



Real-life resilience: Exploring the organisational environment of international water utilities

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ARTICLE INFO

Keywords:

Water utilities
Organisational resilience
And organisational culture

ABSTRACT

The water sector has signalled the need to advance organisational and social resilience efforts. There is a lack of understanding of whether the organisational environment in water utilities is conducive to organisational resilience. Themes from interviews showcased challenges related to cognitive and contextual organisational properties. We identified a need to broaden the cognitive frame of utilities to account for flexible concepts of enhanced sense-making. We propose categories of organisational silos and a set of cultural attributes that contribute to organisational resilience. Interventions are needed to develop the cognitive, behavioural, and contextual properties of utilities that support organisational resilience.

1. Introduction

Resilience is recognised to help organisations prepare for, manage and thrive against the effects of chronic and acute disruptions (Sheffi and Rice, 2005). Despite the disciplinary evolution of the concept and its increased prominence, scholars and practitioners still struggle with interventions to build and sustain resilience (Moser et al., 2019). In particular, integrating different sub-domains of resilience, such as social and organisational, remains one of the main challenges (Macrae, 2019; Moser et al., 2019; Naderpajouh et al., 2018; Rodina, 2019), especially when managing critical infrastructure systems (CIS) (Brown et al., 2017; Crick and Bentley, 2020).

The resilience of CIS, such as water utilities, is paramount for society (van der Merwe et al., 2018). Water utilities have the complex duty of ensuring ongoing water and wastewater services against a backdrop of increasingly complex shocks and stresses (Baehler and Biddle, 2018; Brown et al., 2017). Within the water sector, resilience discussions are traditionally dominated by technocratic and engineering perspectives (Akamani et al., 2015; Crick and Bentley, 2020; Rodina et al., 2017). Increasingly, however, water sector professionals and scholars are emphasizing multiple domains of resilience through more comprehensive resilience approaches that also account for organisational and social capabilities (Akamani et al., 2015; Crick and Bentley, 2020; Naderpajouh et al., 2018; Rodina et al., 2017; Smith et al., 2019). For this study, the term resilience refers to the organisational resilience concept, which we define as an organisation's collective ability to absorb, adapt and

capitalise on shocks and stresses (Lengnick-Hall et al., 2011).

Accordingly, from an organisational perspective, precursors to disruptive events may be linked to organisational behaviour and culture (Taylor et al., 2017). In addition, the water sector has indicated an increasing recognition of the importance of human agency in the resilience of water utilities (Crick and Bentley, 2020; Lawson et al., 2020; Ofwat, 2017; Smith et al., 2019), especially as humans have a significant influence on vulnerabilities of physical assets (Chester and Allenby, 2019). Therefore, insights on these issues from water sector personnel may support a better understanding of the current organisational environment in water utilities and whether it is conducive to resilience initiatives. The term 'organisational environment' is applied in this paper to mean the internal dynamics, perceptions and values of water utilities that influence their organisational resilience.

The authors have had a long-standing research interest in the organisational journeys that water utilities are undergoing; from engineering risk and asset management through to corporate risk governance and, more recently, toward embedded organisational resilience (Chalker et al., 2018; Pollard et al., 2006, 2009, 2014; Tang et al., 2013). However, these developments are not simply a progression within a single domain because the concepts of risk governance, risk management, and resilience each draw in additional elements from disciplines not incorporated within the predecessor concept.

To examine the organisational resilience maturity of recent developments in detail, we draw from the internal cognitive, behavioural, and contextual properties of water utility organisations (Lengnick-Hall

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<https://doi.org/10.1016/j.jup.2022.101394>

Received 26 May 2021; Received in revised form 27 June 2022; Accepted 27 June 2022

Available online 26 August 2022

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and Beck, 2005; Lengnick-Hall et al., 2011). While studies of organisational resilience have been undertaken for the water sector (Crick and Bentley, 2020; Rodríguez et al., 2020), they often lack a clear definition of the concept. This gap may be linked to numerous conceptualisations of resilience that contribute to ambiguous and inconsistent understandings (Duchek, 2020). Organisational resilience is mainly described as a blend of traits, behaviours, resources and capabilities (Duchek, 2020; Gittell et al., 2006; Gover and Duxbury, 2018) that enable dynamic adaptation and sustained delivery of organisations’ products and services. Elsewhere, organisational resilience is seen as the appropriate management of tensions, such as efficiency and adaptive capacity, as well as temporal practices, namely: foresight, insight, oversight and hindsight (Denyer, 2017). Crucially, people, leadership and culture have been identified as the primary sources of organisational resilience (Gittell et al., 2006; Gover and Duxbury, 2018; Mafabi et al., 2015; Resilient Organisations, 2012). A culture of organisational resilience has been described as an ambivalent vigilance of the *status quo* (Sheffi and Rice, 2005), a proactive organisational stance (Denyer, 2017) and a culture that embraces change through innovation and renewal (Chester and Allenby, 2019; Hamel and Valikangas, 2003; Mafabi et al., 2015).

In addition to varying perspectives, literature predominantly signposts characteristics of organisational resilience through attribute-based tools or prescribed frameworks (Denyer, 2017; Resilient Organisations, 2012; van der Merwe et al., 2018) that are often applied as organisational resilience assessments (Brown et al., 2017; Sweya et al., 2020). However, these can lack a detailed account of the reality in organisations and depth of understanding of the complexities of developing organisational properties conducive to resilience. Very few studies have attained a detailed picture of the realities of organisational resilience (Gover and Duxbury, 2018), especially for the water sector (Crick and Bentley, 2020). Therefore, there is a need for an in-depth understanding of the current organisational environments in water utilities, with approaches that focus on resilience assessments and explore the internal properties of utilities from the lens of a clearly defined notion of organisational resilience.

In this paper, we utilise the framework posed by Lengnick-Hall and Beck (2005) and Lengnick-Hall et al. (2011) as an analytical frame due to its detailed illustration of how organisational resilience is manifested in different properties within organisations. Organisational properties must be developed to build the capacity for organisational resilience and honed continuously as capabilities to sustain a resilient performance (Lengnick-Hall and Beck, 2005). Table 1 showcases descriptions and the manifested characteristics of the cognitive, behavioural, and contextual organisational properties that support resilience, thus allowing a more in-depth analytical assessment of the organisational environment. We believe that by utilising the organisational properties below, as opposed to attributes-based frameworks (Denyer, 2017; Resilient Organisations, 2012), we can clarify, in more detail, the realities and complexities of building organisational resilience practically into water utilities.

Based on the analytical framework in Table 1, the research question is posed: “What are the challenges water utilities face in developing the organisational properties that build organisational resilience?”. Using interviews with a sample of managers from international water utilities spanning the public and private sectors in middle and high-income countries, we explore the operational realities of utilities and examine whether there is evidence of a material transition from good corporate risk governance toward organisational resilience in practice.

2. Methods

Semi-structured interviews were conducted with water utility representatives from Australia, Brazil, Canada, East Asia, Greece, Hungary, Netherlands, Portugal, UK and US. A semi-structured interview survey instrument was selected to elicit supportable evidence from water managers (Adams, 2010). The semi-structured interviews established a

Table 1
Analytical framework of organisational properties that support organisational resilience, adapted from Lengnick-Hall and Beck (2005) and Lengnick-Hall et al. (2011).

Organisational Properties:	Description:	Manifested as:
Cognitive	Values and beliefs (cultural identity) that contribute to timely and effective interpretation (sense-making) of growing trends that translate into a favourable behaviour of organisational resilience.	<ul style="list-style-type: none">• Widespread understanding and commitment to the organisational vision and values.• Cognitive frame of ingenuity, flexibility, and decisiveness when confronting uncertainty to support effective responses and opportunities for development.
Behavioural	Ability to manage complexity by proactively and dynamically employing unconventional and standardised responses based upon what generates the best outcome for the organisation’s short and long terms.	<ul style="list-style-type: none">• Cognitive elements are transformed into visible actions: bricolage, improvisation, pro-activeness, and resourcefulness.• Behavioural reserves composed of standardised well-scripted behaviour and the ability to implement organic responses based on the most suitable course of action.
Contextual	Underpinning structures (people, relationships, processes, and resources) that generate cognitive and behavioural characteristics conducive to organisational resilience.	<ul style="list-style-type: none">• Internal and external social capital, psychological safety (collective respect for unconventional and contentious ideas/solutions), diffuse power (inclusive decision-making), resource network (interpersonal connections that generate resources/solutions), accountability, and tangible and intangible resources.

focus for the interviewer while supporting the participants to voice a free flow of ideas and information based on their perceptions and experiences (Adams, 2010). The interviews sought to capture the current organisational environment of utilities from different realities and geographical locations concerning organisational resilience. The geographical scope of this study was focused on middle and high-income countries with relatively well-established centralised utility services.

An interview topic guide provided a detailed account of the organisational domain of water utilities and perspectives on the current organisational environment and challenges faced in building resilience. The guide was informed by the main knowledge gaps identified from the literature and refined by two pilot interviews with relevant representatives from the water sector. The questions covered topics on participants’ understanding of resilience, as well as their views on social and organisational aspects of resilience.

The sample was composed of managers and senior managers from international water utilities. Out of the 31 participants, 13 were selected purposively, as they were involved in a working group of the US Water Research Foundation research project that funded this study (see Acknowledgements). To prevent the predominance of project members, we recruited an additional 18 participants with no direct involvement through snowball sampling (Table 2). These participants were selected due to their strategic and tactical roles in influencing water utilities’ resilience. Two participants were representatives of a Water Association from East Asia. The specific country where the Water Association is located has been omitted to maintain their anonymity.

The interviews attained ethical approval, and the anonymity of

Table 2
Characteristics of the participants in this study.

Region	Participant's area of expertise	Utility scope	Utility Type	Engaged in the project
Australia	Risk management	Clean water and wastewater	Public	X
Brazil	Research, development, and innovation (senior manager)	Clean water and wastewater	Public/private	
Brazil	Asset management and planning	Wastewater	Public/private	
Canada	Corporate governance	Clean water and wastewater	Public	X
Canada	Strategic projects (senior manager)	Clean water and wastewater	Public	X
East Asia	Water association	Clean water	Private (non-profit organization)	
East Asia	Water association	Clean water	Private (non-profit organization)	
Greece	Research, development, and innovation (senior manager)	Clean water and wastewater	Public/private	
Hungary	Water quality and safety	Clean water and wastewater	Public	
Netherlands	Research, development, and innovation	Clean water and wastewater	Public	
Portugal	Asset management and planning (senior manager)	Clean water and wastewater	Public	x
UK	Risk management	Clean water and wastewater	Private	X
UK	Risk management (senior manager)	Clean water and wastewater	Public	X
UK	Asset management and planning	Clean water and wastewater	Private	X
UK	Climate change	Clean water and wastewater	Private	X
UK	Asset management and planning (senior manager)	Clean water and wastewater	Public	X
UK	Climate change	Clean water and wastewater	Private	X
US	Research, development, and innovation	Clean water and wastewater	Public	X
US	Strategic projects (senior manager)	Clean water and wastewater	Public	
US	Asset management and planning	Wastewater	Public	X
US	Asset management and planning	Clean water and wastewater	Public	X
US	Asset management and planning	Clean water and wastewater	Public	
US	Stakeholder outreach, asset	Clean water	Public	

Table 2 (continued)

Region	Participant's area of expertise	Utility scope	Utility Type	Engaged in the project
US	management, and planning	Clean water	Public	
US	Asset management and planning	Wastewater	Public	
US	Strategic projects	Clean water and wastewater	Public	
US	Climate change	Clean water and wastewater	Public	
US	Risk management	Clean water and wastewater	Public	
US	Public relations	Clean water and wastewater	Public	
US	Research, development, and innovation	Clean water and wastewater	Public	
US	Senior management	Clean water and wastewater	Public	
US	Climate change	Clean water and wastewater	Public	

participants was preserved. The interviews were conducted between September 2019 and March 2020 on a one-to-one basis via telephone or Skype, and they ranged in length from 30 min to over 2 h. All interviews were recorded and transcribed verbatim, with two interviews translated (from Portuguese to English) and transcribed by the researchers.

Transcripts were stored and organised in the software Nvivo™ 12 (QSR International Pty Ltd, 2020). Reflexive thematic analysis (Braun and Clarke, 2006) was employed as the analytical method due to its theoretical flexibility and potential to derive insightful patterns of meaning across the dataset. A predominantly inductive approach steered the creation of codes and themes that were regularly revisited across all transcripts. However, we also acknowledge that the literature review partly influenced the analysis of data and the creation of themes. The researchers were conscious about regularly reviewing themes to ensure a clear distinction between them and to certify that the themes devised were consistent across the data set to avoid recency bias. Codes and themes were devised based on patterns that had relevance and importance in clarifying the organisational environment of water utilities with respect to resilience, as opposed to the frequency of citation across the entire dataset (Braun and Clarke, 2006). We related the devised themes with the analytical framework on organisational resilience (Lengnick-Hall and Beck, 2005; Lengnick-Hall et al., 2011) to explore current organisational challenges and their respective implications for the water sector. The assessment of themes against the framework allowed a more comprehensive analysis within different organisational dimensions (cognitive, behavioural, and contextual), thus clarifying the complexity of developing organisational properties conducive to resilience in a water utility environment.

3. Results

The results are structured based on the themes below (Table 3). This table relates the main themes derived from the thematic analysis with the analytical framework (Table 1). We assessed the themes to identify the relevance of organisational properties to the resilience of water utilities. This approach allowed the researchers to pinpoint challenges and their implications, thus providing an initial visualisation of where resilience solutions could be targeted in the organisational sphere.

Our results have shown that progress has been made towards embedding a deeper understanding of the importance of human

Table 3

Identified themes and the implications for building organisational resilience, based on the theoretical framework from Lengnick-Hall and Beck (2005) and Lengnick-Hall et al. (2011).

Identified themes:	Implications to organisational resilience in water utilities:
Narrow understanding of resilience.	<ul style="list-style-type: none"> • Cognitive Interpretations of resilience are narrowly focused on risk management and robustness, with little consideration of flexibility and adaptability elements of resilience, thus limiting sense-making when managing shocks and stresses.
Justifying and sustaining resilience.	<ul style="list-style-type: none"> • Cognitive and behavioural Decreased capacity to read (sense-making) and respond to threats proactively due to dominant reactive and efficiency values that drive behaviour, thus restricting the development/ability to draw from behavioural reserves.
Constrained environment for innovation.	<ul style="list-style-type: none"> • Contextual and cognitive Lack of tangible and intangible resources to foster innovative and flexible values to drive creative solutions and experimentation towards organisational renewal and growth.
Resilience and resources.	<ul style="list-style-type: none"> • Contextual and behavioural Unfavourable contextual scenario due to resilience not being seen as a basic necessity, thus competing with other impending priorities and hindering the ability to manage paradoxical tensions. Insufficient resources and funding impact the range of behavioural reserves (well-rehearsed/organic responses) to manage shocks and stresses.
Silos and conflicting priorities.	<ul style="list-style-type: none"> • Contextual and behavioural Lack of effective resource networks (interpersonal connections) and inclusive decision-making (diffuse power), thus leading to misaligned and duplicated organisational efforts.
Uncertainty on leadership buy-in.	<ul style="list-style-type: none"> • Contextual Absence of a driving force pushing the development of processes and allocation of tangible and intangible resources in support of organisational resilience.
Organisational structures.	<ul style="list-style-type: none"> • Cognitive Lack of a consistent cognitive frame (cultural identity) to ensure organisational-wide understanding and commitment to organisational resilience values.
Lack of understanding of how to embed a culture of organisational resilience.	<ul style="list-style-type: none"> • Cognitive and behavioural Inadequate organisational values and beliefs and under-explored cultural characteristics that influence behaviour toward organisational resilience, thus impacting a cohesive cultural identity and commitment to the organisational vision.

elements in building resilience. However, in this paper, we focused our analysis on the challenges standing in the way of building the organisational properties that support organisational resilience.

3.1. Narrow understanding of resilience

The findings denote a narrow perception of resilience, as some participants rarely related resilience with more flexible concepts such as adaptability and flexibility. Instead, some participants articulated their views on resilience based on more confined concepts such as risk management and engineering robustness. However, resilience is a broader concept composed of multiple interventions underpinned by different (and potentially contrasting) concepts, as unilateral and rigid cognitive lenses are insufficient to build organisational resilience. In addition to

this narrow understanding, the results also showed some confusion around the general concept of resilience, which was manifest predominantly by participants from non-English speaking countries, with one noting: “There is no exact word in [my language] that exceeds this concept. We use the English word, ‘resilience’ [...] I think we still ha[ve] difficulties understanding the complete concept” (WA01).

3.2. Justifying and sustaining resilience

The challenge of justifying resilience to the organisation was related to perceived non-tangible benefits, the frequency of extreme events and resilience being pitched internally based on hypothetical scenarios: “I think it’s really hard to engage people who have never been in a disaster, or who don’t really have the sense of what a disaster and chaos looks like” (RI10). However, the need for resilience was often acknowledged only after a crisis. Sustaining resilience investments in organisations ‘presumed’ to have high levels of resilience maturity was also seen as a major challenge: “[...] over the past years [...] the government and others see us like we are okay. The things we do to keep up with this level of resilience sometimes are regarded – this is really ironic – are regarded as needless” (RI13). This efficiency-driven and reactive stance instils brittleness in the ability of water utilities to read effectively and proactively (sense-making) and respond to potential threats, which are essential cognitive and behavioural properties of organisational resilience.

3.3. Constrained environment for innovation

Innovative advancements drive organisations to improve their expertise and practice and support dynamic responses. However, the findings suggested that uncertainty and scarce resources often inhibited the implementation of innovative efforts: “When you’re in a very financially constrained operating environment, it can be really difficult to make the case for doing something different when you don’t know whether it’s going to work [...]” (RI02). There was a degree of caution about implementing untested solutions, such as green infrastructure, in the context of highly constrained resources with the pressure of sustaining the delivery of what were deemed to be more reliable services.

Additionally, reluctance to change by individuals in the organisation was seen as a barrier to innovation and professional development. Attaining a mindset that embraces change amongst personnel was a dominant issue that was sometimes influenced by fear and unwillingness to experiment with novel approaches: “If something always worked [...] there’s really no benefit to the individual to encompass change. Whereas it might be a huge benefit to the organisation, the risk to themselves might be weighed as greater than their desire to move forward” (RI23B).

3.4. Resilience and resources

Most participants noted that scarce resources and financial limitations hindered proactive behaviour that favoured long-term benefits: “[...] there’s a particular challenge that we’re facing in this moment in time around our ability to invest in what we need to do to maintain, or to improve our performance to meet expectations versus the financeability of water companies [...]” (RI03). Additionally, some participants perceived resilience initiatives not as a basic necessity.

Although lack of resources was a challenge expressed by most participants, middle-income countries were particularly vocal about how deficiencies in the quality of water services and scarce resources impacted their ability to initiate resilience efforts. Therefore, adopting resilience under conditions of scarce and coveted resources was perceived as unnatural due to the need to address other priorities: “So this topic of resilience, I believe that water utilities [here] they know the importance of it, but given that we have more essential and basic problems [...], I believe that for other water utilities [...] this concept is not such a huge priority at the moment” (RI19). This challenge of scarce resources is problematic because organisational resources support contextual

conditions to enact cognitive and behavioural properties of organisational resilience.

Further, participants emphasized financial issues, which were associated with the following factors: (1) societal desire to maintain water prices as low as possible; (2) decreasing demand and revenue due to population/consumption decline; and (3) lack of funding. From the perspective of private utilities, the participants underscored a misalignment between water price determinations by regulators and the long-term resilience needs of utilities: “[...] most water companies ha[d] to put back to the regulators [...] ‘We can’t do what you’re asking us to do with the amount of money that you’re allowing us. It’s not possible. It makes us unfinanceable as a business’” (RI02). Elsewhere, some public utilities reinforced resilience concerns associated with lack of funding due to competition for funds with other sectors: “[...] Resiliency funds would be competing with homelessness funds, with public health funds, with trash funds, even with improving water supply funds. When you look from that perspective, is it right to fund resiliency when you have a lot of people homeless on the street?” (RI21). Still, in the public sphere, some notable yet niche remarks were also made around water tariffs being frozen centrally by the government for a prolonged period, the commission of resilience initiatives “on paper” without governmental funding and dilapidation of infrastructure due to a lack of maintenance funds to ensure its resilience.

3.5. Silos and conflicting priorities

Participants voiced that reaching out to others to assemble more comprehensive solutions beyond their silos was often not supported. The lack of integration impacted effective communication and cohesive information management, where independent and isolated solutions generated unintended and harmful consequences across the organisation. For instance, addressing immediate urgencies within one silo may cause detrimental impacts on different parts of the organisation: “One of the challenges is that the person here may do something which has made their life easier. They’ve achieved what they want to achieve. But actually, they’ve made it difficult for the business over here because there’s a cascade effect (RI06.1)”. Lack of integration and cohesiveness in water utilities was seen as a challenge that could lead to unnecessarily duplicative work.

Sharing information through collaborative integration and resource networks supports the growth and diversity of intellectual capital and increases awareness of interdependencies amongst different silos in the organisation, thus preventing rework and streamlining organisational processes. However, based on the data in this study, we identified three main silos that may lead to conflicting priorities and lack of cohesion within water utilities: (1) physical characteristics, (2) technical background, and (3) hierarchical levels.

3.5.1. Physical characteristics

The physical characteristics of water utilities were noted siloed: “[the] company is very big because it serves the whole state. [...] So, within our organisation there is a great difference according to different regions” (RI19). Some participants recognised that water utilities suffer from compartmentalisation due to their large size and the physical separation of workplaces: “I think part of it is that we have physical separation between some of our places – our workplaces, right?” (RI06). It was highlighted that disseminating information across the whole organisation can be difficult, as in some cases, staff do not have e-mail addresses and have different work patterns.

3.5.2. Technical background

In an environment such as a water utility with highly specialised personnel who are deeply immersed in their own technical mindset, understanding the complementary or conflicting priorities of others’ work was perceived as difficult. This divide led to technical silos, as described by a participant:

“[...] the scaler team and the modelling team ended up having a little bit of an argument with the folks in the field. The folks in the field basically were saying, ‘This is what we are seeing out in the field. [...] We don’t care what you are doing sitting in your cushy cabins and running computer models’” (RI11).

Participants also highlighted the need for different professions and departments within utilities to be open to working collaboratively together for more comprehensive solutions.

3.5.3. Hierarchical levels

The final contributor to a siloed behaviour within water utilities was the divergent priorities and objectives of different hierarchical levels, as pointed out by the following:

“The reason sometimes they don’t see eye-to-eye is because we’ve not taken the time organizationally in connecting [...] the people who work on these physical assets in the field to the people who actually plan and develop long-term capital infrastructure plans for the future” (RI11).

Participants pointed out a misalignment of objectives between (senior) management and some parts of the organisation, which led to contrasting understandings of the impending organisational needs. Fostering integration across different hierarchical levels was seen as a way for individuals to improve their understanding of the real needs and priorities of the organisation.

3.6. Uncertainty on leadership buy-in

The endorsement of resilience efforts by senior management was a topic voiced by the participants. It was underscored that leaders need to understand the importance of resilience and resilience investments. However, some participants expressed a degree of uncertainty as to whether senior managers’ priorities were consistent with the resilience priorities of the organisation “I think they are also driven by their personal liability, so perhaps it’s interesting to see what a typical director sees as important in this topic [...]” (RI08).

Participants, mostly from public water utilities, underscored the issue regarding short-term strategies that do not necessarily contribute to resilience: “As cycles change administratively, if there is no unified framework then it’s only a matter of [...] the next government or the next leadership bringing their own understanding of what resilience or enterprise resilience means” (RI11). Some also questioned the appropriateness of Board members’ objectives, highlighting that they could be influenced by personal liability or political pressures. This situation is problematic because the goals set by leaders steer the collective behaviour of individuals and shape organisational culture, thereby influencing the ability to build organisational resilience.

3.7. Organisational structures

Participants emphasized the importance of centralised organisational structures to enhance integration and embed resilience principles across the organisation. A dominant topic was the need for a centralised department or a champion that drives resilience properties and assembles organisational linkages: “One is again having the centralised group. It’s a small team, but they’re there to help you sort of how to interpret and facilitate and moderate the discussions that we do” (RI09). Accordingly, some participants perceived centralised structures as key to progress with the resilience agenda as they can ensure a sustained organisational commitment.

The need for centralised resilience structures was reinforced by the disadvantages highlighted by a lack of an allocated role/department to deal just with matters related to risk management: “If you look in the water space itself, [we are] one of the few utilities that actually has the position of a risk manager. A lot of people have that position with something

else, so it doesn't get the focus that it does here" (RI23. B). A centralised group or role was viewed as bringing focus to coordinating and sustaining resilience strategies within water utilities without getting replaced by other impending matters.

3.8. Lack of understanding of how to embed a culture of organisational resilience

Organisational culture was a prevalent subject. However, descriptions of how to implement changes to drive a culture conducive to organisational resilience within water utilities were often vague. Instead, the many remarks about culture were associated with a need to change and recreate the current organisational culture: "I'm just going to give you one word; culture. The culture in organisations is fundamental to change. Looking at my organisation, our culture needs to change" (RI07).

Interviewees associated organisational culture with values that shape behaviour. In addition, some participants indicated that the organisational culture should be set and shaped by leaders. Others also highlighted that organisational policies and structures could also shape a culture of resilience. Some noted that a positive culture change might be brought about and leveraged after a crisis.

While 'culture' was vaguely described, some attributes were commonly cited and associated with a culture that contributes to organisational resilience: (1) empowerment, (2) trust, (3) sense of pride and (4) integration and collaboration. The empowerment attribute was characterised as the ability to empower individuals to 'speak up' about any issues or errors. A culture of trust was seen as creating psychological safety through a supportive and 'no-blame' environment for personnel. A sense of pride was described as motivating employees to be enthusiastic about their role in contributing to the broader organisational vision and objectives. Finally, integration and collaboration were perceived as establishing a culture that embraces the infusion of different perspectives and backgrounds in organisational practices.

4. Discussion

Organisational resilience in CIS is often analysed as an assessment against a set of principles (Brown et al., 2017; Sweya et al., 2020), described through prescriptive and attribute-based resources (Denyer, 2017; Resilient Organisations, 2012), with few empirical studies examining in-depth the organisational environment (Gover and Duxbury, 2018), especially in water utilities. This research builds upon existing resources by investigating the organisational environment of water utilities. We related the themes observed to an analytical framework (Lengnick-Hall and Beck, 2005; Lengnick-Hall et al., 2011) to support a better understanding of the challenges standing in the way of organisational resilience in the water sector. We assert that the operational realities in water utilities can create challenges to building organisational properties conducive to organisational resilience. The empirical approach and broad scope allowed us to identify key challenges to building organisational resilience from cognitive, behavioural, and contextual properties, thereby illuminating the complexity of embedding organisational resilience in water utilities. The novel international scope of this research reveals how different regional contexts manage the resilience needs for the future within the daily pressures of a utility environment.

4.1. Clarifying resilience to practitioners

The interpretations of resilience by the participants centred on risk management and robustness, with little consideration of other aspects of resilience, such as flexibility and adaptability. This stability-centred view encompassed fail-safe values (Rodríguez et al., 2020) attached to established procedures without much reflection on the cognitive dynamism required to manage unprecedented events (Chester and Allenby, 2019). This view also contrasts with the flexibility capability in the

cognitive property posited by Lengnick-Hall et al. (2011) that supports enhanced sense-making of events and the environment.

Robustness and risk management were often associated with resilience, as they have traditionally been the basis of infrastructure planning (Crick and Bentley, 2020); however, this narrow perception limits the construction of other, equally important, resilience-cognitive capabilities that support the identification of effective solutions through enhanced sense-making.

Narrow interpretations of resilience may impact practice (Moser et al., 2019), influence culture and thus hinder the capacity to build organisational resilience. Further, participants in this study occupy roles of at least the managerial level and have strategic influence in organisations; an incomplete understanding of resilience may thus cascade down to personnel and influence organisational beliefs and behaviour (Lengnick-Hall et al., 2011; Summerill et al., 2010).

This finding indicates a real need to broaden current thinking on resilience to account not only for conventional fail-safe approaches (Rodríguez et al., 2020) but also for concepts that embody more flexible and dynamic notions in the cognitive frame of the organisation (Lengnick-Hall et al., 2011). A more comprehensive interpretation of the concept across the organisation may support expanding sense-making capabilities, thus enhancing personnel preparedness.

4.2. Embracing paradoxical thinking

The pressures water utilities face, such as a lack of funding, efficiency demands, and increased costs (Chester and Allenby, 2019), were recognised as conflicting with resilience initiatives. Resources are not only contextual enablers of organisational resilience (Lengnick-Hall et al., 2011), but they enhance resilience efforts during and after a crisis (Gittell et al., 2006). The overall sentiment was that investing in resilience entails increasingly constrained resources and, as cited by the participants, often results in intangible outputs.

If the dominant notion of resilience in water utilities revolves around efficiency and reacting to short-term issues (Chester and Allenby, 2019), water utilities may not actively manage tensions through paradoxical thinking. Paradoxical thinking is the ability to manage the trade-offs of contrasting behaviours, such as being open to experimentation while sustaining the reliability of systems, and is one of the main behavioural capabilities of organisational resilience (Denyer, 2017; Lengnick-Hall et al., 2011). Currently, the efficiency-driven cognitive and behavioural properties mean that water utilities may not have the ability to develop other capabilities such as flexibility and adaptability, thus limiting their ability to expand their behavioural reserves. Embracing paradoxical thinking can accommodate the efficiency and resilience needs in water utilities. Future research should seek to understand potential pathways that support paradoxical thinking and drive such capabilities within the operational realities of water utilities and constrained resources.

Similarly, barriers to innovation stemmed from the organisational context of scarce resources, risk-averse values, and the behavioural reluctance to experiment in terms of technological and personnel development. As highlighted by some participants, resource constraints and the tendency of the industry to prevent risks by focusing on tried and tested approaches (Baehler and Biddle, 2018; Chester and Allenby, 2019; Crick and Bentley, 2020) hinder the ability to experiment with novel solutions. From the perspective of the workforce, pitching for renewal and challenging old assumptions was voiced to be blocked by a mentality of "more of the same". This mentality reinforces the challenges and the complexity in managing the tensions attached to organisational resilience (Denyer, 2017), such as innovation and reliability (Biddle and Baehler, 2019), particularly due to the need to devote tangible and intangible resources to promote acceptance and buy-in of an innovative cognitive frame.

Solutions could be fomented by allocating activities for innovation outside the daily pressures of service delivery (Baehler and Biddle, 2018), encouraging new approaches (Mafabi et al., 2015) and

developing a safe environment to encourage creativity amongst the workforce (Denyer, 2017). Shaping human capital for experimentation and creativity could bring opportunities for water utilities to prevent a predominance of path-dependent outcomes (Crick and Bentley, 2020) and develop new capabilities and expertise to deal with emerging events (Lengnick-Hall et al., 2011). We suggest that deeper approaches may also be needed that target the current context in water utilities (resources and processes) to encourage cognitive and behavioural characteristics that stimulate innovation and growth of different organisational assets; human and built capital.

4.3. Bridging silos

Silos were noted by participants from all different regions, utility types and scopes, thus reinforcing siloed working as a significant organisational resilience challenge (Brown et al., 2017; Crick and Bentley, 2020). Therefore, some utilities may find it challenging to build internally social capital and strong resource networks to undertake co-ordinated actions to advance resilience goals across the organisation (Lengnick-Hall et al., 2011). Furthermore, duplicated work compounds a utility's ability to optimally leverage increasingly scarce resources to employ resilience.

Despite not being mentioned in the literature, physical characteristics such as assets and offices dispersed across large areas were perceived as contributors to isolated actions and a lack of effective communication. Further, environments containing individuals with highly specialised backgrounds may struggle to conciliate different views of a problem, generating misunderstandings and limiting the individuals' ability to interpret different mind frames (Timmerman and Langaas, 2005). Finally, different hierarchical levels have distinct priorities (Macrae, 2019), which may cause disagreement in prioritising organisational needs. Operational personnel are more focused on specified resilience efforts (e.g., the resilience of what to what). The relevance of general resilience (e.g., organisational-wide capacity to manage threats) as an organisational strategy increases at higher levels of the organisation (Macrae, 2019; van der Merwe et al., 2018).

The different categories of silos identified may require a more targeted approach that addresses different types of silos, hence going beyond proposed solutions in current literature. Creating an inclusive environment (Crick and Bentley, 2020) through leadership, organisational values (Gibson and Tarrant, 2010), and sharing of knowledge (Chester and Allenby, 2019) may be too unspecific to bridge different categories of silos. We argue that future research should identify ways to pragmatically employ measures that specifically target physical, technical, and hierarchical silos and advance understanding of their linkages in these organisations to promote strong networks of diffuse power to facilitate internal social capital. By bridging silos, a context of positive interpersonal relationships and inclusiveness develops to support organisational knowledge growth, collaboration, and cohesion (Lengnick-Hall et al., 2011).

4.4. Attaining leadership support

The participants indicated some degree of uncertainty regarding support from leadership on resilience. Public utilities flagged concerns about short-term strategies due to political cycles or personal liability. This scenario indicates a lack of tangible and explicit resilience commitment from leadership. Hence political agendas and short-sighted priorities can be detrimental and restrict a utility's ability to implement and sustain long-term resilience initiatives (Baehler and Biddle, 2018). Some studies highlight the importance of leadership as an organisational resilience driver (Denyer, 2017; Gover and Duxbury, 2018), especially as leaders steer strategic priorities for the organisation (Gibson and Tarrant, 2010) and are critical in setting the organisational culture (Baker et al., 2018; Taylor et al., 2017), thus underscoring the contextual significance of leadership support for organisational resilience.

However, it is unclear how senior leaders view resilience and are motivated to support resilience in these organisations. As identified above, utility managers may have a narrow understanding of resilience influenced by fail-safe approaches, thus impacting the development of organisational resilience properties in water utilities. Therefore, clarity is needed on how senior managers view resilience and how political and personal variables impact legitimate resilience endorsement by leaders. Further work should focus on identifying the drivers that influence senior leaders' stance relative to resilience and how resilience strategies can transcend political cycles in the context of public utilities.

Furthermore, the findings indicate that utilities with different contexts and ownership arrangements are trying to accommodate their resilience needs in a financially constrained environment. For privately owned utility monopolies, regulators' stringent water price determination derives from the need to protect ratepayers (Pawsey et al., 2018). The lack of funds in the public sector was more strongly influenced by political pressures related to the short-term satisfaction of the electorate (Baehler and Biddle, 2018). We argue that fundamentally the financial limitations – from either private or public perspectives – derive from motivations to protect water customers from bearing the brunt and its potential political repercussions. Therefore, the water sector may experience financial limitations more acutely due to its monopoly nature and political sensitivity, thus reinforcing the need to attain socio-political will and support for the resilience of water utilities.

Further, we acknowledge the complex socio-political implications and considerable limitations of embedding resilience elements, such as proactively managing low-probability/high-impact events, to the affordability of water services (Decker, 2018). Nevertheless, our findings indicate that water price determinations from the regulatory and political spheres do not reflect the realities of short and long-term resilience needs of water utilities from diverse backgrounds. Therefore, given the complexity of managing water sector resilience and ensuring affordability to customers going forward, the findings shed light on the relevance of building external contextual capabilities of social capital through customer engagement to advance understanding of resilience needs and customer preferences toward establishing appropriate water prices (Ofwat, 2017). Future work should focus on assessing the relationship of how enhanced customer engagement or more inclusive modes of governance may support, specifically, the legitimisation of the resilience needs of the water sector.

4.5. Configuring organisational structures

As opposed to risk management, which has well-defined structures within organisations (Mauelshagen et al., 2016), little is known about how organisational resilience structures should be positioned within water utilities. Respondents in this study expressed a need for centralised organisational resilience structures, which contrasts with views in previous literature that resilience should be ingrained in the 'bloodstream' of organisations and promoted as an organisation-wide commitment, instead of being the responsibility of one specific individual or group (Denyer, 2017; van der Merwe et al., 2018). Respondents suggested that the absence of centralised structures may hinder the ability of a utility to ensure a sustained cultural commitment to, and accountability for, organisational resilience. Nevertheless, we argue that an overly centralised approach may also detract from building a widespread culture conducive to organisational resilience. Such trade-offs must be carefully considered in any intervention to build organisational resilience.

We posit that a balance is needed between fostering a utility-wide resilience commitment and allocating roles with the sole responsibility of driving and sustaining organisational resilience, as both approaches bring benefits and merit experimentation. Therefore, there is a need to improve understanding of how centralised resilience structures should be positioned in water utilities while also ensuring organisational resilience commitment across different levels and departments.

4.6. Need to unpack culture of organisational resilience

Although culture was not explicit in the interview topic guide, the findings denoted a need for an organisational culture change in the water sector, aligned with Baker et al. (2018) and Smith et al. (2019). Given the prominence of culture in our findings and theory (Baker et al., 2018; Gibson and Tarrant, 2010; Gover and Duxbury, 2018; Hamel and Valikangas, 2003; Resilient Organisations, 2012; Sheffi and Rice, 2005; Taylor et al., 2017) we argue that culture is a key element of organisational resilience in water utilities (Summerill et al., 2010).

However, the analysis indicates a vague understanding of how to effectively drive a culture in support of organisational resilience within the context of water utilities, as previously flagged by Smith et al. (2019) and Sweya et al. (2020). Similar to theoretical resources (Gibson and Tarrant, 2010; Resilient Organisations, 2012; Taylor et al., 2017), some participants indicated that an organisational resilience culture should be set and shaped by leaders or can be brought about after a crisis. Despite the above factors, detailed information on building a culture conducive to organisational resilience for the water sector is lacking in theory and practice (Duchek, 2020; van der Merwe et al., 2018).

Consistent with prior research, our findings identified cultural attributes that were cited as beneficial cultural characteristics, including empowerment (Denyer, 2017; Sheffi and Rice, 2005), trust (Gibson and Tarrant, 2010), sense of pride (Mafabi et al., 2015) and integration and collaboration (Crick and Bentley, 2020). Although these attributes have been previously mentioned in literature and are not unique to the water sector, they are often cited individually without an in-depth account of their potential complementarity. This novel grouping of attributes presents a starting point for developing a cultural framework that accounts for the relationship of different cultural characteristics that support organisational resilience in water utilities.

Through the joined values and beliefs of individuals (Gover and Duxbury, 2018), the organisational culture forms part of the cognitive property of organisational resilience that shapes behaviour (Lengnick-Hall et al., 2011). Therefore, the themes and challenges identified across this paper - narrow understanding of resilience, difficulties in managing paradoxical tensions and leadership buy-in, for example - may be heavily influenced by the current culture shared and articulated by individuals in water utilities. However, given that 'culture' was not the main focus of this study, the validity of the above statement needs to be further explored through future research. Clarifying the links between current culture and behaviour and further demarcating cultural attributes conducive to organisational resilience will provide new insights into effective organisational resilience strategies for water utilities.

5. Limitations

This international study delivers a modest snapshot of different contextual realities. Therefore, our findings do not translate as generalizable illustrations of the participating countries. We also acknowledge that the involvement of some project steering group members in the interview study can be a potential source of bias. However, we aimed to minimise this issue by actively recruiting interviewees from outside the project working group. We are also cognizant of the discrepancy in the number of participants per region; therefore, we were conscious to not base the creation of themes simply on the frequency of mentions, which could have skewed the results toward a single country. Instead, we focused on the depth of themes and representation of all regions in the identified themes. Lastly, we recognise that the views of resilience identified here reflect the perceptions of middle and senior managers in water utilities. Therefore, additional research is needed to uncover the views of frontline personnel.

6. Conclusions

The chief contribution of this study stems from showcasing, in detail,

the challenges to building resilience in the cognitive, behavioural, and contextual organisational properties of water utilities. As observed, water utilities experience operational pressures and constraints that may obstruct their ability to build and sustain organisational properties conducive to resilience. In this sense, even though the water sector seeks resilience generally, related principles may not be reflected in the organisational properties that allow organisational resilience to emerge (Lengnick-Hall et al., 2011). This study thus corroborates previous findings that the human elements of resilience are often overlooked by the water sector (Naderpajouh et al., 2018; Smith et al., 2019).

We argue that challenges to building resilience were more significantly related to cognitive and contextual properties, signifying that the challenges identified are deep-rooted in the foundations of utilities. For instance, the cognitive property is composed of values and beliefs that underpin the organisational culture, which is tightly tied with organisational behaviour, while the capabilities of the contextual property serve as a conduit to a resilience cognitive frame and behaviour (Lengnick-Hall et al., 2011). Tellingly, the behavioural property was influenced by challenges derived from cognitive and contextual dimensions, as opposed to being the source of challenges to other organisational properties.

From the perspective of the cognitive property, the firmly embedded views on fail-safe values were observed to over-shadow the cognitive flexibility needed toward a well-tuned and refined sense-making of potential threats. Similarly, inherent values of efficiency and reactivity due to resource constraints also may hinder the cultivation of a cognitive frame driven by innovation and experimentation. Lack of commitment and accountability to resilience values flagged the need to drive a consistent cultural identity of resilience in water utilities. Further, an original question was brought to light as to whether the responsibility of organisational resilience should be centralised or dispersed in water utilities. The findings noted that resilience interventions may not get equal priority as daily operational matters and can be often diluted, hence the need for centralised resilience structures to reinforce a resilience-cognitive frame and drive a consistent cultural identity across the organisation.

Another significant shortcoming pertaining to the cognitive property was the uncertainty of the cultural attributes needed to drive an organisational culture in support of resilience. Our findings have added a novel dimension by grouping a set of key cultural attributes and reinforcing an appetite for a water sector culture change. Future research is needed on how to frame organisational values in water utilities in relation to organisational resilience and empirically investigate how culture impacts the organisational behaviour of water utilities.

In the behavioural property, the need to expand behavioural reserves to enhance preparedness was heavily limited by dominant values of efficiency and reactivity, as well as a lack of tangible and intangible resources. To reinforce such assertion, we drew from our analysis that utilities may not have the ability to effectively manage paradoxical behaviours, an actionable element of organisational resilience.

Contextual challenges ranged from lack of tangible and intangible resources to weakened resource networks and interpersonal connections due to silos. For instance, the development of social capital in utilities through contextual properties of diffuse power and positive resource networks was seen as significantly hindered by silos. As a novel contribution, we added depth to the current understanding of how silos exist in the water sector by structuring sources of silos into three different categories: (1) physical structures, (2) technical expertise, and (3) hierarchical levels.

Another key contextual challenge was the uncertainty of leadership buy-in on resilience efforts. This challenge mainly stemmed from factors related to short-term strategies due to political cycles or personal liability. In addition, a set of challenges more acutely felt by the water sector, compared to other utility sectors, was the context of a financially constrained environment due to stringent regulatory price determinations and political pressures to keep bills low to avoid

displeasing the electorate. This context emphasized establishing positive socio-political resource networks, especially through enhanced customer engagement and buy-in to legitimise inter-institutional changes toward resilience.

Funding source

Research on the themes raised in this paper was funded by Water Research Foundation projects #4707 and #4734. The authors gratefully acknowledge that the Water Research Foundation is the joint owner of the technical information on which this paper is based. The authors thank the Foundation and the numerous participating water utilities for their financial, technical, and administrative assistance in funding and managing the various projects through which this information was discovered. SJ and SJTP were partially funded through EPSRC/ESRC International Centre for Infrastructure Futures (ICIF) grant (EP/K012347/1). The views expressed are the authors' alone.

Data access statement

The data underpinning this paper is accessible by request at the following <https://doi.org/10.17862/cranfield.rd.14555271>.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

URL for accessing data is provided in the manuscript

Acknowledgements

The authors wish to recognise the participation and insight of the interviewees in this study. We also would like to thank the Water Research Foundation for conceding authorisation of the use of the illustrative quotes from project #4734 in this paper.

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Real-life resilience: exploring the organisational environment of international water utilities

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2022-08-26

Elsevier

<https://doi.org/10.1016/j.jup.2022.101394>

Giffoni E, Jude S, Smith H, Pollard SJT. (2022) Real-life resilience: exploring the organisational environment of international water utilities, Utilities Policy, Volume 79, December 2022, Article number 101394