



Innovative land use planning for natural hazard risk reduction: A consequence-driven approach from New Zealand



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ABSTRACT

The traditional land use planning approach for addressing natural hazards in New Zealand has been based on the likelihood of an event occurring, with little consideration of the consequences associated with natural hazard events. This has led to decisions that place developments and communities at risk. Local government planning authorities who want to transition to risk-based planning face a number of challenges, including: how to satisfactorily define acceptable, tolerable and intolerable risk; how to incorporate the views of stakeholders and affected communities; and how to ensure that potentially controversial decisions over land use options are robust and defensible.

This paper describes a practical innovation in land use planning that assists local and regional scale planners incorporate risk into land use planning decisions. Termed the 'Risk-Based Planning Approach' (RBPA), the objective of this framework is to provide local government planners with a process that responds to the key challenges they face in adopting a risk-based approach. It includes strategies to guide engagement and communication with key stakeholders both across local government and with affected communities; it supports a full assessment of the consequences, as well as likelihood, of natural hazard events; and it enables natural hazard policies to be monitored for their effectiveness in either holding-the-line or in reducing risks.

In this paper we review how the RBPA provides for innovation in land use planning. In particular we note how its development with input from planners has ensured its applicability and consistency with statutory planning requirements and we examine an early case of its use in practice. This case demonstrates how a regional planning agency further innovated based on the RBPA, to provide robust and defensible decisions around acceptable, tolerable and intolerable levels of risk for their region.

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1. Introduction

Land use planning is a major tool for reducing risks from natural hazards, in turn aiding sustainability and increasing resilience [2,17]. Risk-based planning provides an opportunity to move beyond planning for a natural hazard only (i.e. the likelihood of an event), to planning for the consequences of an event. This involves assessing the land use, and having planning provisions that become more restrictive as the risk increases. There are a number of challenges in moving towards a risk-based approach which are not unique to New Zealand. Firstly, in planning there is traditionally an over reliance on assessing the probability of an event, and an under capacity to assess and quantify the possible consequences of events beyond annual fatality. In situations where likelihood of events is deemed low, this has led to decisions that have placed developments and communities at risk.

Secondly, at the heart of risk-based planning is the ability to delineate between different levels of risk (such as acceptable, tolerable or intolerable), and link these to suitable land use policies. An acceptable level of risk needs to be based on measurable indicators that allow risk levels to be monitored over time, enabling towns and cities to undertake sustainable development that does not exceed acceptable levels of risk- and may even act to mitigate existing risk. It also makes it possible to track the efficacy of efforts to reduce existing risks.

In this paper we present an innovative, practical framework for risk-based land use planning to support the inclusion of natural hazard risk assessments in land use decisions. The objective of this framework is to provide local government planners with procedures and resources that respond to the key challenges they face in adopting a risk-based approach to policy development. Termed the 'Risk-based planning approach' (RBPA), it is available either as an online toolkit¹, or as a report [23], and includes strategies to guide

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¹ Available at: <http://www.gns.cri.nz/risk-based-planning>.

engagement and communication with key stakeholders within both local government and affected communities. Developed with input from planners to ensure its applicability, the RBPA allows a full assessment of the consequences, as well as likelihood, of natural hazard events. Natural hazard policies can thus be monitored for their effectiveness in either holding-the-line or in reducing risks.

This paper first outlines what innovation is within a land use planning context, and summarises the physical and governance context of natural hazards management in New Zealand. The five-step RBPA framework is then presented, which includes a matrix for assessing the potential consequences of natural hazard events. By reviewing how the framework works in practice, we show that robust and defensible decisions around acceptable, tolerable and intolerable levels of risk can be determined. The paper reviews the design criteria of the RBPA, tested through action research and development methods. This approach ensured the RBPA could be of practical value within known resource and capacity limitations, and the imperfect knowledge that characterises natural hazard risk decision-making.

2. Innovation in land use planning

Innovation within the context of land use planning and natural hazard risk reduction is defined as an opportunity to plan for positive social, economic, and environmental outcomes in a new way, based on old and new planning principles within planning theory and practice. It requires a vision, leadership, and belief which extends beyond political cycles; is comprehensive and integrated with policies and plans from different sectors; and involves the active and meaningful participation of the community [21].

Davila et al. [3] categorise innovation in business (i.e. the market) according to three generic categories:

Incremental innovation brings out as much value as possible from existing products or services without making significant changes or major investments. Incremental innovation represents constrained creativity, where only small changes are feasible at any one time; it often becomes the dominant form of innovation and crowds out other potentially more valuable changes.

Semi-radical innovation involves substantial change to either the business model or technology of an organisation – but not to both. Often change in one dimension is linked to change in the other, although the parallel change may not be as dramatic or disruptive.

Radical innovation is a significant change that simultaneously affects both the business model and the technology of a company. Radical innovations usually bring fundamental changes to the competitive environment in an industry.

While it is often thought that innovation is about making something new, these three types of innovation include a mixture of old and new. Sternberg et al. [31] expand these three generic

categories of innovation to eight distinctive types of innovation, reflecting variations in the nature of the creative contribution each represents (see Table 1). Similarly, innovation in the planning profession, within practice or theory, can be categorised as any one – or a combination of these types depending on of the creative contribution that planning is making. It can be internal to the governance processes and systems that administer the planning, or external to those who use the planning system.

Risk-based planning can fall into all of these innovative categories, depending on the state of planning in a particular area. The New Zealand planning system is briefly outlined below.

3. The need for an innovative approach to risk-based planning in New Zealand

Located on the active boundaries of the Pacific and Australian plates, New Zealand is subject to a wide variety of geological natural hazard events (see Fig. 1). It is also susceptible to extreme meteorological events due to its mountainous topography in the path of moisture-bearing winds. While flooding is the most frequently occurring natural hazard [6], communities also face risks from landslides, coastal storms and erosion, severe winds, snow, drought and the potentially catastrophic impacts of earthquakes, tsunami and volcanic eruptions. As rapid development has occurred along the coast, the exposure to coastal storms and erosion has increased. Increased climate variability and change will likely compound the risks many communities face, especially those on floodplains and along low-lying coastal margins, as sea level, and intensity and frequency of storms increase [7].

As New Zealand is susceptible to so many natural hazards, it is nearly impossible to have zero risk. Avoidance, while useful in extreme risk locations, is not always possible. Mitigation efforts can ironically increase risks to others (e.g., deflecting flood waters), and can increase residual risk (e.g., increased development behind flood control structures). Natural hazards must thus be managed in a way that allows for smarter, risk-aware development.

3.1. Land use planning in New Zealand for natural hazards

No one agency is responsible for natural hazard management in New Zealand. Rather, a number of organisations, including: the Ministry for the Environment (provides national regulatory and non-regulatory guidance); regional councils (responsible for regional or catchment scale policy frameworks); territorial authorities (i.e. city and district councils responsible for specific land use designations and decisions); civil defence emergency management groups (disaster preparedness and response); and engineering lifeline groups (infrastructure management), hold complimentary responsibilities. Co-operation between these agencies is essential to ensure a streamlined and holistic national approach to planning for natural hazards and disasters.

There are four key statutes that contribute to natural hazard

Table 1
Three categories of business innovation [3] with eight types of innovation (based on [31]).

Category	Type
Incremental innovation	<i>Replication</i> – the field is where it should be <i>Redefinition</i> – to redefine the field; a new point of view
Semi-radical innovation	<i>Forward incrementation</i> – moves the field in the direction it is heading, takes the field to a point with others <i>Advance forward incrementation</i> – moves the field in the direction it is heading, moving beyond where others are ready to head
Radical innovation	<i>Redirection</i> – moves the field toward a new and different direction <i>Reconstruction/redirection</i> – moves the field back to where it once was, so it can again move forward in a different direction <i>Reinitiation</i> – moves the field to a different and not yet reached starting point, and then moves in a new direction <i>Integration</i> – moves the field by combining past contributions that were distinct or opposed.

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