adopted is documented in Chapter 3 but was limited to a single

organisation with a small group of participants. The variation in participants is limited to actors within the organisation and the regulating authority. The selection of participants is discussed in Section 3.4.1. The data reporting in Phase I differs from that of reporting in Phase II in that it only includes codes quotes and tables of code frequencies (See Section 3.11).

4.4 Data Analysis: Interviews

The actors took part in a circa 45 minute interview using the questions listed in Table 4.2. and using the principles described in Section 3.6. Section 4.4 discusses the answers given by the actors in response to the interview questions. The interviews were semi-structured and Supplementary questions were asked during the interview process. The supplementary questions varied between interviews as they were part of the conversation in response to the actors reply to the principle questions (employing the iterative process described in Section 3.7 and Figure 3.4). The output of the interviews were analysed using CAQDAS (Section 3.9 and 3.10).

Table 4.2 Summary of actors participating in the Phase I case study exercise

Actor Reference	Organisation	Role	Responsibility
C001	Government	Regulator	Water Quality
A002	Utility A	Director	Finance
B001	Utility A	Director	Asset Management
A001	Utility A	General Manager	Regulation
D001	Utility A	General Manager	Strategy and Planning

4.4.1 Organisation ambition, Regulation and Risk Management

Section 2.1 reviewed and commented on a body of literature concerning changes in regulatory approaches and studies which sought to better understand regulation and institutional arrangements for the water sector. The outcome of the majority of studies pointed to a lack of consensus around regulation of water services, noting variations on geography, social influences and political views as possible influencing factors.

The initial question in the interview designed for the Phase I case study sought to understand how the regulation influenced the objectives and ambition of the organisation while validating the organisational approach to regulation (Table 3.3).

The Regulator`s Response

The regulator highlighted that:

"*Some of the organisations ambitions and approaches are very clearly defined by regulatory objectives". C001*

It was explained that there is a range of legally binding commitments and a number of regulatory mechanisms which can be used to influence the behaviour of Case A (enforcement action, authorised departures, prosecution).

"The most extreme one of these is prosecution which is sort of the last resort really. We're in the process of defining our approach in a policy document to all of these so we're crystal clear again with [Organisation A] as to when we'll use these tools. But really prosecution would be a last resort where the other tools have failed or where we need to be publicly seen to be a strong regulator and achieving our aim of protecting public health and consumers. Having said that, the Scottish legal system makes it difficult for us always to be certain that we're able to use this tool in that it's always the procurator fiscal bringing about the prosecution. So all we can do is recommend a prosecution and provide a report to the PF and then it's completely in the PF's hands as to whether or not it proceeds and how it proceeds." C001

C001 felt that there were many other ambitions which were determined through consensus between the regulator and Case A without the need to amend the regulatory framework.

"There are many other ambitions that are determined through discussion with [Organisation A] and the regulator and generally consensus. We tend to be, as a regulator we tend to be fairly clear with [Organisation A] what we're trying to achieve when we're asking for something. So the outcome we expect is sort of fairly clear to organisation A from the start. We try to leave it up to [Organisation A] to decide how it's delivered. We try not to get too involved in the detail of that." C001

The Directors` Response

Both Directors acknowledge the importance of the regulatory framework in the country:

"Arguably the only reason [Organisation A] came into being was because of regulatory objectives"

And;

"I would like to think our ambitions and activities are consistent with regulatory objectives because we`re here primarily to protect public health and the environment". A002

A002 went on to explain the role of regulation in setting the objectives of the organisation and this was very much the case from the formation of organisation A in 2002 until 2010.

"If I then look at the what I call the first stage of the [Organisation A]`s journey, which was in the period from 2002 to 2006 the whole mindset when we kicked off in organisation A was that it actually felt a bit like survival, it felt like how on earth are

we going to achieve all these required efficiencies, there was a real focus particularly on OPEX efficiency. We had a specific target to achieve by 2005/06, the last year of that first regulatory period. And it almost felt in the business that there was no future beyond 2005/06, it was could we get to the OPEXs target for that particular year and initially that looked very, very daunting. So the whole focus of business was one, to achieve OPEXs target set by the regulator, but two, it was, even from mindset angle, it was set on this regulatory period, there was no sense of the business beyond 2006. Well history shows that we got there and we beat the 05/06 OPEXs target. And over the last part of that period we were preparing for the 2006 to 2010 period where again effectively the regulator set the agenda because it was a regulatory officer and then, from July 2005 onwards, the first Water Industry Commission as a corporate body. They came up with this idea of introducing the OPA[2] mechanism into [Organisation A]`s area of operation, that existed in other parts of the country. And so the whole focus of business in 2006 to 2010 suddenly changed from: 'Yes we need to become more efficient but actually all about improving our customer services measured by OPA and it pains me a bit to say this but that came about because the regulator said that's what we should focus on and not because we as a board believed that that's what we should focus on. I should say, we want to put customers at the heart of the business but we hadn't had the foresight to think through on a specific mechanism on OPA. So the 2006 to 2010 period was then all about living within the

[2] OPA stands for Overall Performance Assessment and was developed by the Financial Regulator for Organisation A. OPA includes metrics for unplanned interruptions, pressure, drinking water quality, response to written complaints, ease of telephone contacts, sewer flooding, sewage treatment works compliance, leakage and complaints. Organisation A`s OPA score went from 162 in 2004 to 397 by 2014.

financial envelope that the commission set but crucially about beating this customer service OPA target." A002

The directors mention that the regulatory contract influences behaviours in a way that focuses on short term delivery but this is in contrast to the vision which goes beyond short term goals and requires more long term strategic planning. There is evidence within the answers that suggests Organisation A has an ambition to set its own objectives but within the boundary of regulation.

"When I come now into the new period of 2010 to 2015, we're starting to get into a more balanced position where yes we are seeking to deliver on regulation objectives but they're actually objectives that we bought into. So right from the very beginning of the preparation for the 2010 to 2015 period we were aligned with the commission's thinking that we should be pursuing an upper quartile agenda. Of trying to get to an upper quartile position on customer service and upper quartile position on efficiency, so in fact our business plan that we put forward very much reflected where the direction of regulatory travel. Clearly it remains to be seen whether we achieve or outperform all those specific objectives. Looking to the future then I think the balance is tilting further still because the commission is saying to us: 'Now right, [Organisation A], you go and own and develop a strategy, you put forward your plans and your propositions, you put forward your assessment of how you can improve service and how you can improve efficiency." A002

And;

"We have to be very clear about our long term objectives with regard to things like water resource management. So regulatory objectives tend to be short term, our ambitions are longer term than that. So we're looking over a 25 year period on issues like water resources and I guess all the other aspects of asset management as well. The ambition is to be able when we get into regulatory price review periods to be able to extract a five year workload from our 25 year plans and use that to formulate investment proposals for the coming five years which feed into the price review." B001

The Managers` Response

The general managers recognise the influence of the regulators in setting objectives in the past but both managers feel that Case A is now in a position to set its own agenda for success and is able to influence future regulation and direction. One manager points out that:

"*We are looking to transcend the regulatory environment". A001*

And;

"In my view [Organisation A]'s ambition for its customers coming through stronger rather than just being there to do what we're told, let someone else interpret. We're now actually trying to influence and shape the impact of regulations upon organisation A from the way the European context. So I think there are things that come down through legislation that do shape what we must do and that's more about a level playing field across Europe." D001

And;

"We were quite historically very, very far behind in terms of efficiency, we were quite behind in terms of our investments to satisfy European directives, like the urban waste water treatment directive, bathing water etc. and even our water quality at that time whilst our water quality was good compared with other world countries, within the UK we were still behind UK companies. So I think the first four to possibly eight years of our existence right up to 2010 a lot of our ambitions were actually shaped by regulatory objectives. I think that's now changing as we go forward, as we went into 2010 to 2015 and the setting our own business plan objectives for the next four years." A001

Author`s Comments

In this section (4.4.1) there is an acknowledgement that regulation is not just formulated at a local or national level, but rather feeds down from Europe and this shapes the objectives and direction of the organisation. All of the actors within organisation A are consistent in the responses given:

- When Organisation A formed it was driven by regulatory objectives.
- By the second regulatory period (2006 – 2010) confidence grew in organisation A`s ability to deliver
- By the third regulatory period (2010 – 2015) the leadership was confident enough to influence and shape the strategic objectives, acknowledging the requirement for further improvement.

The regulator recognises the transformation of Organisation A over the regulatory periods and has stated (in the examples given) that they would prefer a collaborative

relationship going forward but would use regulatory instruments to ensure compliance if necessary.

4.4.2 The interplay between ownership arrangements and regulation

Chapters 1 and 2 drew attention to a range of studies that sought to determine the impact of ownership arrangements on the economic performance of the water utility. Few of these studies took into account the consequences for risk management. Within the limits of Phase I it was of interest to see if the actors felt that ownership arrangements were an important feature, informing business priorities and risk management choices.

The Regulator`s Response

"Speaking from experience, working in a PLC and having knowledge of [Organisation A] in public ownership I'd say that one of the key difference is with the investment side of things. In a PLC there seems to be more flexibility or I perceive there to be more flexibility in terms of funding arrangements. If the regulator says something needs to be done then the money is found. There is more flexibility to move money around because it's up to that organisation how it spends its money as long as it's satisfactory to shareholders. Whereas in [Organisation A] things are much more pigeon holed financially and things need to be agreed well in advance for future investment periods. If that money hasn't been set aside for a particular project then it gives [Organisation A] great difficulty. So there are times when we will use enforcement notices or the threat of prosecution to bring about the improvements we want but historically that has quite often been at the expense of another project rather than just the money

being absorbed by the business. I think that is quite fundamental and it does give us difficulties as regulator because we have to be aware of the limitations around [Organisation A]. I mean perhaps future moves to improve its borrowing powers would assist that. " C001

The regulator suggests that the public ownership status restricts access to capital that is required to invest in improving services to customers. This may lead to funds being moved from one project to another which could expose Organisation A to other risks. When asked about enforcement actions taken to require Organisation A to make choices based on treatment failures, the regulator noted that:

"We have come across challenges to us from within the legal system and from consumers as well when we look at or threaten prosecution of [Organisation A]. In that we would be prosecuting a public body and obviously any fine or any damage would be to a public body. What good does it do? We've had that challenge, however we think the same situation exists with SEPA and local authorities and there's plenty of public bodies get prosecuted." C001

This is an interesting dilemma for a regulator working with publically owned organisations. Legal action to prevent failure (or as a consequence of failure) within the public body is seen, by consumers, as an illogical action. Here the regulator expresses some frustration when faced with taking punitive action towards Organisation A for failings.

The Directors` Response

The Directors of Organisation A, while acknowledging that they operate within private ownership, point to a range of incentives that drive behaviours similar to that of private companies. For example:

"I guess what we've sought to create in the culture of the organisation is a company that operates with all the normal commercial disciplines of a private company albeit it recognising that we are in the business of delivering an essential public service." A002

And;

"we don't have the explicit equity incentives, but we have tried to mirror the incentive properties of an equity owned company that would apply to the managers of an equity owned company in the sense that we've got quite significant personal incentives in place for the sort of top 40 senior people in the business who can typically add anywhere between 25-50+% to their base remunerations through the achievement of demanding performance targets. And I think the existence of those management incentives, which to a large extent mirror what you would have in a private company situation, do make it very difficult to give an objective answer to this question." A002

Another Director highlights the influence of politics within the governance and risk management approach of Organisation A.

"In our case there's an expectation that we will manage the business effectively. Meet all of our obligations. Importantly deliver the ministers objectives for [Organisation A]. So for every price review period there's a formal ministerial letter sent to [Organisation A] and the directors are all legally obliged to deliver the minister's objectives within the price review period. There's, you'd call it a regulatory contract. Now the ownership model for us inevitably brings politics pretty close to where we're at and the political debate around success or failure. I think you've seen an example in Northern Ireland over the winter 2010/11 winter when Northern Ireland got into some difficulties, that the form of ownership immediately made that a very political issue for them. The same would be true of us and has been in the past in terms of how close we are to the political arena. The potential for success can be affected by that because it can induce a risk averse nature in the business. If you're concerned about how things are going to play out politically and reputationally then you'd potentially be quite risk averse in the same way that anything close to government does tend to be risk averse. Civil servants, the civil service is by its nature a very risk averse set up. The civil servants do have a role in the interface between us and our owner, between us and the government. So there's a bit of an influence there in terms of potential for success." B001

The view here is that political involvement (to a greater or lesser extent) drives a more risk averse set of behaviours. The same Director points out that Organisation A did not pursue business opportunities because of perceived low risk appetite of the political owners:

"I can think of business opportunities that we have foregone in the last few years because ministers would not back the things that we were proposing. There's a saying in the governments arrangements around [Organisation A] oblige us to take things which are novel or contentious to the government for the all clear. It's on a reasonably low threshold of value, business value. We have, as I said, we have foregone some business opportunities because there was no risk appetite on the part of the politicians, the government of the day to back us in the business ventures that we were promoting." B001

He expands on this by pointing out:

"I suspect that venture capital owners or other forms of equity owners would probably have a different risk appetite to any degree of political ownership. That potential for success it probably does take you into that whole territory of risk equals reward and how far do you want to go with that. There has to be a line in our business that you won't cross in terms of the protection of public health and environmental protection but that's increasingly the case in any sphere of business now. Reputationally businesses can't be seen to be anything other than diligent in environmental matters these days. So you could argue that the form of ownership perhaps isn't so critical with regard to these kind of reputational issues, public health and the environment. But it does I think have a big bearing on how much your owner's prepared to back you with a business opportunity. " B001

The response perhaps highlights the Directors desire for *"business opportunity and success"* over and above the regulatory requirements to deliver safe drinking water

and protect the environment. The Director is willing to take more risk as a consequence of the financial incentives that are there as part of his contract. Regardless of ownership arrangements, if the leadership is incentivised to take risks, they will aspire to do this.

The Managers` Response

The senior managers put more emphasis on financing rather than ownership arrangements *per se:*

"I'm not sure it's a form of ownership that is as important as how the company is financed or it's available access to financing. I think you should look at the models in England and Wales of privatisation. That was purely around securing capital from the markets to invest in large enhancement programs." D001

The same actor highlights some advantages and disadvantages of public versus private sector ownership arrangements:

"I think some people argue that shareholder accountability drives better innovation etc, I may argue the opposite that I think actually shareholder models drive short-termism and quick returns and as a consequence I think there are merits in public sector ownership that don't exist in private sector and probably there are merits in private sector that don't exist in public and probably by bringing economic regulation to our ownership model, we are trying to mirror some of the benefits of the private sector model within a public sector environment. I think the advantage of the public sector environment is that longer time thinking and doing what's right in the long term whereas short term shareholder pressure will always require a certain degree of

short-termism and risk taking that none of us can tell what the long term bill may be for." D001

The other senior manager talks about incentives and mimicking shareholder pressure, which is perhaps in-line with Director A002:

"Regulators normally say that within the public sector model you can't mimic the shareholder pressure and it's very hard for us to comment on that because we haven't felt the shareholder pressure; but the incentives within both industries are broadly aligned in terms of what's got to be achieved for customers; and what's got to be achieved for compliance; and from a compliance point of view, what's got to be achieved for the environment or for drinking water. I think where the public and the private sector differ, certainly in the UK, we have in [Organisation A], because we're in the public sector, much more reputational incentive than we would perhaps have in the private sector with private shareholders. One of the things that drives us as well as the sort of stated incentives in the regime is the number of complaints in the minister's mail box, whether we have an operational sort of satisfactory relationship with the government and actually continuing to have the freedom to operate even though we are within the public sector and that means a lot to us. So it's actually, it drives certain decisions, it drives behaviours because we want to make sure that reputationally we don't lose any ground with the government or with the customers that much which would then drive back to complaints with the minister." A001

Author`s Comments

The ownership arrangements of Organisation A are public ownership, but incentives have been designed to promote behaviours seen as private sector behaviours (A002); meaning private sector behaviour is valued by Organisation A. The introduction of incentives for senior managers, promoting "private sector" behaviours suggests that private sector operating practises and management cultures are in some way more desirable and lead to outperformance of service levels. However, the literature review (Section 2.3) presents a number of contributions which demonstrate that private sector water utilities do not always outperform public sector water companies across a defined set of regulatory metrics. The responses given within the context of Organisation A`s sphere of operations suggest that:

- Leadership incentives are important to influencing behaviours (as evidenced by A002 and B001).
- Access to financing is of importance to both sustainable operational and investment activities (examples given by D001 and C001).
- Public ownership incentivises a low risk appetite (example given by B001).
- Reputational risks are as important in the political domain as service delivery and financing (examples given by A001).
- Privately owned water service provides do not think longer term (as evidenced by D001)

- Private organisation leadership behaviours are desirable (Examples given by A002 and B001) but evidence (Section 2.3) suggests that public and private organisations can deliver comparable service levels.

4.4.3 Perceptions of risks that should concern the business

Arguably, the principle objectives of the water service provider are the delivery or safe drinking water and sanitation (Section 1 and 2.2). The WSP approach (discussed in Section 2.1) provides a mechanism to identifying and mitigating risk within a water system. Importance is placed on risk management interventions supporting delivery of safe water and sanitation. The actors associated with Organisation A were asked questions to validate their understanding of the risk strategy within the organisation (Table 3.3) to determine how important WSP was to delivering safe drinking water and sanitation.

The Regulator`s Response

The regulator recognises the tension between delivering safe drinking water and the financial limits of the organisation:

"I think primarily financial at the moment in that, I'm speaking from a water quality perspective, [Organisation A] can't possibly deliver everything that it needs to deliver well in any financial climate really. Consequently [Organisation A] has to make some quite tough decisions between equally valid spending areas that require funding. Even you know in some cases the same issue but a different size, Does it deal with say THMs at a plant in the northwest where the zone size is say 20 people or does it target a similar issue at a treatment works serving 10,000 people."C001

The regulator also points to political influence as a risk to the operation of Organisation A:

"I think that's something we struggle with as regulators to be honest in terms of the way we pursue things and we've always taken the view that the size doesn't matter. Somebody in the north of the country is entitled to the same level of water quality. From a personal perspective in terms of major risks I do find the endless political debate over [Organisation A]`s future fairly unhelpful. I mean we're seeing it in this current election in the manifesto, the future of [Organisation A] and the way it's funded is endlessly debated. We are starting to see [Organisation A] valued for the good company it is and in the potential of [Organisation A] being seen. All these questions over its future can only serve to make that harder I think to realise the benefits. Also I would actually have political interference down there as well. It's something I've seen first-hand in dealing with the bursts over the winter period. The government certainly the current encumbrance are very keen to be seen to be actively managing issues. My personal opinion would be to the extent where they're actually interfering with the business of a company that is, yes it is providing a public service but it is equipped and has the skill sets best place to deliver the issues to resolve the issues. So political interference is definitely one there." C001

The regulator would also like Organisation A to be more pro-active about managing risks within the water systems, rather than waiting for the regulator to spot them retrospectively:

"The regulator will try and push [Organisation A] much more to own its own risks on water quality rather than waiting for the regulator to come and tap them on the shoulder and say "Look, this needs something doing about it." To that end this is where we're going, water safety plans but there's still culturally within [Organisation A] I think a need to accept that these are [Organisation A]`s risks." C001

The Director`s Response

Director A002 highlights that there are possibly two main categories of risk that Organisation A has to deal with:

"There are those risks we have that are in common with any other water company. And then there are those risks and indeed, one could argue, opportunities that are a function of our ownership arrangements."A002

The common risks to all water companies include:

"The most obvious risk is the risk of failing to provide a continuous supply of water that is fit for human consumption. As a business there is providing a product that is relatively continually ingested by customers right across the country, from many hundreds of different water sources and treatment plants. We are required to make sure that water is fit for consumption at all times, and clearly there is a view that there is always an inherent risk that something could go wrong at some point in the treatment process or the distribution system that could cause us to fail to deliver on that objective, and that I think that is the number one risk." A002

With ownership specific risks including:

"We have an owner in the [Organisation A] whose currency of value is different to that of private shareholders. Private shareholders primary motivations is the maintenance and growth of the value of their investment in the water company. Typically investors into water companies are looking for a reasonably low risk but predictable return from their investment. Our shareholder in the Government, the thing that matters most to them is the currency of votes. Because that is what politicians get elected on the back of votes, and growth in actual value is of secondary importance to those factors that could impact on voters' views of the worth of the water company. So value therefore is an issue of value in the eyes of the voter or customer and that therefore tends to be more around issues of service than it does around issues of company value. Clearly charging would be something, charge levels would be something that affects customers' and voters' views."A002

The response by A002 concur with some of the views expressed by the regulator in terms of political interference and other examples of political influence given in Sections 4.4.1 and 4.4.2. Reputation and the currency of votes may be more important than risk mitigation. The importance of votes (to the politicians) may also influence choices made by the owners in terms of customer charges which may constrain capital funds required for successful operation. This point was also raised within Phase II (Section 5.5.2).

Director B001 is consistent with Director A002 in terms of recognising the risks around provision of safe drinking water:

"The risk of supplying water that's not fit to drink kind of category and that would manifest in areas where assets are not fit for purpose. So if we've got an investment programme mapped out to overcome historical non-compliances. It is a fact that we live with the risk of that non-compliance recurring until we've made the investment and got the right assets in place. Similarly there's always a risk in implementing an investment programme that there's some disturbance to business as usual as you introduce new assets or new ways of doing things. So there's a kind of short term risk of supplying water that's not fit to drink as you introduce new processes and new works."B001

Again, securing revenue is a critical risk factor and B001 points out that the introduction of retail competition adds to the risk of securing revenue to supply safe drinking water.

"Business risk of securing our revenue which is a little bit harder now with business separation and with a retail set up in the wholesale world which is about £300 million of our income per year not under our direct control. It has caused us an issue in the year just ended where the wholesale revenue was less than we'd budgeted for in the year. There's no regulatory recourse on that, that's a risk that we take."B001

The Manager`s Response

Senior manager D001 suggests that financing investment will lead to a failure to deliver services to customers and impact on reputation:

"I think the major risk that faces [Organisation A] in delivering its objectives right now is, will there actually be the borrowing levels there for the next three years to finance

the objectives we've got and if not, if the ministers shrink the size of the investment program, how many of the things that fall out of the program or objectives will affect the delivery of the [Organisation A]`s vision? Now, one assumption might be that they can delay some of the statutory programs but it's more likely that the ministers will delay the discretionary stuff like pressure for customers etc which will give us a reputational problem with our customers given that that's our highest priority."D001

Similarly Manager A001 also has concerns about financing the business:

"*I think one of the biggest risks that we have at this point is whether the government will continue to lend to us. The government have already withdrawn the ability for us to borrow for the 2011/12 year. It has committed to lending to us to the full extent set out in the final determination over the 11-15 period, but just not in the 2011/12 year. So that means that the 140 million that was due to be lent to us this year is deferred." A001*

These examples provide further evidence that the leaders within Organisation A are concerned with financial risk and, in particular, political influence over access to financing which makes it very difficult to plan strategic investment over a longer time horizon.

Author`s Comments

The answers given by the actors suggest that they are most concerned with the risk to service delivery with financing and political interference affecting Organisation A`s ability to deliver safe drinking water and sanitation. The inference is that:

- Safe drinking water and sanitation are the priority.
- Unexpected changes to finances impact on operations and investment plans.
- Political Inference can lead to rapid changes in the investment plan (mainly due to restriction in funding through caps on customer charges and/or deferral of borrowing).
- The introduction of retail competition adds further uncertainty to previously guaranteed income streams, leading to further risk of service delivery.
- Failure to deliver appropriate levels of service may do significant harm to public health and cause reputational damage.

4.4.4 The characterisation of risk at different levels of accountability

The influence of risk management culture on risk management strategy has been a consideration within previous bodies of work (Section 2.4) and is of interest to this study (Chapters 1&2). Competing demands on staff within organisations leads to prioritisation of objectives (Section 2.4). In this segment of the interviews, the actors were asked to comment on the priority given to risk management within the context of competing business objectives (Table 3.3).

The Regulator`s Response

The regulator recognises that water safety plans were delivered to a high standard in Organisation A, however, the perception is WSPs was a tick box, project management exercise:

"I think in terms of churning out water safety plans as an exercise in project management, [Organisation A]`s done an excellent job, a really excellent job and we've nearly got our full complement of plans. But I think in terms of actually producing something that was meaningful in terms of protecting, well identifying risks to water quality and protecting consumers I think the early plans were somewhat lacking. I think we have seen a shift lately from "This is just another exercise in producing something that's going to sit on a shelf" to producing something that is really going to actively take a part in managing water quality risks and that we will keep updated as we go forward." C001

There is an acknowledgement that Organisation A is starting to recognise the importance of using the plans but this is at an early stage. The regulator goes on to say that buy in is improving and ultimately the investment plans shall be based on the WSP outputs:

"The buy-in from particularly local asset planners has grown. I think there's still some work to do in the accessibility of the plans but they're aware that the water safety plan is the way to secure investment to address water quality risks. I think we still have some work to do in terms of making sure that we are clear and [Organisation A] is clear exactly how this is going to work to inform the next investment period. I'm very keen, I think we're all very keen to move away from the failure driven compartmentalised drivers that have been used in the past to drive investment to something that's better thought out where different risks are evaluated against each other.

The Director`s Response

The directors were quite clear about the responsibilities of personnel for risk management with sections of Organisation A. Here, an example of managing program risk is given by Director B001:

"You do start to put an indicative level of value against an emerging risk and you track it closely to the point at which you would want to build it into your LBE, Latest Best Estimate, of value of the programme. Once you get past that emerging stage we deal with risk in the capital programme at three levels. At the very granule level each project has a detailed risk register that's owned by the project manager and which shows the allocation of risk between the client and the delivery partner. But there are some areas of risk that we instruct the project managers not to allow for. An example of that would be we go through an auctioneering process, we decide on a particular type of process to build into a water treatment works or a waste/water treatment works. There's a good degree of governance around that and sign off by operational colleagues as well as by people in my team at the time of saying we've concluded on a particular type of asset to be built to solve this problem. We then proceed with that project." B001

The example describes the governance of risk within the capital program and illustrates that B001 recognises risk accountability sitting across a number of individual levels within the business.

The Manager`s Response

Manager A001 is accountable for managing the risk processes within Organisation A and perhaps unsurprisingly can describe the processes very well:

"Of course you're talking to the person who is accountable for corporate risk we tend to abide by the risk scoring that we use for corporate risk management so we have a five by five matrix which sets how the likelihood in impact of a risk occurring and we have a defined scoring mechanism for that with criteria etc." A001

And;

"I'm accountable for corporate risk management and with the risk team anything that I do for Scottish Water is mirrored in terms of what I do for my own area, for my business objectives. So we do look at, I should say we look at both risk and opportunity, but we do look at the risks that we're running, we look at the impact that they might have and we look at the likelihood that they might come up. We do that at the corporate level we do that for each directorate and we do that for the big processes and the big project across the business, so for example SR15 has its own corporate risk register, not corporate sorry, has its own risk register."

A001 is clear about the system for identifying and ranking risks. These processes are managed through the corporate risk team and registers for each business unit are completed. Manager D001 provides further evidence that risk management tools were used in planning future investment:

"We then undertake a risk and opportunity management plan, piece of work which looks at partly subjectively, partly objectively what alternatives do we have, both from the point of view of cost or scope. And we do some Monte Carlo simulations and everything else around that that eventually comes out with a view that what numbers are the eighty percent probability of it costing less or twenty percent probability of it costing less and what number have we bid, but what number is in our plan at the moment. Therefore have we pitched it correctly given the whole expectation of the regulatory model" D001

And evidence was given that suggested the corporate risk register (mentioned by B001) was used to inform and test the investment plan:

"in terms of corporate risk approach you look at what's on the company corporate risk register, you look at what your future objectives are going to be, you identify where you think the risks of that plan are and we then use a slight bit of independence around the implementation planning teams to say right, we'll validate that this plan is deliverable, what are your concerns before we submit it all." D001

Author`s Comments

Senior management and directors are aware of, and use, risk management processes in delivering and informing business objectives. There was an emphasis on evidence based risk management decisions particularly around the delivery of the investment plans (the examples given by Director B001) and the long term investment strategy (examples given by manager D001). The regulator pointed to the WSP as the way forward, acknowledging that progress had been made and suggested that more

needed to be done to achieve the ultimate goal of the WSPs informing investment choices.

4.4.5 Governance Structures that influence risk management approaches

Section 2.4 discussed some of the behaviours, cultural features (Johnson, 1992; Drew and Kendrick, 2005; Baumgarter, 2009; Rizak and Hrudey, 2007) and interplays between governance, regulation and risk (Laeven and Levine, 2009). Studies such as McKenna and Martin-Smith (2005) emphasised the importance of leadership in decision making when operating within organisations that have complex adaptive systems and domains of high uncertainty (Tetenbaum and Laurence, 2011). The conversation with the actors sought to establish the appropriateness of the risk management processes/governance (and leadership) of risk management required to ensure the delivery of safe water and sanitation within the stewardship of Organisation A (Table 3.3).

The Regulator`s Response

When it comes to governance processes, the regulator has a sense the regulators themselves are being actively managed by Organisation A:

"We accept we are being managed some of the time, I mean our expectations and the information we're getting is being managed. But we are able to deal with that but they do serve a useful purpose in pointing us in the right direction and a lot of sense checking in terms of what's coming out of the organisation, a useful filter as it were. In terms of the wider government structures in the water industry, certainly we have I

suppose not as close a relationship as I feel perhaps we should do with the water industry commission."C001

With this example there is an acknowledgement that working more closely with other regulators would be beneficial to the longer term operation of water service.

The Director`s Response

The Directors believe that governance is "strong" within Organisation A:

"I think we are a business that is very strong on governance. I'm not saying that there aren't areas that are maybe under-governed but generally we have a very strong governance framework from board down, real clarity on who is accountable, the board, what gets handled through the board, committees of order and remuneration, what's delegated to the executive team, to functional director and then down through the management ranks."A002

And;

"I think our governance structures are very well defined. So from a board level we've got the corporate risk register which is looked at quarterly by the board, reviewed by the ELT. Not just collectively but individually so the finance and regulation manager, who looks after updating the corporate risk register, sits down with each director once a quarter to go through it. To go through the risks that have my name against them or any other directors and we talk about where that risk is in terms of its score or likelihood and impact."B001

And;

"We generally have plenty safeguards in place for managing risk, whether that's through the delegated levels of authority for financial expenditure, whether it's capital approvals arrangements, I think the chance for us is actually in the opposite direction which is trying to work out where are we over-governed, where should we take a lighter touch approach that would be more appropriate to managing risk rather than minimising risk"B001

Both directors gave detailed answers describing the risk management processes and governance arrangements, from the frequency of the board reviews, audit committee reviews to challenge sessions within business units.

The Manager`s Repsonse

The manager responsible for the risk processes within Organisation A is very clear on the processes and accountabilities. The manager also discussed risk appetite, setting the corporate view and then setting it at business unit level. There was acknowledgement that the risk appetite may not be set correctly for every section of the business:

"So we've succeeded in passing the risk ownership onto the right people in the business, so we as a risk team don't own the risks. We've established risk appetite with the board, so that's now producing a different conversation in the business and that will help us understand more about the risks we're willing to take in the business and the risks we're not willing to take in the business, and so we will have to correlate as we monitor risk appetite, what we do now is, we report to the Audit Committee every six months whether we have breached our risk appetite levels ad over time that will

allow us to correlate whether we have set risk appetite at the right level because if we're never breaching risk appetite in some areas then we're clearly not taking enough risk within the business, whereas if we are always breaching we're either taking too much risk or we have set the risk appetite at the wrong level, we've been too risk averse at the board. I think, we have a risk forum, we have a risk working group, so the risk professionals in the business, a sort of risk community; they work together."A001

Manager D001 feels that Organisation A confuses governance, management and control. This manifests itself in a significant number of meetings where decisions are made by committee rather than by the accountable person:

"I think we confuse good governance with management and we create lots of steering groups and boards and all sorts of things that have this badge governance but they end up doing management. I think we've got to be clear, the difference between governance and management. I think we have become probably overly controlling. I'm not sure that really means there's a feeling of trust inside the business. I think we're almost too supportive of people. It drives a lack of accountability rather than, you know, it's easy to just trot up to a meeting and wait till the others make a decision."D001

D001 goes on to suggest that the meeting culture within Organisation A acts as a blocker to delivering services and acts as a mechanism to defer responsibility:

"Because good governance is asking questions, it's not telling people what to do. It's assurances, you know. If we have good governance then the board are confident that

the business can deliver, the ELT are confident they know what's important and what the risks are and what the opportunities are, but they don't know how to deliver them. Somebody else's job is do it. And I think we confuse governance and management, instead of the start. I think we've created far too many steering groups and control groups that actually get in the way of people doing their job but they've become a crutch to people and if you remove them now people will think they're being hung out to dry or something daft like that which, it would be the intended but it could be the unintended consequence."D001

Author`s Comments

There is agreement between the directors and the manager A001 that Organisation A is governed well. All are very clear on the hierarchy from board through audit committee to more local governance arrangements. The actors gave examples of governance processes that were designed to identify, reach consensus, record and monitor emerging risks. In contrast manager D001 challenges the definition of governance and suggests that:

"we confuse good governance with management and we create lots of steering groups and boards". D001

The answers given by the actors support a view that multiple meetings take place. D001 goes on to suggest that Organisation A exhibits high levels of control rather than devolving accountability for risk management decisions. The outcome is that the meetings are used as a mechanism to either defer decision making and/or block others from making decisions. Management by committee has the potential to slow

down decision making to the point where risks decisions are delayed resulting in failure.

4.5 Emerging themes and conclusions

Political influence

The actors acknowledge political influence may overrule existing decisions (Section 4.4.3). The directors highlight the example of political intervention in December 2011 in-line with the Government announced that Organisation A would not increase charges in April 2011 when the planned price increase of Retail Price Index (RPI) minus a percentage value. The actors emphasised that this had two initial consequences. Firstly, the decision was not in line with the regulatory contract agreed through the Water Industry Commission (WIC) which undermined the authority of the WIC. Secondly, there was an immediate impact on the balance sheet of the organisation which means a circa £80m shortfall in financing. The organisation had to take action to ensure the business plan reflected the changes in capital availability. The shortfall in capital could be adsorbed in the short term by deferring investment in strategic projects but it was unclear what effect this would have on the long term performance and risk to the business.

Acquiring capital funding

This is a theme that came through all of the interviews. The directors and senior managers reflected that the decisions of the business owners can limit or release capital very quickly (Section 4.4.2 and 4.4.3). Uncertainty around available funding impacts on the business planning process, asset maintenance and long term asset

strategy (Section 4.4.3). D001 stated that the easiest way to manage the shortfall was to:

"play tunes with capital maintenance". D001

It was also noted by the regulators that they had concerns over inflexibility within the investment plan (Section 4.4.2).

The drive for efficiency

The ability of the organisation to out-perform the efficiency targets as measured by Operational Performance Assessment (OPA) was noted (Section 4.4.1). A002 referred to OPA and the importance this is given within the culture of the business. The regulators raised concerns that funding was restricted and that operational resources were stretched which may lead to operational risks translating into incidents or events. The regulators felt that investigations into process failures were not sufficiently robust and in many cases possible root causes were missed. For example in one investigation:

"*the event was closed on the basis of sampling error, however on further investigation by the regulator it was clear that the failing asset had not been cleaned". C001*

The regulator suggested that the asset itself was a possible cause of the failure but the drive to reduce cost prevented the asset from being maintained to an operable state.

Management Culture

The management culture plays a significant role when approaching risk management (Sections 4.4.1 through 4.4.5), wither its influencing the processes (Section 4.4.2 and 4.4.3), the responsibilities (Section 4.4.3) or governance (section 4.4.5). The responses of the actors suggests that the regulators expect investment to be based on improving and maintaining water and wastewater quality through risk appraisal of the assets (Section 4.4.4). While the business aspires to going beyond the objectives of regulation (Section 4.4.1), the regulators feel that the business is driven by targets (Section 4.4.3) which means that the management focus may not be fully on understanding the risks within the business. The directors highlight that the top 40 managers are incentivised to make efficiencies (Section 4.4.2) which drives management culture to reduce cost and suggests that full attention might not be paid to risk management. The managers highlight that risk management practise is delivered through meetings and is a chore (Section 4.4.5), it may be seen as a distraction to the delivery of the financial targets that the management are incentivised to achieve (Section 4.4.2).

The inclusion of risk appetite (Section 4.4.3, 4.4.4 and 4.4.5) may provide the management with a nebulous target for risk management that allow the management some internal mitigation to achieving the regulatory targets. This is noted by the regulators when they suggest that risk management (and water safety planning) is perhaps seen as a tick box exercise (Section 4.4.4) rather than a way of identifying and addressing underlying risks. The management might want to consider focusing more

on the outcomes of the water safety planning to identify and manage risks rather than relying on a risk appetite statement which is largely psychological (Section1.7.4) and nebulous.

Chapter 5: Research Activity – Phase II

5.1 Purpose of Phase II

The Phase II research activity builds on the output of the literature review and Phase I of the case study exercise. Table 5.1 summarises the research agenda of Phase II. The interview responses in Phase I suggested that financing and political decisions affect the risk management choices within Organisation A and impact on the risk tolerance of the business (Section 4.5). The elicited responses where from one organisation and its regulators which means that the particular elements that the business sees as important may be peculiar to that country, regulatory system, ownership arrangements or strategic business plan of the water service provider. The Phase II research agenda seeks to understand if the themes discussed in Phase I and the literature review are consistent (or differ) across a range of other organisations and countries. In doing so, the output of Phase II can be used to develop tools or guidance (Chapter 6) that inform organisations who wish to make improvements to the risk management effectiveness within their business without impacting on efficiency, environmental, regulatory or public health commitments.

5.2 Scope of Phase II

The Phase II case study work focused on a wider group of organisations which are described (but anonymised). Respondents with job roles from Chief Executive through to operational staff where interviewed across the water service providers, along with a number of regulators (predominantly water quality regulators) who monitor the performance of the water industry for the range of countries included in the study. In addition to the interviews, and in line with the principles of case study methodology (Yin, 2009; Neuman, 2003), other documented evidence was examined (Section 3.4). Phase II sought to expose how actors with different levels of accountability within an organisation approach risk management and how this is aligned (or not) to regulatory objectives (Section 5.4.5). The inclusion of organisations and regulatory authorities across a small number of countries, with differing regulatory frameworks and water services ownership arrangements allows for a qualitative comparison across a limited number of operating models (Section 3.4.1). The output of the Phase II research agenda therefore offers a limited qualitative assessment between, and within, organisations with the same principle purpose of supplying safe water. The analysis informs suggestions for improving board engagement (Chapter 6). The output may be applied to a wider range of water service provision ownership arrangements and regulatory frameworks.

5.3 Phase II Specific Methodology

Consideration was given to the selection of target organisations, actors and countries that operated within different ownership arrangements and regulatory frameworks. The selection process used a range of elements which had been identified through

the literature review and the Phase I research activity. Table 5.1 lists the selection criteria used.

Table 5.1: Phase II Interview Candidate Organisation Selection Criteria

Features identified in Chapter 2 and 4	Identified In Literature Review	Identified in Phase I Research Activity	Importance Ranking (1-10)
Ownership arrangements	Section 2.3	Section 4.4.2	1
Regulatory framework	Section 2.2	Section 4.4.1 and 4.4.2	1
Service coverage	Section 2.2, 2.3 and 2.4	Section 4.4.1	2
Market structure	Section 2.4	Section 4.4.1 and 4.4.3	1
Quality of service	Section 2.2, 2.3 and 2.4	Section 4.4	1
Tariff setting arrangements	Section 2.3	Section 4.4.2 and 4.4.3	3
Area of coverage	Section 2.3	Section 4.4	5
Population served	Section 2.3	Section 4.4	7
Number of operators per country	Section 2.3	Section 4.4.1 and 4.4.2	8
Volume of water abstracted	Section 2.2 and 2.3	Not mentioned	6
Volume of water abstracted for drinking water	Section 2.2 and 2.3	Section 4.4.1	8
Average consumption (litres per day per person)	Section 2.2 and 2.3	Section 4.4	9
Water service, average price	Section 2.3	Section 4.4.3, 4.4.4 and 4.4.5	4
Average invoice per customer per annum (in Euros to allow for direct comparison)	Section 2.3	Section 4.4.3, 4.4.4 and 4.4.5	5
Sectoral Employment	An important feature in defining the size and shape of the organisation included in the case study. Indirectly mentioned in Section 2.3	Not mentioned	10

The ranking in Table 5.1 has been assigned by carefully considering the relationship between the evidence identified from the literature review, the initial output of Phase I (Chapter 4) and by drawing upon professional judgement. It is accepted that the weightings are subjective and as such are influenced by individual experience which may differ from that of readers. The ranking is not a quantitative measure but rather a qualitative measure used as a guideline to aid the differentiation of the features of interest when considering the organisations and countries chosen for Phase II.

The "multi-criteria" selection process was the first practical step in identifying targets for the case study work. The data used in the analysis and summaries in Table 5.2 is derived from a range of sources which include the Pinsen & Mason Year Book (Owen, 2011), Regulation of Water and Waste water Services (Marques, 2010) and web based sources (company and regulators` websites).

The metrics were examined along with a number of practical considerations which included; access to the target countries, organisations and actors within organisations; security issues; confidentiality conflicts; conflicts of interest; and possible language barriers.

Table 5.2 presents the proposed countries for the Phase II research activity identified through the qualitative multi-criteria assessment process. The data contained within the Table demonstrates the range of differences in operating environments that exist within the target countries. For example Scotland is a relatively small country with a homogeneous and well-defined operating environment (tariff structure, regulatory

arrangements, market structure, etc.) compared to Canada which is a large country which operates multiple arrangements for water management on a province by province basis.

Table 5.2: Candidate Jurisdictions for inclusion in Phase II

Country	Regulatory Model	Market Structure	Tariff Setting	Quality of Service	Area of country	Population	Population Density	Service Coverage			Ownership		Number of operators		Volume Water Abstracted	Volume Abstracted for Drinking water	Ave Consumption	Water Losses	Water Services Average Price	Ave Invoice per Customer per Annum	Sectoral Employment
								Water	Waste Water services	Waste Water Treatment	Water	Waste Water	Water	Waste Water							
Units	N/A	N/A	N/A	N/A	km2	x Million	inhabitants/km^2	%	%	%	% Public	% Public	N/A	N/A	Million m^3	Million m^3	Litres per Day per Person	%	Euro/m^3	Euro	N/A
Canada (Excluding Prince Edward Island)*	Self Regulated	Public Ownership and operation	No National structure. Local arrangements based on 3 levers. Fixed according to consumption, fixed regardless of consumption and/or variable inked to consumption.	Level of service generally regarded as good. Level maintained under threat of revoking operational licence or contract.	9984700	33.3	3.2	85	85	80	100	100	9000	9000	5400	4200	343	22.5	0.72	235	300000
England and Wales	Sector regulated by 3 independent regulators on Water Quality (DWI), Environment (EA) and Financial (OFWAT)	Private Operation	Tariffs are based on a fixed element and variable element . Domestic and Commercial customers are charged differently. Tariffs are set through OFWAT.	Service levels regarded as very good and are monitored through regulators. Minimum levels of service may lead to compensation payments which acts as an incentive.	156200	53.7	343.8	99	96	93	0	0	25	10	5469	4267	147	22	1.5	390	35000
France	Similar to many EU countries, France does not operate a sector specific regulatory agency for water service. There are a number of agencies that have quality, environment and economic interests in water. The compex nature of the market makes it unfeasable to implement economic regullation.	Municipalities (circa 36,500) are responsible for delivery of services. Many of the municipalities operate concession agreements and/or deligated management and leasing agreements.	Tariff setting is complex due to the large number of municipalities and in particular the interconnecting networks and inter-municiple agreements. As a general rule the tariffs are set by the administrative authority and approved by the municipality but linked to the service contract and indexed.	Service leveles are regarded as excellent with France regarded as a global leader in water service provision.	543965	64.4	112	99	80	80	75	52	14900	14400	3350	600	165	Not Available	3	177	Circa 500,000
Portugal	Regulated by the institute for the regulation of water and solid waste (IRAR)	Predominantly Public ownership with around 20% private sector service provision. Of note is the operating structure which delivers wholesale and end user systems separately.	Tariff setting by operators is commonly proportioned between a fixed component and a variable element which is based on the volume of water and the property size.	Services are generally regarded as high quality with the IRAR conducting an annual benchmarking exercise which compares the perfomrance of the service providers.	92300	11	111	91	75	66	80	20	523	314	862	560	153	35	0.33	130	
Scotland	Sector regulated by 3 independent regulators on Water Quality (DWQR), Environment (SEPA) and Financial (WIC)	Public Ownership	Tariffs are based on a fixed element and/or variable element . Domestic and Commercial customers are charged differently. Tariffs are set through WIC. Competition has been introduced to the non-domestic customers.	Service levels are regarded as excellent with respect to reliability and continuity of service. Some issue remain problematic, for example water losses.	78800	5.1	65	100	100	100	100	100	1	1	838	523	160	37	1	380	3700

*Prince Edward Island (PEI) has a multi-sectoral regulatory agency that acts as an independent governance group on matters relating to such things as tariff setting.

There are some limitations which have be taken into account when selecting the organisations of interest for Phase II. The performance measures of the organisations`, management cultures and risk management systems may be influenced by geographically specific challenges which are taken into account during Phase II. Canada is made up of a number of provinces, each with differing regulatory arrangements, geographies, population densities and raw water quality variations. The provinces have adopted different ownership arrangements for water service provision and governing bodies operate different tariff structures. Canada provides a rich and diverse set of circumstances. Scotland in contrast to other case study candidates, is a relatively small country by population (circa 5 million people) albeit it accounts for approximately one third of the land mass of the UK and has a large number of islands, island groups, small rural communities and large urban centre which provides a range of water management challenges. Scotland`s public water services are managed by a single organisation, Scottish Water, and are regulated by three regulatory bodies as previously discussed in Chapter 1. Portugal is another smaller country having a population of slightly more than double that of Scotland (circa 11m). Ownership arrangements for water services in Portugal are based on a public ownership model but provide another variant to Scotland and Canada. In each case access to organisations within each target country was possible and there were no barriers to entry, security concerns or ethical considerations the precluded these countries from being appropriate Cases in the study.

Other countries considered included Chile, the USA, China, other Asian countries, African and Middle East countries. Chile is moving its water service provision to a

privatised model similar to that of England and Wales with around 75% of the water and waste water markets privatised to-date (Owen, 2011; Marques, 2010). Chile would provide and alternative case study to England and Wales for comparison. Unfortunately, Chile was not included as access to the appropriate actors was not possible, authorisation was difficult to secure. The USA was considered and provided a similar diverse set of arrangements to that of Canada, differing in regulatory approaches with more federal control in the USA compared to that of Canada`s devolved provincial system. The USA has similar challenges to Canada in terms of geography, water quantity and quality. The USA was not included in this study but could be included in any future work. China, Asian countries, African countries and middle east countries were considered but there were challenges in terms of getting access to the right organisations, language barriers, documentation and actors within these regions. Veolia and Kelda water are two organisations included in the study and operate across Asian, American, South American and African countries so some limited insight into geographical variations can be drawn from the experiences of these organisations. Veolia in particular highlighted in the interviews that their corporate risk management systems are cascaded across the organisation and countries of operation (Section 5.5). Veolia suggested consistent application of risk management systems across geographies and management cultures presented challenges such as interpretation of the documents, implementation and buy-in.

5.3.1 Selection of actors within organisations

Actors were chosen from a range of vertical and horizontal hierarchal positions within the case study organisations. The horizontal approach allows for a comparison of opinions across the various actor groups (Directors, Managers, etc). The vertical approach allows an examination of opinion within organisations. The vertical and horizontal approach informs a richer analysis of opinion of the features under examination, within and across organisations.

A similar horizontal/vertical selection strategy was adopted in Phase I (Section 3.4.1 and Table 3.3). However in Phase II the number of vertical levels was increased to include operational staff below management. The inclusion of further levels of accountability allowed the researcher to investigate how risk management was adopted by operational staff. Access to some agencies and staff was difficult and, when access granted, time restrictions applied. Interviews were recorded with prior agreement, however in some cases the actors did not wish to be recorded which meant that full interview transcripts were not produced for all interviews. Interviews not recorded rely on field notes and observations (Section 3.5). Table 5.3 lists the interview groups.

Table 5.3: Selected roles and their relative positions of accountability with organisations.

Role	Purpose	Numbers interviewed	Countries Covered	Transcript Available
Chief Executive	To gain understanding of strategic leadership	2	UK; France	Yes
Finance Directors	To Understand the role of Finance	2	UK; France	Yes
Operations Directors	To understand operational priorities	6	UK; France; Canada; Portugal	Yes
Senior/General Managers	To understand day to day priority	6	UK; France; Canada; Portugal	Yes
Risk Managers	To gain insight into the influence and effectiveness of the risk manager	4	UK; France; Canada; Portugal	Yes
Regulators	To better understand the regulators view of risk and how the organisations embrace risk management	4	UK; Canada	Yes
Operation Team members	To understand how risk management is implemented at a local level	5	UK; France; Canada;	No – The operators and Team Leaders did not want to be recorded but notes were taken.

5.4 The case studies

This section describes in detail the five organisations participating in Phase II. Case study information includes reference to regulation and ownership arrangements specific to the respective organisations. The data sets include some performance metrics taken from published company records.

5.4.1 United Kingdom Case A

Case A is a publically owned water service provider delivering drinking water and wastewater services to circa 5m customers. The majority of the UK water industry was privatised in 1989 but water service provision in this region was a devolved issue and the population voted to opt out of the privatisation program for water. In 1996

three water authorities were established and eventually in 2002 a single water company was created with the task of driving in cost efficiency, improving services and delivering compliant drinking water. In the first four years of operation the water company achieved some 40% cost saving and reduced staff numbers from circa 7,500 to 3,800 while improving on water quality. The organisation operates 267 treatment works at the time of writing this thesis and in 2012 and undertook 64,731 test with some 709 water quality events being reported. A water quality event is defined as an observation that may or could lead to a failure in the water treatment process. Twenty three of these events were classified as serious and defined as incidents, where an incident represents a significant or notable failure of the water treatment process resulting in a breach of the regulation and has the potential to cause harm to human health. The number of events and incidents needs to be seen in context and the 2012 Figures represent a reduction in the number from 2011 (892 events and 84 incidents).

Table 5.4 summarises some of the reported annual financial metrics from 2008 to 2012, providing an overview of the financial performance running in parallel with water quality improvements. Case A is a publically owned institute and therefore does not make a profit or declare a shareholder dividend. To allow comparison with other Cases, “surplus” has been included which is the difference between operational costs and the income generated through regulated charges. This is the closest comparator to profit and offers some indication of equivalence or performance, here it is referred to as profit before tax and has been calculated in the same way as the calculations used for profit before tax for the private water companies. The data submitted in

Table 5.4 is verified and approved by Case A`s finance department. Gearing is a factor of interest, as it indicates the amount of borrowing in relation to assets as a percentage and helps inform the amount of financial risk that the organisation is carrying with respect to borrowings.

Table 5.4 Extract of some financial information reported by Case A

Financial Metric	2008	2009	2010	2011	2012
Operational Expenditure (£m)	290.3	301.9	328.5	340.8	349.9
Capital Investment (£m)	700.4	653.1	449.1	461.7	504.4
Profit Before Tax (PBT) (£m)	192.4	174.0	114.7	73.8	67.8
Cash Reserves (£m)	133.4	133.4	133.4	133.4	133.4
Gearing (%)	55.4%	53.2%	50.3%	48.4%	47.6%

Table 5.4 shows operational costs (OPEX) increasing in real terms as capital investment (CAPEX) decreases. The total costs (TOTEX) to the business go from £990.3m to £854.3m in 2012 with a dip to £777.6m in 2010. PBT has been decreasing but this is perhaps not surprising as operational costs increase and efficiencies within the business become more difficult to find. The cash reserves are static as the regulatory contract requires the organisation to hold this reserve to deal with epistemic risks such as flooding, climate change and more recently the introduction of retail competition which puts at risk some £300m per annum of income (See Section 4.4.3, the example given by B001). £300m of retail income lost would impact on the wholesale company's ability to operate and certainly exceed the risk tolerance value which can be taken as £133.4m (see Chapter 6). In addition to this risk, austerity and

political pressure (Section 4.4.3 to 4.5) may result in a proportion of the £133.4m being diverted to other government initiatives, reducing the risk tolerance value, leaving the water company very exposed to risk.

5.4.2 United Kingdom Case B

Case B is located in the UK but this time in England. The organisation was specifically chosen as its ownership arrangements are based on a fully privatised model. Privatisation occurred in England and Wales in 1989 and a fully history of the lead up to an implementation of privatisation is recorded in "The Official History of Privatisation" Volume II (Parker, 2012). Although the ownership arrangements differing between Cases A and B they share the same general customer base size of circa 5m people. What differs substantially is the geographical location where Case A manages water supplies that cover approximately one third of the land mass (including a significant number of islands) of the UK which requires a larger number of treatment works (267 at the time of writing) and assets supplying a range of population centres with differing populations densities. Case B occupies a smaller geographical area and has a smaller number of treatment works (91 at the time of writing), compared to Case A. Water quality in England continues to improve but at a slower rate than other parts of the UK. This is because substantive improvement was achieved post privatisation in 1989 (Parker, 2012) and before 2002; the water quality comparison starts at 2002.

Table 5.5 summaries the financial performance of Case B and here, profit is included rather than surplus. The amount of profit generated will inform the dividend paid to shareholders.

Table 5.5 Extract of some financial information reported by Case B

Financial Metric	2008	2009	2010	2011	2012
Operational Expenditure (£m)	453.3	495.3	495.9	553.8	590.3
Capital Investment (£m)	377.8	362.3	262.0	300.3	404.3
Profit Before Tax (PBT) (£m)	172.9	152.1	126.1	117.7	77.7
Cash Reserves (£m)	235.3	840.8	756.5	827.9	842.7
Gearing (%)	60.4	65.7	67.5	73.7	79.7

The financial picture for Case B is very different from A. The OPEX costs are higher and the CAPEX costs lower. TOTEX goes from £831.1m to £994.6m compared to that of Case A which is £990.3m to £854.3m. This is against a backdrop of Case A operating 267 assets compared to Case B`s 91. Case A is possibly underfunded for the number of operational sites it has, meaning there may be significant underlying infrastructure risk (under investment, reduction in capital maintenance, and too few operational resources) or Case B is resource rich. The answer probably lies somewhere in between and a supplementary study could be undertaken to benchmark the risk profiles of the organisations.

The cash reserves of Case B, by 2012, are £842.7m which is close to matching the OPEX figure of £854.3m. Overall the cash position for Case B is better than Case A and

the ratio between OPEX and cash reserve suggests Case B has a much better risk tolerance than Case A.

5.4.3 France Case C

Case C offers another variation in ownership arrangements and is French based. The organisation operates across a range of countries and continents. It is a private organisation, and at the beginning of this project provided water and waste water services directly (owning at least two water companies in England). Changes in the operating arrangement were initiated in 2011 as part of a strategic review which led to the decision to withdraw from owning and operating water service. The organisation is now built around capital investment delivery, asset maintenance and third party operations. Although the organisation no longer owns a water company, it is still a relevant candidate for this research project. The changes to operating mode where promoted by challenging market conditions risking the organisations financial health with a potential breach of risk tolerance (Section 1.7.4 and Chapter 6). The full set of financial results are not readily available for comparison however in 2013 it was reported that the overall net income (including the sale of businesses) for the group was circa 223m Euros compared to 58m Euros in 2012. This at least gives an indication of the scale of difference between operations with Case A through to C. This particular Case (C) has specific challenges in marshalling efforts to ensure risk management is not only consistent at board and group level but that it is applied consistently through the divisions, countries and regional business units.

5.4.4 Portugal Case D

Case D is based in Portugal and has a close to 2.9m customers, so a slightly smaller customer base than Cases A and B. It has around 736 direct employees compared to the 3500 of Case A and the 2500 of Case B. In 2012 the water quality compliance was reported at 99.6% overall (this includes microbiology and chemical compliance) this compares to 99.81% for Case A and 99.95% for Case B. The organisation operates 2 principle treatment works (Case A has 267 and Case B has 91). Case D operates within different ownership arrangements compared to A, B and C in that it is part of a larger public holding company (but still publically owned). Portugal has undergone reform since it emerged from dictatorship in 1974 after the "Carnation Revolution". Change took place and led to Portugal's inclusion in EU by 1986 but it was not until 1991 when the EU Commission passed the Urban wastewater directive that real change occurred in the way Portugal managed its water services. It was in 1993 that the government introduced a policy to actively promote multi-municipal companies. This was delivered through the statutory instrument 379/93. A public holding company, *Águas de Portugal* was formed in the 1993, which was to be the majority shareholder of a newly created multi-municipal company that partnered with the participating municipalities. The government provided financial support through EU structural funds to those municipalities that agreed to participate in the new multi-municipal companies. It took until 1995 to fully establish the operating arrangements of the new business model for water service provision. It was not until 2004 when the then Institute for the Regulation of Water and Solid Waste became The Water and Waste Services Regulation Authority, that concise performance reports on the

Portuguese water sector were published[3]. The executive summary report contains water quality information going back to 2004 up to 2011 and demonstrates an improvement across a number of parameters, which serves as an indicator that water quality in Portugal shows improvement. Table 5.6 summarises the comparative financial information of the general operation of Case D over the same five year period used in Tables 5.4 and 5.5. The gearing values were not accessible within the published data for Case D.

Table 5.6 Extract of some financial information reported by Case D

Financial Metric	**2008**	**2009**	**2010**	**2011**	**2012**
Operational Expenditure (£m)	96.2	96	96.9	92.9	90.4
Capital Investment (£m)	21.5	22.0	19.4	9.8	10.7
Profit Before Tax (PBT) (Euros m)	30.2	30.9	37.6	35.0	36.0
Cash Reserves (£ m)	7.0	26.0	30.1	37.8	38.6
Gearing (%)	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported

Note: The Figures in Table 5.6 are taken from the annual reports which are in Euros. The data has been converted into pounds to allow direct comparison and an exchange rate of 1 Euro = £0.82 was used as this was the reported exchange rate at the time of writing.

Case D has two drinking water treatment works with an annual OPEX of £96m to £90.4m. Although efficiencies have been achieved, the average OPEX per asset is £48m to £45m compared to Case A with an average OPEX of £1.08m to £1.31m per

[3] ANNUAL REPORT ON WATER AND WASTE SERVICES IN PORTUGAL (2012), The Water and Waste Services Regulation Authority.

assets (based on the figures in Table 5.4 and 267 assets) and Case B with an average OPEX of £4.98m to £6.49m (based on the figures in Table 5.5 and 91 assets). The implication here is that Case D is very well funded for the operation of two treatment works and yet the drinking water quality compliance is lowest of all Cases (See Table 5.8), even water quality compliance is trending up for Case D since 2004 (See Annual report on water and wastewater services in Portugal 2012). According to the report, improvements in quality have been attributed to aspects such as better pH control and disinfection; however there is still opportunity for improvement. Aspects such as asset resilience, catchment management, treatment design and distribution could be investigated to further enhance protection of public health.

5.4.5 Canada Case E

Case E is a publically owned utility business based in Canada. It serves a population of circa one million people and supplies water and wastewater services. The company differs from the others in the study, in that it provides electricity as well as water services. Another strategic difference is that the organisation has been allowed to buy other companies in North America. The companies procured have similar core services to Case E. The company finances are a little bit more difficult to decipher as the organisation reports operational costs and investment for the whole group rather than for the individual business units or by utility type (water or electricity). Table 5.7 summaries, the available financial data.

Water quality compliance is also reported differently to that in Europe. Care has been taken to translate the available reports for a direct comparison between the five

utility companies. The business owns 4 water treatment plants and operates a further 19 under concession contracts, similar to those operated by Case C.

Table 5.7 Extract of some financial information reported by Case E

Financial Metric	2008	2009	2010	2011	2012
Operational Expenditure (£m)	127	136	119	127	176
Capital Investment (£m)	40	101	58	58	78
Profit Before Tax (PBT) (Euros m)	35	37	35	28	58
Cash Reserves (£ m)	43	60	6	56	171
Gearing (%)	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported

Note: The Figures in Table 5.7 are taken from the annual reports which are in Canadian Dollars. The data has been converted into pounds to allow direct comparison and an exchange rate of $1 = £0.54 was used as this was the reported exchange rate at the time of writing.

Case E is similar to Case D with respect to size and the OPEX costs needed for running the business are higher per asset than Cases A and B. The efficiencies of water service providers (in terms of cost) are covered in other studies (Saal, *et al.,*2007; Ruester and Zschille, 2010) and this thesis contribution does not intend to cover this topic in detail.

By 2012 Case E`s cash in the bank is close to 100% of the OPEX value (similar to that of Case B) with Case D having cash in the bank closer to 50% of its OPEX and Case A having cash in the bank equivalent to 38% of OPEX but the largest number of assets.

The relative values of OPEX to Cash in the bank suggest that Cases B and E have the greatest chance of tolerating risk with Case D having a slightly lower tolerance and Case A having the lowest tolerance to risk (within the group of organisations included in the study). Case C, in selling off higher risk asset intense businesses has improved its cash flow and reduced the number or assets, in doing so has improved its risk tolerance (Section 5.4.3).

5.4.6 Comparison of selected metrics of Cases

Table 5.8 compares cross section of metrics for each organisation in 2012. Similar Tables can be produced for any given financial year but a snapshot for 2012 is the most recent and update set of Figures at the time of writing. The data is not readily available for the multinational Case C (Section 5.4.3). Therefore it could not be included in the comparison.

Table 5.8 Comparison of a range of business performance metrics for four of the participating organisations at the financial year end 2012.

	Population Served (million)	Number of Employe	Operating Costs (£m)	Capital Investment (£m)	Profit before tax (£m)	Cash reserves (£m)	number of Treatment works Operated (and or Owned)	Water Quality Compliance	Volume of water Produced per annum(Mega Litres)	Cost per cubic meter ($)
Participant A	5	3500	350	504	68	133	267	99.81	475	1
Participant B	4.9	2500	590	404	78	843	91	99.95	475	1.5
Participant D	2.9	736	90	11	36	39	2	99.6	210	0.33
Participant E	1	2700*	176	78	58	171	23	99.7	125	0.72

*This includes total staff for the organisation which includes provision of power services. The number of staff associated with provision of water and waste water services will be lower.

The data presented in Table 5.8 gives an insight into the relative costs and staff requirements needed to supply water and waste water services. All of the organisations operate their finances as profit and loss accounts irrespective of ownership arrangements (although profit is generally referred to as surplus). The difference is that the privately owned businesses will pay out a dividend to their shareholders whereas the publically owned organisations will pay the "profit" or surplus back to the municipality or governing organisation. All organisations deliver a reasonable profit. The cash reserves give an indication of the risk tolerance values of the Cases (Section 1.7.4 and Sections 5.4.1 to 5.4.5). The definition of risk appetite (Section 1.7.4) requires that the financial impact of risk is less than the risk tolerance value. Reporting risk tolerance in a meaningful way is discussed in Chapter 6. During the course of this study there was no evidence to suggest any of the organisations have calculated the cost of a water quality failure and how this would impact and influence the risk appetite and (or) risk tolerance. Further analysis into the cost of failure using a range of scenarios would be a valuable exercise to undertake, and could inform future risk analysis activity. The closest the Cases come to defining risk appetite, is to deliver a risk appetite statement that include a generic statement to protect public health.

It is notable that in the literature review Parker (1999, 2003) suggests that water in the UK is cheap, but the data presented here in Table 5.8, Table 1.1 and Table 5.2 provide evidence which confirms that UK water costs are still high relative to other regulatory and ownership models. Case study D has the cheapest overall costs of

provision of water with Case study E being the next cheapest. Case Study B (the privatised service provider) is actually produces the most expensive water by volume.

Cases A, B and C submitted actual copies of their risk registers as part of the data collection exercise. Four out of the top five risks on the registers submitted are finance related with only one risk referencing public health. This is in contrast to the strategic business plans which put public health as the top priority. Financial risks appear to be of higher importance in the minds of executives and senior management, than other strategic risks.

All of the participating organisations have documents that could be described as strategic business plans. Organisation A, B and C`s business plans are detailed to a five year time horizon and these plans map out the investment profile which splits the capital expenditure into new asset delivery and capital maintenance. Cases D and E have documents that consider a shorter planning time horizon (less than five years but greater than one year) with aspirational statements for the longer term future service improvements, rather than a defined strategy. In all cases the company documents refer to risk management and list major categories of risk, for example, climate change impact, financial risk, supply demand balance and aging infrastructure. In all cases the risk appetite is not defined or quantified in a way that is easily understood. There is no evidence to suggest how risks have been ranked. The documents generally refer to Enterprise risk management, monitoring and controlling "controllable risk" while considering a response to "uncontrollable risk" (this example is taken from Case E`s business plan). More could be done within the business plans

to emphasise the importance of risk management and the opportunity that risk management and water safety planning can offer in terms of public health protection, environmental stewardship and investment planning.

The financial, business and quality metrics indicate that all Cases in the study have improved drinking water quality while making a profit (or surplus).

5.5 Phase II interviews

A total of 29 respondents with job roles from Regulators, Chief Executives through to operational staff were selected to be take part in the interview process. The intention of the interview program was to elicit a response between organisations at similar levels and at the same time explore the responses vertically within the participating organisations. By adopting a vertical and horizontal interview strategy, a deeper appreciation of the pervasive nature of risk management, with respect to regulation and ownership arrangements, can be gained within and across the participating organisations.

Interpretation of the interviews considered text in the Case's business plans with respect to the risk management objective in order to establish the consistency of the interview responses with respect to the documented corporate strategy. The tensions and interdependencies between the various interviewees were examined and some suggestions for improving board engagement, regulatory choices, ownership arrangement considerations and risk management have been proposed (Chapters 6 & 7).

The interviews were conducted either in person, where practical, or by phone. It was appreciated that the actors within the various organisations had multiple pressures on their time and it was not always easy to get sufficient time with the individuals. It is with great thanks that the individual actors appreciated the aspirations of the project and were willing to give up sufficient time to talk to the researcher which enabled a full and frank discussion of the study theme.

The majority of regulators and senior managers were happy to be recorded on the basis that the conversations would remain confidential, where this is the case the recordings were transcribed and the transcriptions were used in the analysis. Field notes were taken when interviews were not recorded. The principle researcher supplemented the notes and transcripts with observation. Case D did not agree to interviews; rather the organisation supplied a collective written response signed off by their board. The response has still been included as this “corporate” view is still regarded as legitimate. Within the context of critical realist thinking (Easterby-Smith, 2008, Neuman, 2003).

The actors that took part in the interview were anonymised in line with the agreed ethics proposal (Appendix I). An interview identification key was developed (Table 5.9) to aid the researcher in making meaningful interpretation of the interview response. The interview identification system allowed for easy grouping of interview responses across similar roles across organisations and geographical locations.

Table 5.9 Interviewee identification key

Part One	Part Two	Part Three	Part Four
A = Organisation A	1 = 1st Interviewee in an organisation	D = Director	T = Transcription Available
B = Organiastion B	2 = 2nd Interviewee in an organisation	M = Manager	F = Based on Field Notes
C = Organisation C	3 = 3rd Interviewee in an organisation	R = Regulator	O = Personal Observation
D = Orgniasation D	…….	O = Operator	W= Written Response given with board sign off.
E = Organisation E			

For example a director from organisation E can be represented by the code E1DT if the director for the first interviewed and the transcript was available.

5.5.1 Strategic Objectives

The strategic objectives of the water service providers, irrespective of ownership arrangements are centred on the provision of drinking water, removal and treatment of waste waters and the protection of the environment. One company (E) provides electricity and so has additional strategic objectives around security of supply of energy to customers. All participating organisations aim to deliver these objectives as cheaply as possible, where available finance is used for operational activity, capital maintenance and investment in new infrastructure to replace existing infrastructure and deliver new assets. For the purposes of this project it was of interest to understand the tensions (if any) between the differing objectives. The same questions were put to the regulators in order to better understand if the strategic actions proposed by the Cases met the expectations of the regulators when it came to delivering the regulatory priorities for water services. Organisations may translate regulatory requirements into strategic objectives that do not deliver the expected

outcome required by regulation and this in turn changes the risks that the business carries (good or bad). In general the board members and senior managers of all of the organisations were consistent in their response about the drivers for their organisations. For example:

> *"We clearly have a drive to protect public health and the environment so the core kind of essence of the business, and that is very much reinforced by the obligations placed on us by legislation regulation and the ministerial objectives that are set for the business for each price review period"* (A2DT)
>
> And;
>
> *"Public health is obviously a driver for us, we have had considerable growth within the city and that has caused a number of problems with us in order to keep up at the time. We have limited resources, we are on a closed basin, there is a lot of issues with water quantity as well that needs to be looked at. Regulation would be driver for us, Climate Change and Finance and resilience, also looking at workforce, maintaining ageing infrastructure and environmental protection."* (E1DT)

The written response from organisation D was very concise and is a short list of drivers with no explanation of why they are important.

> *"Business sustainability, business profitability, water quality, water quantity, reliability of water supply, reputation & trust." (D1DW)*

All of the organisations alluded to financial sustainability as a significant focus.

> "*If not managed properly, the financial resources needed to ensure the achievement of the operational drivers might have a negative impact on the business sustainability and profitability." (D1DW)*
>
> And;

"I feel the most tension on at the moment is financial. So when we talk about putting the customer at the heart of what we've got to do, that has to be tempered by a realisation and an understanding that we are a commercial organisation." (C1DT)

As well as;

"We are always balancing an attention between what the customers want us to deliver, what do politicians want us to deliver, how much are they prepared to pay for it through their bills and how do we then find the cash to finance that, and the source of cash is not just customer bills, it's borrowings." (A1DT)

Regardless of the ownership arrangements of the water utility there is a common use of the term profit within all organisations including A, D and E who are publically owned. Suggesting there might be a cultural shift in the desire for the organisations to see themselves as operating using the principles of private enterprise and is consistent with the responses given in Section 4.4.2, where Organisation incentivised the senior staff to operate the business as a private enterprise. Pointing to leadership teams within the organisation promoting a management culture centred on perceived private sector behaviours (Section 4.4.2).

The business plans (with the exception of organisation C) are centred on investing in infrastructure that will make improvements with water quality compliance. Case C, as described in Section 5.5.3 has moved away from owning assets to acting as an operator and as such does not have a capital investment plan that is comparable to the other organisations. Within the other Case`s strategic plans there is a tension between investing for improved drinking water quality and affordability. The regulators` responses support the comment expressed by the actors of Organisation A

(Section 4.4.2 and 4.4.3), that capital maintenance may be de-selected to save money in the capital program For example:

> *"We have been at treatment works audits, getting details of scheduled planned maintenance, there is quite a lot of gaps and we have not really had information about when maintenance is being carried out, so I think there is some issues with planned maintenance and some of the water quality incidents we see are because a crucial piece of monitoring equipment was off-line for maintenance or the standby pump was not available."* (A1RT)
>
> And;
>
> *"They (The Company) are not charging the full economic rate there is no real long term financial strategy to maintain infrastructure or to allow developments in infrastructure. Most of the small communities have a financial plan that we describe as "pray for a grant" where the government is the banker of last resort and they stick their hand out and expect to be bailed out of the hole that they are in."* (E1RT)

The regulator from Case E goes further to suggest that there is little or no long term strategy to invest in and maintain infrastructure operated by smaller community based service providers. The service providers appear to rely on the government to cover the costs of the infrastructure. Application of water safety planning with a view to investing in risk mitigation would offer opportunities for improvement to resilience of water supply (Macgillivray, *et al*., 2008) rather than relying on government intervention. (Case study Case E).

Table 5.10 and Figure 5.1 provide a summary of the number of references coded within the transcript interviews relating to strategic planning. The table contains additional example quotes from each interview. The evidence suggest that the

directors in Cases E, B and C aspire to build longer term plans that address the drivers and priorities discussed here in Section 5.5.1. The clusters of coding around reactive management and short term planning are dominated by responses from the managers and regulators who feel that the businesses tend to manage the current problems, for example leakage in Case E`s country; where Case E`s actors observe that more effort is put into fixing leaks short term rather than focusing efforts on replacing old pipes for new. The view is that if pipes were replaced, there would be a more resilient system and less money would be spent on reactive leakage activities, saving money longer term. However, in Case E`s case, the governing body (the local municipality) did not approve the longer term strategic plan for asset (pipe) replacement due to competing political priorities (roads, schools, etc.). This meant that Case E was forced to maintain reactive management activities. Reactive management as a feature of management culture is discussed further in Section 5.5.3 and political intervention discussed in Section 5.5.4.

Table 5.10: Code summary for strategic objectives.

	Code description and number of references (n)				
	Long term planning	**Reactive management**	**Short term planning**	**Efficiency targets**	
Code description	Long term planning is seen as an important activity within the organisation.	Reactive management is evident within the organisation.	Short term planning is the norm within the organisation.	There is a strategic drive for efficiency within the organisation.	
Actor					**Example Quote**
E1DT	11	0	0	1	We put together a five year long term business plan which we maintain going forward which drives all our business decisions and that long term plan is built around growth.
E2DT	3	9	5	0	I always walk away thinking if we could put those resources into the stuff that we know that really makes a difference we'd be far better at managing out risks.
E3MT	0	0	3	0	being a plant manager is not a menial task and neither is being a water quality engineer and yet we only had limited numbers of people so everyone was trying to cover what we could and after a while that's not very sustainable.
E4MT	2	0	0	4	We do long term planning as well, and various terms of long term planning, there is a ten year forecast looking forward and then a fifth year plan for putting in new Waste Water Treatment plants and that type of thing.
E5RT	0	1	2	0	it's sort of sight-unseen, so they may be dealing with leaks on a regular basis, so all winter there's sixteen leaks, they're spending most of the time fixing leaks rather than spending the money to replace those water pipes.
E6RT	3	2	1	0	Over the last 20 years that planning horizons by the politicians has come significantly shorter, we are now looking at 3-5 years, rather than making the strategic plans that they would have done in the past.
B1DT	14	23	13	5	Which obviously diverts resource away from areas where we might be at greater risk but which are less visible to our customers or investments at a strategic level within the business.
B2MT	3	5	2	0	it's constantly about managing the tension between all those different objectives and we do that using our strategic risk value process as well as we have a sustainability strategy.
B3MT	3	7	3	4	if you tried to look into things and plan a bit further to the future you wouldn't have the additional cost or the additional time that the risk realising would take up from you.
B4MT	1	0	1	0	The risks that are actually managed at the moment tend to be dominated by slightly shorter time scale.
C1D	2	1	1	0	we are in somewhat of a state of flux.
C2MT	2	0	0	3	looking at where do we want to be in three, five years? How do we get there? And what could happen that could compromise us getting there?
D1WT	0	0	0	0	No Examples.
D2WT	1	0	1	0	one of its goals being to manage risks connected with our service level, identifying critical points in the network and creating specific measures to assure that risks are known, minimized and managed in our daily routines.
A1DT	3	0	0	0	our strategy is going to be over a period of years on an incremental basis to just build in more and more connectivity so we have a grid really covering Ayrshire right through to Dundee and potentially further north but there is more of a question mark about that.
A2DT	5	0	0	3	one of the things that we are doing for the first time, is we are in the process of developing 25 year projections for the business, historically we have operated on a 4-5 year regulatory periods and that was an improvement from when it was done on an annual basis, for the first time we are looking at planning from 2015 – 2040
A3DT	22	4	3	8	What our economic regulator agreed with us was that we should enter into what are called "strategic land management projects", so this is about trying to identify the source of these pollutants and eliminate at source rather than stripping out of the water at the treatment plant.
A4DT	0	0	0	1	Well if you listen to the regulator, you would say it's been wonderful on savings costs and it also costs an absolute fortune.
A5MT	4	2	0	11	we really need to target our money affectively across the country.
A6MT	9	5	9	1	well management is at fault, because they never actually encouraged the escalation and the same management is at fault in terms of if you have knowingly neglected.
A7MT	3	1	5	0	there is a drive to do a lot in a short period of time, rather than investing for long term sustainability, and it is how do you strike that balance, how do you get somebody who is in post today that might be retiring in five or ten years time to think about the legacy that he is leaving behind for the person that takes his place.
A8RT	1	4	2	3	I think one of my concerns at the minute is maintenance, well our concerns as well. We have been at treatment works audits, getting details of scheduled planned maintenance, there is quite a lot of gaps.
A9RT	1	1	0	2	I think a lot of it seems to be driven by again the team leaders and the team managers, but I have seen a move for the team managers to really sort of try and take things where they see frustrations and tensions and lack of money being spent on maintenance which actually is a big tension in operations at the moment, taking into their own hands and setting up maintenance service contracts themselves, which I argue should not be down to them really, I mean it is great they have done it, but really it should be handled centrally, they are seeing risks and because they don't want the plant to fall flat on it's face they are trying to address these themselves the best they can.
Total Reference Count	93	65	51	46	

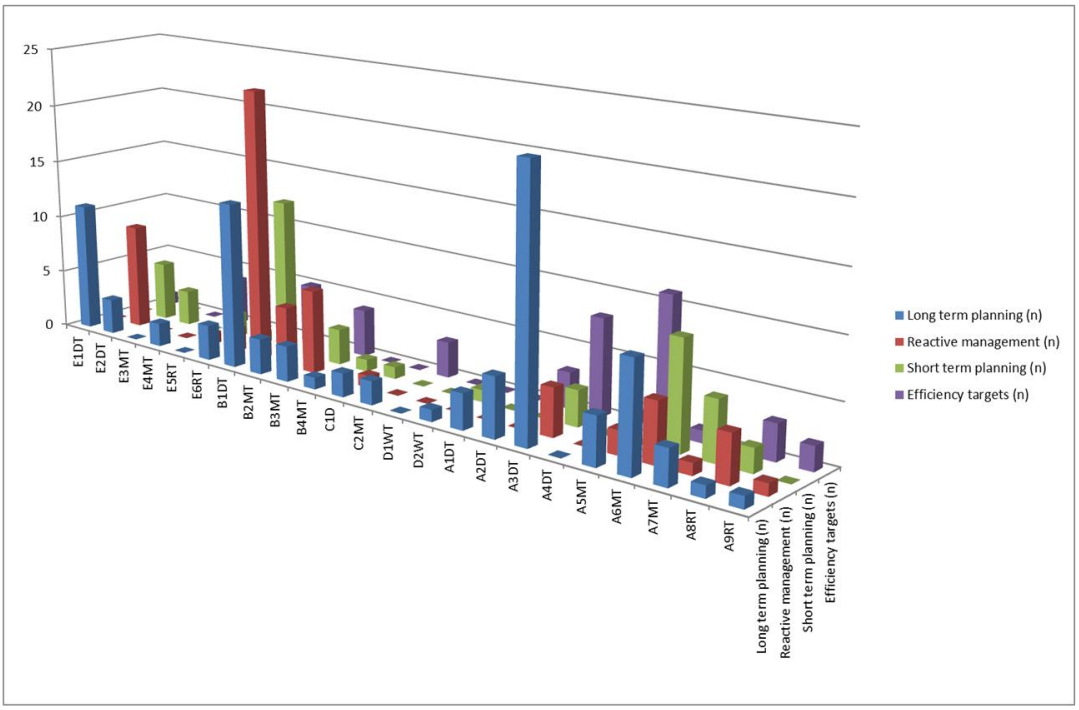


Figure 5.1 Number of code references for selected codes related to strategy and planning. The X axis is the number of references (n)

The coded references within the interviews suggest that decentralised regulation combined with small locally operated water management systems (publically owned) suffer from a lack of short term planning and investment. This is explored in more detail in Section 5.5.2., reflecting the observations made in Sections 1.2, 2.2, 4.4.2 and 4.4.3. The general view of the operators across all case study organisations was that that there was no real focus on long term planning. The operators felt that:

"We escalate issues such as faulty equipment, for example on-line pH meters but nothing gets fixed. Why bother if the organisation cannot prioritise fixing such critical early warning systems?" B5ON.

And:

"We have been waiting for new control systems for years. The business says this is a priority but all their worried about is saving money." E7ON.

5.5.2 Financing investment in infrastructure

Financing water services is an influencing feature identified through the literature review (Section 2.3) and Phase I (Sections 4.4.2, 4.4.3 and 4.4.7). The significance of financing water services was further re-enforced across all of the case study organisation and by the regulators (Figure 5.2 and Table 5.11).

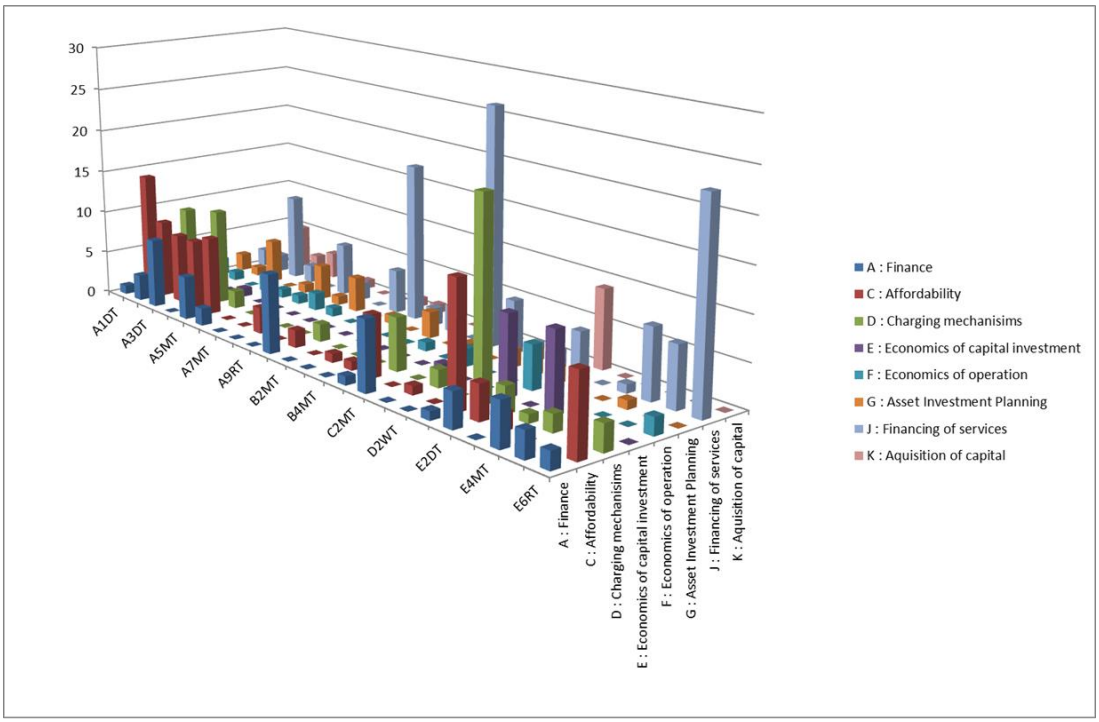


Figure 5.2 Number of code references for selected codes related to financing. The X axis is the number of references (n)

Table 5.11 Code summary for finances

	A : Finance	C : Affordability	D : Charging mechanisims	E : Economics of capital investment	F : Economics of operation	G : Asset Investment Planning	J : Financing of services	K : Aquisition of capital	
Code description	Finances is seen as an important driving factor.	Affordability is seen as a driver for policy/regulation	Charging mechanisims are considered a regulatory feature and an important success factor for delivering water services.	Economics is considered important to delivery of service and has an influence on risk management.	Economics of operation is considered important to delivery of service and has an influence on risk management.	Planning asset investment (either new assets or capital maintenance) is considered important to service deliver and risk mitigation.	Financing of services is a sub-set of financing, charging mechanisims and economics.	Securing additional capital is seen as important to ongoing service delivery.	
Actors									Example quote
A1DT	1	14	3	2	2	2	2	0	We are always balancing an attention between what the customers want us to deliver, what the politicians want us to deliver, how much are they prepared to pay for it through their bills and how do we then find the cash to finance that, and the source of cash is not just customer bills it's borrowings
A2DT	3	9	10	0	1	1	2	5	any increase in charge is difficult for customers, so that pressure to keep charges at what is perceived to be an affordable level is obviously tension with the rates at which we can improve the business.
A3DT	8	8	4	0	0	5	10	2	the borrowing requirement is set, so that gives us an efficiency challenge within operating cost and in capital efficiency.
A4DT	0	8	11	1	2	0	2	3	Up here, where 85% of our cost charges, the last thing you want to do is feed that through charges and where debt and borrowing is constrained we want the smallest effective programme we can possibly put in place, so that links to charging mechanisms.
A5MT	5	9	2	0	1	1	0	0	I think like all businesses, regardless of whether we are in the private sector or the public sector, there is always going to be affordability.
A6MT	2	0	0	0	1	4	6	1	I think then you get the kind of other key risks are probably around the financial, so the inability to meet our finance and requirements, whether it be bad debt, whether it be borrowing, whether it be revenue streams, or the fact that we have no other source of getting money other than the customer and the government at the moment
A7MT	0	0	0	0	2	1	2	0	we need to get better in terms of asset performance, understanding our assets, understanding how well they are performing and what stops them performing well, and I think we carry quite a lot of risk around the balance of investment and maintenance, with financial pressures, the first thing that tends to go within the business is routine maintenance, and we kind of tend to step back on that, and don't understand what the risk is in doing that.
A8RT	0	3	0	0	1	4	0	0	I think we will always end up with a barrier that there is not the funding for that so it's not necessarily being addressed, we have highlighted the risk and there might be some operational control measures, so I think the real test is going to be how successful it is in terms of what comes out of them.
A9RT	0	0	0	0	0	0	5	1	Financial constraints, to some extent are a bit of a straight jacket. Politically bills are not going to be allowed to go up, you could argue that the bills may have needed to go up in the past possibly, and we would be in a better position now if they had done, and we had cut fewer corners with investment.
B1DT	9	2	2	0	1	1	18	1	The areas that I'm most concerned about are our understanding of the assets, their level of deterioration and what the long term investment needs are in the context of economic climate, affordability to customers, tariffs, social tariffs, financing, all of that. I think we're facing a bow wave of investment in the next ten to twenty years to maintain current standards of service.
B2MT	0	0	0	0	0	0	2	0	managing the assets or putting trigger plans for liability maintenance, your ICA maintenance or whatever. It's just the mind-set from not in the corporate governance world, I mean, I'm in the practical process world.
B3MT	0	1	0	0	0	3	3	0	There's obviously always the tension with what you have to do and what you feel that you can do within the budget that you've been given.
B4MT	0	1	0	0	1	0	0	0	I would say there's inevitably tension, stuff I've previously come across and thought about are tensions between affordability and reliability, resilience, efficiency.
C1DT	1	7	6	0	0	1	27	0	That would be a key area for us as well, of risk, on our operating model; five years, ten years service contracts, how do you value what the inflation is going to do or what commodity prices are going to do
C2MT	8	0	0	1	2	0	6	0	Their intention is to reduce their debt so they had to sell something that was quite easily sellable and that would bring a lot of cash.
D1WT	0	1	2	0	0	2	2	0	as a preliminary approach one may say that the key areas are: assets' ageing; lack of water availability at sources due to climate changes; difficulties in obtaining financing support; increase in the price of energy.
D2WT	0	0	0	0	0	3	2	0	Of course, the company also benefits with risk management as we can be able to do better choices in terms of the use of the resources (financial and others)
E1DT	1	14	22	9	5	2	5	9	We do have a separate source of funding now, that is going to run out at some point in time, once that company is 100% publically traded there is going to be nothing left to sell, that is going to change our business model a little bit and how we borrow money.
E2DT	4	4	3	0	0	0	0	0	when we're doing those things, obviously we want to be cost effective and we've been pretty strategic on how we've leveraged the most benefit that we can for those kinds of work. We're cheapskates, we'll pick and choose very carefully who we partner with and we try to get a lot of leverage on what we do.
E3MT	0	2	1	9	1	0	1	0	you really don't know what the growth will be each year, so you try to budget assuming a certain growth and if that growth does not happen, you don't have the finances.
E4MT	5	0	2	0	0	1	8	0	The rate of growth is a big risk for us and financial, those two are key from the Director, that is where the focus is, trying to manage those two, heavy emphasis on financial for us, the other things would be public health, environmental impact and limited resources.
E5RT	3	0	0	0	0	0	7	0	Most do not charge enough for their water. So they use their own taxing system. Then there's the gas tax program, which I don't really know a whole lot about but essentially money that the municipalities get back from the taxes that we obtain for gas use in the province. Most gas tax, it goes to the municipalities and the municipalities have to indicate what they're going to use it for.
E6RT	2	9	3	0	2	0	23	0	He was going to raise the charge from 35 cents a cubic metre to 50 cents a cubic metre, there was outrage at this.
Total reference count	52	92	71	22	22	31	133	22	

Board members involved in the study appear most interested in the financial stability and wellbeing of the organisation they lead. Organisations, and in particular smaller municipal organisations, tend to have limited powers to raise capital through borrowing.

"we are funded through the water rates 100% we don't get subsidised in any other way and we are expected to make a return on capital investment, a fair return on capital investment" E1DT

And;

"We are financed through customer charges, we don't borrow from government." E1DT

Funding available can be insufficient to maintain current levels of service and fall below the investment levels, particularly when the tariffs for customer charges are set directly by the governing body which is normally the elected official. The tariffs are lower than the combined OPEX and CAPEX requirements to maintain serviceability as the elected official is often under pressure to keep charges low by the electorate;

"This guy got voted out at the next election because he wanted to raise the charge, so it is absolutely politically charged and because it is the individual municipal small town hamlet that is responsible for it, you have only got about 150 voters for them to get fed up and you are pushed out, whereas if that had been about 100,000 voters and

there were only about 150 that were fed up then it would have made no difference" E6RT

The regulator highlights significant political influence on tariff setting, particularly in small locally run systems. This is further evidenced in Case E, For example, the charges for water to the customer were quoted as circa 35 cents per cubic metre compared to the treatment and infrastructure costs which are close to $2 per cubic metre. This is not sustainable and operational and systems risks will be more likely within under invested systems. It was also found that shortfalls in capital for investment lead to a reduction in planned capital maintenance, which again will increase operational risks (Section 4.4.2 and 4.4.3).

Board level discourse on financial risk is about the financial consequences of risk rather than financial risk *per se*. Tensions are noted between investing in the water network, maintaining operability and paying out a dividend to shareholders in the privatised business models. The ability of the water company to raise sufficient funds to remain in operation and invest in infrastructure is at the core of protecting public health and managing risk. The strategic business plans set an agenda that is designed to meet water quality improvement goals as well as protecting the environment and securing water volumes. The importance of financing is reflected in the number of coding intervals that appear in the analysis. The most frequently talked about issue was financial risk, for example:

> *"I think the other major risk that faces the organisation in delivering its objectives right now is, will there actually be the borrowing levels there for the next three years to finance the objectives we've got and if not, if the ministers*

shrink the size of the investment program, how many of the things that fall out of the program or objectives will affect the delivery of the organisation`s vision?" (A3DT)

And;

"Other risks that are around related to our public sector model, the way we gather revenue at the moment from customers is through council tax and councils are in discussion with government about changing the formula as to how that is actually calculated and how the organisation gets its contribution from it. We do quite well out of this formula at the moment because the bad debt element is weighted towards the councils than ourselves and any change to it will bring with it a reduction in revenue to us." (A4DT)

Although the examples here are from the same organisation, the theme is consistent throughout the participating organisations. For example Case C made a comment that:

"At the start of the credit crunch, 2007, 2008, Case C had expanded rapidly, found itself in a position where it had debt that was seen as being too big for the size of the organisation, had a lot of debt. So strategically the decision was taken to sell the transport division. So that's one, that's going through as we speak. It's not confidential, that's well understood in the marketplace, basically Case C is going through a divestment process to reduce its debt, and that's well understood in the marketplace." (C1DT)

And even in organisations D`s written response, financing is a prominent theme:

*"If not managed properly, the financial resources needed to ensure the achievement of the operational drivers might have a negative impact on the business sustainability and profitability." (*D1WT)

From a regulatory perspective financing is also seen as important but concern for operability arises when regulators become aware that agreed investment is not delivered to the timescales (or deferred) which put public health at risk.

> *"The cost of providing water and wastewater service on a sustainable footing for them is extortionate, they basically just ignore it in the hope that it will sort itself out somehow, sometime. The financial structures that are in place to allow sustainable systems is the biggest challenge."* (E6RT)
>
> And:
>
> *"There is obviously the financial constraint there that perhaps means that the best solution for an area is not getting implemented and sort of corners are being cut or less ideal solutions being considered."* (A7RT)

Some regulators noted that the publically owned water companies acquire income through customer charges supplemented by government borrowings, which while normally having a lower interest rate than private equity, can be limited or diverted to other public projects at short notice. The privately owned Cases in this project (Cases B and C) have access to funds through customer charges and the capital markets. They also have more flexibility to move capital from one project to another as priorities changed (See the response from the regulator in Section 4.4.2), whereas public organisations are generally committed to the projects specified in the regulatory contracts. The political influence appears stronger with public companies and may constrain borrowing or charges, as the same regulator points out:

> *"There is the financial side, financial constraints, to some extent it is in a bit of a strait jacket in that, politically, bills are not going to be allowed to go up, you could argue that the bills may have needed to go up in the past possibly, and*

we would be in a better position now if they had done, and we had cut fewer corners with investment, I think one of the drivers for us is making sure investment is delivered and there is value received for that investment." (A7RT)

The evidence presented in Section 4.5 highlights a real example of a political decision that fundamentally changed the cost base of a water service provider. The decision had an impact within days. Making swift decisions about changes to financing will fundamentally change the investment, risk and therefore the way risk management is applied within the utility. To complicate matters, not only were the domestic charges frozen but the public utility was in detailed discussions with the local authority about how domestic customer charges would be recovered though council tax charges. The local authorities who collect the revenue wanted to change the formula which would remove protections for income to the water utility from citizens below the poverty line who could not afford to pay council taxes. This change in formula would reduce the income to the water authority further and increase stress on the investment programme priorities. Another pressure on finances came from recovery of income from the "retail" arm of Case A, which was now open to market competition (at the time of writing Case A lost a £350m retail contract to a competitor). The retail income was much lower than expected because of a variety of contractual issues which remain confidential and are out with the scope of this study. One of the directors observed that:

"In difficult times like we are in at the moment, then any increase in charge is difficult for customers, so that pressure to keep charges at what is perceived to be an affordable level is obviously tension with the rates at which we can improve the business." (A2DT)

And;

"One of the biggest risks that I'm currently running at the moment is to do with the way that we bill and collect charges from our household customers. Around 70 % of our revenue comes from our household customers; the charges for these customers are linked to council tax band and in interests of efficiency these charges are billed together with council tax and they are collected by each of the local authorities along with the council tax and then what is collected is then remitted to [Case A]. Since 1996 there has been a formula in place that governs how much of the cash that is collected by the local authorities is remitted to [Case A]. And it's a formula that basically looks at the total cash collected across council tax and water charges and then it apportions the amount of cash that we receive in relation to the value of the water and sewage element of the bill as a percentage of the total bill of council tax and water and sewage charges together. Now this formula has given a very strong incentive to the local authorities to collect what is known as water only debt. The specific issue here is that if someone is in receipt of full council tax benefit, they don't get a council tax bill but they do get a bill for water and sewage charges albeit it that can be discounted by up to 25 %. Unsurprisingly because of the socio-economic characteristics of people who are low income earners and on full council tax benefit there is probably a higher level of non-payment of water only bills compared to the non-payment of combined council tax and water and sewage bills. And that's why it has been particularly important that the councils have a very strong incentive to collect the water only debt because otherwise the risk to [Case A] is they may think 'Well, it doesn't really matter if we collect or don't collect the water only debt because it's [Case A] who will bare the cash and bad debt consequences'. The local authorities are increasingly understanding their relative levels of collection of council tax and water debt and some of them particularly in the more economically disadvantaged areas have come to the view that this current billing collection formula works against them. So the risk to [Case A] is that the

councils successfully mount a case for the current collection arrangements to be changed. Not so much that they collect the cash but more the formula by which the cash is allocated between the councils and [Case A]. So that's the risk, the risk is that we could end up with relatively less cash than we've done previously." (A2DT)

The three identified pressures on income (Government capping customer charges, local authorities changing the charging formula and lower than expected retail income) will have a cumulative negative effect on the available finances required to deliver water and wastewater services. Assuming no other funding is available, the organisation must make choices that deviate from the agreed regulatory contract. They could choose to take resources out of frontline services, reduce spend on capital maintenance and/or stop capital investment projects. In this case the organisation took decisions around all three funded areas to ensure that the budget targets were met. In the example Case A became cash constrained over a short period of time because of political decisions about funding mechanism. Ultimately these choices impacted on the funds and moved the business closer to the risk tolerance value (Section 1.7.4). The organisation was placed in a reactive situation (Section 5.5.1 and 5.5.3) in which risks needed to be managed but there was little evidence within the case study sample to suggest that the organisations adapt risk management practise to deal with the fluid nature of capital availability, which put this as a strategically higher priority than operational and public health risks, in the minds of the executives.

Organisations operating private ownership arrangements have financial challenges which impact on the risk management choices. Case A faced specific challenges after

the financial crisis of 2008 but so did the private sector. The private sector was less constrained in the choices it could make to ensure ongoing sustainability of the organisation. Case C chose to re-focus business activity on servicing and maintenance which meant divesting itself of owning water assets. Two actors within the organisation observed;

> *"[Case C] had expanded rapidly, found itself in a position where it had debt that was seen as being too big for the size of the organisation, it had a lot of debt. So strategically the decision was taken to sell the transport and water divisions. So that's one, that's going through as we speak. It's not confidential, that's well understood in the marketplace, basically [Case C] is going through a divestment process to reduce its debt, and that's well understood in the marketplace. "*(C1DT)
>
> And;
>
> *"that decision was taken by Paris, the headquarters of the company in France. Their intention is to reduce their debt so they had to sell something that was quite easily sellable and that would bring a lot of cash. And also they wanted to re-centre themselves on their core skills and core jobs which is to run services and provide services to water companies rather than own assets. That was the intention behind it. The first drive is financial, reduce the debts of the company and restore the confidence of investors."* (C1MT)

The decision for Case C meant that they de-risked the business by giving up asset ownership arrangements and focusing on service provision to the water sector.

The constraints in funding have lead the two organisations with differing ownership arrangements to take very different decisions. Case A`s funding was dictated to by politics and they had to limit operational and investment activity as a result. Case C

has acquired too much debt and this meant it had to sell off elements of its business. All of the choices taken altered the risk profile within the respective businesses. Case A`s cash reserves were reduced thus reducing risk tolerance, for example, investment and maintenance was reduced increasing the probability of treatment failure. In contrast Case C increased its cash surplus therefore increasing its risk tolerance (Section 1.7.4) by selling physical assets that needed operational intervention, investment and maintenance (Section 5.4.3).

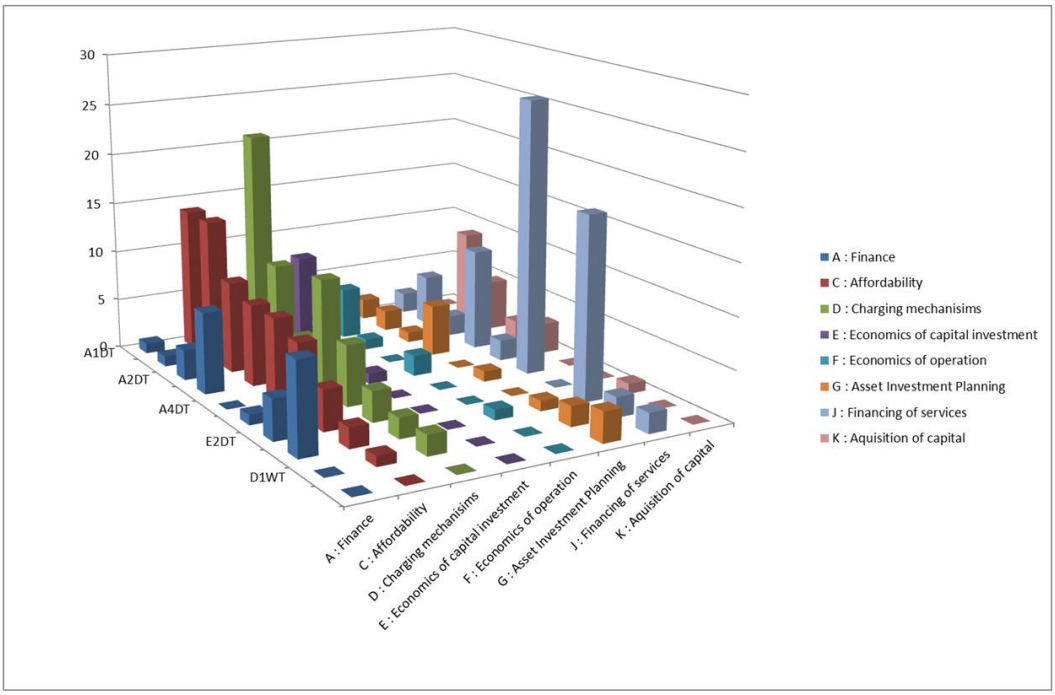


Figure 5.3 (a) Comparison of finance related coding frequencies between hierarchal groups (directors).

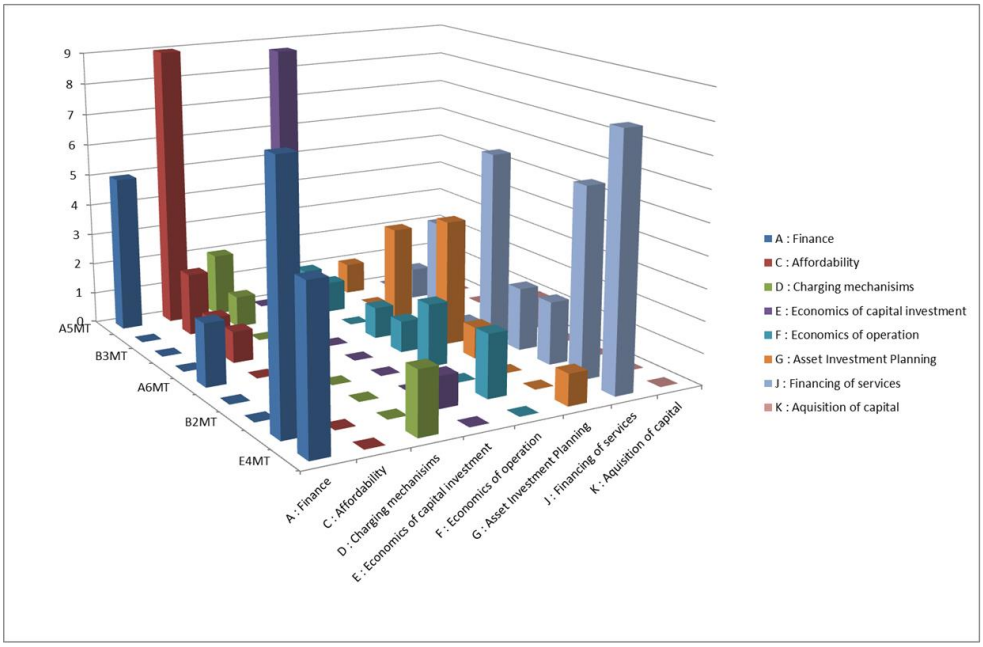


Figure 5.3 (b) Comparison of finance related coding frequencies between hierarchal groups (managers).

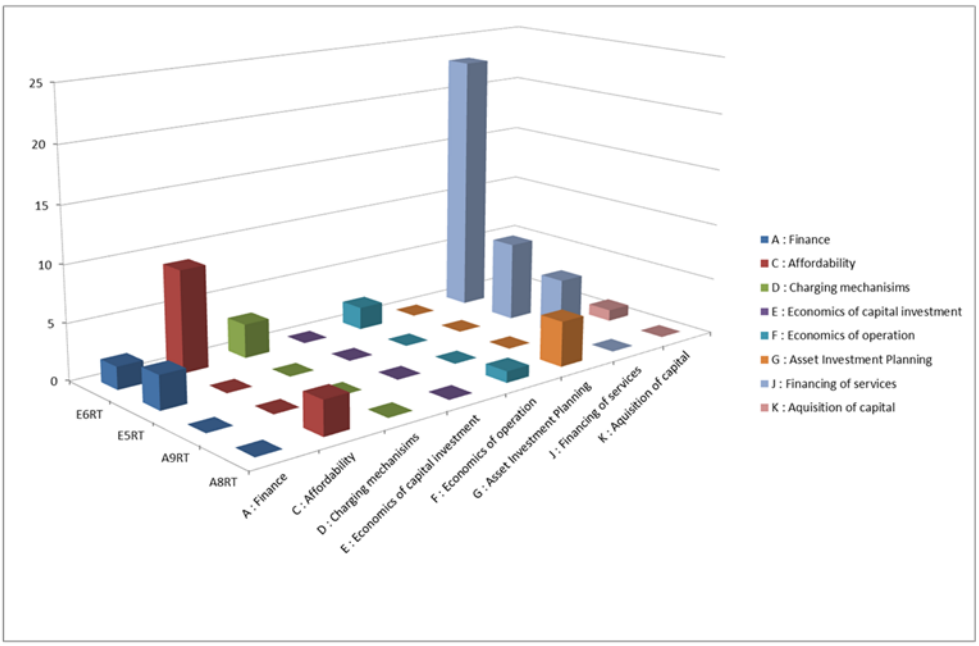


Figure 5.3 (c) Comparison of finance related coding frequencies between hierarchal groups (regulators).

The frequency of references on the topic of financing, between groups (Figure 5.3 a, b and c), supports the analysis that the director community are most concerned with the financing of services. The number of codes and frequency across the range of case studies (perhaps with the exception of Case Study D) highlights that it is a common concern for executives across international boundaries, regulatory regimes and ownership arrangements.

Managers show similar concerns to directors with a similar range of coded references; however the issue was mentioned less, with the frequencies across the codes being lower.

Regulators, while still concerned with financing discussed this less, focusing more on public health and service delivery as high priority areas for water service providers. Only one of the regulators in case study E mentioned financing of services with a similar frequency to that of the director community.

Summary

To summarise, financing is an important driver for water service delivery and is directly influenced by regulation and ownership arrangements (illustrated in the study framework, Figure 2.5) and highlighted in both the literature review (Section 2.3), the Phase I research (Chapter 4) and here in Section 5.5.2. The interviews exposed a number of features of regulation and ownership arrangements that influence financing and have consequences for risk management. Table 5.12 summarises the financing arrangements highlighted by the interviewees across the case study organisations together with some of the implications for risk management.

Table 5.12 Summary of financing arrangements discussed by interviewees and implications for risk management.

Financing Arrangement	Description	Ownership Arrangement	Regulatory Features	Implications for Risk Management	Evidence
Charging based on metering (domestic customers)	Tariffs are based on a charge per cubic meter of water supplied. Customers are metered and charged on volume of water used.	This mechanism has been used by public and private companies.	Some regulators favour this approach particularly in water scarce areas as it drives behaviours around water use reductions.	There is often a shortfall between income generated and the cost of delivering the water service. Meaning less money to invest in building and maintaining asset. Operational elements such as Leakage and drinking water quality failures may increase as a result.	Case Study E
Charging based on metering (business customers)	Tariffs are based on a charge per cubic meter of water supplied. Customers are metered and charged on volume of water used.	This mechanism has been used by private companies in water retail markets.	Some regulators favour this approach when seeking to "improve the efficiency of the water companies through retail market competition".	There is often a shortfall between income generated and the cost of delivering the water service. Meaning less money to invest in building and maintaining asset. Operational elements such as Leakage and drinking water quality failures may increase as a result.	Case Study A
Fixed annual tariff for domestic customers	Tariffs are based on the aggregated cost of service delivery and then a single annual charge is applied to domestic customers.	This mechanism has been used by public and private companies.	The tariffs are normally agreed at a national level with the financial regulator with sign off from environmental and drinking water regulators, where they exits.	The tariff will be based on a strategic plan that will identify priorities for investment and affordability. Some strategic investment may not go forward and, in the case of public ownership, the charges are open to influence by political decision making. Meaning there may be a shortfall in financing.	Case Study A, B and D
Fixed annual tariff for business customers	Tariffs are based on the aggregated cost of service delivery and then a single annual charge is applied to business customers.	This mechanism has been used by public and private companies in water retail markets.	The tariffs are normally agreed at a local level and usually linked to the water consumption of the business.	The tariff will be based on wholesale price of water and consumption. A shortfall in the wholesale operating cost may result from a gap in the revenue collected by the retail company relative to the wholesale operating costs, resulting in under investment in strategic assets.	Case Study A,B, C and E
Income recovery through third parties	Fixed tariffs sometime are collected through third parties (case study A uses a local authority system).	Used principally by public utilities.	The income is usually defined by a calculation which can be influenced by the local authority, politicians and water company. There is constant pressure to reduce the amount of recovered income going to the water utility.	Under recovery of income will create a shortfall in the operational budget and investment plan, leading to under investment in strategic assets and a need to find further operational efficiencies (usually a reduction of staff numbers).	Case study A and E
government borrowing	Borrowing additional capital through the government. This is usually a cheaper from of borrowing but is restricted in terms of value. The borrowing in normally required to make up the shortfall in income recovery.	Used principally by public utilities.	There is little guarantee that the borrowing will be forthcoming. The value of borrowing is fully dependant upon the local or national government. The government may divert borrowing to other national or local priorities.	Additional Government borrowing may allow investment in strategic assets in the short term which should improve resilience.	Case study A and D
borrowing from capital markets	Borrowing additional capital through the markets. The borrowing in normally required to meet the service providers contractual obligations (investment and operational)	Used principally by private utilities.	There is no direct involvement from the regulators. The control of borrowing normally goes through the company board and shareholders.	Borrowing capital is expensive and may lead to higher interest rate payments. Some private organisation may find a gap in cash flow and need to divest themselves of capital intensive element of their business to release capital (to repay loans) and reduce risk. Loss of control of strategic assets may be a national concern.	Case study C

The range of financing mechanisms has implications for the operability of the water service provider. The biggest risk for financing is the creation of a funding gap. In the case of Case E, financing is based on growth projections:

"The other thing is that we have model where growth pays for growth, so we have sort of assessment that occurs and so you really don't know what the growth will be each year, so you try to budget assuming a certain growth and if that growth does not happen, you don't have the finances." E4MT

Tariff setting, either for metering or for fixed charges is open to political influence with pressure to keep charges artificially low (Case study A and E), leading again to under investment of infrastructure. Income recovery mechanisms (such as 3rd party collections (Case Study A) may also lead to financing shortfalls. Borrowing can be used to make up shortfalls where available (for example Case Study E candidates are unable to borrow) but interest charge payments may be applied meaning income is diverted to interest payments rather than investment.

The financing options influenced less by political decision making appear to support longer term asset planning (Case Study B and C) but there is a risk that the private companies are forced to sell strategic assets (Case Study C) to make up a shortfall in capital. The loss of control of strategic assets may be seen as a risk to national interests but more research would be needed to confirm this.

Overall Table 5.12 gives some insight into the range of choices of financing water service. Each system will have limitations and potentially lead to limited funding to deliver services. Retail competition in particular may have implications for risk

management as the loss of revenue of the reduction in revenue may restrict capital investment and capital maintenance increasing the likely hood of risks occurring within the water and wastewater systems. Similarly borrowing from capital markets may cost more meaning the servicing of debt is likely to be higher. It is worth noting that there is no evidence from the privatised company (Case study B) that they service the debts. If the debts are not serviced sufficiently then debt will build up within the business to an extent where the company cannot replay the loans and this will have a critical impact on the delivery of water and wastewater service. Servicing of debt should be of concern to risk managers within private organisations and mitigations put in place to manage debt effectively, in doing so, protecting the business from risk.

5.5.3 Management culture and risk management

Protecting public health and customer experience

Board representatives, are changing the way they discuss providing water and wastewater services. Traditionally companies focused on the *"protection of public health"* however in the interviews conducted; there is a move towards considering the *"customer experience".* The importance of customer experience is also referred to in many of the strategic business plans. To put this into context here are some quotes from a range of actors at board level.

> "*I think more recently what we have been grappling with is what is it that matters to customers beyond the purely regulatory measure success, and we have been giving a lot of focus on what is it that drives customer satisfaction or customer dissatisfaction, so that is going a lot of work to try and make sure*

that things never go wrong for customers and trying to increase the extent to which the system just works or if it breaks down, we would become aware of it breaking down and we fix the asset before it has an impact on customers and then to the extent that things do impact on customers, there is an increasing focus driven my measures of customer experience to make sure that we are resolving things first time and obviously where we are not, that we have an exceptionally good recovery service" (A1DT)

And;

"Our shareholders for [Case E] is also our sort of rate setter as well and they are speaking on behalf of the rate payers in the city, folks who pay their water bills, and we have to convince our shareholders every five years that rate increases that we are proposing that are for infrastructure renewal or improvements are justified and prudent." (E1DT)

Together with comments from the privatised water companies:

"In terms of service, we colloquially put that down as doing what we say we're going to do. But also trying to put the customer and the client at the forefront of our service." (C1DT)

And;

"To be operationally excellent in the basics of everything that you do and in doing that we should deliver safe water, become the most water efficient region and deliver our services at a price customers are willing to pay, able to pay and give attractive return." (B1DT)

Organisation C, in its written response, is the only Case that does not openly discuss customers, customer experience or valuing the customers. The response given focuses on meeting regulatory objective, financing and preparing for possible privatisation. Figure 5.4 depicts the frequency that customer experience is discussed across all actors.

It is unclear what impact the change to “customer focus” has on the management culture within the organisations in terms of risk management and the protection of public health.

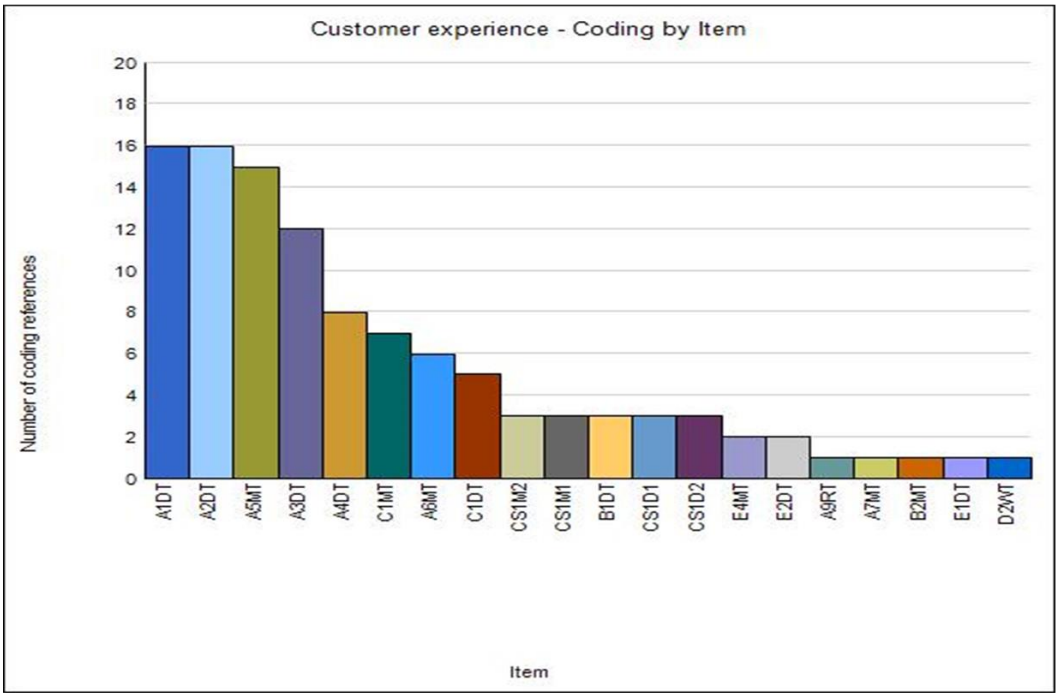


Figure 5.4 Frequency of the term “Customer experience”

The drive for efficiency targets

Conversations with actors involved in the study suggested that more priority may be put on achieving efficiency targets (including OPA) rather than fully appreciating the risks and mitigating them (Figures 5.5 and 5.6). The efficiency targets, where they exist are driven by the financial regulators and in response to the limits on finances (Section 5.5.2). The drive for efficiency is lead from the top and appears to be a pervasive within the management culture of Cases A, B and C, which are either

privatised (B and C) or public incentivised to behave like privatised organisations (A) (Section 4.4.2).

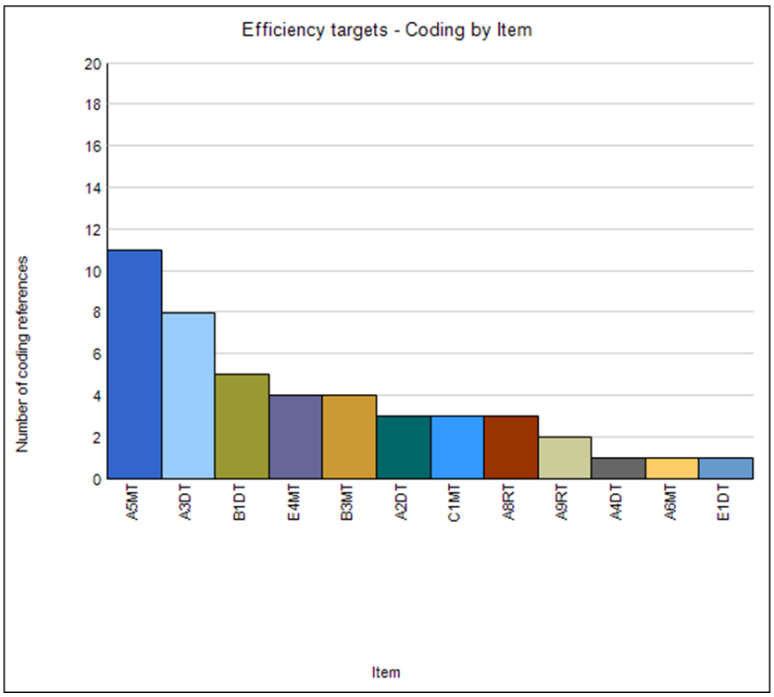


Figure 5.5 Frequency of coding related to Efficiency targets

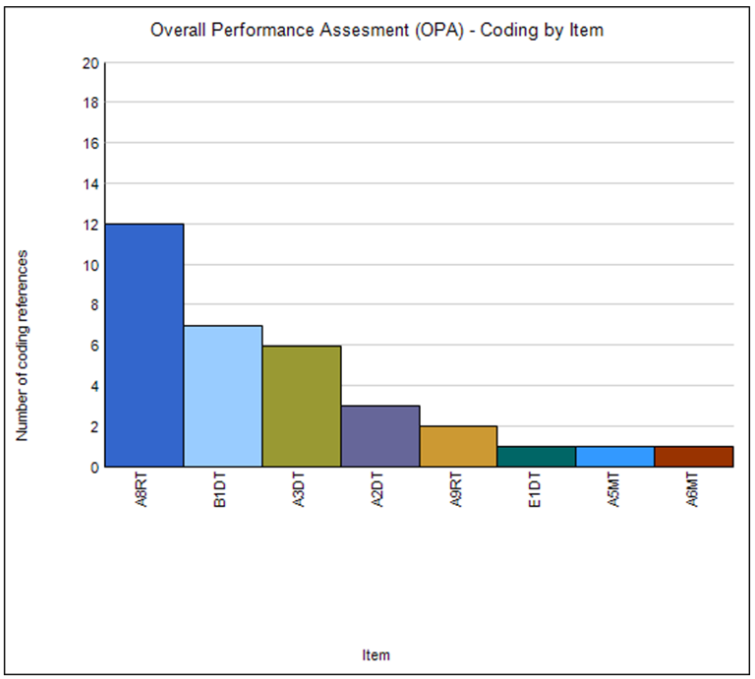


Figure 5.6 Coding frequency related to OPA

Regulators raised concerns that the drive for efficiency targets had unintended consequences for the overall management of significant operational risk. The following examples illustrate this point;

> *"I think there is a very big focus in terms of OPA in terms of performance coming from the Water Industry Commission, seems to be the lead driver and that is obviously only a small number of water quality parameters versus the bigger picture of the regulations as a whole."* (A7RT)

OPA (Figure 5.6) has been highlighted previously by Directors of Organisation A (See Section 4.4.2) and was a principle focus for Organisation A from OPA`s introduction. While the OPA figures improved from 2004 to 2014 (the OPA figure went from 162 to 397). The drinking water quality regulator has concerns that the water quality element of OPA did not articulate the full range of risks to drinking water compliance.

In Phase II Case A continued to emphasis OPA but directors from Cases B and E also referred to OPA. When efficiency targets are included Case C is brought into the group of organisations concerned with efficiency targets and there is a slightly broader spread of comments from Cases B and E. The regulator observed:

> *"What I have seen since I have been here is there seems to be a focus on regulatory failures in very small zones that can have a big impact in score and I have been quoted that if we have a failure of that in that zone it effects the OPA by some many points, whereas I tend to look at it and say well actually you have had five chloroform failures in this supply area, but it is not raising any alarm bells anywhere, because it is a big zone, so it is probably sitting there at 98% compliance."* (A6RT)

The regulator suggests that the OPA calculations may mask some underlying risk not picked up by the water service provider. The implication is that significant public health risk is missed as the organisation strives to meet regulatory efficiency targets.

The list of codes are subjective and qualitative in nature, however, it is clear that there is a shift towards a domination of terms such as "target driven" and "Strategy Planning" as well as "trade-offs" and "risk, operations and investment". The qualitative analysis of this limited number of interviews suggests "tone at the top" leans towards a target driven culture. Risk management and long term planning, while noted as a strategic business priority (Section 5.5.1) appear to be a secondary and of lesser importance compared to financing (Section 5.5.2). The drive for efficiency is reflected in the literature (Parker, 1999; Saal and Parker, 2001; Abbott, 2009) and, as discussed in Chapter 2, the efficiency performance calculations do not

necessarily take into account water quality improvements and/or underlying risks within the water systems.

The culture of reactive management

The strategic plans of the water service providers (Section 5.5.1) pointed to aspirations around the protection of public health and the environment. Many of the Directors emphasised the importance of long term planning (Table 5.10) with a total of 93 coded references across all transcribed interviews. Yet many of the actors felt that day to day decision making was driven by reactive management:

"Rather than taking a balanced approach we react to those situations in a way which is disproportionate to the level of risk" B1DT

And;

"We tend to employ, certainly on the front line, people who are fire fighters rather than fire marshals." B2MT

And;

"We're only barely able to come above water and meet our regulations." E2DT

And;

"it's actually been fixing failures, so there is a big cultural shift to go from a company that is about fixing things that are broke to being a company that identifies things that might break and deals with them in advance." A6MT

All these quotes are reflected in a frequency of coding at 65 (Table 5.10). The coding frequency is broken down by actor in Figure 5.7.

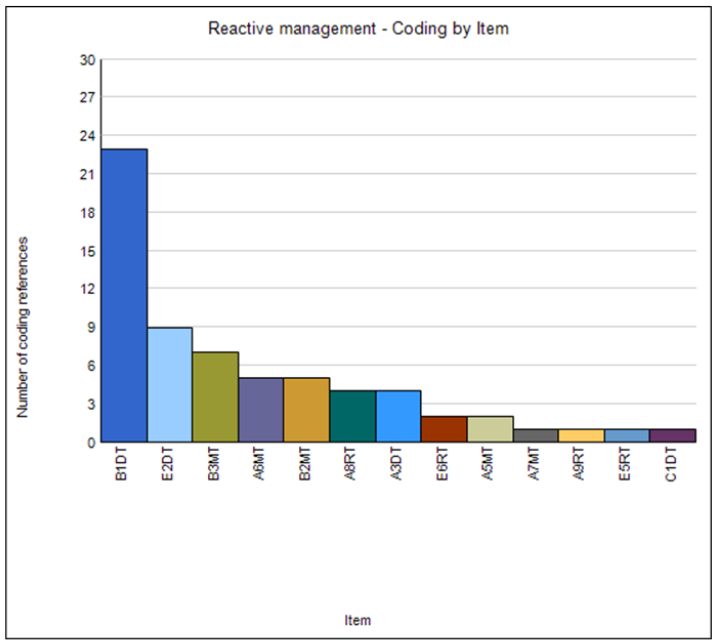


Figure 5.7 Frequency of coding related to reactive management

There is a spread of references across all of the Participating organisations with Cases A and B having the greatest number of actors refer to reactive management. Director B1 mentions reactive management with the greatest frequency. Meeting regulatory targets within financial boundaries influences reactive management behaviour as explained by Director B1:

"Where I struggle is that very often when cost pressures hit or we have an immediate problem we'll tend to merge into response to that which is in excess of what is actually required because we're very much influenced by our public perception of the organisation or by the threat of regulatory penalties." B1DT

And;

"Which obviously diverts resource away from areas where we might be at greater risk but which are less visible to our customers or investments at a strategic level within the business." B1DT

Director B1 makes the point that reacting to hear and now issues distracts from managing risks and diverts valuable resources from delivering the strategic plan; yet reactive management pervades many of the organisations involved in this study. What can be seen (Section 5.5.1 and 5.5.2) is that regulation and ownership arrangements provide a range of frameworks (OPA, charging mechanisms, etc) which influence the degree to which reactive management is adopted within organisations.

Summary

Customer experience, the drive for efficiency, reactive management appear to be features embedded in the management culture of the Cases of this study. Where the management culture *"can be characterised as a set of behaviours that been deliberately encouraged by management with the purpose of delivering the corporate objectives."* (Section 1.3.3). As discussed in this section (5.5.3) the drive for efficiency is linked to decisions about financing, charging mechanism and political influence. Creating efficient services is s strategic objective of most water service providers (Saal. *et al*, 2007; Ruester and Zschille, 2010) but does not always take into account incidents, quality improvement or longer term sustainability which means more breakdowns of the system are possible leading to a greater requirement for reactive management and *"Fire fighting".* In some cases (Case study E, Section 5.5.2) strategic objective such as pipe replacement are unfunded by the governing body which leaves

the business no choice but to act reactively (in this case to pipe bursts). Some actors noted that the activity related to reactive management is a distraction from what can be more serious risks that need attention (Quote of Actor B1DT above). Water service providers would benefit from promoting management cultures that are more focused on planning and pro-active management of risks, with a change of focus to emphasise the protection of public health more.

5.5.4 Risk Management

Risk management is the central issue of this thesis (Chapter 1 and 2). Accountability for risk management varies between and within the participating organisations of this study. Figure 5.8 (a, b and c) plot the frequencies of a range of codes split between the various actor groups (Directors, Managers and Regulators).

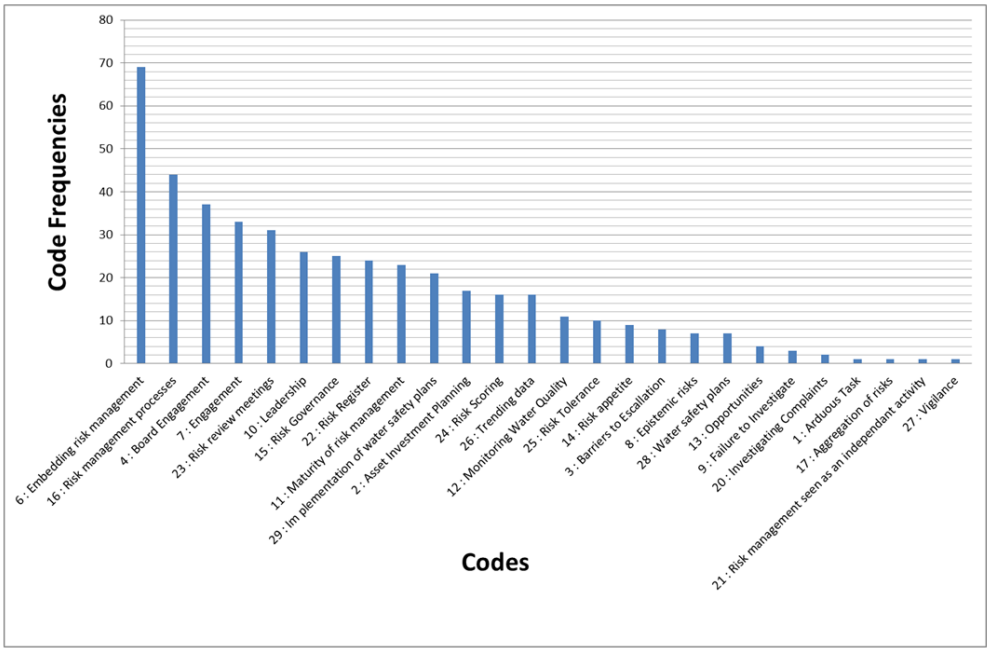


Figure 5.8 (a) Comparison of risk management related coding frequencies between hierarchal groups (directors).

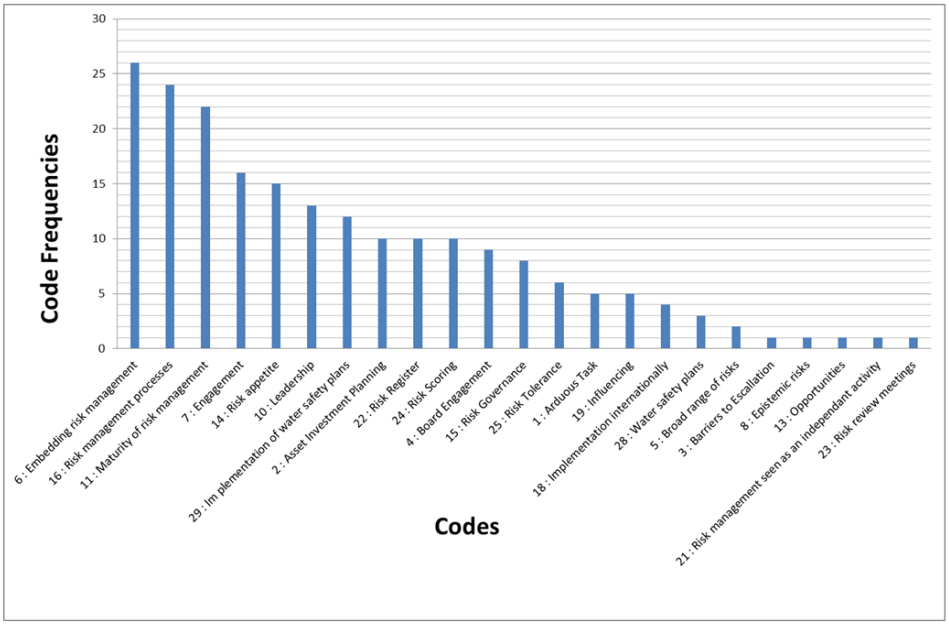


Figure 5.8 (b) Comparison of risk management related coding frequencies between hierarchal groups (managers).

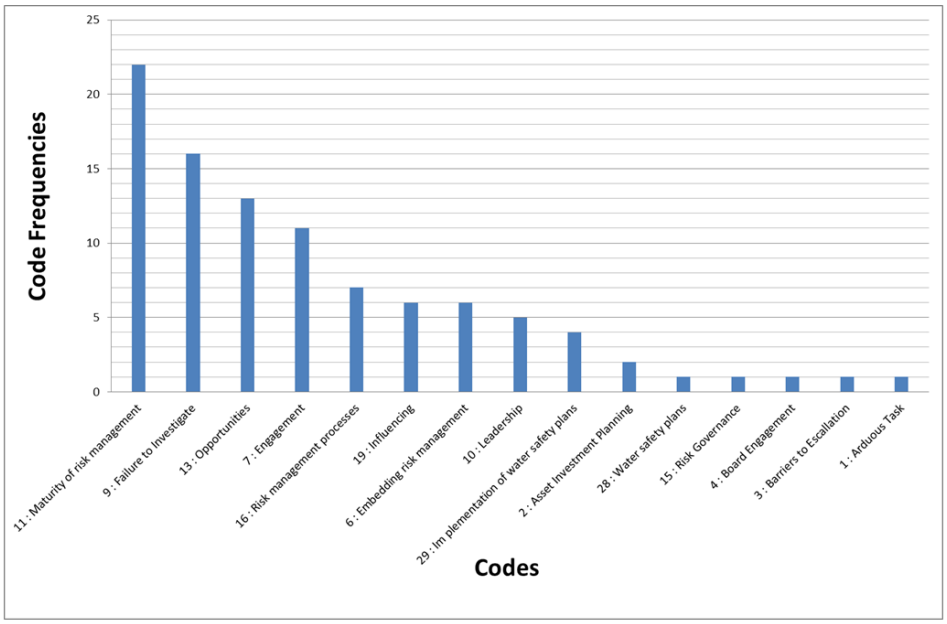


Figure 5.8 (c) Comparison of risk management related coding frequencies between hierarchal groups (regulators).

The code frequencies in the collated in Figures 5.8 (a),(b) and (c) together with the detailed comments of the actors were interpreted with regulators raised concerns with the weaknesses and lack of attention to ongoing risks, mitigation or risks and the application of suitable intervention. All of the board level responses discuss risk management and governance processes in detail, with the exception of Case D, who`s written response said;

> *"Risk management culture in [Case D] is between levels 2 and 3 of maturity: risk management is well engrained in the culture of some processes /departments, but there is still the need to move to a more integrated level."* (D1DW)

The response from Case D was limited and they did not provide any further evidence to support their statement that the organisation is between level 2 and 3 of maturity.

The boards articulate the risk management structures and processes within their organisations. As the conversation moves down through the organisations subtle changes are noted in the importance that actors place on the strategic objectives and approaches to risk management.

For example, the risk manager in Case C feels that, while risk management is taken seriously, the focus is on the cost to the business rather than a more holistic view.

> *"I think it's taken quite seriously at operational level in the organisation, people understand what it is. They've been through the workshops, they understand the risk register is not meant to be just ticking the boxes. It's a list of what I'm worried about, basically. Most of them understand that. At executive level it's a bit more difficult because they generally see the risks just in terms of their financial impact, "okay, how much is it going to cost me?*

You're talking about this risk and that risk, tell me how much it's going to cost." So it's a bit more difficult to make sure that they understand there are different aspects. You have reputation, you have environmental consequences." (C1MT)

Cases B, who are also private, note that;

"Well, basically what we have is central function of which I'm part, which has an analytics function. It's not a very big team, there's only three or four of us. What we do is we're like guarding the conscious of our risk process. And we work with every leadership team, both providing training and support to all our leadership teams. So what we do is we run workshops and monthly sessions to review risk, but we'll do dedicated bespoke training as well. And during that strategic risk process, we'll also review how we're doing against our risk policies. The board have signed up to stated risk policies in our corporate performance manual that states that all managing directors shall do this, and it literally states what the process is. But they are ultimately responsible for managing risk in their business. We effectively are a second line of defence and audit a third line of defence." B1MT

With both these privatised companies the maturity of risk management appears better than in some of the public authorities, for example;

"I do worry about the kind of drivers and objective settings they set the way that the business runs, it is almost like the law of unintended consequences, you set a target and you don't mean for someone to put the blinkers on and just aim for that target, but that's what happens and it causes two or three different problems for other people elsewhere or it's priorities the short term over the long term and I think we need to become more aware of what we are doing when we are target setting, I don't think we always take that into account." (A1MT)

and

> *"We don't know what our starting position is particularly, so we can guess where we think we are, but we don't actually know where we are at the moment, and we know where we would like to get to, to where our residual risk is ideally, but we don't know whether that's where our appetite is."* (A1MT)

Taken with evidence in Sections 5.5.1 through to 5.5.3, it appears that risk management processes are adopted but the ranking of risks (public health, environmental and operational) are lower than financial risk nodes (Figures 5.2 and 5.3). Middle management within utilities play a critical role in ensuring that risks are managed appropriately within the organisation through roll out of appropriate training, allocation of resources, monitoring compliance and reporting on near misses, events and incidents. In most cases middle management have a range of competing demands to contend with and have limited time. The focus at this level of the hierarchy within the business tends to be time bound to the financial year, compared to directors and senior managers that may take a longer term strategic view of the company. Delivering on performance targets set around financial, quality and operability metrics tend to be set as the most important priority. Within that context, risk management will take a "*back seat*" to "*in the moment business priorities".* In the organisations where the middle managers were interviewed it was noted many (if not all) are under pressure to ensure that they, and the organisation they represent, achieve success in reducing costs which is perceived as value for customers.

"I would say there is a kind of tension created by the drive for efficiencies and cutting costs, it means we stop doing things that we should rather than be necessarily efficient, so in some cases we don't comply." (A3MT)

The responses from some interviewees indicated a reluctance to escalate risks (in the sense of highlighting or drawing them to the attention of colleagues and superiors), as the perception is that this would be seen as a risk to success and would lead to some degree of personal loss (reputational or financial in most cases).

"We try get things fixed quickly before they need escalating but sometimes we leave reporting failure too late". A10OF

And;

"Often we just work around the problems rather than escalate them. Raising issues leads to blame, even if it`s not your fault." A11OF

And;

"The operators get hauled over the coals when things fail, so we avoid reporting issues when it`s easier to just get on and fix them." B5OF

Some critical current risks may not get escalated and may lead to a genuine failure in the organisation's operating system that could impact on the utility's ability to protect public health. This type of avoidance behaviour will also prevent, or at the very least slow down, a pervasive risk management culture within the organisation. The risk managers interviewed also found it difficult to get sufficient time with middle management to review the risks within their part of the business. The review of

detailed risk registers was largely seen as a *"chore"* amongst the management population. In order to keep risk management alive and relevant, risk managers should consider promoting process improvement and identifying opportunities that provide competitive advantage for the organisation. This suggests that, in the reality of day to day management, finances come before managing operational and public health risks.

Those working at the operational level were fully focused on current risks. In other words, the risks live within their operational remit. For example, aging membranes, sensor failures, treatment systems that were showing signs of wear (these are classified as the risk mitigation barriers of a multi-barrier system). In most cases, the operators did not use or recognise the corporate risk language and did not talk explicitly about risk. The examples given tended towards technical or engineering problems that, if not addressed, could lead to system failure.

"We have a number of turbidity meters that do not work, this has been reported but nothing gets done." B5OF

And;

"We have been asking to get new pH probes and chlorine meters but no one listens. We have had to set up local agreements to get what we need, by-passing the corporate purchasing systems, to get what we need." A10OF

The operators interviewed understood the impact and implications of a system failure for the treatment works under their charge. In general, operators were fully aware of the escalation protocol for emerging process risks. In some cases, escalation was

delayed because the operator felt they could rectify the failure before it became more serious and there was evidence to suggest that the individuals did not want to let the organisation or their customers down. The result of this failure to escalate quickly has resulted in many cases of treatment failure that could have been avoided. Figure 5.9 is a representation of some of the observations made from the interviews, and highlights the types of risk conversations that happen within the different levels of the water utilities involved in the study.

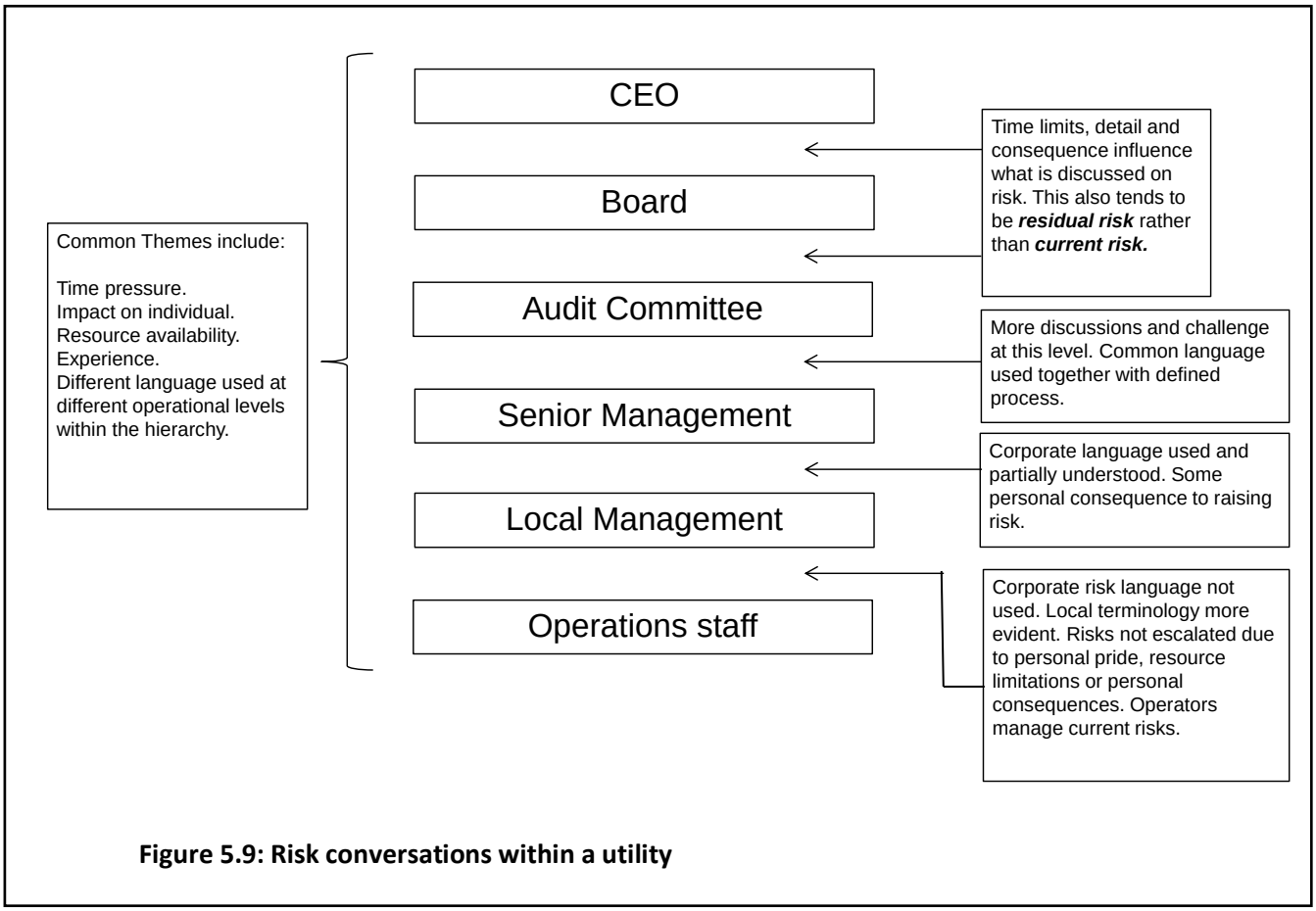


Figure 5.9: Risk conversations within a utility

5.5.5 Politics, ownership arrangements, regulation and risk

The analysis and discussion of the interview out-put and review of company documents has, up until now, centred on the ownership arrangements and risk management approaches taken within a variety of regulatory frameworks (North America and Europe). In the section the debate moves on to political influence on ownership arrangements, risk and regulation so that the interplay between these elements can be further understood.

As explained in Chapter 2 the debate over ownership arrangements for water utilities has been going on for many decades (Parker, 2012, Ruester and Zschille, 2010) and there are a wide range of ownership arrangements from publically owned utilities (for example Scottish Water) through to Private (English and Welsh companies) with a range of other arrangements in between (mutualisation, municipal, public private partnership, etc.)(Chapter 2). In each case the ownership arrangements have been set by political process that has been influenced typically by factors such as societal need, short term release of capital, drive for efficiency and water quality improvements. The political structure and the "will" of the people set the direction for many social services (health, education, transport, infrastructure, etc) and water services is very much one of these priorities. Privatisation of water, at its core, is a very contentious issue (unlike some other industries, mining, telecoms, electricity, etc) in that it is required to sustain life and it occupies a natural monopoly status (Parker, 1999, Parker and Sewell, 1988). However, when water service provision remains in the public sector it is open to an increased influence by the political establishment which

may introduce risk through lack of investment due to public sector limits on finance and/or access to capital markets (Section 5.5.2) or indeed when there is a need for political parties to seek votes and focus on other spending priorities (Section 4.4 and 5.5.1). The opposite of this is that a private water company can restrict access to water services to individuals who may not be able to pay the charges; the companies need to ensure a return to shareholders and this may lead to under investment and short term planning (less than five years).

Decentralised regulatory frameworks are becoming more common (Gunningham, 2002; Haines, 2011) as financial pressures on governments drive them to seek cost reductions within government at the same time as trying to reduce "red tape" in regulation for businesses. This contributes to the movement of regulation centrally out into more regional space and places the burden of risk cost back into the community or organisation (Gunningham, 2002). In addition to national government action, many water services have in fact evolved at a local level (for example Case E) and there is quite a push back on centralised control from the local governance groups. In the case of Case E, the regulator explains:

"The federal government has no mandated role in the provision of water service in the provinces of the territories. The reason for that is it is set out in the constitutional acts which sets out what the provinces are responsible for and what the federal government is responsible for, so the federal government is responsible for things like foreign policy, for the maintenance of the armed services, for provision of the high level courts, so the supreme court or [Case E] Country, that sort of thing." E6RT

And;

"It is a confederation so the provinces, rather more than the services, the provinces are considered to be autonomous."E6RT

Within Case E`s regulatory framework there are multiple government departments that are accountable for water regulation and this can lead to confusion and tensions:

"One of the major tensions I find is in [Case E]`s area is you have two regulatory parties, the department of environment and the department of health, and the differences in mandate between those two departments can cause some tension in terms of what's driving what. The health act typically trumps the environment act, but that's only where there's an immediate health risk." E5RT

And;

"There's always a little bit of tension between the municipalities and the water system operators on are we applying the legislation equally. Now, we do our best to work around that but where you have a large number of people dealing with drinking water sometimes that can be a bit of an issue." E5RT

These smaller decentralised systems are often operated by individuals who have multiple jobs and/or are part of the political establishment or governance system. These multiple accountabilities can often lead to conflict and risk:

"What you might hear is [municipality A] was issued a boil order advising but [municipality B] was not, under what they believe are the same conditions. So we do our very best to try to work with our medical officers at health and work with their

health inspectors to minimise that, but that is definitely something that causes a bit of contention that we have to deal with. And then where there's contention sometimes they go to their political advisors and it can end up being a political issue." E5RT

And;

"Fear of issuing a boil order. Sometimes, this is where we get the smaller politics, a mayor might tell the water operator "don't call health, we don't ever want to have to issue an advisory unless it's necessary. Oh, it's not really a big issue, so don't call health." Where our perspective is call us and we'll let you know whether or not. We're the ones that can do a risk assessment, so we'll let you know." E5RT

And;

"Often times they call we don't have to issue and advisory, but it's just a bit of fear of having an advisory issued. And again it comes back to when they have an advisory on, the municipality or mayor might find there'll be a lack of confidence in the public in their water supply systems." E5RT

This is very different to regulatory systems operating in Case A and B`s area where the regulators are largely independent of the political establishment and risk are reported by independent Public Health teams within the business. Risk would be reported at two levels; An event which could be classified as a near miss (for example treatment is in operation but the alarms have been deactivated); or an incident which may be classed as a failure (for example disinfection had failed). In the case of Case A and B the regulators would audit and inspect the business proactively and seek out

potential risks. The regulators would check the Water Safety Plans as part of the exercise:

"I have been really impressed with the audits I have been on so far with the knowledge and commitment the operators" A8RT

And;

" I think they probably have an awareness of what safety plans are, but in terms of how that relates to their day job, I think there is still a kind of disconnect there" A9RT

Political decisions around centralised or decentralised regulation will drive behaviours around risk management. The evidence here corroborates the observations of Gunningham (2002) and Haines (2011) in that while centralised command and control regulation is not the ideal solution, too much autonomy at a local level will not support effective regulation. The examples given by Cases A, B and E suggest that regulators should be independent of political influence, have sufficient powers of enforcement and be pro-actively auditing and checking operational practise.

The elicited responses also suggest political influence may be contained at a local level and/or change the operating principles of larger organisations very quickly and unintentionally. Whither at the local level or at a regional or state level, unexpected change through political process can have a significant impact on the risk profile of the organisation and the actors interviewed were very aware of the political influences and this is reflected in the frequency of coding on this issue (Figure 5.10).

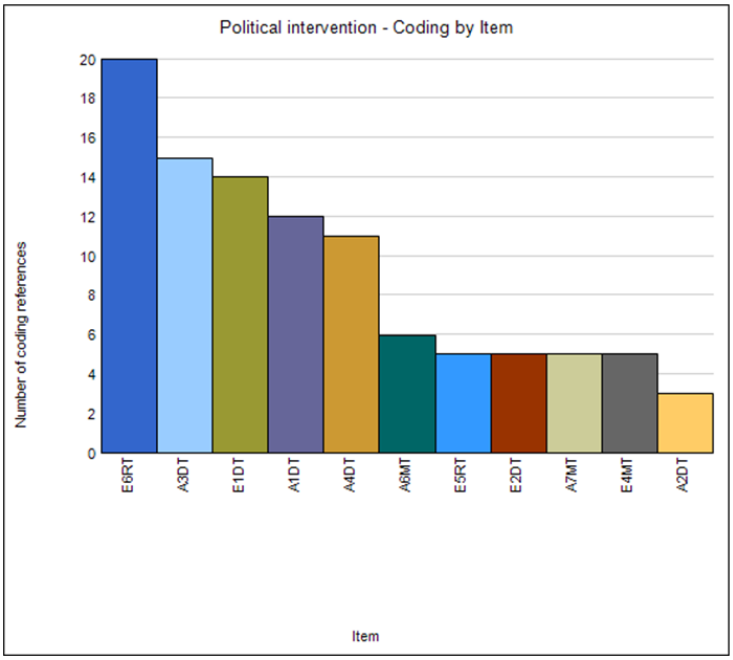


Figure 5.10 Frequency of coding related to Political Intervention

Taking the example of Case A, the political owner decided to hold customer charges in 2011 which was counter to the existing regulatory contract (Section 4.5 and Section 5.5.2). The risk manager of the organisation observed the sudden change to the financial stability of the organisation:

> *"I think then you get the kind of other key risks are probably around the financial, so the inability to meet our finance and requirements, whether it be bad debt, whether it be borrowing, whether it be revenue streams, or the fact that we have no other source of getting money other than the customer and the government at the moment, that might be a high risk for us going forward given the political and economic environment."* (A1MT)

The same actor observed:

"Similarly, recently we have been dragged into conversations which I don't think we would naturally assist in those conversations, so we have had examples where a company that we use is having financial difficulties and because that company is sitting in a constituency of a senior politician, all of a sudden we are being dragged into conversations in order to keep a particular company alive, whereas, we would maybe be looking to protect our interests to go to a second or third party in order to ensure the continuity of the service that that customer provides us, all of a sudden we are being asked not to do that, and again that's an uncomfortable position to be put in for any company, there is certain situations like that." (A1MT)

Some of the senior management and directors understand the political impact on the business;

"I think the bigger problem for us as a company operating in public ownership arrangements is of being constrained by public pay policies because we are actually being regulated in a comparative world to private sector, we're not able to shall we say offer the same terms and conditions and incentives that maybe the private sector can offer." (A4MT)

And;

"There are reputational risks for us in all of that as well, because we have very clear objectives laid on the business, and that's the ministerial direction with regard to objectives in the regulatory price review period is an obligation on

the Directors of [Case A], that is quite a difference to the privatised companies, who can make I think, a little bit more freedom to make choices of what they deliver and when." (A2DT)

The same is true for other organisations.

"The context of [Case D]`s reality is as follows: [Case D] is a self-funding company; one regulator sets out the performance objectives but these are for benchmarking purposes only (no fines or similar are set if the performance objectives are not met); another regulator approves the tariffs. In other words, the regulatory priorities set out by the regulators (acceptable increase in the tariffs justified by the achievement of good performance indicators) have no direct link with the funding model." (D1DW)

And at a small local level politics can have a more personal impact;

"Generally, if the official falls out with [Case E]`s officials they get sacked. It's like going back to the 1950's in the United Kingdom, if you think outside of X, Y and Z, all the wee towns that have their own drinking water systems now somehow tried to deal with the local authority, or rural farms is another example, probably a better example, where there is outsiders, where you have got the big multi-nationals, it's the municipality that is responsible for everything." (E1RT)

This can be compared to the two predominantly privatised companies looked to manage the relationships with the political and regulatory stakeholders.

"There's a lot of tensions there, that exist between different facets of the organisation and different accountabilities for the relationship with various stakeholders. A lot of the external stakeholder management including financial regulations, we have a single director of finance regulation who has accountability for maintaining stakeholder relationships with a number of key stakeholders. Obviously regulatory stakeholders are managed by the regulation team, although mainly the economic regulator." (B2DT)

At a global scale some organisations work positively within a range of political environments, delivering best practise:

"And OFWat has recognised that and there's a lot of talk now about tot-ex, total expenditure, where I think operating costs are going to be a lot more scrutinised and a lot more taken into account in the overall mix. So you won't have "free" capital expenditure. So that's our second big area, is on capital delivery, but particularly looking at how we can help water companies with the tot-ex challenge. And the third area is around smart networks which is in Shanghai, actually, part of Shanghai, [Case C] has built a water distribution network which is using the latest monitoring technology and you can more or less tell where every litre of water goes in the network. It's sort of like a real-time analysis of your network." (C1DT)

Summary

Politics does influence regulation and ownership arrangements. The qualitative evidence suggests that perhaps both political influence and ownership arrangements of water utilities can act favourably together but at the same time it is easy to build in unwanted risk if short term and/or local priorities are placed ahead of sustainability and public health accountabilities. It is likely that public ownership arrangements of water utilities will be successful if political interaction is limited. Regulation should also be independent of politics (Parker, 2012 and Section 5.5.5) with the remit very well defined (Gunningham 2002 and Section 5.5.5). Privatised models may drive short term efficiency gains under some operational and geographical conditions however they may put shareholder value ahead of longer term sustainable investment in infrastructure priorities. Privatised companies may well have access to capital which enables them to invest in innovation (for example smart networks in the example above).

Chapter 6: Discussion

6.1 Introduction

Chapter 6 discusses the outputs and learning from the case studies presented in Chapters 4 and 5 together with the insights gained through the literature review. A synthesis of the evidence provides the basis for improving understanding of the interplay between regulation, ownership arrangements and management culture and their influence on approaches to risk management.

An exploration of the literature landscape (Chapter 2) exposed a richness in studies whose primary focus was the effectiveness and efficiency of water service providers (Richardson et al., 1992, McGuinness and Thomas, 1997, Bakker, 2003a) with many seeking to understand the merits of ownership arrangement variations on the efficiency of service delivery (Parker, 1997, Parker, 1999, Saal and Parker, 2001, Renzetti and Dupont, 2003, Renzetti and Dupont, 2004, Ruester and Zschille, 2010). This is understandable given the broader public debate on the wisdom and benefits of privatised water services. The review identified that few had considered the impact of regulation, ownership arrangements and management culture on risk management. Other literatures examined the influence of regulation on risk perception and management (Haines, 2011b), which have recognized and articulated a rich landscape of influences on risk environments and management response preferences. Additional contributions in this area have sought to benchmark risk management capability within the international water utility sector (MacGillivray *et al.,* 2006; 2007a,b; 2008) and exploring operational antecedents of good risk governance in the

sector (Hrudey *et al.,* 2006; Summerill *et al.,*2010a,b). This thesis contributes to these findings through developing a qualitative understanding of the priorities of executives, middle management and operators who manage and enact risk management processes. The study revealed that there were changes to the risk language and conversation within the business and between organisations that operate under different regulation and ownership arrangements (Section 5.5.4).

6.2 Discussion of Phase I findings

Phase I comprised of a limited set of interviews with a number of actors who hold strategically important roles in Organisation A and the regulators office. The transcripts were analysed using methodology described in Section 3.10. Table 4.3 lists some of quotes (relevant to the coding themes) and the coding frequencies for each group of actors.

Funding (Sections 4.4.1 – 4.4.3) and politics (Sections 4.4.2 and 4.4.3) are themes which reoccur through the interviews. Both funding and politics are intrinsically linked to ownership (Section 4.4.3) and as discussed in Chapters 1 and 2. There has been a great deal of interest in the relative efficiencies of public sector operated water organisations compared to their privately operated equivalents (Braadbaart, 2002, Bel and Warner, 2008, Gonzalez-Gómez and García-Rubio, 2008, Abbott and Cohen, 2009). Other contributions (Parker, 2003, Renzetti and Dupont, 2004, Chenoweth, 2004, Dassler et al., 2006, Saal et al., 2007, Martínez-Espiñeira et al., 2009, Walter et al., 2009, García-Rubio et al., 2010) debated the merits of privatisation and many of these studies came to the conclusion that there was no

clear trend in efficiency improvement when it was related to ownership arrangements. There were various reasons reported for this such as geography, age of assets, raw water quality variations and the fact that water services were considered natural monopolies (Rodriguez, 2004, Ruester and Zschille, 2010). Yet the respondents of organisation point to incentives (Section 4.4.2) designed to enact behaviours of those seen in "*an equity owned company" A002.*

Post the 2008 banking crisis, many countries are operating under austerity measures which imply reduced spending on public services. The constraints on capital and the cost of regulation influenced a move away from centralised command and control regulation (Gunningham, 2002) together with the political *"Currency of votes" A002* is influencing politicians` decisions to reduce red tape, reduce regulatory resources and push the burden of managing risk back into industry (Gunningham, 2002, Haines, 2011). The additional risk management considerations for business may move them towards their risk tolerance (Section 1.7.4) threshold without the time or opportunity to apply appropriate risk management systems.

In organisation A`s case this lead to the political decision in 2011 to overrule the price setting in the regulatory contract (section 4.5) influencing investment choices mentioned by the regulator (Section 4.4.3) and the other actors (Sections 4.4.1 to 4.4.3). The shock changes to cash availability will have an instantaneous effect on the risk tolerance (section 1.7.4) of the business. In the case of Organisation A, an £80m shortfall (Section 4.5) will reduce the risk tolerance by this amount and bring the risk appetite (Section 1.7.4) closer to the tolerance value. The consequences are that the

business is more cash constrained and need to deselect investments in projects and operational activity which have the potential to increase operational risk and risk to public health and the environment (Section 4.4.2 and 4.4.3). This is further discussed in Chapter 6.

In Organisation A`s case, public ownership has advantages in being able to plan investments and risk mitigation measures (Section 4.4.2) but political decision making (Sections 4.4.1 to 4.5) and management incentives (Section 4.4.2) lead to reactive decisions and choices that conflict with regulatory objectives (Sections 4.4.1 to 4.4.3).

Phase I of this study, while limited to one principle organisation, has exposed a number of qualitative elements which are significant to the actors involved in delivering and regulating water services. These include:

- Sustainable financing of the service.
- Political decisions which cause material changes to financing resulting in reactive action and risks to investment and operation, leading to a higher than planned exposure of risk to public health.
- Decisions leading to shock reduction in capital will reduce the business` risk tolerance.
- The regulator sees some activity around water safety planning (WSP) (Section 4.4.4) and wants to see more alignment between WSP and investment choices going forward.

Table 6.1: Summary of Interview themes and perceived importance to respondents

		Regulator		Directors		Managers	
Primary Code	**Sub-Code**	Number of References (n)	Example Statement	Number of References (n)	Example Statement	Number of References (n)	Example Statement
Regulation	Collaborative	6	There are many other ambitions that are determined through discussion with Organisation A and the regulator and generally consensus. (Section 4.4.1)	4	the commission is saying to us: 'Now right, Organisation A, you go and own and develop a strategy, you put forward your plans and your propositions, you put forward your assessment of how you can improve service and how you can improve efficiency." (Section 4.4.1)	4	In my view organisation A's ambition for its customers coming through stronger rather than just being there to do what we're told, let someone else interpret. We're now actually trying to influence and shape the impact of regulations (Section 4.4.1)
	Objectives	5	Some of the organisations ambitions and approaches are very clearly defined by regulatory objectives. (Section 4.4.1)	7	Arguably the only reason Organisation A came into being was because of regulatory objectives. (Section 4.4.1)	6	I think the first four to possibly eight years of our existence right up to 2010 a lot of our ambitions were actually shaped by regulatory objectives. (Section 4.4.1)
Ownership	Political	9	I do find the endless political debate over Organisation A`s future fairly unhelpful. I mean we're seeing it in this current election in the manifesto, the future of Organisation A and the way it's funded is endlessly debated. We are starting to see Organisation A valued for the good company it is and in the potential of Organisation A being seen. All these questions over its future can only serve to make that harder I think to realise the benefits. (Section 4.4.3)	11	the ownership model for us inevitably brings politics pretty close to where we're at and the political debate around success or failure. I think you've seen an example in Northern Ireland over the winter 2010/11 winter when Northern Ireland got into some difficulties, that the form of ownership immediately made that a very political issue for them. (Section 4.4.2)	10	if the ministers shrink the size of the investment program, how many of the things that fall out of the program or objectives will affect the delivery of the Organisation A`s vision? Now, one assumption might be that they can delay some of the statutory programs but it's more likely that the ministers will delay the discretionary stuff like pressure for customers etc. which will give us a reputational problem with our customers given that that's our highest priority. (Section 4.4.3)
	Incentives	10	in Organisation A things are much more pigeon holed financially and things need to be agreed well in advance for future investment periods. If that money hasn't been set aside for a particular project then it gives Organisation A great difficulty. So there are times when we will use enforcement notices or the threat of prosecution to bring about the improvements we want but historically that has quite often been at the expense of another project rather than just the money being absorbed by the business. (Section 4.4.2)	11	we don't have the explicit equity incentives, but we have tried to mirror the incentive properties of an equity owned company that would apply to the managers of an equity owned company in the sense that we've got quite significant personal incentives in place for the sort of top 40 senior people in the business who can typically add anywhere between 25-50+% to their base enumeration through the achievement of demanding performance targets. (Section 4.4.2)	9	I think where the public and the private sector differ, certainly in the UK, we have in Organisation A, because we're in the public sector, much more reputational incentive than we would perhaps have in the private sector with private shareholders. One of the things that drives us as well as the sort of stated incentives in the regime is the number of complaints in the minister's mail box, (Section 4.4.2)
	Shareholders	0	No Response	4	Regulators normally say that actually public sector, within the public sector model you can't mimic the shareholder pressure and it's very hard for us to comment on that because we haven't felt the shareholder pressure but the incentives within both industries are broadly aligned in terms of what's got to be achieved for customers and what's got to be achieved for compliance and from a compliance point of view, what's got to be achieved for the environment or for drinking water. (Section 4.4.2)	2	I think actually shareholder models drive short-termism and quick returns and as a consequence I think there are merits in public sector ownership that don't exist in private sector and probably there are merits in private sector that don't exist in public and probably by bringing economic regulation to our ownership model, we are trying to mirror some of the benefits of the private sector model within a public sector environment. (Section 4.4.2)
	Funding	11	the key difference is with the investment side of things. In a PLC there seems to be more flexibility or I perceive there to be more flexibility in terms of funding arrangements. If the regulator says something needs to be done then the money is found. (Section 4.4.2)	9	We had a specific target to achieve by 2005/06, the last year of that first regulatory period. And it almost felt in the business that there was no future beyond 2005/06, it was could we get to the OPEXs target for that particular year and initially that looked very, very daunting. So the whole focus of business was one, to achieve OPEXs target set by the regulator, but two, it was, even from mind-set angle, it was set on this regulatory period, there was no sense of the business beyond 2006. (Section 4.4.1)	7	I'm not sure it's a form of ownership that is as important as how the company is financed or it's available access to financing. I think you should look at the models in England and Wales of privatisation. That was purely around securing capital from the markets to invest in large enhancement programs. (Section 4.4.2)
Governance	Process	9	I think in terms of churning out water safety plans as an exercise in project management, Organisation A`s done an excellent job, a really excellent job and we've nearly got our full complement of plans. But I think in terms of actually producing something that was meaningful in terms of protecting, well identifying risks to water quality and protecting consumers I think the early plans were somewhat lacking. (Section 4.4.4)	11	I think we are a business that is very strong on governance. I'm not saying that there aren't areas that are maybe under-governed but generally we have a very strong governance framework from board down, real clarity on who is accountable, the board, what gets handled through the board, committees of order and remuneration, what's delegated to the executive team, to functional director and then down through the management ranks. (Section 4.4.5)	8	I should say we look at both risk and opportunity, but we do look at the risks that we're running, we look at the impact that they might have and we look at the likelihood that they might come up. We do that at the corporate level we do that for each directorate and we do that for the big processes and the big project across the business. (Section 4.4.4)
	Decision Making	7	I think we're all very keen to move away from the failure driven compartmentalised drivers that have been used in the past to drive investment to something that's better thought out where different risks are evaluated against each other. (Section 4.4.4)	9	You do start to put an indicative level of value against an emerging risk and you track it closely to the point at which you would want to build it into your LBE, Latest Best Estimate, of value of the programme. Once you get past that emerging stage we deal with risk in the capital programme at three levels. (Section 4.4.4)	10	we do some Monte Carlo simulations and everything else around that that eventually comes out with a view that what numbers are the eighty percent probability of it costing less or twenty percent probability of it costing less and what number have we bid (Section 4.4.4)
	Accountability	6	The buy-in from particularly local asset planners has grown. I think there's still some work to do in the accessibility of the plans but they're aware that the water safety plan is the way to secure investment to address water quality risks. (Section 4.4.4)	12	There's a good degree of governance around that and sign off by operational colleagues as well as by people in my team at the time of saying we've concluded on a particular type of asset to be built to solve this problem. We then proceed with that project. (Section 4.4.4)	5	And I think we confuse governance and management, instead of the start. I think we've created far too many steering groups and control groups that actually get in the way of people doing their job but they've become a crutch to people and if you remove them now people will think they're being hung out to dry or something daft like that which, it would be the intended but it could be the unintended consequence (section 4.4.5)
Risk Management	Economic	7	Organisation A can't possibly deliver everything that it needs to deliver well in any financial climate really. Consequently Organisation A has to make some quite tough decisions between, equally valid spending areas, areas requiring funding. (Section 4.4.3)	11	Business risk of securing our revenue which is a little bit harder now with business separation and with a retail set up in the wholesale world which is about £300 million of our income per year not under our direct control. It has caused us an issue in the year just ended where the wholesale revenue was less than we'd budgeted for in the year. There's no regulatory recourse on that, that's a risk that we take. (Section 4.4.3)	9	I think one of the biggest risks that we have at this point is whether the government will continue to lend to us. The government have already withdrawn the ability for us to borrow for the 2011/12 year. It has committed to lending to us to the full extent set out in the final determination over the 11-15 period, but just not in the 2011/12 year. So that means that the 140 million that was due to be lent to us this year is deferred. (Section 4.4.3)
	Political	12	I would actually have political interference down there as well. It's something I've seen first-hand in dealing with the bursts over the winter period. The government certainly the current encumbrance are very keen to be seen to be actively managing issues. (Section 4.4.3)	12	We have an owner in the Organisation A whose currency of value is different to that of private shareholders. Private shareholders primary motivations is the maintenance and growth of the value of their investment in the water company. Typically investors into water companies are looking for a reasonably low risk but predictable return from their investment. Our shareholder in the Government, the thing that matters most to them is the currency of votes. (4.4.3)	11	we have an operational sort of satisfactory relationship with the government and actually continuing to have the freedom to operate even though we are within the public sector and that means a lot to us. So it's actually, it drives certain decisions, it drives behaviours because we want to make sure that reputationally we don't lose any ground with the government or with the customers that much which would then drive back to complaints with the minister. (Section 4.4.2)
	Public Health	14	The regulator will try and push Organisation A much more to own its own risks on water quality rather than waiting for the regulator to come and tap them on the shoulder and say "Look, this needs something doing about it." (Section 4.4.3)	5	The most obvious risk is the risk of failing to provide a continuous supply of water that is fit for human consumption. As a business there is providing a product that is relatively continually ingested by customers right across the country, from many hundreds of different water sources and treatment plants. We are required to make sure that water is fit for consumption at all times (Section 4.4.3)	0	No Response

6.3 Discussion of Phase II findings

The Phase II activity highlighted that ownership arrangements, regulation and management culture do influence risk management activities (Section 5.5) in a number of ways. Explicitly the choices made by the political, institutional or governance bodies will impact on the financial stability of the water utility by altering charging mechanisms and access to borrowing (Section 5.5.2 and 4.4). This will enable or impede (dependant on the aspirational capital program, assets condition, number and scale of assets and operational interventions). Political influence can act to support or impede the sustainability of the water utility (Section 5.5.5) as can private ownership arrangements (5.5.2). What is perhaps important is the leadership capability of the water utility in managing the complex array of external influences on the organisations ability to protect public health by sustaining drinking water and waste water services (both quality and quantity) (Section 5.5.3). The organisation should be mindful of the leadership choices that will help inform, determine and, as a consequence, manage the risks facing the business (Section 5.5.3 and Section 5.5.4). Risk management will be enhanced if all personnel within the water utility are clear on the meaning implied in risk conversations (Section 5.5.4) and are fully engaged in designing and implementing the risk mitigation measures. Water service providers strategic, regulatory and political objectives are centred around provision of safe drinking water and protection of public health, however, the rankings and importance placed on operational and public health risks are lower compared to financial risk (Section 5.5.2). There is a disconnect between what is laid out in the strategic business plans and what is delivered on the ground by managers on a day to day

basis. While risk management processes exist there is little evidence to suggest that risk mitigation measures have been costed and that risk has been properly ranked within the context of the operability of the water service providers (Section 5.5.4).

6.4 Regulation and risk management

Water service providers aspire to deliver safe drinking water and sanitation (Section 2.2) with regulation providing a national or local framework for delivery of water services (Pollard, 2008). The outcome of the literature review recognised that the majority of studies pointed to a lack of consensus around regulation of water services, noting variations on geography, social and political views as possible influencing factors (Bakker, 2003a; Cubbin and Stern, 2004; Reuster and Zschille, 2010). Financial factors also influenced choices in terms of central command and control regulation versus devolved local regulation (Haines, 2011; Gunningham, 2007). It was noted that regulatory frameworks influence risks to service and efficiency of operation (Reuster and Zschille, 2010; Parker, 1999).

The initial question in the interview designed for the Phase I case study sought to understand how the regulation influenced the objectives and ambition of the organisation while validating the organisational approach to regulation (Table 3.3). In Phase I, regulation was influential in defining the water service provision model (Section 4.4.1) where the regulator pointed out that the water service provider`s (Organisation A) ambition and activities are defined by regulation. There was clearly some discussion between Organisation A and the regulators to define targets but the directors and managers both felt that the organisation was planning to go beyond the

regulations in terms of improvements to water quality, operational efficiency and customer experience. The introduction of OPA drove greater ambition within Organisation A to make efficiencies (in terms of reduced costs) and the regulator had concerns that the organisation would over look some basic quality issues. As one director said *"the whole focus of the business in 2006 to 2010 suddenly changed from: "yes we need to become more efficient but actually all about improving our customer services measured by OPA".* This sudden shift in management behaviour did not appear to take into account the risks to water quality as highlighted by the regulator in the Phase II discussion (Section 5.5.3).

In Phase II (Case Study E) raised concerns that the regulators were not independent enough and there was evidence of some political pressure to not report failures (Section 5.5.5). The regulation of water in Case Study E`s country is decentralised, multi-sector and administered by a number of independently operating departments. The difficulties in enforcing the regulations and, as a consequence, the risks to public health suggest that accountability and independence of the regulator needs to be very well defined. The regulators need to have independence and the ability to enforce regulation if risk management measures are to be effective.

The case studies supported the literature (Parker, 2000; Saal and Parker, 2001; Saal and Reis, 2004; Renzettie and Dupont, 2010) suggesting that efficiency targets were the focus of water service providers driven by regulation (Gunningham 2007; Haines, 2011) with risks to the regulators authority when devolved to a regional or local level (Gunningham, 2007, Baldwin, 2012).

While some regulatory frameworks are developed to define the economics of operation and capital investment (Pollard, 2008), attention needs to be paid to the consequences for water quality and safe sanitation (Hrudey, *et al*, 2006). The output from Chapters 4 and 5 suggests that regulation for water services needs to be defined and costed on the water quality and sanitation challenges, if risks are to be managed appropriately. Regulators may consider defining service targets which have an emphasis on water safety planning (WHO, 2004) which informs the financial requirements. This should improve opportunities for effective risk management. The principle focus on efficiency was a feature that re-occurred when considering ownership arrangements (Section 6.4).

6.5 Ownership and risk management

The economic performance of a variation in ownership arrangements is widely debated (Richardson, *et al., 1992;* McGuinness and Thomas, 1997; Bakker, 2003a, Saal, 2007; Renzetti and Dupont, 2003). Few of these studies took into account the consequences for risk management. Arguably, the principle objectives of the water service provider are the delivery or safe drinking water and sanitation (Section 1 and 2.2). The WSP approach (discussed in Section 2.1) provides a mechanism to identifying and mitigating risk within a water system. Importance is placed on risk management interventions supporting delivery of safe water and sanitation (Pollard, 2008; Davidson and Deere, 2005; Hrudey, 2001). The actors associated with Organisation A were asked questions to validate their understanding of the risk strategy within the organisation (Table 3.3) to determine how important WSP was to ensuring day to day delivery of safe water. The introduction of incentives for senior

managers, promoting "private sector" behaviours is not reflected in the body of research (Chapter 2), which suggests public sector and private sector organisations perform equally well (Renzetti and Dupont, 2003; Dore *et al., 2004, Bel and Warner, 2008;* Ruester and Zchille, 2010). Other studies (Saal and Parker, 2001; Saal and Reid, 2004; and Saal *et.al*, 2007) point to factors such as price caps, raw water quality and water services occupying a natural monopoly position as factors influencing the effectiveness of the water service provider, rather than ownership (Section 2.3). A range of ownership arrangements were considered (Section 5.4). Table 6.2 summarises the ownership arrangements of the participating organisations.

Table 6.2 Ownership arrangements of the case study candidates

Country of Case	Ownership arrangements	Services Covered	Regulatory Framework
United Kingdom	Public ownership arrangements	Water and Waste Water: Assets owned and operated.	Local Regulation based on EU Directives.
United Kingdom	Private ownership arrangements	Water and Waste Water: Assets owned and operated.	Local Regulation based on EU Directives.
France	Private ownership arrangements	Water and Waste Water: Assets operated but not owned.	Multi-national company operating in a number of countries with a range or regulatory frameworks.
Portugal	Public ownership arrangements	Water: Assets owned and operated.	Local Regulation based on EU Directives.
Canada	Public ownership arrangements	Energy, Water and Waste Water: Assets owned and operated.	Provincial Regulations aligned to Federal Law.

The case studies provided a range of ownership arrangements and services that operated under a variety of regulatory frameworks. The variation of ownership arrangements offers an insight into the potentially different approaches to risk management associated with delivering core water and waste water services.

The review of the business plans highlighted that, regardless of ownership arrangements, there were aspirational strategic objectives centred around water quality improvement, customer experience and environmental stewardship (Section 5.4 and 5.5.1). Supporting these objectives were (in the majority of cases) investment plans that had a range of time horizons from annual to five years (Section 5.5.1). The balance between financing operations, capital investment and capital maintenance varied between organisations and was limited by the institutions ability to raise funds through customer tariffs, government borrowings and/or capital markets. The value of "cash in the bank" or reserves varied greatly (Tables 5.4 to 5.8) and this monetary amount, when taken in the context of the number of assets that the organisation requires to operate, give some insight into the risk tolerance that the can be borne by the institutions. The risk tolerance here (as described in Section 1.7.4) is taken to mean the organisations financial capacity to bear the cost of a risk or risks without going bankrupt or needing a bail out from an institute or government and excludes difficult to measure psychological aspects of risk tolerance and appetite. Most of the Cases in the study only presented aspirational risk appetite statements (more psychological in nature) which included reference to causing no harm to human health or the environment. The issue for the water service providers is that there is no evidence to suggest that they have costed out a range of scenarios for various operational risks (Section 5.4-5.6), all of which may cost substantive amounts of money to resolve reactively and put stress on capital reserves irrespective of risk appetite statements (Section 5.5.2). It would be to the water service providers advantage to invest some resource into fully costing out the impact of risk on the

financial capacity of the organisation, removing in the first instance at least, the more psychological elements of risk impact. It is the access to capital reserves which is a principle differentiating factor of ownership arrangements (Table 5.12). By considering the investment of capital as a solution to mitigating the primary risks of public health and environment the organisations will start to priorities risks that are more in-line with the aspirations laid out in their business strategies (Section 5.5.1). The more epistemic (and psychological) aspects of risk appetite/tolerance can then be layered upon a baseline measured set of values for risk appetite and tolerance.

6.6 Management culture and risk management

The influence of risk management culture on risk management strategy has been a consideration within previous bodies of work (Macgillivray *et al*., 2006; Pollard, 2008; Summerill *et al.*, 2010b) and is of interest to this study (Chapters 1&2). Competing demands on staff within organisations leads to prioritisation of objectives (Section 2.4). In Phase I and Phase II, the actors were asked to comment on the priority given to risk management within the context of competing business objectives (Table 3.3 and 3.4).

Section 2.4 discussed some of the behaviours, cultural features (Johnson, 1992; Drew and Kendrick, 2005; Baumgarter, 2009; Rizak and Hrudey, 2007) and interplays between governance, regulation and risk (Laeven and Levine, 2009). Studies such as McKenna and Martin-Smith (2005) emphasised the importance of leadership in decision making when operating within organisations that have complex adaptive systems and domains of high uncertainty (Tetenbaum and Laurence, 2011). The

conversation with the actors sought to establish the appropriateness of the risk management processes/governance (and leadership) of risk management required to ensure the delivery of safe water and sanitation within the stewardship of Organisation A (Table 3.3).

Regardless of regulation, ownership arrangements, politics and other influences; ultimately it is individuals who make choices within the boundaries of a set of parameters that lead to the success or failure of a business. Of importance here is the clarity of vision and the leadership messages (George *et al.*, 1999, Chatman and Eunyoung Cha, 2003, Furash, 2003, Bal, 2008, Baumgartner, 2009, Bacon, 2010). Irrespective of regulation and ownership arrangements, if the leadership do not see risk management as important then the staff (and therefore the culture) will not embrace risk management principles. The evidence from the case studies suggests that the majority of board members and senior managers see risk management as an important feature of business decision making (Section 5.5.4). however staff`s interpretation of "risk" within the organisation may differ and some evidence suggests that target driven organisations see risk management as yet another box to tick rather than risk management being part of a wider decision making strategy (Section 5.5.4). Some evidence suggests that within organisations there are a range of views on how successful risk management is applied and in some occasions managers confuse meetings with good governance (Section 4.4.5).

6.7 Summary

The case study evidence suggests that regulators need to be independent of political influence and control if they are to deliver the appropriate incentives to drive the water service providers to protect public health and the environment. Ownership arrangements when considered with financing of services influence management culture. The more common behaviours of water service providers (Evidenced in Case Studies A,B and E) suggest a reactive management culture which is promoted through limits on financing and therefore efficiency targets delivered through reductions in resources (normally staff reductions). Case Study E presented evidence (Section 5.5.2) which suggested that the income generated through customer charges was significantly lower than the cost of the service per cubic meter. Case Study A and E highlighted tariff setting and, in particular, keeping customer charges as low as possible, as being a significant political driver. Customer charges should be set independently to ensure service levels are achieved and risks within the water systems are appropriately managed.

Figure 6.1 applies the learning from the case study work to the study framework developed in Chapter 2.

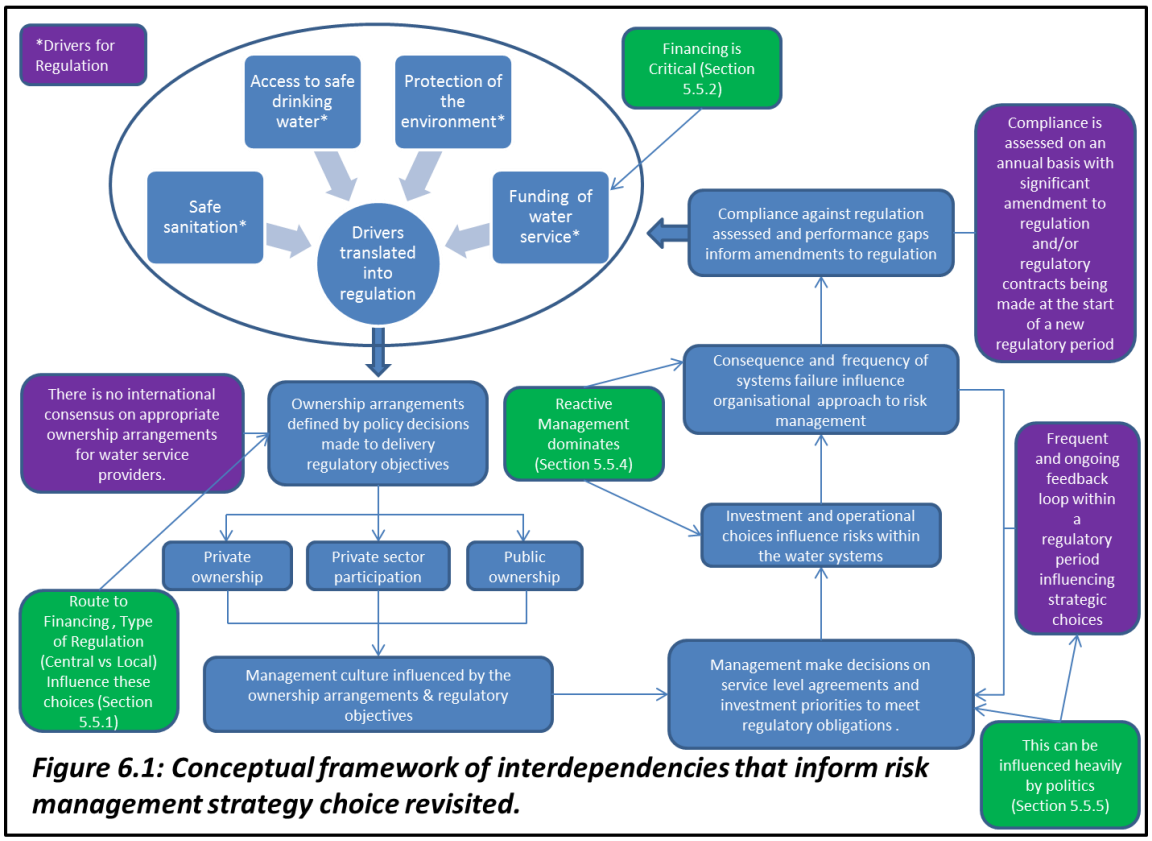


Figure 6.1: Conceptual framework of interdependencies that inform risk management strategy choice revisited.

Overall the research supported the literature by confirming:

- Performance (efficiency) of the water service provider is not dependent upon ownership arrangements (Section 5.4, 5.5.2) supporting, for example, Renzetti and Dupont (2003, 2004) and Reuster and Zschille (2010).
- Water safety planning and risk management is not embedded within the water sector as it should be (Section 5.5.4) supporting MacGillivray *et al.* (2006, 2007, 2008) and Summerill *et al.* (2010a,b).
- Decentralised command and control regulation is becoming more common (for example Case E) but too much local autonomy without empowered independent regulation will lead to public health risk (Section 5.5.5) supporting Gunningham (2002) and Haines (2011).

In addition to the confirmatory evidence, the study exposed a number of feature that need to be considered, improved upon or changed significantly to improve risk management within the water sector:

- Charging mechanisms and financing need to be based on strategic investment plans and, once agreed, need to be free from political intervention. Overtime investment to improve system reliance will reduce failure and reactive management action. Ultimately this will save money and secure public health protection. (Section 5.5)
- Regulators need to be independent and empowered to enact. Collaboration with water service providers should be encouraged. Regulatory objectives need to be fine-tuned and the dominant position of the financial regulators (for example Case A) needs to be aligned to the principle purposes of the water company (protection of public health and the environment) (Section 5.5.2 and 5.5.3).
- Attention needs to be paid to the risk conversations within the organisations (Section 5.5.4). The executives should make it easier for operational staff to report risk rather than the current status quo where operators are potentially penalised (Section 5.5.4) for reporting and escalating risk. More time needs to be given to meaningful risk conversations.

Chapter 7: Conclusions and recommendations

Chapter 7 proposes a simple reporting mechanism articulating the consequences of financial choices on operational and public health risks (Section 7.3). The conclusions and recommendations of the study provide insights that will be useful to policy makers, risk managers and senior executives who have a desire to improve the effectiveness of risk management thinking within their organisations irrespective of ownership arrangements or regulatory frameworks. Further work needs to be done to develop a framework which recognises the significance of public health and operational risks in the context of water service provision. The evidence presented in Section 5.5 exposes the need to remove political influence from the risk management process and regulatory decision making. This supports the views of Parker (2012) where he suggests that regulatory frameworks should operate at arm's length from politics. Setting the charging mechanism more effectively and sustaining finances to deliver planned investment will allow, or at least support, a move to a more resilient water supply system. This in turn will reduce the number of operational failures and elevate the need for reactive management. Evidence presented from Case E further support Gunningham (2002) and Parker (2012) by suggesting that too much local control over regulation and ownership/operation of services can lead to failure. The evidence suggests that embedding risk management would be best supported by empowered independent regulators working with autonomous water service providers that had longer term strategic investment plans based on water safety plan outputs, appropriately costed.

This may seem obvious but many countries do not have empowered independent regulators (for some examples see Table 1.1) and in Phase II only Cases A and B appeared to have operating environments closest to having empowered regulators and financed investment plans (Section 5.5.2). Even Cases A and B still had a dominance of reactive management and a drive for efficiency as features of management culture (Section 5.5.3) suggesting risk management could be improved. This final chapter reviews the contribution that the thesis and research activity has made to inform the understanding of the interplay between regulation, ownership arrangements and management culture on approaches to risk management. The first part of Chapter 7 suggests improvements to risk reporting. The second element of Chapter 7 majors on the principle research question and how this prompted and exploration of the research landscape which influenced the approach to data gathering, analysis and interpretation that developed and adds to existing knowledge. The final part of Chapter 7 is a personal reflection and review of the research journey taken, the challenges experienced through the process and how these where overcame. The final part of the chapter concludes the thesis report by discussing the principle findings, the potential implications (and applications) of the research out-put as well as identifying some areas of future work.

7.1 Development of a conceptual framework based on the case study outputs.

The two parts of the case study work have highlighted a tension between the amount of capital available to water utilities and the performance priorities of the stakeholder groups (Chapters 4 and 5). The political influence is critical and smaller publically

owned municipal systems appear to be more open to political interference compared to independently regulated larger organisations (public or private) (Section 5.5.5). It has also been noted that the boards tend to discuss residual risks compared to operational teams that focus on technical current risks (Section 5.5.4). Boards are focused on discussions around the financial consequences of risk (Section 5.5.2 and 5.5.4). Respondents inferred that competency of staff was a central issue and that more time needed to be spent on understanding the root cause of risks and developing improvement plans, rather than seeing the risk management functions within the business as an audit function. The study identified that the risk managers within the organisation were not fully empowered and would benefit from more board engagement, as well as being given the time to fully roll out and support risk management within the operational teams. The regulators, in general, highlighted financial constraints, staff competence and a change in language around protection of public health as influencing factors on risk (in both Chapters 4 and 5). This study recognises that the optimum balance of risk management practise will include support from empowered independent regulators; prioritised public health risks mitigated by meaningful choices of investment.

Successful risk management strategy will dependent upon the ownership arrangements, management culture (and leadership), regulations, funding, efficiency and political environment (Allan *et al.*, 2013). Maturity models are needed to benchmark performance and identify improvement opportunities (MacGillivray *et al.*, 2007a, MacGillivray *et al.*, 2007b) and define best practice in risk management for water utilities.

7.2 The research informing improvements to risk management practise.

Despite the protection of public health and environment being strategically important issues articulated in water service providers business plans (Section 5.4.1), the priorities of the water service providers was financing (Section 4.5 and 5.5.2) with risk registers highlighting financial risk being scored higher than public health (Figure 5.1). There is little doubt that the financial well-being of the organisations needs to be sustained to deliver water and wastewater services (Saal and Parker, 2010, Renzetti and Dupont, 2003, Renzetti and Dupont, 2004) however financial performance measures (Section 5.5.2) and political influence (Section 5.5.5) tend to mean cost reduction and profitability (Sections 5.4 and 5.5) rather than investment in securing high reliability by investing in resilient managed water systems.

The implementation of risk management can be improved by:

- Costing out a range of risk mitigation measures and assessing the quality improvements (most cost efficiency calculations don't take into account quality and quantity enhancements (Saal and Parker, 2010).
- Reporting risk mitigation measures in relation to risk tolerance and risk appetite (Section 5.4 and 5.5) that creates a meaningful context within organisations and stakeholder groups. Using the measurable rather than psychological risk factors as a baseline (Section 1.7.4).
- Acknowledging that current risks is more relevant to operational staff while residual risks are more concerning for executives. In doing so calibrate the reporting to be explicit about the nature of risk measured and reported.

- Simply improving the quality of risk conversations within the business and making time for risk management priorities.

7.3 Improvements for reporting or risk

Senior executives understand the importance of risk within the decision making process and, in conversation, do acknowledge that more time should be spent discussing and reviewing risk. The executives and leaders of these organisations have many competing demands on their time which in itself is a risk to the business. The more reactive they are the higher the probability of them missing some strategic risk priority which could be catastrophic to their business. When executives to review the risk register it appears to be a dreaded task or chore rather than a vital part of the decision making process. It may be advisable for risk managers to take a look at how risks are presented to boards. As highlighted in Section 5.5.2 directors are very interested in the financial consequences of risk which indicates, to some extent at least, that they are really discussing the risk impact relative to the risk tolerance of the organisation. It may be appropriate for risk managers to present risks in a way which demonstrate the financial implications of risk in relation to the risk tolerance value. The presentation should also include factors such as reputational impact and personal impact on directors. Figure 7.1 is a representation of how risk managers could present risks in a more compelling way to senior management that allows them to see the financial impact of risks. By representing risk impact in a visual way it may get more buy in from leadership teams and help to make risk management more relevant and consistent at all levels in the business. The visualisation of risk impact

could also be used to explain the impact of decisions to stakeholders outside the business.

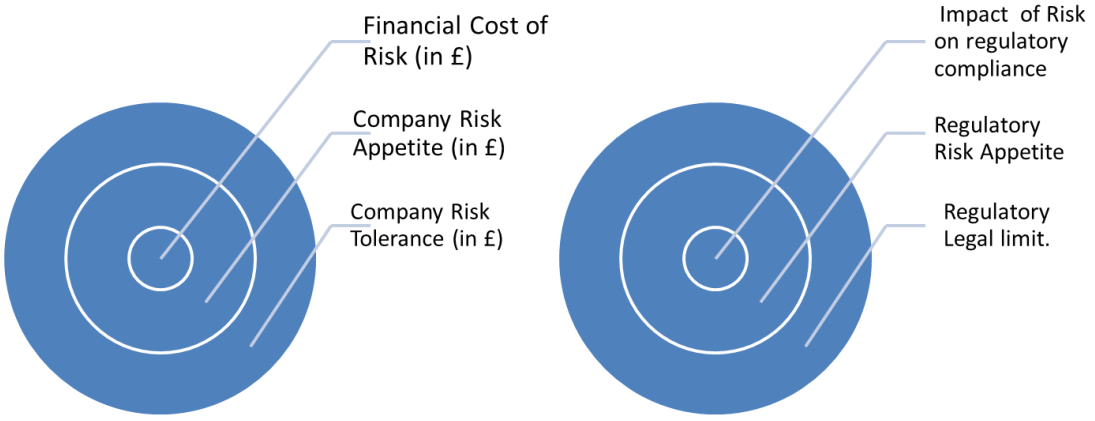


Figure 7.1 Representation of risk impact relative to risk appetite and tolerance values

The representation in Figure 7.1 could be applied to an individual risk, or a number of risks could be aggregated to give a very clear picture of risk impact. This can be adapted to financial impact or some other metric, for example water quality parameters set in the regulations. The point here is that a visual representation of risk impact could be understood by many operational teams within a business and gives a common understanding of how close the organisation is to financial or legal operational limits (measured parameters rather than psychological components). These diagrams could be easily constructed based on available company data and would provide one set of tools that helps support improving pervasive risk management and ensuring that risk management is seen as a leadership issue. Figure 7.1 is a representation of an elevated view of risk appetite in relation to risk tolerance at any chosen point in time along the x-axis of Figure 1.2 (Figure 7.2) and could

represents the current or future predicted risk profile of a business, department or project.

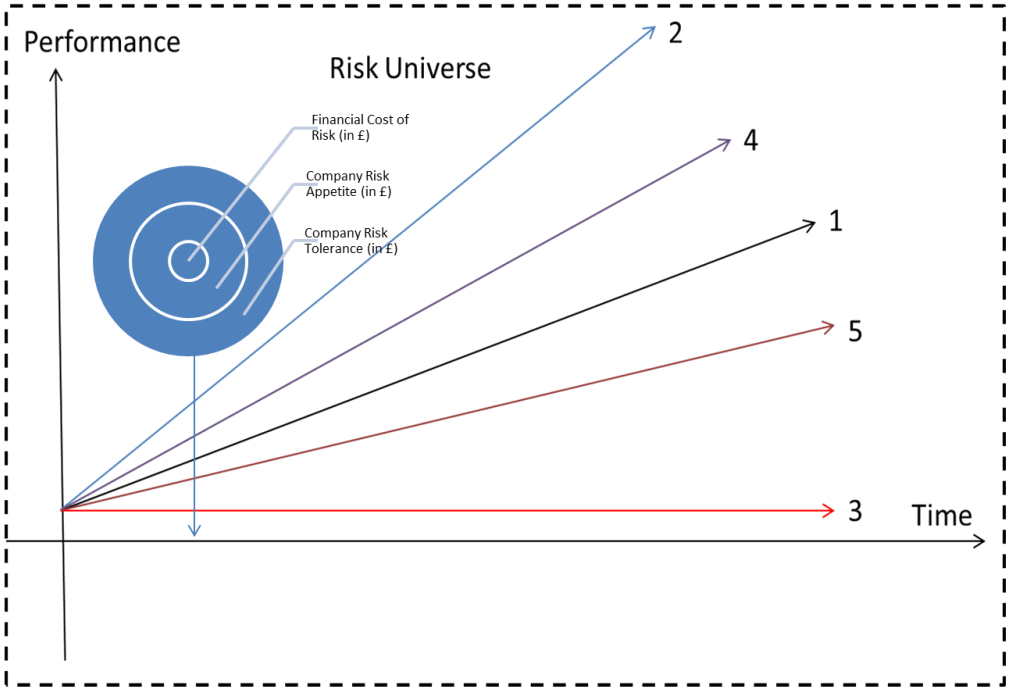


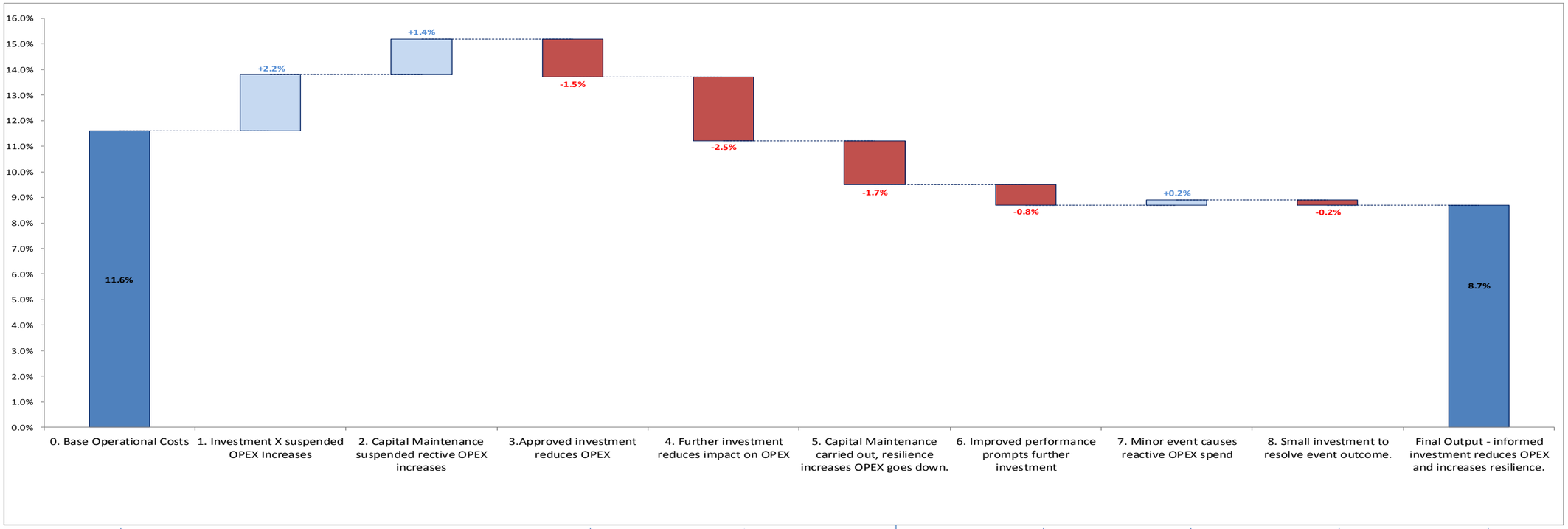
Figure 7.2 Representation of the current risk profile at a point in time within the risk universe (taken from Figure 1.2)

A consistent theme throughout the investigation was the actors` concerns over financing, affordability and charging mechanisms (Section 5.5.2).There appears to be a need to develop a reporting standard which represents the components of the financial consequences of risk and in particular, the stress that risk costs place on the risk tolerance (Section 1.7.4) of the business. At the same time there is a need to represent data that can be easily understood by all actors within an organisation in a way that is relevant to them, particularly looking at risks at a local, regional or corporate or project level. A standard visual report should support pervasive risk management, with greater buy-in, at all levels within a business. Figure 7.1 can be

used to represent, in very simple but explicit terms, how close an organisations finances are to the risk tolerance value. The diagram can easily represent individual projects, business units or treatment systems. Equally the finances can be aggregated to represent directorates, business units or the overall financial position of the organisation. A more detailed analysis can be conducted so that decision makers can make informed choices. Figure 7.3 is a representation of a real budget from Case A. The business unit, operational activities and investment choices have been anonymised. The proposed interventions have been costed accurately and confirmed by the financial department of Case A. The numbers have been converted into the *"waterfall diagram"*. The increases in cost have been colour coded in blue with decreases in cost colour coded in wine. The diagram gives a visual representation of a *"spend to save"* investment, where some additional funding is required to reduce ongoing operational cost, resulting in an lower overall cost to the business and ultimately the tax payer (in this case).

Original business plan proposal

Revised business plan taking into account the cost of risk mitigation



Original (final) financial model shows an 11.6% increase in OPEX Spend if no investment made.

- Capital investment of £1.7m removed from original outlay.
- Increase in expected OPEX as a result of lack of investment.

- OPEX under further pressure as planned maintenance suspended to save money.

- Spend approved for Capital Maintenance as a result of a minor quality failure.

- Capital investment increased by £0.6m over the original planned £1.7m as the minor failure results in the deterioration of the water treatment system.

- The water service provider recognises the risk of furthher treatment failure and insrease investment which leads to a reduction in OPEX.

- Improvements to performance increasese confidence in the system and prompt further investment to improve resilience leading to a further reduction in OPEX.

- a minor failure occurs prompting some reactive OPEX spend to avoid impact on public health.

- Delayed investment approved a s a result of the minor failure. The systems resilience increases and OPEX reduced

Overall, investment has lead to a reduction in the risk of operational failure and has reduced the pressure on the risk tolerance value of the organisation by reducing the OPEX value from 11.6% to 8.7%

Figure 7.3: A representation of the impact on operational cost of various investment choices.

This approach to representing the movement of total costs (TOTEX) should be easy to quantify for the majority of water service providers as many of them (if not all) have very sophisticated financial accounting systems that allocated costs to operational cost codes and project codes. In many cases the cost codes can be analysed across supply types (Chemicals, energy, staff costs, etc) and/or departments, activities and projects. The cost information can be analysed by department or section right up to directorate, division or organisation. The costs of failure of treatment, in many cases, is captured as a specific activity (some organisations, for example Cases A and B, capture treatment failure costs under an emergency financial code). It is possible to calculate the costs of failure at individual small works right through to large scale works. This financial analysis does not take into account other more psychological risks such as reputational risks or political risks, but these could be layered on once the financial risks were calculated. For example, If the political decision is made to cap customer charges (as happened in Case A in 2011, Section 4.5, 5.5.3 and 5.5.5) then the financial analysis and risk diagram would give the politicians and water utility a common view of the financial impact of the decision and the potential consequences to operability of treatment. Similarly the analysis could inform the impact on reputation as treatment failure from lack of investment could result in community illness and/or fatalities. These additional risks (and impacts) could be explicit in a commentary that accompanies the financial report. Figure 7.4 represents a constructed report that could be presented to a range of stakeholders, giving them a common understanding of financial risk.

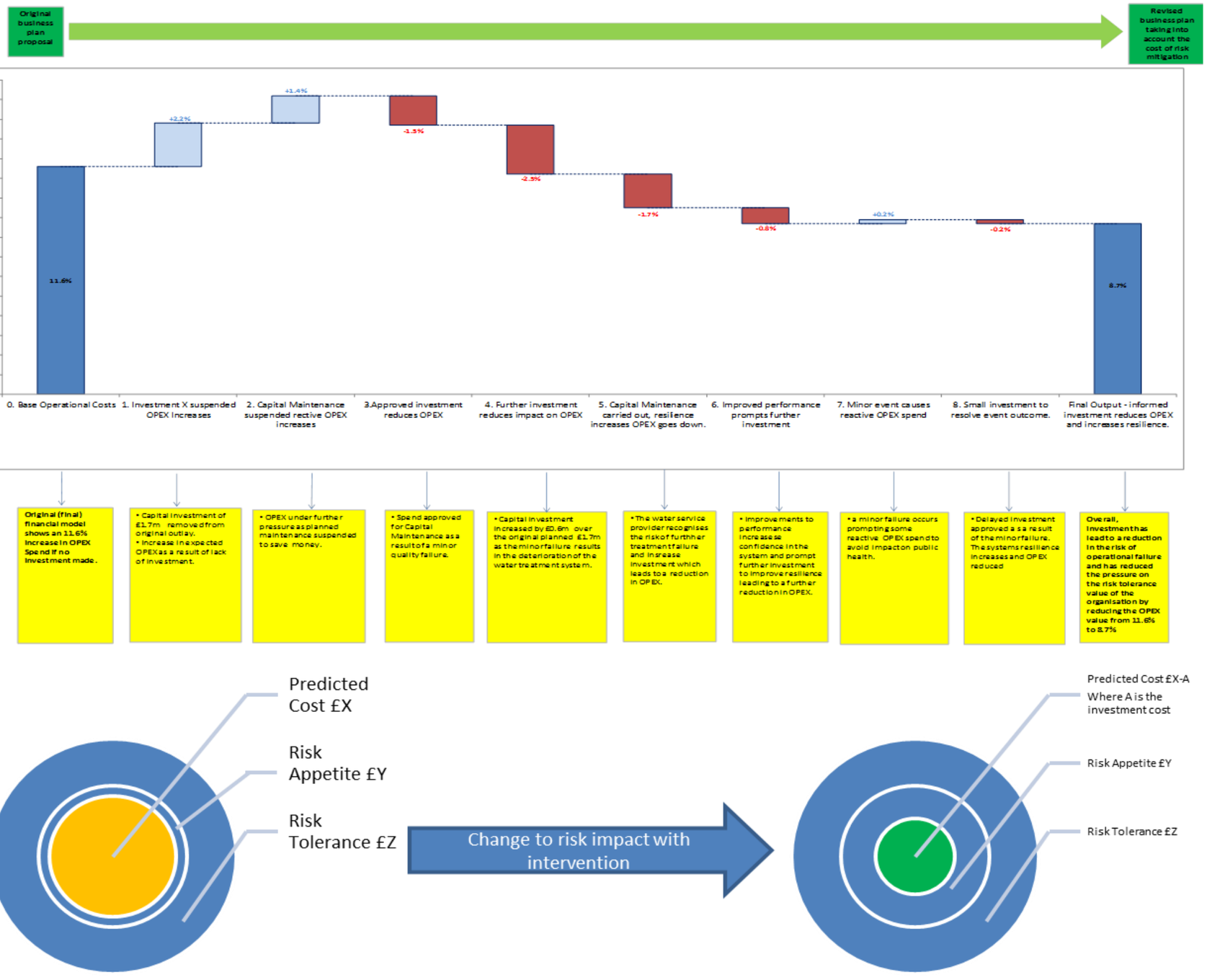


Figure 7.4: A possible simple representation of the changes to the financial impact of risk with investment.

Figure 7.4 is simplistic but has high visual impact. The circular representation in the bottom left hand corner represents a financial position that is close to the risk appetite for the activity being reported. The diagram implies that the risk appetite might be exceeded but the risk tolerance will not be breached. As the impact of the interventions in the graph move across to the right hand of the diagram, the circular diagram in the bottom right hand of the picture shows an improvement in financial position and a reduction in threat to breaching the risk appetite value. In representing planned changes in this way, board members (and other stakeholders) can get a single view of the interventions planned and the overall impact of the proposed changes on the financial wellbeing of that element (or all elements) of the business being examined.

The report lends itself to representing a range of scenarios which would be of importance when building a business case for investment. This methodological approach could be used to build cost profiles for water safety plans, where multiple investments in treatment systems may be required to mitigate the risk to public health. In doing so, it would be clear to investors, how much investment is required and what financial benefits could be realised in reducing reactive interventions when treatment fails.

7.4 Answering the research question

The research question developed in Chapter 2 is:

> *How do the specifics of regulation, ownership and management culture influence risk management choices for water service providers?*

The research activity (Chapters 4 and 5) was built to investigate the research question and revealed a number of features of regulation, ownership arrangements and management culture that influence risk management including:

- Regulation, ownership arrangements influence and define financial limits for water and wastewater services. The constraints of financing are of greatest concern to the majority of actors participating in this study (Sections 4.5 and 5.5.2).
- Political intervention may overrule regulation (Section 5.5.5). Water and wastewater services would be best supported by independent empowered regulators working with water service providers that operate under a regulatory contract that is at arm's length from politics (Chapter 5).
- Privatised companies (Cases B and C) may choose to sell strategic assets (Case C) which will improve the financial well-being of the organisation and de-risk the operations but may increase national risk by selling strategic assets (Section 5.4 and 5.5.2).
- Policy informs regulation, ownership arrangements, financing and investment choices which drive management culture towards efficiency targets and reactive management (Section 5.5.1, 5.5.3, 5.5.5). Culturally this limits the

time that executives, managers and operators have to spend on risk management activities and conversations.

There is still a need to re-evaluate the priority given to public health risks and financial risks. Here, the thesis recognises the need to achieve consensus on tools for tracking uncertainty and develop consistent processes for the reporting and implementation of risk management throughout a utility. Furthermore there is a need to build on previous work and develop novel ways to ensure that the board are fully engaged in the risk management conversations and that the output of these discussions are relevant to all levels of employee within the business. A critical component in this (identified by our interviewees) is the need to create the sufficient priority and time for risk management conversations that lead to improvement action within the organisation (Section 5.5)**,** coupled with a need to present compelling evidence of the impact of risk and intervention in a way that is easily understood through-out the business and by other stakeholders. There is a need to ensure that both regulators and water service providers can operate independently from political intervention (Section 5.5.5) and Parker (2012).

While risk itself can be both desirable and undesirable (influenced by the nature of risk and the impact vs the reward) it was noted that within the water industry the general organisational position tended towards being risk adverse. Here, this is taken to mean there was a desire to reduce the exposure of risk in a broad sense within the water sector service providers. Maturity in risk management will promote a planned approach and strategic plan to deploy capital in a way which adds resilience to the utility, this has a higher probability of shifting the business actively towards pro-active

and adaptive risk management. Again regulation, ownership arrangements and the management culture have influence over the utilities approach to risk management. The output of the literature review therefore informed the principle elements of the research activity which included consideration of:

- Regulatory and governance structures
- Financing water services
- Ownership arrangements
- Management culture

The research activity was then designed to explore the interplay of the elements listed above. Chapter 3 outlines the methodology used to develop an approach to a two stage research activity. The principle methodology was qualitative in nature and sought to explore the views and experiences of a range of actors that deliver or regulate water services in a selection of countries that have adopted different ownership arrangements and/or regulatory frameworks (or instruments).

The research agenda was broken down into two phase where Phase I (Chapter 4) was designed to test the output and observations made from the research proposal and literature review. The Phase I activity also acted as a way to test and check the principle researchers technique and quality of output before investment was made in a more substantive interview exercise across multiple international organisations. Phase II (Chapter 5) built on the output of the literature review and Phase I. The method was modified (Section 5.3) to take into account the learning from Chapter 2 and 4.

Chapters 4 through 6 describe in detail, the findings of the case study activities which confirms that interplay between ownership arrangements, regulation and management culture do inform choices made about risk management. The analysis highlighted that financing is a major area of concern for executives and while this is expressed in a number of ways there are consistent messages about availability of funds; agreement (or lack of agreement) on the priority for spend; the impact of the change to funding routes on the financial stability of the organisation (in other words the impact on the risk tolerance (Section 1.7.4) value of the business). The evidence presented (Section 5.5.1) revealed tensions between the aspirations of the strategic business plans (public health comes first) and the risk management priorities (finances come first). The analysis highlighted that within organisations the context and language of risk within the business as debate moves from strategic discussions to operational risk (Section 5.5.4). Boards discuss residual risks compared to operators who discuss current risk and are concerned with short term operational interventions (Section 5.5.4). The challenge for the risk professional is to recognise the variation in conversation and ensure that there is consistency in the meaning of risk types that are relevant to the organisation. Chapter 6 offers some simple suggestions for reporting the financial impacts of decisions that may alter the business` ability to manage the impact of risks (in this context risk refers to operational risk and impact may be a treatment failure or distribution failure).

The analysis conducted in Phase II highlighted that all cases, regardless of ownership arrangements or regulation aspired to deliver clean safe water within the financial limits of their capability and ensure no detriment to the environment (Section 5.5.1).

The strategy adopted by each organisation varied in terms of investment planning horizon, number of customers served, geographical area, staff numbers and value of investment (which included a range of splits between capital investment and capital maintenance) (Section 5.4).

The analysis re-enforced the importance of “tone at the top” when considering the implementation of risk management (Section 6.5). It is important for the leadership teams to engage with risk management discussions in a meaningful way and ensure that the risk management professionals within their business have sufficient gravitas to ensure that risk management is embedded into the management culture. If managing risk is seen as an important feature of business as usual activity, then it is likely that it will become pervasive within the business and lead to more mature risk management approaches that will ultimately protect public health and increase trust and confidence in the water service provider.

This study was designed to explore the interplay between regulation, ownership arrangements and management culture (Chapter 1, 2 and Section 2.6) in order to better understand the effect that these elements have on risk management choices. This is of importance to risk managers and professionals who want to know what makes risk management “stick” within organisations.

This research has informed understanding of the tensions that exist between water service providers and regulators together with tensions that are present within organisations when there is competition between what action needs to be taken to deliver clean safe drinking water and the financing available to support investment in

infrastructure. Culturally many business leaders take comfort, perhaps unwisely, in the existence of detailed processes and meeting structure to manage risk, in contrast, risk managers sometimes feel unsupported or not empowered to drive in risk management thinking within an organisation. This may be, in part, down to unclear definitions and changes in risk language used through the organisations; where at a board level they mainly focus on residual risk and the financial consequence of risk rather than current risk; compared to operators who have a day to day concern with current risks that will impact on live operations.

The most significant concern for board members, politician, shareholders and regulators is financing arrangements that support service deliver and the choices that are then made to invest the limited funds. Multiple tensions exist which effect the choices made by decision makes with respect to their relative positions. Politically, customer charges must remain low; borrowing to supplement customer charges must be available; and in trade-offs must be made between operational expense, capital maintenance and capital investment projects. Many of the regulators interviewed highlighted concerns with lack of spend on capital maintenance. Actors within organisations were not always clear on the priority of spending (Section 5.5.1 and 5.5.2) and the impact that lack of investment had on the risk appetite and risk tolerance of the organisation (Section 5.5.4). In fact many actors saw risk appetite a general statement committing them aspirational objectives (considered psychological aspects of risk appetite (Section 1.7.4)) to avoid the impact of risk (Section 5.5.4). In fact risk appetite and the risk tolerance of the business can be defined (or party defined) through financial analysis where the risk tolerance can be taken as the limit

of financial impact an organisation can sustain (Section 1.7.4), as a consequence or risk, without going bankrupt. The risk appetite can then be calculated as a quantum that provides a monitoring measure (Section 6.4 and 6.5) that acts as a warning signal to the business when risk impact occurs. No organisation that was interviewed had quantified risk appetite or risk tolerance in this way. In Chapter 6, simple representations of risk appetite and risk tolerance are combined with a financial profile that contains calculable financial information relating to interventions that materially affect the quantifiable risk impact as a financial measure (Figure 6.3). In this way it is possible to produce a report (with company data) which articulates the impact of risk intervention on the financial limits of the organisation. The model presented can be applied to local projects, operational systems and/or aggregated up to directorate and organisational level as needed. The important factor is that the model uses easily accessible corporate data. The report may also be used to inform investment choices, political decisions and regulatory approvals; if taken in context with the organisations strategic business plan. A representation of the diagram could be used to help engage risk owners in the business to ensure they understand the financial impact of the choices they make.

The simplistic report does not include factors such as reputational risk or other types of psychological risk impact but, as explained in Chapter 6 (Section 6.3 and 6.4), these could be overlaid in commentary report.

The findings of the investigation demonstrate the complex nature of the interplay between regulation, ownership arrangements, management culture and risk

management (Chapters 4 and 5); by exploring and expanding on the nature of interactions and priorities of the actors within water service providers, regulators and other stakeholder groups. While the actors interviewed do state that risk and risk management are an important issue (Section 5.5.4), limited time is spent within organisations discussing risk. Most of the organisations point to risk management controls, processes and governance groups designed to control and monitor risk (Section 5.5.4), however, many of the very busy middle and senior managers see little value in many of the processes and meeting, citing the level of from filling and reporting as something of a chore rather than adding strategic value to the process (Section 5.5.4). Risk management is an important factor in managing water utilities and time needs to be given over to relevant conversation.

Regulators also had a range of concern around the priorities of the water companies and suggested that capital maintenance was often overlooked (Section 5.5.2). It is critical that once commitments are given to the regulator to implement investment (improvements or maintenance) these activities happen. If funding changes then planned intervention that do not happen should be notified to the regulator for sign off (Section 5.5.2 and 5.5.5). Such changes to the programme should have detailed risk assessments with them so that the regulator and other stakeholders make an informed choice.

When it comes to ensuring risk management remains relevant (and pervasive) regardless of regulation, ownership arrangements or management culture, what is important is, clarity on the impact of risk; keeping the message simple and clear;

ensuring that quality conversation around risk happens (which means time is given to risk management debate); the risk management professionals have gravitas and authority within the organisation; and there is not an overreliance on governance or process to ensure risks are managed.

7.5 The research findings and novelty of the project

This thesis describes the regulatory frameworks, ownership arrangements and management cultures across five case studies operating in a number of countries. The study explores the interplay between the features of the case studies to first understand the approaches to risk management and then offer some insight into how risk management can be improved within water service providers and communicated to a broader range of stakeholders. The research finding and novelty are summarised as follows:

- The research provides a novel approach to understanding risk management within the context of regulation, ownership arrangements and management culture which differs from the body of literature (Chapter 2) which majors more on efficiency of public versus private ownership.
- The research is, in part, confirmatory in re-enforcing previous works (for example (Saal and Parker, 2001, Bakker, 2003b, Parker, 2003, Renzetti and Dupont, 2003, Saal and Parker, 2006, Nauges and van Den Berg, 2010)) that financing, efficiency and investment is of primary importance to the leadership team within a water utility.

- The research identifies a number of social processes and associated cultural factors (Chapter 5) that influence organisational priorities of risk management.
- The research identifies a need for improved board reporting of risk and develops a scalable tool which can be used to present measurable financial data (TOTEX) in relation to risk appetite and tolerance. The proposed report does not include less measurable psychological aspects of risk appetite and tolerance (Section 6.3 and 6.4), these can be considered separately.
- The research supports the literature (Gunningham, 2002, Gouldson et al., 2009, Parker, 2009, Haines, 2011b, Parker, 2012), confirming that regulation needs to be independent and free from political intervention (Section 5.5.5).
- The research exposes that regardless of the strategic priority of the water utility, financing is a critical factor (Section 4.5 and 5.5.2) and that constraints in capital will mean less strategic investment and more reactive management (Chapter 5).

7.6 Limitations of the study

The study undertaken included a detailed scoping exercise, an in-depth literature review and two phases of case study activity. The case studies covered a number of organisation and regulatory regimes across a range of countries. In addition to this a vertical approach was adopted where actors at a range of hierarchal positions within the organisations were interviewed. Finally the qualitative analysis and coding structure was verified by a 3rd party post-doctoral researcher. This multi-dimensional approach supported the development of a legitimate qualitative study (Yin, 2009;

Silverman, 2011; Creswell, 2009; Neuman, 2003). However the qualitative study does have limitations which need to be noted.

The study is limited to a small group of actors meaning that the extent to which the findings can be confidently generalised will be limited. The interviews were conducted over a short period of time (approximately 3 months) meaning the study does not have a strong longitudinal aspect. Politicians, regulators, regulations and staff within organisations change with time. Therefore risk management maturity will progress and the concern with, for example financing, will change. The study findings may be modified and updated as new regulatory and ownership arrangements are developed.

The bias of the researcher has been a consideration from the conception of the project and has already been reported in Chapter 3 and is of concern. The researcher was embedded in Case A for part of the project; this allowed greater access to actors within the organisation but the researcher could have been influenced by the actors or indeed influence of them. This was in part addressed by third party verification of the interview analysis (Chapter 3).

7.7 Recommendations for further work

Through the research process, this thesis has sought to develop a better understanding of the interplay between regulation, ownership arrangements and management culture on risk management. Some interesting elements have been noted through the research, such as the type of risk conversations that occur; the importance of securing the right access to capital; the potential impact of political decision making on the operability of public water companies; and the variation in

risk management application across a range of service providers; the different priority put on risks; and the different interpretations of risk. It was also clear that the risk management professional need to have more gravitas within the organisation, so that risk management is seen as an important day to day consideration when considering the elements required to successfully managing business operations.

Some useful commentary has been developed on some of the consistent views of actors within the water sector that demonstrate that most see risk management as important but believe governance, process and the risk management professionals provide safe guards against failure. However other actors (including regulators and risk professionals) feel that risk management should go beyond process and governance, becoming embedded in the broader decision making process.

The thesis has made some suggestions for improving risk conversations, delivering consistent definitions of risk terminology and providing simple reports that can supplement risk conversations by providing a single, easily understood picture. The proposed reports can be adapted to cover a range of risks, projects and department specific needs.

Further work could be done to develop the calculations that define the financial risk tolerance of an organisation. This is a critical component when assessing the impact of risk on the financial well-being of an organisation and should be seen as the value that an organisation cannot exceed. Once this is defined then a risk appetite value can be more easily established. Financial performance can then be measured against

appetite and tolerance where getting close to or exceeding the risk appetite would act as a prompt to act.

Following on from that, more work can be done to develop simple reports that help risk management professionals demonstrate the possible impact of decisions on the finances of the organisation and ultimately the potential risk profile of the organisation, where less tangible risk factors are presented as commentary to supplement the reports.

Risk management professionals need to be fully supported and empowered. Having a risk director on the board may be a way of escalating the importance of risk. More work could be done to explore a range of tools to be used by the risk professional to ensure risk management becomes pervasive and embedded in the organisation. It would also be of interest to see how many senior managers responsible for risk operate at board level within water companies.

The research agenda has highlighted some real examples of political decisions that have a measurable impact on the financial wellbeing of public utilities (for example, the Case study A Government`s decision in 2011 to hold customer charges (Section 4.5, 5.5.2). The full impact of the decision will not be understood for some time and it would be useful to conduct further analysis on the long term outcomes associated with such decision on company performance, impact on public health and unintended changes to regulatory authority.

The industry, based on the five selected case studies, appears to be more focused on drinking water. From a risk management perspective the water service providers

should consider both water and wastewater services in concert as part of the whole system. Clean safe drinking water and safe sanitation are both public health considerations and risk management should consider all possible risks within these systems. This will be of particular importance when considering water systems that both receive wastewater effluent discharges and are also used for abstraction of drinking water. Further work could be done in this area.

The researcher's initial thoughts on risk appetite (Section 1.7.4) were that a different approach was needed to quantifying elements of risk which could inform decision making between stakeholders. However, the results of Phase I (Chapter 4) and Phase II (Chapter 5) forced a reconsideration of the original position (Section 1.7.4) as it became evident that the water service providers may use risk appetite as mitigation for failure to meet regulatory obligations. The researcher notes that water service providers should focus on current risks within their business; spending time planning investments to reduce current risks. In doing so, the water service provider will meet the regulatory requirements; protect public health and the environment with more certainty and confidence. Further work could be done to explore the possibility of replacing a focus on risk appetite in favour of more robust risk management aligned to systems thinking.

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Appendix I – Ethics Committee Approvals and Confidentiality Agreement

Ethics Committee Proposal

Title: Risk challenges in the water industry – the impact of regulation and business model choices on the risk profile within the utility.

Proposal Submitted by: Richard Allan
Supervisors: Professor Paul Jeffrey and Professor Simon Pollard

Introduction

This PhD thesis is part of Richard Allan's personal development goals within Scottish Water and will meet the requirements of Continued Professional Development. The project is sponsored by Scottish Water.

Richard Allan is the Chief Scientist at Scottish Water and reports to the director of asset management (Geoff Aitkenhead) with a reporting line to the Chief Executive (Richard Ackhroyd). Richard is responsible for Scientific matters within Scottish water that include sampling, laboratories and public health related matters.

This thesis sets out to examine how regulation and the ownership arrangements of a water utility influence the business decisions made by the organisation in developing strategy to achieve the objectives set out in the Bonn Charter. The study will go on to examine the risk management strategy adopted by the utilities and look at quantifying the risk (Operational, engineering and financial) held within the chosen organisations. The project will conclude with an examination of the unintended consequences of the regulations on the delivery of the objectives of the Bonn Charter by the water utilities taking part in the study.

During the study it is the intention to examine the extent to which epistemic and stochastic uncertainty is taken into account during key business decisions that influence both the risk management strategy and the priority for investment of each utility. In other words how do the organisations justify the business priority in the face of the limit of the companies' knowledge, experiences and accumulated data?

The thesis objectives can be summarised as follows:

- What are the water companies' business plan priorities with respect to meeting the demands of regulation, owners' objectives and maintaining operability?
- What are the risk management strategies of each of the water companies and how do these strategies take into account epistemic and stochastic uncertaintyWhat are the emerging unintended consequences of the business plan implementation?

By focusing the thesis on these questions it will be possible to make recommendations that will inform the water utility sector on preventative interventions that will better support the achievement of the objectives of the Bonn Charter.

Method

The questions listed above will be answered using a number of different methods:

1. A survey of (max 20) senior Scottish Water managers (conducted by interview) to validate the project proposal and literature review.
2. A review of the existing and proposed regulations.
3. A review of water utility ownership arrangements applied across a range of countries.
4. A review of risk management strategies adopted by a selected representative group of utilities.
5. A number of surveys (conducted partly direct interview, partly by e-mail, and partly using an online survey tool) of individuals working in a. Water Utilities, b. Water Regulators, c. Sector Policy-making bodies.
6. Analysis of primary data and other data sources using CAQDAS software.

Study respondents will be middle and senior management / technical staff typically educated to degree level. They will be asked questions relating to their work related opinions and experiences. This proposal to SEREC relates to components 1 and 5 of the methodology outlined above. Snowball sampling will be used for all surveys with initial contacts from the researcher's own professional community.

Ethical Considerations

Informed consent and deception

Participation in this study will be voluntary and by invitation only. The research should be neutral and unbiased which means that there is a requirement to fully brief the Cases in the nature of the study. As an employee of a water utility the principal researcher will need to ensure that personal bias and professional opinion do not compromise the validity of the project. It is also a requirement that the principal researcher explains their status within the water utility to each Case.

Cases will be asked to provide full informed consent (either verbally or in writing) prior to the commencement of interviews. Cases will be provided with information on the purpose of the study, the information being sought, and how the data will be used, as well as procedures undertaken by the researcher to ensure confidentiality. Contact details for the researcher and supervisor will also be provided.

The research methodology does not require the use of deception and such techniques will not be used during this study. Cases will be fully informed of the purpose and structure of the project and provided advance warning of the interview topics several days in advance.

Full disclosure of the researcher's employer (Scottish Water) and position within the organisation (Chief Scientist) will be made as part of the invitation for each interview. This will

be information will be included in writing along with the research proposal and the purpose of the interview.

The data will not be disclosed to Scottish Water. The data will only be used for the purposes of this research project and be available to the researcher and supervisory team.

Freedom of participation

All Cases will be asked to take part on a purely voluntary basis. At the beginning of each interview, the researcher will:

- Verify that participation is on a purely voluntary.
- Explain the nature of the study and the position the researcher holds within Scottish Water.
- Stress that Cases may decline to answer particular questions if they so wish.
- Agree not to tape-record the interview, should the Case raise any specific reservations.

The attached consent form outlines the key points documented in this proposal and the Case will be asked to sign off before the interview takes place. It is also recognised that the interviewee has the right to withdraw from the interview at any stage and that they have the right to request that their answers are not used as part of the research.

Confidentiality

The only personal data to be collected during this study will be respondent name, job title and organisation. The knowledge generated from the study is dependent on relating responses to both the role of the respondent and the type of organisation they are located in. Consequently, respondents will be asked whether they are happy for their job role, organisational affiliation or type of organisation (e.g. regulator / utility) to be mentioned in study reporting. This information will only be used in publically accessible outputs with the full consent of Cases.

All recordings, transcripts and interview notes will be stored in accordance with the Data Protection Act (1998) and access to the data will be restricted to Richard Allan, Paul Jeffrey and Simon Pollard.

Protection of Cases

Cases will not require any special skill in order to take part in the study and will not be placed in any physical or psychological harm due to participation in the research.

Professional Conduct

The research will be carried out in a professional manner, with respect and consideration to all persons involved whether they have participated or not to this study. The nature of the research will be clearly explained in a way that is suiTable and not patronizing to the individuals. Case refusal to participate, be recorded using a dictaphone, or be mentioned by

name or affiliation in outputs will be accepted in a respectful manner. Interviews will be conducted away from front-line work activities and will not involve any physical danger over and above those associated with everyday life. Measures highlighted above to address informed consent, freedom of participation, freedom to withdraw and confidentiality will minimise the potential for psychological harm or harm to individual careers.

The researchers interview technique will be validated by the supervisor through a control set of trail interviews to address any concerns with bias of the researcher. This acknowledges the position of the researcher with Scottish Water.

Observation

No observational work will be conducted in this study. If there is an emerging requirement for observable experimentation then a supplementary submission to SEREC will be prepared.

Right to withdraw

Immediately prior to the interview, the researcher will advise Cases of their right to withdraw at any stage of the interview process.

Debriefing

Full details of the basis of the research and subsequent analysis will have been provided at the outset. Debriefing will be limited to answering any questions that may arise as a result of the interview itself, as well as informing Cases of their right to request a summary of the key findings of the study once the research is complete (contact details will be provided).

The researcher will ask the interviewee for permission to contact them for possible follow up meetings during the course of the research. The interviewee may wish to receive updates on progress of the research, which the researcher will endeavour to provide.

Control and storage of Raw Data

The raw data (interview files) will be kept on a secure server and password protected. It is the intention to retain the raw data for a period of 1 year after submission of the final thesis. This policy will be explained to the interviewee as part of the interview briefing and invitation.

Richard Allan

CONSENT FORM FOR PARTICIPATION IN RESEARCH

(by interview)

Being over the age of 18 years I hereby consent to participate as requested in the letter of introduction for the research project on "Risk challenges in the water industry – the impact of regulation and business model choices on the risk profile within the utility*". By signing this consent form I confirm that;*

1. I have read the information provided.
2. Details of procedures and any risks have been explained to my satisfaction.
3. I agree to my information and participation being recorded on tape.
4. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.
5. I understand that:

    - I may not directly benefit from taking part in this research.
    - I am free to withdraw from the project at any time and am free to decline to answer particular questions.
    - While the information gained in this study will be published as explained, I will not be identified, and individual information will remain confidential.
    - I may ask that the recording be stopped at any time, and that I may withdraw at any time from the session or the research without disadvantage.
    - I understand that I may request to withdraw my interview answers even after the interview has taken place but before final publication.
    - I understand that the raw data (recordings and documentation) will be kept in password protected files in a secure location and that only the principle researcher and the supervisory team will have access to the files.
    - I understand that the raw data (recordings and documentation) will be kept for up to a year after publication of the final thesis and will be destroyed after this time.

Case's signature……Date……...

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

Researcher's name……Richard Allan…….……

Researcher's signature……..Date…….

Appendix II – Codes generated using CAQDAS

Nodes	Number of coding references	Number of items coded
Nodes\ \ Management culture\ Target driven\ Customer experience	98	17
Nodes\ \ Management culture\ Accountability	95	16
Nodes\ \ Management culture\ Long term planning	93	19
Nodes\ \ Management culture\ Reactive management	65	13
Nodes\ \ Management culture\ Drivers\ Finance	52	13
Nodes\ \ Management culture\ Short term planning	51	14
Nodes\ \ Management culture\ Target driven\ Efficiency targets	46	12
Nodes\ \ Management culture\ Language of risk	44	15
Nodes\ \ Management culture\ Target driven\ Overall Performance Assesment (OPA)	33	8
Nodes\ \ Management culture\ Drivers\ Public Health	27	11
Nodes\ \ Management culture\ Drivers\ Environment	26	10
Nodes\ \ Management culture\ Risk maturity	24	10
Nodes\ \ Management culture\ Risk taking	24	8
Nodes\ \ Management culture\ Target driven\ Political objectives	23	7
Nodes\ \ Management culture\ Target driven\ Regulatory objectives	23	10
Nodes\ \ Management culture\ Compliance	22	9
Nodes\ \ Management culture\ Centralised control	21	9
Nodes\ \ Management culture\ Drivers\ Regulatory	19	6
Nodes\ \ Management culture\ Drivers\ Service Provision	17	5
Nodes\ \ Management culture\ Drivers\ Water Quality	15	3
Nodes\ \ Management culture\ Ownership of Issues	13	4
Nodes\ \ Management culture\ Reactive management\ Incident management	12	9
Nodes\ \ Management culture\ Drivers\ Health and Safety	10	3
Nodes\ \ Management culture\ Drivers\ Growth	9	2
Nodes\ \ Management culture\ Pro-active operational activity	9	1
Nodes\ \ Management culture\ Dont value data	8	2
Nodes\ \ Management culture\ Drivers\ Politics	6	3
Nodes\ \ Management culture\ Target driven	5	3
Nodes\ \ Management culture\ Internal competition between managers	4	2
Nodes\ \ Management culture\ Management incentives	4	1
Nodes\ \ Management culture\ Task focused	4	4
Nodes\ \ Management culture\ Drivers	3	2
Nodes\ \ Management culture\ Organizational Change	3	1
Nodes\ \ Management culture	2	2
Nodes\ \ Management culture\ Pro-active operational activity\ Critical Mass and Economy of Scale	1	1

Nodes	Number of coding references	Number of items coded
Nodes\ \ Ownership Arrangements\ Private ownership	46	10
Nodes\ \ Ownership Arrangements\ Public ownership	32	10
Nodes\ \ Ownership Arrangements	14	5

Nodes	Number of coding references	Number of items coded
Nodes\ \ Public Health	5	3

Nodes	Number of coding references	Number of items coded
Nodes\ \ Regulation\ Affordability	92	15
Nodes\ \ Regulation\ Charging mechanisims	71	13
Nodes\ \ Regulation\ Tension	62	16
Nodes\ \ Regulation\ De-centralised	27	3
Nodes\ \ Regulation\ Enforcement	23	4
Nodes\ \ Regulation\ Economics of capital investment	22	5
Nodes\ \ Regulation\ Economics of operation	22	13
Nodes\ \ Regulation\ Collaboration	21	11
Nodes\ \ Regulation\ Water quality	18	10
Nodes\ \ Regulation\ Competition	14	5
Nodes\ \ Regulation\ Public health	13	7
Nodes\ \ Regulation\ Regulation influincing risk management and operational practise	11	2
Nodes\ \ Regulation	10	9
Nodes\ \ Regulation\ Regulation improving performance	10	2
Nodes\ \ Regulation\ Drivers\ Reputational	8	5
Nodes\ \ Regulation\ Environment	8	6
Nodes\ \ Regulation\ Cost of implementing regulation	5	2
Nodes\ \ Regulation\ Drivers	4	2
Nodes\ \ Regulation\ Reducing red tape	4	4
Nodes\ \ Regulation\ Going beyond regulation	3	1
Nodes\ \ Regulation\ Trending Data	3	2
Nodes\ \ Regulation\ Mandating systems	2	1
Nodes\ \ Regulation\ Private supplies	2	1
Nodes\ \ Regulation\ Investigating	1	1

Nodes	Number of coding references	Number of items coded
Nodes\ \ Risk Management\ Embedding risk management	101	17
Nodes\ \ Risk Management\ Risk management processes	79	15
Nodes\ \ Risk Management\ Engagement	56	13
Nodes\ \ Risk Management\ Maturity of risk management	50	15
Nodes\ \ Risk Management\ Board Engagement	47	8
Nodes\ \ Risk Management\ Leadership	41	13
Nodes\ \ Risk Management\ Risk Governance	39	11
Nodes\ \ Risk Management\ Risk Register	34	8
Nodes\ \ Risk Management\ Risk review meetings	32	6
Nodes\ \ Risk Management\ Asset Investment Planning	31	14
Nodes\ \ Risk Management\ Risk Scoring	26	6
Nodes\ \ Risk Management\ Risk appetite	24	7
Nodes\ \ Risk Management\ Failure to Investigate	16	3
Nodes\ \ Risk Management\ Risk Tolerance	16	6
Nodes\ \ Risk Management\ Trending data	16	3
Nodes\ \ Risk Management\ Monitoring Water Quality	11	3
Nodes\ \ Risk Management\ Barriers to Escallation	10	4
Nodes\ \ Risk Management\ Epistemic risks	8	3
Nodes\ \ Risk Management\ Arduous Task	7	3
Nodes\ \ Risk Management\ Opportunities	6	5
Nodes\ \ Risk Management\ Risk management processes\ Influencing	6	2
Nodes\ \ Risk Management\ Risk management processes\ Implementation internationally	4	1
Nodes\ \ Risk Management	3	1
Nodes\ \ Risk Management\ Broad range of risks	2	1
Nodes\ \ Risk Management\ Risk management processes\ Investigating Complaints	2	1
Nodes\ \ Risk Management\ Risk management seen as an independant activity	2	2
Nodes\ \ Risk Management\ Risk management processes\ Aggregation of risks	1	1
Nodes\ \ Risk Management\ Vigilance	1	1

Nodes	Number of coding references	Number of items coded
Nodes\ \ Risks to service delivery\ Financing of services	133	19
Nodes\ \ Risks to service delivery\ Political intervention	101	11
Nodes\ \ Risks to service delivery\ Staff competence	45	13
Nodes\ \ Risks to service delivery\ Resource availability	40	7
Nodes\ \ Risks to service delivery\ Staff retention	28	8
Nodes\ \ Risks to service delivery\ Reputational	26	10
Nodes\ \ Risks to service delivery\ Delivering non-core activities	25	7
Nodes\ \ Risks to service delivery\ Financing of services\ Aquisition of capital	22	7
Nodes\ \ Risks to service delivery\ Climate Change	19	8
Nodes\ \ Risks to service delivery\ Operational Risk	19	4
Nodes\ \ Risks to service delivery\ Resiliance	18	9
Nodes\ \ Risks to service delivery\ Asset Investment	17	3
Nodes\ \ Risks to service delivery\ Treatment	16	5
Nodes\ \ Risks to service delivery\ Value of Water	15	3
Nodes\ \ Risks to service delivery\ Financial consequences to customers	9	6
Nodes\ \ Risks to service delivery\ Building competence	7	4
Nodes\ \ Risks to service delivery\ Non-reporting of risks	6	3
Nodes\ \ Risks to service delivery\ Outsourcing	6	1
Nodes\ \ Risks to service delivery\ Political intervention\ Low risk appetite	6	3
Nodes\ \ Risks to service delivery\ Shareholder expectations	6	2
Nodes\ \ Risks to service delivery\ Changes in raw water quality	5	1
Nodes\ \ Risks to service delivery\ Health and safety	3	3
Nodes\ \ Risks to service delivery\ Distraction through change	2	1
Nodes\ \ Risks to service delivery\ Lack of management buy-in	2	2
Nodes\ \ Risks to service delivery\ Internationalisation	1	1
Nodes\ \ Risks to service delivery\ Value of Water\ Occupying a Natural Monopoly	1	1

Nodes	Number of coding references	Number of items coded
Nodes\ \ Water safety plans	26	10
Nodes\ \ Water safety plans\ Implementation of water safety plans	55	11