

Funding Climate Change Adaptation

the case for a new policy framework

Abstract

Adapting to climate change poses unprecedented technical, administrative and political challenges for which New Zealand's current planning, regulatory and funding frameworks are ill-equipped. Without reform, they will deliver neither efficient nor equitable outcomes. Indeed, they will encourage governmental delay, incentivise sub-optimal solutions, increase future burdens, and reduce societal resilience. For sound anticipatory governance, our current frameworks need reform. This article summarises the nature of the adaptation challenges facing New Zealand, outlines the problems with current policy settings, identifies principles and considerations that should guide the reform agenda, and reviews several policy options. On balance, we favour creating a new national institution mandated to fund or co-fund, in accordance with statutory criteria, the major costs of adaptation.

Keywords climate change adaptation, funding, cost effectiveness, equity, anticipatory governance

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The task of mitigating climate change (i.e. reducing greenhouse gas emissions) has been called a 'super wicked' policy problem (Lazarus, 2009). But adapting to, and minimising the impacts of, climate change will be no less daunting (Mullan et al., 2013; OECD, 2015; Reisinger et al., 2014). Indeed, adaptation poses unprecedented technical, administrative and political challenges. In effect, policymakers are confronted not only with an unparalleled, slow-motion natural disaster, but also one that is destined to intensify in scope and scale as the century progresses. There will be multiple negative impacts: rising sea levels; more severe droughts and rainfall events; new biosecurity risks; an accelerated loss of biodiversity; and changing human disease vectors. Many of these phenomena will be outside the variability ranges previously experienced.

As an island nation, New Zealand will be particularly badly affected over the coming century and beyond by coastal erosion and inundation (Royal Society of New Zealand, 2016; Stephenson, McKenzie and Orchiston, 2017). Tens of thousands

of people – and perhaps more – will eventually need resettling on higher ground. Large investments will also be required to redesign, reposition and future-proof public infrastructure, especially transport networks and water services. Additionally, the damage caused by climate-related natural disasters will impose growing financial burdens – on citizens, businesses and public authorities. Already the annual cost of repairing land transport networks damaged by weather-related events has more than quadrupled over the past decade, while the economic impact of major floods and droughts is increasing. The series of major rainfall events which afflicted parts of New Zealand in early 2018 are merely a foretaste of what lies ahead. Likewise, the visibility of recent plant pathogens affecting our native trees (e.g. myrtle rust and kauri die-back), on top of the stresses our natural ecosystems are exposed to from the combination of exotic animal pests (e.g. deer, possums, stoats, rats and mice), are a portend for the future facing New Zealand.

Governments will face numerous policy challenges in seeking to reduce and mitigate such impacts. Many of the likely impacts are beset with ‘deep uncertainty’ (Walker, Lempert and Kwakkel, 2012; Walker, Marchau and Kwakkel, 2013), especially beyond mid-century. Policymakers will be faced with abrupt and unexpected biophysical changes; multiple, compounding and cascading risks (between and across sectors and domains of interest); the complexities of planning over extremely long time horizons; and complicated intra-generational and intergenerational trade-offs (Lawrence et al., 2013; Lawrence et al., 2016). Politically, too, there is an acute problem: the adaptation strategies needed to safeguard future interests will often entail significant upfront costs, not least to ensure that today’s investments can be adjusted depending on the evolution of climate change. Moreover, while such costs are visible, direct and relatively certain, many of the benefits are indirect and much less certain. Concerted public opposition to prudent, proactive, anticipatory measures is thus inevitable; all the more so if those who face substantial losses are unable financially to make the necessary adjustments in a timely and just manner.

Are New Zealand’s current funding, planning and regulatory frameworks, and their related policy tools and instruments, well designed to meet the scope, scale and duration of the challenges of climate change adaptation? In our view, the answer is unequivocal: existing arrangements are not fit for purpose. They lack the capacity to ensure sound anticipatory governance.¹ They will not deliver equitable or efficient outcomes. This article explains why. In so doing, it gives particular attention to the weaknesses in current adaptation funding mechanisms and how these might be rectified. Here we highlight only a selection of issues and consider a limited number of policy options. Our primary purpose is to

of adaptation measures or protection strategies adopted.

Based on a study of 136 major coastal cities, Hallegatte et al. (2013) estimated that, in the absence of additional protective measures, sea level rise and related changes to storm surges, floods and major storms could cost globally as much as US\$1 trillion annually by 2050 and multiple times this figure by 2100. Likewise, Hinkel et al. (2014) estimate that if the sea level rises by 1.23 metres by 2100, and if no adaptation occurs, then up to 4.6% of the global population would be flooded annually, with expected losses of over 9% of global domestic product annually. Losses of this magnitude would be totally unsustainable.

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underscore the need for reform, rather than provide a fully-developed and comprehensive policy approach.

The costs of climate change

Estimating the likely long-term costs of climate change poses significant analytical and technical challenges. Take, for instance, the costs of sea level rise, which is but one of the many anticipated impacts (Boettle, Rybski and Kropp, 2016; Hallegatte et al., 2013; Hinkel et al., 2014; IPCC, 2014). The expected costs will depend on numerous variables, including: the time frames under consideration; the path of global greenhouse gas emissions; the projected impact of global warming on the polar ice sheets, ocean currents and storm patterns; the assumptions made about the pattern and scale of future human development; the nature and types of risks considered and their related costs (e.g. direct and indirect, market and non-market); how losses (e.g. of land, buildings and infrastructure) are valued; and the kind

According to Hinkel et al., effective coastal adaptation measures, including managed retreat (see Box 1), can be expected to reduce these losses substantially (see also Reisinger et al., 2015).

There are no comprehensive estimates of the costs of sea level rise for New Zealand over the coming century. But an initial study of exposed residents, buildings and some infrastructure (i.e. roads, railways, port and airport facilities, and critical facilities or government buildings) by Bell, Paulik and Wadwha (2015) for the Parliamentary Commissioner for the Environment (2015) provides an indication of the scale of costs. For instance, it is estimated that at least 43,683 homes (or about 133,000 people) and 1,448 commercial properties are within 1.5 metres of the current average high tide in spring (Bell, Paulik and Wadwha, 2015).² The buildings affected have a replacement cost of about \$20 billion (in 2011 dollars). Sea level rise of up to three metres would affect over 280,000 people and damage

buildings with a replacement cost exceeding \$50 billion (in 2011 dollars). Public infrastructure, including transport networks, energy systems and water services, will also be significantly affected (e.g. coastal roads and numerous waste water treatment plants). Much of this infrastructure is the responsibility of subnational government and some of it has not been well maintained (Office of the Auditor-General, 2014).

Several matters are clear: a) the costs will increase in a non-linear manner (i.e. as seas rise, the costs will rise even faster); b) the costs will be greater if global emissions peak late and then fall slowly; c) the costs will escalate significantly as the century advances; d) the costs will be

reduced by preventing further housing developments in risky areas, relocating existing settlements, and prudent investments in more resilient infrastructure. Significantly, Local Government New Zealand estimates that \$1 spent on risk reduction saves at least \$3 in future disaster costs by avoiding losses and disruption (Deloitte Access Economics, 2013). Some international estimates of the likely savings are substantially higher (Healy and Malhotra, 2009). But there is a problem: public expenditure on *pre-event risk reduction* is much harder to 'sell' politically than the funding of *post-disaster recovery*. Voters, it seems, reward governments that spend money on disaster relief, but not those investing in prevention and

2016).³ We address the most obvious limitations and deficiencies here.

First, while local authorities in New Zealand have various proactive legislative responsibilities to reduce the risks posed by natural hazards, including the effects of climate change, the relevant statutes (e.g. the Resource Management Act 1991 (RMA), the Soil Conservation and Rivers Control Act 1941, the Civil Defence Emergency Management Act 2002 and the Building Act 2004) are poorly aligned. For instance, whereas the Building Act focuses on a 50-year time frame, the New Zealand Coastal Policy Statement issued under the RMA requires local authorities to look forward 'at least 100 years'. Additionally, the various legislative and regulatory requirements are not being applied consistently by decision-makers. Some local authorities have been much more proactive than others. Guidance and support from central government has been generally insufficient.

Second, notwithstanding their responsibilities to mitigate long-term risks, many local authorities, often under pressure from property developers, have been approving major new subdivisions and other developments in areas that are likely to be vulnerable to rising seas later in the century (see, for example, Gibson and Mason, 2017). This suggests that current policy frameworks and regulatory standards may need adjustment, or at least that ways must be found to ensure that councils use their available powers more effectively to safeguard future interests.

Third, the existing policy arrangements focus too much on *post-event* responses (e.g. post-disaster assistance and recovery) and too little on *pre-event* responses – that is, public funding designed to enhance societal resilience, minimise risk, and enable cost-effective adjustments and transitions. Hence, New Zealand has a Natural Disaster Fund (administered by EQC) and an Adverse Events Fund (administered by the Ministry for Primary Industries to assist rural communities), but no equivalent dedicated funds to reduce risk exposure (i.e. arising from climate change). Similarly, there are different national-level policies for repairing and future-proofing local government infrastructure. For instance, the national

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greater if urban development continues in areas exposed to rising seas and inundation; e) the costs will fall unevenly geographically and intermittently; and f) the costs will be greater if governments (national and subnational) fail to plan and invest in effective risk reduction and adaptation initiatives.

Aside from sea level rise, New Zealand faces many other climate-related costs. For instance, insured losses due to extreme weather events were \$175 million in 2013 and \$135 million in 2014 (Insurance Council of New Zealand, 2017). The Treasury estimates that the drought in 2013 cost New Zealand around \$1.5 billion. Meanwhile, the cost of repairing land transport networks damaged by weather-related events continues to increase, quite apart from the ongoing disruption to people and the economy.

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preparedness (ibid.). This phenomenon is common across advanced democracies. It reflects humanity's cognitive biases, including myopia: citizens tend to value post-event cures over preventative interventions (Boston, 2017a, 2017b; White and Haughton, 2017). Finding ways to counter such propensities will be crucial over the coming decades. Otherwise, there will be many sub-optimal policy decisions – ones that increase and entrench risk exposure, thereby placing additional burdens on future generations. This works in the opposite direction to what effective adaptation requires, namely to reduce risk now and for the future.

The problems with current funding, planning and regulatory frameworks

New Zealand's current policy frameworks are poorly equipped to address the nature, magnitude and duration of the problems posed by climate change (Lawrence, 2015,

civil defence plan provides for central government to contribute up to 60% of the costs of repairing underground water and sewerage services after a catastrophic event, but there are no similar guaranteed contributions for future-proofing infrastructure.⁴

Fourth, and related to this, the provisions in most household insurance contracts (and related EQC cover) do not provide for 'betterment'. This means, for instance, that an insurer will repair a home which is at risk of future flooding but will not contribute to the relocation of the home or the construction of a new home on a safer site. As a result, risk exposures have become entrenched. Eventually, some residents will be unable to secure adequate insurance for their properties.

Fifth, regarding the overall role of insurance, it is sometimes argued that governments should rely on private insurance markets, the pricing of risk and individual self-interest to generate the desired adaptive responses by citizens to climate change. But insurance merely redistributes and transfers risk; it does not lessen it. Hence, while insurance is a desirable – indeed vital – complement to robust risk management, it is no substitute for it. Moreover, the limitations of insurance markets will be exacerbated as risk profiles change over coming decades (IPCC, 2014; Kunreuther and Lyster, 2016; Storey et al., 2017; O'Hare, White and Connelly, 2016; Treasury, 2015).

Finally, aside from the post-event focus of much disaster-related funding, there are multiple other problems with existing funding arrangements for adaptation:

Currently, local government owns and manages at least \$120 billion of fixed assets (including 100% of the country's drinking water, waste water and storm water assets, and 88% of the roads) (Office of the Auditor-General, 2014). But there is a gross mismatch between the resources and capabilities available to local authorities and the scale of their adaptation challenges. For instance, many communities (e.g. Dunedin, the eastern Bay of Plenty and the West Coast of the South Island) face the prospect of relocating significant numbers of people by mid-century, but they lack the capacity (via their rating

base and borrowing limits) to fund large-scale relocation of affected assets and communities, the purchase of land for resettlement, and the construction of new infrastructure. More generally, many local authorities – and especially those with ageing populations – will struggle to raise the capital necessary for renewing, upgrading and future-proofing their public infrastructure. The current mechanisms through which the central government provides financial assistance to communities, businesses and households affected by natural disasters tend to be ad hoc and inconsistent. For instance, in response

perpetuates lock-in of communities in risky areas. Second, it generates a potential 'safety paradox', where communities are lulled into a feeling of safety which can then rebound on public authorities when the next 'disaster' happens.

There is no current consistent and centrally managed mechanism for funding the costs of managed retreat (see Box 1). As a result, local authorities are attempting to develop their own approaches. But these will generate inconsistencies and inequities across New Zealand. Moreover, without a fair, consistent and nationally mandated

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to the severe flooding of Edgecumbe in the Bay of Plenty in 2017, where around 70% of the town's properties were damaged, the government announced that EQC would be responsible for cleaning up and repairing all affected properties, including the 100 or so that were not insured or where the owners lacked the necessary funds to undertake repairs. Residents in many other communities similarly affected by severe flooding have not always been so fortunate. Meanwhile, special arrangements were made for the many thousands of Christchurch residents whose properties were 'red-zoned' as a result of the major earthquakes in 2010–11.

Leaving aside the inequities caused by inconsistent Crown 'bailouts' following natural disasters, bailouts cause several other problems. First, they raise public expectations of continued structural protection and funding assistance. This creates a high degree of path dependence, at least politically, and

approach to adaptation funding, affected residents are likely to resist locally crafted proposals for managed retreat. This poses at least three problems: a) the risk of lengthy and expensive legal proceedings; b) the prospect of prevarication and long delays in decision making, thereby intensifying risk exposure, exacerbating future damages, and increasing the overall long-term costs of adjustment; and c) the likelihood that residents will demand the construction of hard structures to protect their properties; in many cases such structures will not be cost-effective and will offer only temporary protection.

There are no mechanisms to ensure that the costs of climate change adaptation are shared equitably, whether intergenerationally or intra-generationally.

In short, current regulatory, planning and funding arrangements are not adequate for the policy challenges posed by climate change. This applies not only

Box 1: Managed retreat

Technically, 'managed retreat' has been defined in a coastal setting as 'the application of coastal zone management and mitigation tools designed to move existing and planned development out of the path of eroding coastlines and coastal hazards' (quoted in Hino, Field and Mach, 2017, p.1). It is deliberate, coordinated and planned. The aim is to reduce natural hazard risk permanently, rather than temporarily. According to Hino, Field and Mach, over the past three decades approximately 1.3 million people in 22 countries have been relocated – in both pre- and post-disaster contexts and both voluntarily and involuntarily – through managed retreat. While significant, this is a tiny number compared to the scale of displacement expected during the 21st century and beyond (which will affect hundreds of millions globally).

Understandably, managed retreat is often viewed as complex and controversial, partly because of the financial costs, but also because of the more intangible costs – the loss of 'place', the social, emotional and psychological challenges of displacing people from their homes, the disruption to community life, and the loss of buildings or land of architectural, aesthetic or spiritual value. However, managed retreat can be implemented in a staged and progressive manner, as 'managed' suggests, preferably through community engagement processes that can address the sense of loss of place and value.

An example in New Zealand where managed retreat has been implemented is Twin Streams in Waitākere, Auckland (Vandenbeld and MacDonald, 2013). Voluntary property

purchase was offered within an inclusive participatory process across the community which linked environmental, social, economic and cultural goals by providing new public resources and accommodating those who moved to other areas. The availability of a regional fund enabled the retreat from flooding to be implemented.

Managed retreat options are being considered currently as part of a suite of adaptation options in two coastal localities. In Matatā in the Bay of Plenty a voluntary retreat option has been included after ten years of investigations following a weather-induced debris flow that engulfed a coastal community.⁵ For voluntary retreat, landowner support will be essential for any property purchase arrangements. If retreat were to be enforced, empowering legislation is likely to be required. Funding to incentivise implementation is beyond the means of most district councils, which means that regional and central government funding would be required. Other issues make implementation difficult: rating equity; confirmation of retreat boundaries; availability of affordable alternative building sites; existing use rights; planning issues; and property purchase criteria.

In the second case, the Clifton to Tangoio Coastal Hazards Strategy 2120 in Hawke's Bay included managed retreat within adaptive pathways for the medium-to-long term in a year-long community engagement process that has recommended adaptive pathways to the three participating councils for implementation.⁶

to the problems generated by sea level rise and more severe rainfall events, but also to many of the other impacts that climate change will generate (e.g. the impacts on agriculture, aquaculture and fishing resulting from warmer temperatures, more severe droughts and ocean acidification). Without appropriate reforms, existing policy frameworks are destined to increase, rather than reduce, risk exposure, exacerbate future adaptation costs, and contribute to multiple inequities. In the interests of sound anticipatory governance, a better framework is required.

Funding climate change adaptation – guiding principles

Any new policy framework for climate change adaptation must be guided by sound principles. Adaptation funding arrangements which seek to reduce exposure to climate change risks should

have two overarching goals: long-term cost minimisation and equitable burden sharing.

1. *Long-term cost minimisation* – funding arrangements should seek to minimise the long-term net costs of climate change adaptation by encouraging cost-effective decisions regarding district planning and investment in public infrastructure. The aim would be to reduce the likely costs of climate-related impacts (e.g. from major floods) through cost-effective measures to future-proof infrastructure and undertake managed retreat. Successful adaptation will, in turn, help to reduce future insurance (including EQC) costs, thereby keeping insurance more affordable and available. Consistent with this, funding arrangements, and related planning and regulatory frameworks, must be well-coordinated and designed to minimise moral hazard

(e.g. the risk of giving individuals, companies or other organisations incentives to act in ways that are likely to increase overall adaptation costs and/or shift costs inappropriately onto taxpayers or ratepayers).

2. *Equitable burden sharing* – funding arrangements should be consistent with widely accepted principles of social equity (or distributive justice) (Kunreuther and Pauly, 2017). Such principles include the fair opportunity requirement. This is the idea that people should not be discriminated against or suffer disadvantages for things over which they have little or no control. Such a principle provides an ethical basis for funding assistance for people who suffer an accident or are harmed by a natural disaster which could not have been reasonably foreseen or avoided. Another relevant principle is that of 'comparative justice'

or ‘like treatment’: cases that are alike in all relevant respects should be treated alike; where cases differ, ‘material principles’ of justice can be applied to determine the extent to which, and the means by which, differential treatment is justified. These include considerations of need, the capacity to pay, and various notions of moral responsibility (Miller, 2007). One of the latter, known as ‘outcome responsibility’, is the idea that people (and public authorities) should bear responsibility for their own actions and decisions. Another is the idea of ‘remedial responsibility’: this responsibility arises whenever there is a situation needing a remedy. If those who have caused the harm are in a position to rectify the problem, then they have a moral responsibility to do so. If they are unable to, but there are others with the requisite capacity (e.g. a central government), then the remedial responsibility falls to those who are most capable. Regarding the costs of climate change adaptation, the relevant principles of distributive justice should be applied both intergenerationally and intra-generationally.

Any adaptation funding framework (and related institutional arrangements and policy instruments) should also take into account a range of other considerations (Boston, 2017a), including:

- making the best possible use of the available scientific evidence and relevant expert advice;
- minimising administrative and compliance costs;
- ensuring procedural fairness and thereby minimising the likelihood of costly litigation;
- ensuring sufficient policy clarity, consistency and stability over time to facilitate effective long-term regional spatial planning and infrastructure investment, thus generating an adequate degree of certainty for affected households, businesses and other organisations;
- enabling sufficient policy flexibility to accommodate changing risk profiles;
- disincentivising policy responses that create path dependence;

- ensuring a high level of transparency in relation to revenue collection and funding allocations; and
- ensuring fiscal sustainability.

Applying these principles to the question of who pays, for what and when raises some practical questions. First, is there a case for pre-funding some of the expected costs of adaptation? Second, are there grounds for the central government to contribute to the adaptation costs facing subnational governments? Third, is there a case for public authorities compensating those harmed by the impacts of climate change: for instance, by funding some or all of citizens’ private property losses (including land) or funding some or all of

affordability. Perhaps the strongest objection, however, is the claim that future generations will be better off than current generations, at least in terms of real incomes per capita. Hence, they will be in a better position than those alive today to cover the long-term costs of adaptation. Also, if the costs are much less than some fear, future governments will have little difficulty covering them from normal ongoing revenues.

But there can be no guarantee that future generations will be better off, however ‘better off’ is defined. After all, humanity’s failure to live within safe and sustainable planetary boundaries may curb future economic growth. And even if per

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the costs of managed retreat (e.g. moving expenses, the loss of business income, providing risk-free land, etc.)?

The issue of pre-funding future adaptation costs

The case for pre-funding rests primarily on the principle of responsibility, namely that those who have caused a harm should be required to contribute to alleviating the damage they have caused (or will cause in the future). This principle of justice is embodied in the idea of polluter pays. In the case of climate change, the damage that will be inflicted on current and future generations (and hence the costs of adaptation that they will bear) is largely due to the activities of recent generations. Accordingly, there is a strong case for taxing current citizens (e.g. taxpayers and ratepayers) and building up a public fund (or funds) which can be deployed to help cover the financial costs of adapting to climate change later in the century.

Against this, the scale of the costs of adaptation remains uncertain. Also, future technological innovations may significantly reduce them, thus enhancing their

capita incomes continue to rise, there remain strong moral grounds for those who have caused climate-related harm to bear part of the cost. Societies do not, after all, avoid prosecuting and penalising criminals who are poorer than their victims.

In our view, there is a plausible *prima facie* case for proportionate pre-funding of future costs of climate change adaptation. This suggests that any overall adaptation funding framework should include a mechanism – perhaps similar in concept to the New Zealand Superannuation Fund – to help cover future climate-related liabilities. A potential source for pre-funding could be revenue generated via an additional levy on fossil fuels, with the pooled funds invested and then drawn down progressively later in the century.

National cost sharing

There are multiple grounds for sharing the costs of adaptation across central and subnational government, including the considerations of efficiency and equity (including the principle of remedial responsibility). As noted earlier, adaptation costs are bound to vary – often significantly

– across different households, communities, regions and economic sectors. Many of the costs will fall in arbitrary ways, with little or no regard to the extent of each citizen's (or region's) contribution to climate change (i.e. via their cumulative greenhouse gas emissions) or their capacity to pay either for the damages inflicted or for the measures required to minimise future risks (e.g. by relocating to safer locations). Importantly, the resources available to subnational governments to implement prudent and cost-effective adaptation measures vary (depending on their relative wealth, demographic structure, etc.). Some may face only modest costs, yet have ample resources; others will face very large costs, yet have limited resources. Without some form of national cost sharing, the

and how readily those affected can bear the expected losses. In practice, many of the situations that will arise over coming decades are likely to be complex, not least because of rapidly changing risk profiles and unpleasant surprises. For instance, increased drought risk will have impacts on the range within which current land uses can operate, triggering potentially disruptive changes if inadequately anticipated and planned for, stranding assets and livelihoods. Similarly, coastal areas previously deemed to be safe may unexpectedly face the risk of inundation or the sea level may rise much faster in certain areas than previously projected. In some cases the relevant authorities may be obliged to force people to relocate to safer areas. Where compulsion is involved

government pronouncement that compensation will not be provided (e.g. to those who build in certain vulnerable areas) is unlikely to be believed. In short, a credible commitment problem seems bound to arise.

- There will be strong pressures, in the interests of overall fairness, for any compensatory arrangements to be broadly consistent, both across the country and over extended periods of time. This points to the need for a nationally mandated framework with cross-party support.

- In the absence of a well-designed, principled and consistent system of compensation, there will be political pressures for governments to implement high-cost engineering 'solutions' to protect vulnerable properties (and also threats of legal action). Yet many of these potential 'adaptations' will provide only temporary respite.

- Pre-event compensation could generate moral hazard (e.g. by encouraging risky investments). It will be imperative to mitigate such risks through well-designed regulatory and planning frameworks.

Any compensatory regime will be controversial and its implementation open to fraudulent claims.⁷ As indicated, there are many relevant principles and considerations, and some of these will be in tension. It will be important, therefore, to design any regime carefully, with proper public engagement on the relevant issues and options, and detailed stakeholder involvement.

Reforming the funding of climate change adaptation – the broad options

In terms of the future funding of climate change adaptation, there are at least four possible options:

1. expand and modify existing local government funding instruments;
2. expand and modify existing central government funding instruments (excluding EQC), albeit in the context of annual appropriations;
3. amend the legislative mandate of EQC so that it becomes responsible for both pre-disaster funding (i.e. for protective and preventative measures) and post-disaster funding; and

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principles of need and ability to pay will almost certainly be violated. Equally, it will be hard for poorer communities to find the resources necessary to fund proactive measures to mitigate future risks.

Public compensation for losses

The question of whether those faced with the loss of property (including land) and/or income should receive public compensation is challenging (Sprinz and von Büna, 2013). There are various, often conflicting, principles. For instance, it might seem inequitable to provide compensation to wealthy people who have purchased second or third homes on vulnerable coasts in the full knowledge that climate change might render their properties uninhabitable at some future date. Against this, it is often hard to determine whether particular risks could have reasonably been foreseen

in acquiring land, there has been a long history in New Zealand (and elsewhere) of providing compensation to those directly affected (and sometimes those indirectly affected). The provisions relating to such compensation in New Zealand are set out in considerable detail in the Public Works Act 1981.

While designing compensatory arrangements is beyond the scope of this article, several matters deserve emphasis:

- Given the long-standing practice in New Zealand of societal risk pooling and cost sharing for natural disasters, the public are likely to expect governments to compensate (at least partially) those suffering loss and damage from climate change, including those facing significant costs in order to reduce climate-related risks (e.g. relocation). In these circumstances, any

4. establish a new national Climate Change Adaptation Fund with a statutory mandate to fully fund, part-fund or co-fund various specified adaptation-related costs.

In our view, the first three options are unlikely to satisfy the relevant funding principles discussed above. Hence, the fourth option is the one that could be developed further, potentially to apply to the full range of climate change impacts.

Regarding option 1, as previously argued, existing local government funding arrangements will not be sufficient to meet the expected costs of climate change adaptation, including large-scale managed retreat and major infrastructure investments. Only central government has the necessary resources and mechanisms to undertake such tasks.

Regarding option 2, central government could, at least in theory, rely on existing funding instruments, using annual appropriations to co-fund some of the costs of climate change adaptation. Potentially, it could also fund specific adaptation projects (including managed retreat) directly, rather than funding local authorities to do it. The funding of 'red-zoned' properties in Christchurch provides a possible model (Canterbury Earthquake Recovery Authority, 2016). But such arrangements would be ad hoc and thus unlikely to generate the desired level of consistency, certainty, stability, credibility or long-term durability. Moreover, as the scale of the adaptation challenges increases over coming decades, there are bound to be political pressures – from subnational governments, civil society and affected citizens – for the central government to develop more comprehensive, principled and tailored approaches. Aside from this, there would be limited scope under current fiscal arrangements for specific pre-funding of future adaptation costs, except via more concerted efforts to reduce net Crown debt.

Option 3 would involve amending the legislative mandate of EQC and extending the role of the Natural Disaster Fund to include proactive, pre-event adaptation funding. Arguably, this would provide EQC with both a stronger incentive and a greater capacity to reduce *post-disaster* costs through cost-effective adaptation measures. Assuming that the commission was

adequately funded to undertake such interventions, it could reduce the commission's future liabilities and the overall financial costs of climate change impacts. Further, under such an approach responsibilities for (some aspects of) funding adaptation would be assigned to an independent body operating in accordance with statutory criteria. Potentially this would increase the likelihood of funding decisions being evidence-informed and principled, and broadly consistent over time, thus increasing the fairness and legitimacy of the policy regime. A modified EQC could also incorporate an element of pre-funding for future adaptation costs.

do not pay the EQC levy. Yet many of these households and businesses will stand to gain significantly if the EQC becomes a pre-event funder of managed retreat and other large-scale, area-wide adaptation responses. Lastly, effective pre-event planning and adaptation will require extensive public consultation and deliberation. Such processes and procedures are far removed from those currently undertaken by EQC. This, in turn, would entail very different skills and expertise. For such reasons, we do not favour option 3.

The final option would be to create a new funding entity – such as a Climate Change Adaptation Fund – and modify

The primary aims [of a new funding entity] would be to enhance the capacity for sound anticipatory governance through the funding of cost-effective and equitable responses ...

Against this, giving EQC major responsibilities for pre-event adaptation funding would fundamentally alter the commission's current role as an insurer. It would result in the commission having multiple and potentially conflicting objectives – serving simultaneously as an insurer of residential properties (with a primary focus on seismic events), a mechanism for mitigating a wide range of risks, and a funder (or co-funder) of often large-scale adaptation projects, including major infrastructure investments and residential relocation. Among other things, it would raise questions over whether the insurance mandate of EQC should be extended (e.g. to include public property and businesses). It would also pose the risk that any fund that was built up over time to help pay for the future costs of adaptation could be depleted (unless quarantined separately from the post-disaster fund) every time a major natural disaster occurred.

Aside from this, questions would arise about how EQC should be funded. Currently, those who are not insured, together with commercial property owners,

other policy settings accordingly. The primary aims of such an entity would be to enhance the capacity for sound anticipatory governance through the funding of cost-effective and equitable responses, thereby reducing climate change risk exposure over time and minimising future damage and loss. Ideally, such a fund would complement existing *post-event* funding mechanisms, such as EQC and private insurance arrangements, so long as conflicting outcomes between them were addressed at the same time. As with the Natural Disaster Fund, a funding pool could be built up over several decades for allocation increasingly over the century, thereby enabling the burden of climate change adaptation to be shared more fairly across several generations.

An advantage of such an approach is that it would enable policymakers to establish a purpose-built institution with a specific and enduring statutory mandate. Creating any new statutory funding entity, however, raises multiple and complex design issues. These include its institutional form and mode of governance and the

nature and scope of its funding responsibilities (e.g. whether these should cover the full range of climate change impacts or only specific types, and whether there should be transitional assistance available for industries or regions facing large-scale, compounded climate-related impacts). Similarly, there is the question of what specific costs should be funded, to what extent and in accordance with what criteria. Different types of responses (e.g. investment in public infrastructure, the funding of managed retreat, transitional assistance, etc.) would require very different criteria. At the same time, any large-scale relocations will require new infrastructure investments, so the two functions would need to be properly integrated.

Related to this, concomitant changes to current regional and district planning arrangements would also need to be made. If the central government becomes a major funder of adaptation – albeit via an arm’s-length statutory entity – it would require a greater influence over long-term spatial planning, not least to minimise the risk of moral hazard. But this raises important constitutional issues regarding the respective roles of central and subnational government, some of which are bound to be politically sensitive. Consideration of such institutional design issues raised here deserves rigorous analysis and public deliberation.

Conclusion

New Zealand’s existing institutional arrangements are poorly designed for the adaptation challenges posed by climate change: they are too ad hoc and

post hoc, inadequately proactive and preventative, and poorly integrated. Not only are overall resources insufficient for the required adaptive responses – such as building resilient public infrastructure, undertaking large-scale managed retreat, and transitioning to more sustainable rural land uses as the frequency and magnitude of impacts increase – but in many cases there is a gross mismatch between the resources and capabilities available to local authorities and the scale of the task in hand. For such reasons, current arrangements will not achieve the goals of cost minimisation and equitable burden sharing, whether intra-generationally or intergenerationally. Instead, they will contribute to sub-optimal decisions and outcomes, thereby unnecessarily burdening future generations. As part of any comprehensive plan to enhance the country’s adaptive capacity, there is a good case for establishing a new national, publicly administered fund that is pre-event and preventative. Such a fund would need to be carefully designed, with the relevant criteria for its funding responsibilities clearly prescribed in enabling legislation. Creating such a fund would require potentially significant changes to current spatial planning rules, building regulations, insurance arrangements and the funding of local infrastructure. Accordingly, any move in this direction will need thorough independent scrutiny, extensive public deliberation and a concerted political effort to achieve a durable cross-party consensus on the new policy framework.

- 2 This study covered only the more populated regions of New Zealand. It included only some infrastructure assets.
- 3 See also recent contributions from the Society of Local Government Managers (2015) and Local Government New Zealand (2016a, 2016b).
- 4 Note that a Housing Infrastructure Fund was announced in early February 2017. This is designed to assist councils in high-growth areas with significant housing pressures to fund new public infrastructure (including water supply, storm water, waste water and roading). Funding of around \$1 billion is available to eligible councils via a competitive bidding process.
- 5 ‘A process towards a settlement framework to mitigate debris flow risk – Awatarariki fanhead, Matatā’, https://www.whakatane.govt.nz/sites/www.whakatane.govt.nz/files/documents/about-council/council-projects/debris-flow-and-landslide-hazards/policy_committee_2_july_2015.pdf.
- 6 Clifton to Tangoio Coastal Hazards Strategy, <http://www.hbcoast.co.nz/strategy-development/>.
- 7 So far in Christchurch, for instance, EQC has identified fraudulent claims following the earthquakes worth about \$4.6 million, and 979 fraudulent claims have been prosecuted.

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