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# What it took to catalyse uptake of dynamic adaptive pathways planning to address climate change uncertainty

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ABSTRACT

Implementing climate-resilient pathways in conditions of uncertainty and change is a serious challenge. Approaches have been developed for this type of problem, one of which, Dynamic Adaptive Policy Pathways approach (DAPP), has been applied in practice in a limited number of circumstances, mainly for large infrastructure projects and at national scales. To better understand what it takes to catalyse uptake of DAPP to better address uncertainty and change than typical static planning approaches, we examined the role of a simulation game facilitated by a knowledge broker, in a real-life local decision setting on flood risk management in New Zealand. Four intervention phases over four years are described and their influence analysed: 1) creating interest through framing the science, 2) increasing awareness using the Game, 3) experimenting with DAPP, and 4) uptake of DAPP. We found that a knowledge broker introducing new framing of changing risk profiles, facilitating use of the Game and the DAPP approach in a real-life decision making setting, with contextual support from events and (inter)national reports, catalysed the uptake of adaptive pathways planning. We identified enabling requirements necessary for embedding adaptive planning into decision-making practice for addressing uncertainty and change.


## 1. Introduction

In response to uncertain environmental and socio-economic change, those managing flood risk are urged to develop adaptive plans to ensure communities' long-term sustainable economic development (Hallegatte et al., 2016). However, there are challenges in developing and implementing such plans to address changing climate impacts and socio-economic conditions, including; dealing with uncertainty and the need to do so; understanding and acknowledging different types of uncertainty; making robust and adaptive decisions that can cope with uncertainties about the future, and shifting planning practice from static to dynamic approaches.

A number of approaches that address uncertainty and change have been taken up in practice and science, allowing decision makers across many domains to address risk aversion in their choices (Webster, 2003). These include, real options analysis (Neufville, 2003), robust decision making (Lempert et al., 2003), iterative risk management (Haasnoot et al., 2011) and strategic planning approaches (Roggema, 2009). Another approach, Dynamic Adaptive Policy Pathways (DAPP) (Haasnoot et al., 2013), has been used increasingly for evaluating and implementing climate-resilient pathways for water management under uncertainty. Within the DAPP approach, a plan is conceptualized as a series of actions over time (pathways). The essence is the proactive planning for flexible adaptation over time, in response to how the future actually unfolds. The DAPP approach starts from the premise that policies/decisions have a design life and might fail as the operating conditions change (Kwadijk et al., 2010). Once actions fail, additional or other actions are needed to achieve objectives, and a series of pathways emerge; at pre-determined trigger points the course can change while still achieving the objectives. By exploring different pathways and considering path-dependency of actions, an adaptive plan can be designed, that includes short-term actions and long-term options. The plan is monitored for signals that indicate when the next step of a pathway should be implemented or whether reassessment of the plan is needed.

Adaptive pathways have been applied in real-world decision settings based on multiple scenarios and mainly for large, engineered infrastructure projects that manage floods, droughts and sea-level rise, such as for the Rhine delta, for the Thames

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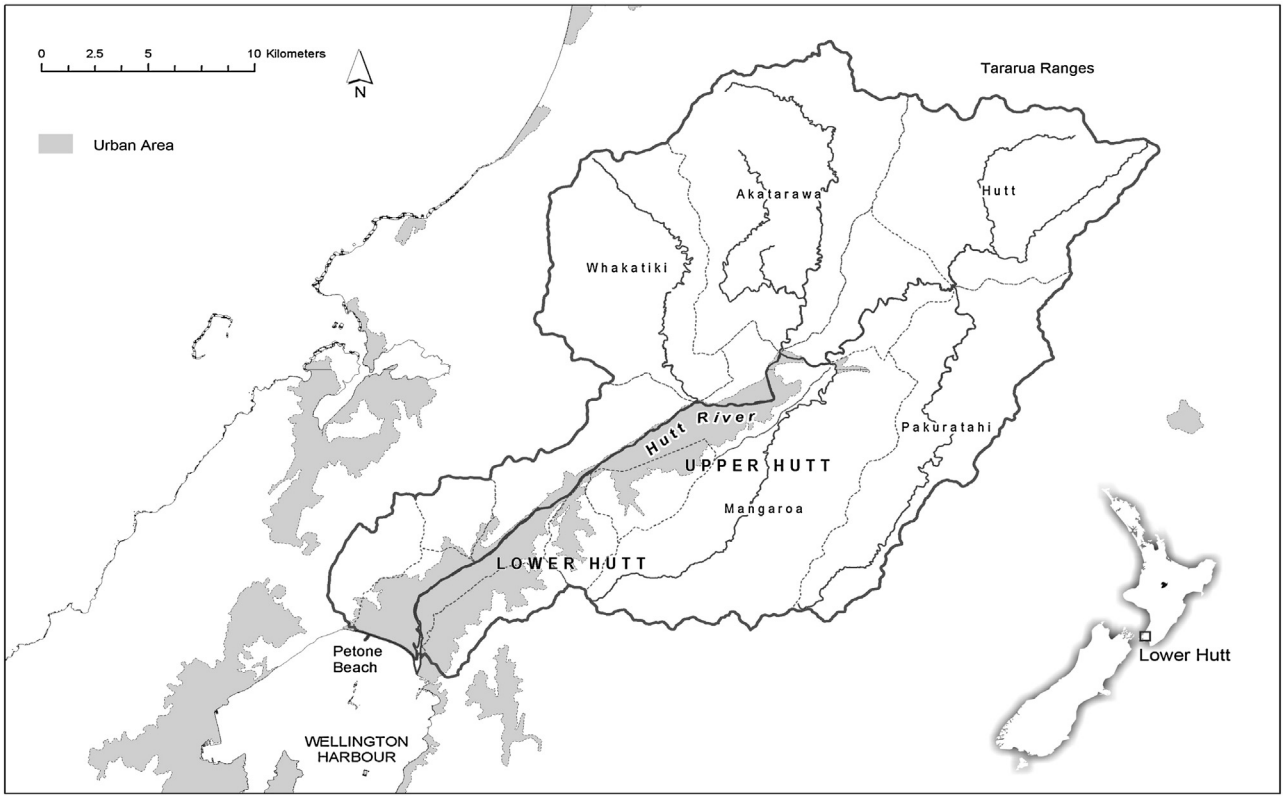


**Fig. 1.** Location of Hutt City in the Hutt catchment and New Zealand.

estuary and river catchment (Haasnoot et al., 2013; Ranger et al., 2013). These are at national scales with ready access to resources. Whether such pathways applications are applicable at other scales, institutional settings, cultures and resource scarce areas, is not yet fully tested. Where local government has no clear mandate for action and adaptation requires greater community consensus to implement adaptive approaches, such approaches hold promise, as shown by Barnett et al. (2014) in a coastal setting in south-eastern Australia where a locally focused and socially relevant adaptation pathway was developed. However, there are few examples of such pathways having been *implemented* within sub-national decision settings. Moreover, there exists no examination of what it takes to implement adaptation pathways in practice.

New approaches for adaptive planning are not just taken up by being made available to decision makers, additional measures are needed to catalyse the uptake of adaptive planning. Institutionalising adaptive planning requires well-tuned processes that address preferences and values of current, and those representing future generations (Haasnoot et al., 2011; Offermans et al., 2011). Also, complementary measures will be required to address societal change that has long lead times (Park et al., 2012). Campos et al. (2016) suggested that good communication of climate change risk is needed, to make climate change adaptation decisions. The following complementary measures for the adoption of adaptive pathways planning are suggested in the literature (Rosenzweig et al., 2011; Schenk and Susskind, 2015; Van der Brugge and Roosjen, 2015):

1. Public sector actors from multiple governance levels and the private sector
2. 'Buy-in from the top'
3. A coordinating agent
4. Regular interaction between scientists and stakeholders and
5. Uncertainty communication

Creating interactions between scientists and stakeholders, communicating uncertainty and coordinating within agencies to get 'buy-in from the top' for 'testing' adaptive planning approaches, suggested to us that 'serious games' had a part to play alongside knowledge broking. Serious games have been used to understand the interplay between human activities and water management decisions, for some time. More recently their use has focused on (social) learning about uncertainty, training water managers, increasing cooperative behaviour where there is high complexity, where actors are diverse and where values drive different perspectives on climate change (Harteveld, 2012; Hoekstra, 2012; Schenk and Susskind, 2015; Valkering et al., 2012; Van der Wal et al., 2016; Van Pelt et al., 2015). Games can also address the social and political conditions that create decision-making challenges in uncertain and changing conditions (Wise et al., 2014). We therefore turned to a potential priming tool, a simulation game, for gauging its effect on the adoption of DAPP and what is required to support the tool. The simulation game used is called 'Sustainable Delta Game' (adapted from Valkering et al. (2012) and described in the Appendix A) and a knowledge broker[1] (from the New Zealand Climate Change Research Institute (NZCCRI)) applied it in a local context in New Zealand.

In this paper we describe how simulation games, and knowledge broking, bridging science and practice, can, a) lead to changes in the practice of implementing adaptation at a local scale (Pelling, 2011), where facilitation, and otherwise unavailable new knowledge frames, can be introduced, and can, b) play a catalysing role in developing adaptive pathways, evaluating them and developing an adaptive plan, within current decision-making processes. We sought to 'test' whether by experiencing decision

[1] Knowledge broker is defined in this paper to mean people or organisations who move knowledge around and create connections between researchers and users of knowledge, creating new types of knowledge for particular audiences.