

RESILIENCE LEARNING FOR WATER SECTOR CULTURE CHANGE

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1 INTRODUCTION

Global threats such as climate change, population growth, and rapid urbanization are posing a significant challenge to water management in the UK (Butler et al., 2017). The approach to ‘carry on as normal’ will no longer be possible or acceptable and instead the water sector needs to create a reliable, sustainable and resilient water service. A resilient water sector is not just dependent on the development of new technology and equipment. People are an important and significant part of the water sector and are, therefore, integral to enhancing its resilience. A resilient workforce requires a range of properties, including people who are flexible, adaptable to new and unknown situations, transparent, effective communicators and strong team workers (White et al, 2013; Ofwat, 2017). Based on the resilience definition of Butler et al. (2017), the contribution to water sector resilience of the workforce can be defined as the degree to which people can minimise the level of service failure magnitude and duration of a water system when it is subject to exceptional conditions.

As definitions of resilience differ between disciplines—engineering (Butler et al., 2017) geography (Adger, 2000; Pelling, 2010), and business and management (Linnenluecke, 2015)—and the water sector is multidisciplinary, there is contrasting worldviews over, firstly, what is resilience, and secondly, how it can be implemented successfully in the water sector (Johannessen and Wamsler, 2017). Different components of the water sector, including the regulators, water service providers and professional institutes, as well as the people within these organisations, are at different stages of understanding and learning in their resilience journey. There is a regulatory requirement for the whole sector to be resilient, as well as the individual sections. In the UK, the Water Act 2014 places a duty on the water and wastewater sectors to “further the resilience objective”. It

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highlights a need for long-term planning of water, wastewater and service provisions under increasing global threats. Last year Ofwat released the 'Resilience in the Round' document (Ofwat, 2017) which stresses that resilience needs to be assessed holistically and go beyond the more traditional operational views of resilience to include financial, corporate and related natural environment, social systems, economy and other wider factors. A regime shift, similar to what is experienced in ecological systems, is required in the water sector to change its structure and function (Kemp et al., 1998).

This paper investigates barriers to creating a resilient water sector, focussing on the workforce. Firstly, it explores the definition of resilience and whether the workforce and customers are ready for a culture shift to create a more resilient sector. Secondly, it reports the threats that water companies are facing in making the shift to create a more resilient workforce. Thirdly, the resilience-building measures reported are mapped onto the Safe & SuRe framework (Butler et al. 2017), which enables interventions to be classified as either mitigation, adaptation, coping or learning and helps to illustrate how they act to minimise the consequences of any future threats (Figure 1). The paper concludes by summarising its wider contributions to knowledge, policy and practice.



Figure 1: Mapping culture change-focused resilience interventions onto the Safe and SuRe framework

2 METHODOLOGY

This paper uses the Safe & SuRe framework (described in detail below) to map the resilience learning for water sector culture change (Figure 1), from case studies which include five water companies, and the regulator Ofwat.

2.2 Case Studies

Water and sewerage companies: Semi-structured interviews were conducted with five water and sewerage companies (includes water and sewerage companies and water only companies). Four out of the five interviewees (i.e., company employees) were in director or managerial positions with more than 20 years of industry experience. To maintain confidentiality, interview participants whose quotes are presented in this paper are referred to as Water Company 1 to 5. Participants were asked to reflect on what resilience means to their business, how to implement culture change in their company, and to highlight some of the learning points including processes and metrics to develop a resilient workforce. Information gathered from the interviews were mapped onto the Safe & SuRe framework to assess the different approaches to engender learning and culture change across the water sector. Each interview lasted approximately one hour and was recorded and fully transcribed, providing a rich and extensive source of qualitative data

Ofwat: Since the late 1980s when the UK water sector was privatised, the Water Services Regulation Authority (Ofwat) has been responsible for overseeing the sector and setting price limits for water and sewerage services. Every five years Ofwat conducts a price review, and the next one is scheduled for 2019 (PR19). In preparation for this review Ofwat are exploring the operationalisation of resilience across the sector. This case study reflects on how the organisation is conducting this from the top down and the challenges of moving from risk management to resilience enhancement. In particular, we asked Ofwat if the definition of resilience was still evolving, what are the main cultural threats facing the water sector and to list any success stories in overcoming these threats. Understanding Ofwat's approach is important because it will influence how water companies themselves further the resilience objective.

2.3 Data Analysis

The first stage of data analysis involved careful reading of the interview transcripts followed by an iterative process of 'open coding' (Corbin and Strauss, 1990). We created nodes – combining segments of text reflecting similar wordings or activities – based on the Safe & SuRe Framework. Emergent themes within these nodes and across the five case study companies were then coded. In the final stage of data analysis axial coding was used to search for patterns and relationships within and between nodes and case study companies, as well as Ofwat (Strauss and Corbin, 1998).

2.4 The Safe & SuRe Interventions Framework

The Safe & SuRe interventions framework (Figure 1) provides a diagrammatic representation of the relationship between threats and their consequences, and enables opportunities for intervention to be identified in order to develop a more resilient system. The framework allows the role of and need for four types of intervention strategies – Mitigation, Adaptation, Coping, and Learning – to be determined. Combined use of these types of intervention enables water problems and challenges to be addressed in a holistic manner. The framework also provides a logical foundation for the analysis of reliability, resilience and sustainability, enabling greater consistency in assessment methodologies and methodical identification of opportunities for intervention. The four types of interventions used in the Safe & SuRe framework are defined in Table 1.

Table 1: Types of intervention in the Safe & SuRe framework

Intervention	Definition
Mitigation	Any physical or non-physical action taken to reduce the frequency, magnitude or duration of a threat
Adaptation	Action taken to modify specific properties of the water system to enhance its capability to maintain levels of service under varying conditions
Coping	Any preparation or action taken to reduce the frequency, magnitude or duration of an impact on a recipient
Learning	Embedding experiences and new knowledge in best practice

Mitigation measures are typically long-term actions and must address a specific threat. For example, disengagement of customers is a potential threat to the water sector and may be mitigated by improvements in communication. Adaptation measures aim to reduce the level of service failures resulting from a given system failure mode, irrespective of the causal threat, and can be undertaken before, during or after the event. If the identified system failure mode is loss of knowledge, for example, a corresponding adaptation could be improved training and knowledge management. Coping measures address specific consequences and aim to reduce the vulnerability of the recipient to these. Purchase of insurance (a coping measure), for example, may be used to minimise financial losses (a potential consequence). Learning is necessary since the negative consequences of a threat cannot be eliminated entirely by mitigation, adaptation and coping measures. Unlike the other forms of intervention, it does not need to address a

specific threat, system failure mode, impact or consequence. There are many approaches to learning and these can include learning from past events, developing pilot schemes to generate new knowledge for best practice and learning from others. Good data collection and effective communication strategies can also facilitate learning. In all cases, it is important that lessons are learnt from both good and bad practices.

3 RESULTS AND DISCUSSION

3.2 Resilience Definition

Before investigating resilience learning for water sector culture change, it is important to clarify how water and sewerage companies understand resilience. Of the five water companies interviewed, only two had a formal definition of 'resilience' that was closely aligned to the regulator Ofwat's:

“Resilience is the ability to cope with, and recover from, disruption, and anticipate trends and variability in order to maintain services for people and protect the natural environment now and in the future.”

The remaining three water companies expressed that they were still exploring the meaning of resilience with respect to measurement and what it means to customers. Some of the informal working definitions and approaches to resilience included:

“If something goes wrong, the customers don't even know that something has happened” (Water company Two)

“Cultural change is what we mean by resilience. Resilience is about people, process, recovery programmes” (Water Company Three).

The companies that are embedding and tweaking the Ofwat definition could be viewed as being more innovative. They are taking their time to reflect on how this definition needs to be adjusted to their company and environment. Ofwat stated that the definition of resilience is still evolving, with resilience being a journey. Although the current definition is not perfect, Ofwat will keep this for the near future while water companies complete the current periodic review. When Ofwat was asked if water companies should follow their resilience definition, they stated that there must be flexibility in the definition but there needs to be an audit trail to see the justification.

In a similar vein to previous research, there are many stakeholders and factors that shape the development of a resilient company. When asked to describe the main features of a resilient company, most interviewees described the process as holistic, incorporating all aspects of the company, including assets, infrastructure, customers, workforce, innovation, skills, technology, and effective data management. However, whilst firms recognised the importance of reflecting on all aspects of the company, they highlighted the difficulty in effectively balancing all aspects together and the significant economic cost in successfully achieving that.

One company also highlighted the difficulties of joining all the aspects of resilience together and thinking about how they may depend on each other:

“The many aspects of resilience need to be joined with a focus on their interdependencies, the elements need to work smartly together with the customers at the centre” (Water Company Three).

Both Ofwat and the water companies state that the customers are at the heart of the resilience agenda. Customers need to recognise the importance and therefore the significance of resilience, which ultimately means they need to be brought into the conversation and the resilience journey. By engaging and integrating customers into the process, water companies are able to both learn and enhance its resilience, since customers become more aware of their actions and take responsibility, changing their water use behaviour which in turn contributes to the firm’s behaviour.

3.3 Resilience culture change: are the customers and workforce ready?

Customers: The enhanced customer engagement by water companies in England and Wales over the past few years has been suggested to be a way to break the established dynamic between the regulators and the water companies (Heims and Lodge, 2016). The perception was that the price reviews were not stretching companies to be innovative enough. A review of Ofwat practices (Gray, 2011) highlighted the need for companies to take ownership of their decisions; customer engagement was seen by Ofwat as a way of providing a different type of challenge and for companies to reflect their customer views in their business plans (Heims and Lodge, 2016). Water companies have appeared to have listened to this request, with customers very much in the centre of resilience (as highlighted above). However, engaging customers into the resilience agenda is hard. Building resilience costs money; therefore, water bills will increase:

“Customer expectations need to be within the limitations of budget, with tension between affordability and satisfaction” (Water company One).

Businesses in general have changed their organisational structures to be more responsive to customer needs (Homburg et al, 2000; Plouffe et al 2016). Water companies need to manage customer expectations by effectively bringing them on the resilience journey. It was highlighted by one water company (Water company One) that they feel they are being compared to other companies that are built on the customer with a high level of service such as Amazon and John Lewis. Although the level of service provided to customers by their water company has stayed the same for many decades, customer expectations have increased, with the expectation that the company will be on call 24/7.

Workforce: A resilient company should switch from being reactive to proactive. Daily tasks will be focussed on preventative measures rather than on coping and ‘firefighting’. However, this organisational change needs to have the support from the employees (Andrew and Mohankumar, 2017). One water company (Water Company Five) highlighted that many of the workforce, specifically the operational teams, enjoy the problem-solving aspect of incidents.

It is an exciting aspect of the role where they are often seen as heroes. Re-connecting a community with a water supply after an interruption brings praise and a sense of accomplishment, along with the adrenalin rush in fixing the problem. However, a resilient organisation wants to reduce the number of incidents with job descriptions to focus on more routine tasks:

“Water companies need to make staff feel passionate and rewarded by doing the routine work very well instead of fixing a major problem”. (Water Company Five)

3.4 The Safe & SuRe: Threats and Interventions

This section is split into two parts. The first will highlight the main cultural threats mentioned by the interviewed water companies. This includes weak leadership, resources, geography (rural communities) and changing staff profile. The second section will categorise the different types of resilience learning that are used by the water companies with the Safe & SuRe interventions; mitigate, adapt, cope and learn.

3.4.1 Threats and failure modes for resilience learning for water sector culture change

Leadership: Leadership was highlighted by two of the water companies as being essential to the attainment of resilience (Water company Two and Water Company Five). Leadership was even classed as “The biggest cultural threat” by one water company (Water Company Five). Leadership is important as it gives the company and workforce direction:

“Everything comes down leadership. If there is poor leadership then sub-factions will build up and the workforce will lose direction.” (Water company Two).

This finding mirrors work by Hunt and Auster (1990), Berry and Rondinelli (1998), and González-Benito and González-Benito (2006) on managerial attitudes to environmental management. Whereby, support and commitment from top management is a key element of the implementation and success of proactive organisational behaviour.

Resources: The theme of resources came out in this study, in relation to people, power and technology. Automation is becoming increasingly ubiquitous in companies (Lee and See, 2004); with the water sector being no exception. As technology has improved, water companies have become more efficient, and staff numbers have reduced. One company interviewed gave an example of having nearly half the staff they had 15 years ago (Water Company Four). There are positives to the automation of water systems including the reduction of human error and increased efficiency (Mahalik and Nambiar, 2010), but when technology fails it can cause significant problems. Two water companies (Water Company Four & Water company Two) and Ofwat stated they were concerned that the workforce could be out of practice of doing things manually or lack the capacity:

“Although technology increases automation and efficiency it must reduce the flexibility of the company, with less capacity to absorb change in the short term” (Water Company Four).

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“If all mobile phones/mobile masts go down – would many companies know how to operate their network?” (Ofwat)

This study found that as water companies are planning for their long-term strategy there are decisions over either creating highly automatic and independent sites which requires highly skilled people to conduct maintenance or creating very simple systems which are easy for most people (e.g. firefighters) to operate. Ofwat notes that if things do change with robotics and Artificial Intelligence, will water companies be ready to deal with it, with suggestions that the water sector is not as dynamic as other sectors and could lose out if they are not ready.

Geography (rural communities): When a water company covers a rural area, it can make operations more difficult in terms of site access and in raising awareness through the company. Rural areas in the UK are more challenging for communication with poor internet access and mobile signal (Townsend et al, 2015). Road networks are also not as extensive as compared to urban areas which can impact physical access especially during poor weather.

“It is easier to drive awareness in a densely populated area compared to a geographically dispersed company” (Water company One).

One water company noted that when covering a large area, there may be cultural differences between the workforce which can make communication and cohesion more difficult:

“People in different parts of the company may think differently if they live in different areas; this can make it feel like separate entities” (Water Company Five).

Changing staff profile: Traditionally, people would get a job for life, with little movement between companies during a career (Grigg, 2006). However, today the workforce is more transient with it being common for people to move between companies. There is more flexibility in the job market and the hooks for staying with one company are not as strong as they were in the past. The younger generation are more flexible and not interested in doing the same job, in the same way, everyday (Lave et al 2007). This means the younger generation are less likely to stay with one company for their whole career. This study found there was some debate within water companies over the types of ‘hooks’ to keep staff employed in companies. Should there be incentives to keep employers, or do water companies need to accept this is the new culture. The negatives of a transient workforce and the retirement of the long term employees is the loss of institutional knowledge (Grigg, 2006). There are real advantages of having staff with a long duration of service, mainly due to their experience and understanding of the company which can be passed onto the workforce:

“A water company does not work from a script, it takes time and experience to be competent” (Water Company Three and Water Company Two).

However, there are negatives of having an older workforce which has been suggested to include a lack of flexibility, reluctance to learn new skills or finding it more difficult and resistant to new technology (Johnson et al, 2007). These

characteristics are important in creating a resilient and innovative company and therefore refreshing the workforce can be positive if there is retention of knowledge within the company.

3.4.2 Interventions to resilience learning for water sector culture change: Mitigation, Adaptation, Coping & Learning

This section will now categorise the different types of resilience learning used by the water companies with the Safe & SuRe interventions; mitigate, adapt, cope and learn:

Mitigation interventions in resilience learning for water sector culture change

Communicate and engage with customers: All water companies interviewed said that customers are at the heart of resilience. In particular, they expressed the importance of engaging with customers in order to understand what they perceive to be a resilient company and how this can be achieved:

“Understanding is very important and it comes from engagement, active listening and communication” (Water Company Three).

Firms employ a range of activities (e.g., focus groups, workshops) to communicate with customers to manage expectations. One company (Water Company Three), for example, conducts customer communication groups which can include talking to people on the street, workshops and focus groups to understand what the customers think of risk and resilience. Engaging with customers not only informs companies about perceptions on their social performance (i.e. whether they are a good corporate citizen in customers eyes), but it also increases the likelihood that customers and other stakeholders (e.g. regulator) will support investment and changes. Through engagement, customers develop a sense of ownership for the process, and thus want to see it be successful (Jaakkola and Alexander, 2014).

Communication and engagement with customers can be considered a mitigation measure as it aims to minimise the effects of disengaged customers (a potential threat) on the operation of water companies. However, it can also be a form of adaptation (e.g. when developing a sense of ownership) and also contributes to learning in the water sector.

Adaptation interventions in resilience learning for water sector culture change

Communicate and engage with workforce: Effective communication and engagement increases understanding and willingness to work effectively and accept any new policies or changes in a company. This can help to minimise the effects that any disturbances in the workforce system have on the level of service that they provide and is considered an adaptation rather than a mitigation measure as it does not tackle the root cause (i.e. threat) that results in the workforce disturbances. Water company four noted that clear communication and a strong

vision was especially important when the company covers a large geographic area:

“A strong corporate vision can be especially important when a water company is covering a large area” (Water Company Four).

Technology has assisted to make communication easier with mobile phones, email and internal social networking tools such as Yammer within organisations. However, one water company (Water Company Three) highlighted that the employees still need to engage with the communications if they are to be effective in mitigating threats: for example, the workforce needs to actually read the relevant emails. Sometimes stronger levels of engagement are required, including workshops and meetings, but these take time and costs more money.

Two water companies (Water Company Four and Water Company Two) found that creating space and time for the workforce to mix can be powerful, especially when events are cross-department. They can also be helpful in breaking down barriers between the workforce and senior leaders – creating space for conversation and feedback.

“Water companies are divided with those out in the field and those in offices – getting everyone to mix during staff events is important” (Water Company Two).

Diversify perspectives; In today’s society, diversity can be defined to include culture, gender, nationality, sexual orientation, physical abilities, social class, religion, socioeconomic status and age (Allen, 1995, Sadri and Tran, 2002). There has been considerable emphasis in companies to facilitate diversity, although the evidence to demonstrate the positives of having a diverse workforce is difficult to define and evaluate, it has been suggested that a diverse workforce will improve productivity, creativity and resilience (Armstrong et al, 2010; Kilian et al, 2005). Companies are seeing the need to have a workforce that reflects today’s society and to gain the best available talent in the context of the workforce demographic trends (Prieto et al, 2009). Findings from this study have suggested that adaptation of the workforce to obtain a diversity of ages could help to minimise the loss of institutional knowledge as long standing employees begin to retire (as described above). However, to encourage young people, and to include those from a range of backgrounds, there needs to be career routes that are accessible and possible for everyone. Ofwat highlighted the return of apprenticeship schemes to water companies as being a success story to improving workforce resilience:

“It is rewarding to see apprenticeship schemes being available in water companies.” (Ofwat)

“There are many roles in water companies that do not require a degree and these people need to be supported, for example through apprenticeships” (Water Company Three).

It was highlighted that workforce diversity needs to be throughout the company and more responsibility needs to be given to the younger workforce, which may encourage them to stay in the company:

“Diversity needs to be encouraged at all levels in the company” (Water Company Three).

Strengthen leadership: Investment in the managers and leaders with training programmes is important, as strong leadership can minimise the impact of many cultural challenges within a workforce. This study found that a strong leader includes someone with a strong vision, visible throughout the company, and someone who is a good communicator. One water company highlighted the need to spot the ‘rising stars’ and to encourage and train these employees into the leaders of the future:

“These are the employees that are supported and encouraged to stay in the company, with investment to develop their skills, train them to think outside of the box and teach them to work off-script” (Water Company Three).

Ofwat said that cultural threats are difficult to overcome without good leadership:

“Leadership inside the company should be able to spot the cultural threats- and put the management time and leadership into place- so the [company] is on its front foot” (Ofwat)

Although leadership is seen to be important, one water company highlighted that it is very difficult to measure and define good leadership:

“Very nebulous – almost like being a good parent – leadership is very important but how do you measure and define it? It is a journey” (Water Company Two).

In many sectors, it is normal for leadership training not to be monitored or measured, this is unlike other capital investments where the financial return on investment is important to consider (Avolio et al, 2010). It could be argued that without evaluation, it is more difficult for leadership training to be improved and could prevent the development of strong future leaders.

Improve knowledge management; Knowledge management has been an essential part of business since the nineties with the development of computers (Donate and de Pablo, 2015). Successful knowledge management is based on improving efficiency, processes, innovation and increasing productivity and quality (Nguyen & Mohamed, 2011). All of the water companies interviewed and Ofwat highlighted the importance of codifying knowledge as a way to adapt and be resilient to a workforce which is becoming more transient in nature, with an increased effort to manage out the single person dependencies:

“Avoid single points of failure in people, with people moving across the business so they have a broad knowledge across the business” (Water company One).

“Retention of knowledge of what a pipe or bit of equipment was designed to do and how it works needs to be available for a long period of time” (Water Company Five).

“Bright people are coming into water sector but they have a gap in experience. So many water networks have not been digitised – and a lot of knowledge is lost as

people retire. The information can't just be put in a report as most reports are put on a shelf and are difficult to access" (Ofwat)

Decision support systems have become essential in many businesses as they can be used to support complex decision making and problem solving (Shim et al, 2002). One water company (Water Company Four) has introduced a new decision support tool to assist with knowledge management. This builds resilience as decisions are based on something that can be measured and documented.

Provide well trained and experienced staff: Training and development for the workforce has a positive impact on the individual employer and team performance, while also improving the economic prosperity of the company (Aguinis and Kraiger, 2009). The investment in training and development of staff is essential for the workforce to gain new skills, improve job performance and develop emotive skills (Hill and Lent 2006, Satterfield and Hughes 2007). In this study, the water companies listed a range of courses and development programmes that are used to help to develop their workforce skills. It was also noted by one water company (Water Company Three) that there should be flexibility in the business structures to enable young people to develop as individuals and help them understand and use their strengths through experience and training, while improving their weaknesses, which will ultimately increase the resilience of the workforce. Ofwat highlighted that it was good to see coaching and mentoring being used in water companies, not just as a tick box exercise but because they generally believed it helped the workforce.

It is important that training is available and accessible to employees but it is also important that the benefits are documented (Aguinis and Kraiger, 2009). This is recognised by water companies but there were also questions on how this is possible with emotive skills:

"Training and skills should be monitored to enable management to build up a larger picture of the technical skills within the company" (Water Company Five).

"How to measure empathy? Very subjective" (Water Company Two).

Two water companies (Water Company two and Water Company five) highlighted that the development of technical skills shouldn't be forgotten, with discussion of emotive and engagement skills, as it is difficult to find staff with the right technical skills. Ofwat also referred to the EU Skills Group Annual Review (2017) and noted that the water sector needs to be competitive to get the right people with the right skills.

"It is easier to employ staff with good social skills than someone with the right technical skills" (Water Company Two).

Coping interventions in resilience learning for water sector culture change

Utilise good will: To an extent a company's long-term success is built upon the employee's contributions, with the employer-employee goodwill being essential to commercial success (Roslender and Dyson, 1992). This study has found that the

“can do, will do” culture in water companies is very powerful. All the companies interviewed stated that when things go wrong, the workforce are good at responding, with the Operation teams in water companies being highlighted as very committed people:

“It is personal for the workforce, and when there is an incident, it is taken seriously with a sense of pride and responsibility” (Water Company Three).

Engaged employees are crucial to the success of a company, bringing motivation, ideas and willingness to go the “extra mile” (Moreira, 2013). Results found that engagement is important during an incident in helping the water company cope and reduce the consequences on a water system. However, many of the water companies interviewed noted that the top management can take advantage of this ‘good will’. During the interview with Ofwat, they discussed the willingness of employees to help during incidents, for example employees might expect to stay up two nights in a row, twice a year. However, employees will not want to stay up two nights in a row once a month. Ofwat continued to state that this leads to the wider resilience question, of how often is the company exposed to having to deal with response and recovery. Companies need to have a resilient infrastructure that can deal with shocks without going into mode of incident operation.

In response to managing ‘good will’, many of the water companies interviewed are attempting to formalise the structure to reduce the dependence on certain members of the workforce. For example, starting an Emergency Volunteer List in which employees can sign up and training is given to support various tasks and functions which may occur during an incident.

Ensure flexibility: Findings have suggested that an organisation cannot be agile without the existence of an agile workforce (Sherehiy et al, 2007). The ability of a workforce to work ‘off script’ and be flexible has been highlighted by the water companies in this study to be an important coping mechanism. When an incident occurs the workforce needs to be resourceful to minimise impact. Having well trained and experienced staff that are flexible and personally committed to what they are doing is essential in dealing with an incident. A limitless amount of effort can be put into building resilience but when something totally unexpected happens, the workforce needs to be prepared to cope:

“Having procedural approaches to resilience is fanciful as all droughts and floods are never the same” (Water company Two).

The water companies also highlighted that the impact of an incident is as much dependent on society as the actual event. Society changes through time, and coping methods used during a drought in the 1970s would be very different from those used today. This highlights the importance of bringing the customer on the resilience journey.

Learning interventions in resilience learning for water sector culture change

Produce failure/learning reports: All of the water companies interviewed conducted some type of learning or failure report after an incident but none of the companies stated that their companies were good at learning:

“Failure still has the old-fashioned understanding. [The water sector] is in contrast to the aviation industry which has a no blame policy. Although failure is natural it goes against human nature, we want to succeed” (Water company Two).

It was highlighted that sometimes it’s difficult to do root cause analysis if blame is held on to. An hypothetical example was given:

“if it’s cold (freezing) and a pipe bursts then this is held on to instead of investigating further” (Water Company Five).

Findings from this study suggest that the water sector could improve their learning by looking more outward to other sectors and to other countries. This study did find a success story in the water sector where learnings and case studies are shared across the Health and Safety departments who meet every quarter. This transparent and open approach could be expanded to other departments in the water companies.

Embed learning:

“Embedding findings can be difficult” (Water Company Five).

Water companies in this study noted that they are usually good at finding and fixing, but less good at making the lessons stick. Problems can come around again and people revert to type and forget. The size of the company can impact their ability to make changes from learning reports, one company stated,

“Having a large organisation makes it more difficult to embed changes if there is no one monitoring” (Water company One).

One water company built up a library of historic incidents, which highlighted the number of near miss events. This helped them to think holistically and on a long-time scale. The immediate response after an incident is to invest to prevent the incident from happening again but this may be a knee jerk reaction:

“[Recent incidents can] skew resilience more than it ought – you need to take a step back and assess the probability of it happening again compared to other risks and threats” (Water Company Four).

4 CONCLUSIONS

People are fundamental in creating any paradigm or regime shift. However, people are complex, with different histories and drivers, making it difficult to implement culture change. This paper explores the challenges, opportunities and learning points from the top down (Ofwat) and bottom up (water and sewerage companies)

to explore the shift in creating a resilient workforce culture. Findings suggest that resilience is a journey, it needs to be holistic and both the customers and workforce need to be on board for it to work. The main threats and failure modes for resilience learning in the water sector were highlighted as leadership, resources, geography (rural communities) and the changing staff profile. The Safe and SuRe framework worked a powerful toolkit to raise awareness of the need to tailor approaches to engender learning and culture change across the water sector. Mitigation methods included communication and engagement with customers. Adaptation methods included engagement with workforce, diversification of workforce to ensure that the workforce is a reflection of society, strong leadership, importance of knowledge management and the provision of well trained and experienced staff. Coping interventions included the employee's good will and flexibility in the workforce. While, learning interventions included the production of learning and failure reports as well as the importance of embedding learning.

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