

## Aotearoa NZ Catastrophe Resilience Project

### Submission to Productivity Commission: Improving Economic Resilience Issues Paper

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#### Background on submitters

- Dr Matt Boyd, Adapt Research Ltd
    - Expertise on catastrophic and existential risks
    - List of publications: <https://adaptresearchwriting.com/our-work/>
  - Professor Nick Wilson, University of Otago
    - Expertise on catastrophic and existential risks, particularly pandemics, volcanic winter (see also the publication list of Dr Boyd above)
    - Profile: <https://www.otago.ac.nz/wellington/departments/publichealth/staff/otago024455.html>
  - Dr Ben Payne, Adapt Research Ltd/Massey University
    - Expertise on disasters and risk
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#### Preamble

Firstly – congratulations on establishing this consultation process. It is on a very timely and important topic.

Please note we would very much like to meet with Productivity Commission to allow for us to do a presentation or have a more in-depth discussion of the points we have raised below.

#### Q1: What supply chain disruptions and trends are you worried about?

Our key supply chain related concerns, are summarised as follows:

- Global catastrophic risks (increasing probability)
- NZ trade isolation (if global industry disabled)
- Inability to supply necessities of life (eg, food, energy)

It would be wise and prudent if Aotearoa New Zealand would perform an integrated and public National Risk Assessment with extensive public and expert consultation to identify, characterise and prioritise risks and trends of national significance (see our year 2023 publication on this topic in an international journal: <https://onlinelibrary.wiley.com/doi/full/10.1111/risa.14123>).

This would then inform how resources are most cost-effectively deployed across risks and across sectors, with resources allocated in proportion to the magnitude of risk. This would include management of risks to the economy and critical supply chains.

A National Risk Assessment of this sort has been repeatedly recommended by Sir Peter Gluckman, former NZ Chief Science Advisor. Most recently here (27-03-2023):

<https://informedfutures.org/risk-listening-rethinking-how-we-understand-and-manage-risk/>

We are most concerned about the class of risks that would cause the most harm to New Zealand (including a risk of permanent economic and social damage). These are global catastrophic risks (GCRs) and include: major volcanic eruptions at global pinch points, nuclear war (with or without nuclear winter or high-altitude electromagnetic pulse), severe pandemics (natural or engineered), major global food shock, industry disabling solar flares, devastating global cyber-attack, catastrophe from misaligned artificial intelligence (AI), large asteroid/comet impact, etc.

Although individually such risks may have a low probability of occurring in any given year, collectively they are plausible, and some are even likely in the long term. Each could cause persistent medium to long-term supply chain disruptions, significantly altering life in New Zealand. The risk of GCRs is probably rising given advances in biotechnology and AI, increasing geopolitical tensions, and the amplifying impact of climate change.

From a risk analytic perspective almost all the harm that occurs is contained in a few extreme events. For example, Covid-19 has caused 95% of all disaster deaths in the 21<sup>st</sup> Century. The same is true for harm to industry and the economy, where occasional catastrophes do most of the damage. We are concerned that much risk mitigation activity in New Zealand addresses only smaller more common risks (eg, floods and earthquakes) and therefore leaves most of the actual future harm to New Zealanders unaddressed.

The Issues Paper states that, “the inquiry cannot be limited to analysing a narrow set of predictable scenarios”. We agree - absolutely. This point is driven home by historical examples, eg, the UK National Risk Register omitting “volcanic eruption” prior to the extremely disruptive 2010 eruption of Eyjafjallajökull in Iceland, or the same Risk Register stating prior to the Covid-19 pandemic that a non-influenza disease outbreak might put at risk “100 lives” in the UK.

The major concern common to many of the GCRs identified above is trade and/or service isolation for New Zealand and any mitigation strategies need to address the issue of (potentially protracted) trade and/or service isolation.

We are mostly concerned about disruptions that threaten the necessities of life, for example food, energy, transportation, and communications. Without critical supplies and the means to distribute them, there is a serious risk of the collapse of both digital and industrial society. It is not merely a matter of fudging through such trade isolation, because the economic and geopolitical landscape could be permanently and radically changed after many of the events above.

Any economic resilience perspective should ideally be married with a catastrophe resilience perspective that prioritises and ensures the continued supply of basic services.

We further note that although the Productivity Commission's terms of reference for this inquiry refer to the 'medium term' of one to ten years, we are yet to see evidence of a long-term strategy in New Zealand for mitigation of GCRs (this includes the work of NEMA, DPMC, Waka Kotahi, etc). Given that across time these events contain almost all the actual harm, this can be considered a major oversight. The Productivity Commission should use the present inquiry as an opportunity to recommend this oversight be addressed and we refer the Commission to the recent United States Global Catastrophic Risk Management Act 2022, which provides a framework for approaching this global problem at the country level.

We note the list of sectors that the Commission suggests including in this work. We agree that 'Food' is critical (not merely the food and beverage industry, but actually ensuring food can be produced and transported and paid for), also Manufacturing, and Digital Technology (which needs to include overseas cloud services). However, we would add the critical sectors of Transport (including coastal/interisland shipping), Energy (especially scenarios of multi-year disruptions to imported fuels), Water (components/energy etc needed for drinking, wastewater, irrigation), Finance (especially dependent on the continuing supply of ICT services), and Industrial inputs (eg, disruptions to fertiliser and seed imports, metals and plastics etc).

We mention the above issues specifically in the context of the Commission's Economic Resilience Issues Paper, because it is not clear they are adequately addressed elsewhere, for example they are not discussed in Waka Kotahi's long-term infrastructure plans, nor in material we are aware of coming out of MFAT or MBIE. Someone must take ownership for these GCRs, or they risk slipping through the cracks. As we noted above, GCRs probably account for most of the risk to New Zealand.

## **Q2: What is your industry/community currently doing or planning to do to address supply chain concerns?**

- Developing hazard profiles for major global catastrophes
- Impact and gap analysis of NZ after major nuclear war (also relevant to other sun-blocking catastrophes such as "volcanic winter")
- Strategy and plan for NZ resilience to global catastrophe

We are undertaking the Aotearoa New Zealand Catastrophe Resilience Project (NZCat), which seeks to understand the impact that representative major global catastrophes might have on Aotearoa NZ, for example a Northern Hemisphere nuclear war (with nuclear winter impacts). We also aim to deduce adaptive strategies and plans that might mitigate these effects, to lower the risk that our digital and industrial society collapses.

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Using Swiss National Risk Assessment methodology, we have developed a Hazard Profile for Nuclear War/Winter and New Zealand. We validated this profile in a multistakeholder expert workshop on 9 February 2023 (we invited the Productivity Commission to this event but perhaps staff were too busy to reply).

The Hazard Profile is now being used as the basis for a survey across ten sectors we have prioritised as critical in the aftermath of a GCR. The survey asks about impacts, but has a focus on solutions. The survey results are due mid-year. We will organise a cross-sector roundtable to discuss the survey results, and then we will follow-up the survey with targeted in-depth interviews with sector experts. Finally, a Delphi process will assess and prioritise the crowd-sourced solutions. Our reports are due by the end of 2023. This timeframe means that the Productivity Commission could consider highlighting these findings in their present inquiry. We would be happy to present interim themes to the Commission if interested, and to invite the Commission to the roundtable event we are organising.

Here are examples of links to our work on New Zealand resilience and global catastrophe:

- Our workshop and Hazard Profile on nuclear war/winter as a representative global catastrophe impacting New Zealand:  
<https://adaptresearchwriting.com/2023/02/20/workshop-on-nuclear-war-winter-nz-wellbeing-of-millions-and-1-trillion-plus-at-risk-strategic-resilience-must-become-bread-butter-nz-policy/>
- The omission of large-scale risks from most national risk assessments:  
<https://onlinelibrary.wiley.com/doi/10.1111/risa.14123>
- The impact of nuclear war/winter on New Zealand and some mitigation strategies:  
<https://onlinelibrary.wiley.com/doi/10.1111/risa.14072>
- Food security strategies for New Zealand in major global catastrophe (two studies):  
<https://www.researchsquare.com/article/rs-2670766/v1>  
<https://www.medrxiv.org/content/10.1101/2022.05.13.22275065v3> (this study is in press with a peer-reviewed journal)
- “Volcanic winter” impacts – which includes some historical data for New Zealand:  
<https://www.nature.com/articles/s41598-023-30729-2>
- The need for anticipatory governance of these risks in New Zealand:  
<https://ojs.victoria.ac.nz/pq/article/view/7313>

### **Q3: How can the government help to enhance the resilience of your industry/community to supply chain disruptions?**

- We make 12 recommendations (as follows)

We fully agree with the Issues Paper that a primary role of government is to develop and protect the physical and social infrastructure underpinning supply chains and helping to ensure key inputs (eg, energy, pharmaceuticals) during emergencies.

We suggest that the New Zealand Government should take a much more active, long-term, resilience-focused, intergenerational justice inspired approach. Including a view to large scale global catastrophes beyond the capability of markets to manage.

There are several concrete actions that the New Zealand Government could take to reduce the impact of the increasingly likely of global catastrophes:

1. Include global catastrophic risks in National Risk Assessments and communicate national risk information to industries and communities (including inviting engagement on this work from the public and experts).
2. Replicate the 2022 US Global Catastrophic Risk Management Act that mandates a systematic assessment of global catastrophic risks and inter-agency plans for how to supply necessities of life in the event of such catastrophes.
3. Prepare strategies and plans to ensure food security (and ensure that necessary enabling infrastructure eg, fuel, transport, electricity, communications, can remain operating) under circumstances of global catastrophe and/or trade isolation.
4. Conduct interagency/multi-sector scenario-based simulation (walk-through) exercises that explore the impact and response of New Zealand to major global catastrophes to identify critical infrastructure, workforce, supply chain and resilience issues.
5. Red-team the above exercises and include scenarios where New Zealand is isolated from global trade for an extended period (as is plausible in a number of the GCRs mentioned above), and where internet and cloud communications are disabled.
6. Introduce a new National Science Mission to study the likelihood, consequences, and mitigating policies of global catastrophes with a particular focus on preserving or adapting transport, supply chains, food supply, communications and industrial functioning.
7. Conduct analysis of risk and response, provide data and information that industries and communities can use to make decisions about adaptation (this should include analysis of how/where to reallocate resources under persisting catastrophe conditions, eg, diversion of fodder crops to human consumption – or whatever analysis suggests is optimal, an example of this are the national resilient food plans for the US and Australia produced by ALLFED the Alliance to Feed the Earth in Disasters). Our own research on prioritising particular crop production in New Zealand after certain catastrophes is also relevant:  
<https://www.researchsquare.com/article/rs-2670766/v1>
8. Support industries and communities to produce commodities that local export markets (eg, Australia) will likely need and desire in a global catastrophe to hedge against the collapse of long-distance trade.
9. Develop a plan to keep domestic and local regional trade and supply operating in conditions following a global catastrophe, including scenarios where fuel imports have ceased (eg, prioritise diesel rationing to trans-Tasman or interisland shipping and ensure local possession of shipping capacity).
10. Nurture a global catastrophic risk think tank based in New Zealand (or combined with an Australian effort) to advise across government and industry in a systematic way (all GCRs, all agencies and departments).

11. Undertake rapid cost-effectiveness analyses across a suite of potential mitigation measures to ensure that investment in resilience provides the best value for money (and ideally enhances business-as-usual, eg, through efficiency, emissions reductions, or cost-savings)
12. Ensure that the above analysis is conducted at national level, but also identifies regional variation in capabilities and needs, especially under conditions of global catastrophe that might limit supply of necessities such as fuel, food, industrial inputs differentially across the regions.

#### **Q4: What should the Commission study to learn more about the economic resilience of industries and communities?**

Overall, we worry that the scope and scale of analysis may end up being too narrow. Our major recommendation is to extend the frame to specifically include the risks known as 'global catastrophic risks', where the majority of the potential harm to New Zealand lies.

There exist some excellent high-level accounts of economic resilience (and collapse) in existing work on global interconnectedness and catastrophic risk. Two excellent works are:

- Peter Zeihan's book 'The End of the World is Just the Beginning', which we have reviewed here through an Aotearoa New Zealand lens:  
<https://adaptresearchwriting.com/2022/07/18/the-end-of-the-world-is-just-the-beginning-and-the-value-of-a-nz-national-catastrophe-resilience-strategy/>
- The 1980s New Zealand Nuclear Impacts Study which was coordinated by the NZ Planning Council is another excellent resource about the interdependencies and fragilities across sectors on an isolated island nation. The McGuinness Institute has an excellent write-up of this work, which they published in 2022. It is available here:  
<https://www.mcguinnessinstitute.org/policy-projects/foresightnz/revisiting-tomorrow/nuclear-war/>

The Commission should study the capability of New Zealand to adapt to loss of long-distance global shipping. How could New Zealand maintain trade, eg, with Australia, or maintain coastal shipping (at required volumes), or interisland connections, especially in a context of isolation from imported fuel, components for maintenance, or expertise. There may be scope here for supporting further development of modern wind-powered cargo ships (see: <https://www.theguardian.com/environment/2023/mar/23/cargo-ships-powered-by-wind-could-help-tackle-climate-crisis>).

The Commission should also study the dependencies of various critical industries. Analysis should include volumes and flows. For example, how much diesel does the agricultural sector consume for each unit of human food caloric output? If supply of diesel was halved or eliminated, what are the optimal components of the system to prioritise for rationing to maximise caloric output? There are many other analyses along these lines that would be useful to aid decision-making.

Without getting into extraneous detail, the role of data and understanding the potential for industries/sectors to pivot their activities to address shortfalls in critical necessities is important.

An interesting analysis was undertaken in Hungary, which mapped the interrelationships of VAT payments (this allowed researchers to identify supply chains). The findings suggest that there are a handful of high-risk pressure points where resilience measures could be targeted: <https://phys.org/news/2022-05-country-entire-economy-predictand-forthe.html>. Similar research could be undertaken in New Zealand.

Data will then allow modelling, and the Commission's modelling study should include:

- A zero-trade scenario (this is not an unlikely scenario and could be brought on by a major volcanic eruption, a major solar flare, extreme pandemic (natural or engineered), nuclear war, global cyberattack, etc).
- A North Island/South Island disconnection scenario (ie, no operational ferries with fuel or components unavailable).
- A scenario where trade is possible only with Australia.

It is important to assess which parts of the system are most critical. Such assessments should not just aim to improve resilience of these components but should also plan for their failure. How will the system work when those critical components are disabled? The economy and supply chain system should ideally "gracefully degrade" under stress, it shouldn't immediately grind to a halt. For example, heavy reliance on road transport and diesel may be problematic.

We would like to accept the Commissions offer to discuss the results of modelling. We believe our project team is well-placed to help red-team the scenarios and outputs. The modelling is also likely to complement our survey and interview studies, which we described in Question 2 above.

The Commission's Issues Paper appropriately mentions the analysis of trade-offs (between resilience and efficiency), but special analytic emphasis should be put towards understanding the benefits of resilience measures to business-as-usual, and to other national goals. For example, it may be that increasing domestic solar electricity installations has the effect of reducing the cost of electricity, reducing greenhouse gas emissions, and increases the efficiency and security of energy supply. There are likely to be many low-hanging fruit, where government incentives can bring about longer-term cost-savings as well as resilience.

Finally, the Commission is absolutely right to note that New Zealand occupies a unique position in the world with unique challenges. However, it is also the case the some of these unique features make New Zealand less susceptible to catastrophic harm from some GCRs (eg, New Zealand had the lowest excess mortality rates due to Covid-19 amongst OECD countries). There are different scales at work here. The resilience of New Zealand depends on particular features of our economy and supply chains. But the resilience of the world and humanity depends on particular countries ensuring they can flourish through global

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catastrophe. There may be an obligation upon New Zealand to ensure resilience for this wider goal. Such questions should be explicitly articulated and put to ongoing public discussion.

Again, we would welcome the opportunity to meet with the Productivity Commission to discuss these issues further.

Kind regards,

Dr Matt Boyd  
Prof Nick Wilson  
Dr Ben Payne