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Assessing interdependent operational, tactical and strategic risks for improved utility master plans

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ABSTRACT

Risk management plays a key role in water utilities. Although risk tools are well-established at operational levels, approaches at the strategic level are rarely informed by systemic assessments of the water supply and lack a long-term perspective. Here, we report a baseline strategic risk analysis, founded on a systemic analysis of operational risks developed 'bottom-up' and validated in a large water utility. Deploying an action-oriented research method, supported by semi-structured interviews with in-house water utility risk experts, deep connections are established between operational risk and strategic risk that surpass those existing elsewhere in the sector. Accessible presentational formats – influence diagrams, risk "heat-maps" and supporting narratives are used to promote Board-level risk discussions, and characterise a baseline set of strategic risks core to forward utility master planning. Uniquely, the influence of operational events, exposures and potential harms, together with the mitigating measures in place to mediate these risks are linked to corporate objectives on business sustainability, profitability, water quality, water quantity, supply disruption and reputation.

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1. Introduction

Managing risk well is a key competency for water utilities, and many utilities have established risk manager roles to coordinate their efforts (MacGillivray et al., 2006; Hruđey et al., 2006). An essential requirement for utilities is to develop a preventative and anticipatory approach to risk and opportunity that ensures they are resilient to threats, whilst equally alive to opportunities (Pollard et al., 2013). In practice, this means developing an organisational capability to connect operational activities to utility-wide risk management programmes; to understand the impact of risk on a utility's corporate

priorities; and then forecast future risks into the mid- and long term so stakeholders can be confident in the master plans designed to manage risk over the planning cycle. A growing research agenda has developed around this need (MacGillivray and Pollard, 2008; Schiller and Prpich, 2013; Allan et al., 2013); one that straddles the engineering, decision and social sciences in the context of water utility management.

One observation we have is that engineering and asset risk analyses, including the human dimensions of managing risk (Wu et al., 2009), rarely appear to inform strategic risk management activity directly. Often, operational and strategic risk analyses are performed in isolation of one another for a

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host of reasons (e.g. the engineering versus a managerial focus), and there is rarely a truly systemic approach to assessing the water supply system. What can then occur is a potential disconnect between the view of strategic risk and the operational reality of risks in the business. In seeking to address this deficiency, our interest here is in how a systemic analysis of risk can inform the corporate priorities set by a utility now (in a baseline assessment) and then, by projecting risks forward in time, for decades to come; in doing so, linking a utility's thinking on risk and futures, as expressed by their master plans. Can we better align operational and strategic risk to improve insight at the top of a utility, and then better inform long-term master planning?

Analytically, assessing the interdependencies between operational, tactical and strategic risk, and then projecting risks forward in time, is not straightforward and requires applied research to investigate how it can be achieved in a meaningful way that adds business value. Intellectual contributions to this agenda are coming from the risk sciences (Lindhe et al., 2009), from the environmental assessment and water planning communities (Kumar et al., 2013) and from specialists in regulation and governance (Pegram et al., 2009). The broader goal of our research efforts over the last 10 years has been to improve the maturity of the water sector's capabilities in risk governance; a principal motivation being to build stakeholder confidence in the sector's capacity to manage the substantive changes it faces in the short-, medium – and long-term. These include (i) dealing with multiple dimensions of risk and multidisciplinary knowledge; (ii) managing tightly coupled risk interdependencies; (iii) the pressing need for better cross-departmental communication on risk across business 'silos'; and (iv) accepting high degrees of unresolvable decision uncertainty, due to the spatial and temporal variability of many utility risks.

Here then, we present a novel approach to support strategic risk management in water utilities that employs a 'bottom-up' analysis, involves all levels of the organisation and that addresses interdependent risks in a systemic fashion. The research tool was developed and tested in EPAL – Empresa Portuguesa das Águas Livres, the largest and oldest water supply company in Portugal. We believe it has wide applicability across public, private and corporatized water utilities, and for asset rich organisations more broadly.

2. Material and methods

Our research deployed an action-oriented research framework (Coghlan and Brannick, 2005) and a combination of methods, including (i) brainstorming (International Standards Organisation, 2009); (ii) observation, conversation, interviews and document analysis to generate qualitative data (Robson, 2002); (iii) cognitive mapping (Waal and Ritchey, 2007); (iv) semi-quantitative risk assessments (Pollard et al., 2004a; MacGillivray and Pollard, 2008); and (v) the development of risk visualisation tools (Prpich et al., 2013). This framework was deemed essential because of the need to process authentic risk data in a live decision context, using EPAL as the case-study. Founded in 1868, EPAL supplies wholesale quality water to approximately three million people (more than one-

quarter of the Portuguese population), as well as retail water to approximately 500 thousand inhabitants in the city of Lisbon. With approximately 700 staff, EPAL has assets with a net fixed value of around 900 million EUR and has been generating profits of around 40 million EUR. Over recent years, structured risk management practices have been adopted at operational and tactical levels of decision-making at EPAL (e.g. health and safety procedures, water safety planning, capital investment planning, reliability centred maintenance), but an integrated approach for managing risks at the strategic level has been lacking.

The team involved in this research encompassed a risk co-ordinator, the management Board (n = 3), senior risk managers (n = 14) and technical domain risk experts (n = 24). Senior risk managers were 'Heads' of the following departments at EPAL: asset management, planning and control, finance, customer relations, human resources, infrastructure maintenance, operations, water quality control, supply chain management, legal compliance, design and works, information systems, general secretariat, and organisational development. External researchers from Cranfield University (n = 5) had a discrete participation in the project, moderating group discussions in a one-day workshop.

2.1. 'Top-down' and 'bottom-up' approach

We employed a 'top-down'/'bottom-up' approach to assess strategic risks, as depicted in Fig. 1.

The process was initiated at a strategic level, with the identification of EPAL's corporate objectives by the Board; it then cascaded down to tactical and operational levels, where risk managers and individual risk experts performed a systemic analysis of strategic risks; and finally, it escalated up to the strategic level again, for the assessment of the results by the Board.

2.2. Corporate objectives identification

EPAL's corporate objectives were identified in a Board meeting. Translating organisational values into corporate objectives is often not consensual, so a preliminary clarification of basic concepts was made, by distinguishing *means objectives* from corresponding *fundamental objectives* and from *corporate, strategic objectives*; the latter defined as the utility decision makers' core objectives running through all utility decisions (Keeney, 1992).

2.3. Systemic analysis of strategic risk

Since strategic risks are those that express a likelihood and consequence of not meeting the corporate objectives of a utility, the model to assess strategic risks was based on the steps presented in Table 1.

2.3.1. Preliminary risk screening and securing buy-in

A workshop was held with the participation of risk managers, where the research was explained and their role emphasized, thus securing their buy-in. Moreover, risk brainstorming was used to collect a broad set of ideas and a preliminary risk

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