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Aotearoa NZ Catastrophe Resilience Project

Submission to the New Zealand Government: Strengthening the resilience of Aotearoa New Zealand's critical infrastructure system

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Background on submitters

- This submission was prepared by members of the Aotearoa NZ Catastrophe Resilience Project (NZCat) Research Team
- NZCat is a philanthropically funded, non-profit, non-partisan, independent, multidisciplinary research project that aims to identify, and provide analysis and information about, global catastrophic risks and NZ's vulnerability, with the aim of increasing NZ's resilience to major disaster.
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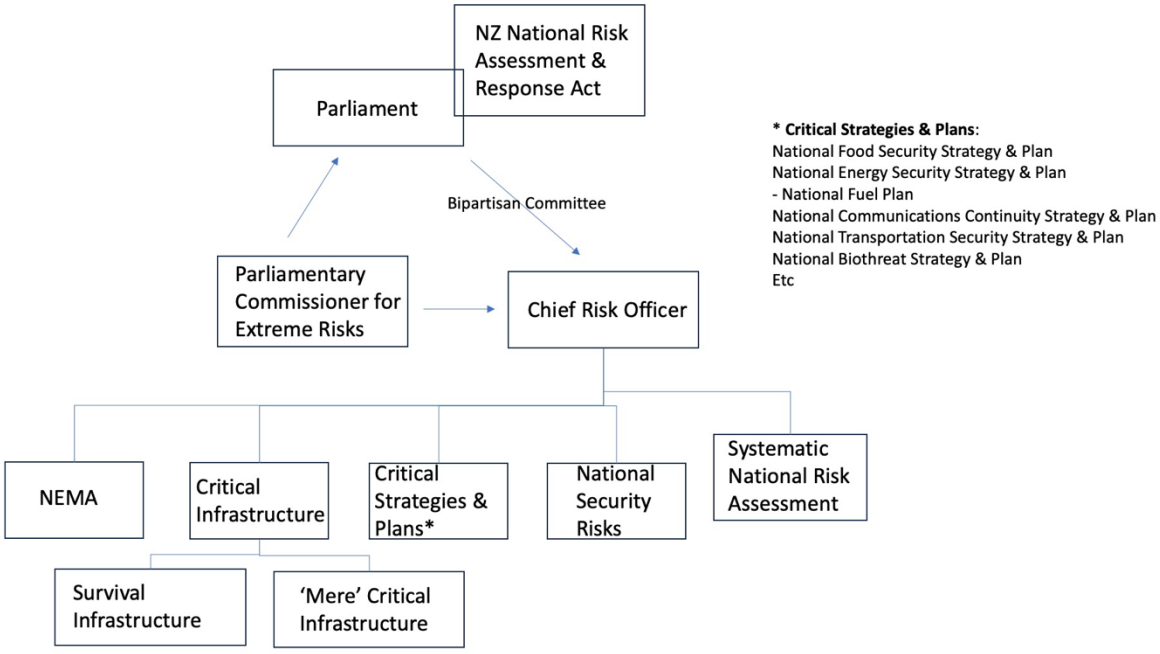
Executive summary

We applaud the initiative to enhance the resilience of New Zealand's critical infrastructure. In response to the Discussion Document, we make the following key points (explained in more detail in the full submission below).

1. A distinction needs to be made between ensuring existing critical infrastructure is *resilient* and investing in infrastructure needed for *resilience*. NZ needs more of the latter (we give examples below) and this should be legislated.
2. A further distinction needs to be made between infrastructure needed for *survival* (eg water, agriculture, food transport, heating, etc) and *merely critical* infrastructure. The current Emergency Management Bill does not yet achieve this.
3. Regulation of survival and critical infrastructures should not stop at requirements for currently existing infrastructure. There are *resilience* infrastructures NZ currently lacks that would be critical to survival in certain catastrophe situations (eg, domestic biofuel production capacity, coastal shipping, seed stockpiles, etc). New Zealand must foster '*resilient*' infrastructure and develop '*resilience*' infrastructure.
4. Any regulatory approach to critical national infrastructure needs to be informed by a properly resourced, systematic, public, and transparent National Risk Assessment that addresses all hazards and all threats to help prioritise risk mitigation activity.
5. All hazards and all threats must mean exactly that (not just familiar or recent hazards such as flooding, earthquakes, or Covid-19) and explicitly include the global catastrophic risks that likely contain most of the risk to NZ. The risks should include catastrophic trade isolation and its impact on critical infrastructure.
6. New Zealand could replicate something like the US Global Catastrophic Risk Management Act 2022 that defines and lists such risks and defines 'basic needs'.
7. If not the above detailed US-style legislation, there could be a NZ National Risk Assessment and Response Act, requiring government to conduct a regular comprehensive, publicly facing, systematic assessment of national risks, including cross-border global catastrophic risks, and to engage with the public, experts, and other stakeholders, including Australia, on these risks and possible solutions.
8. The National Risk Assessment could be coordinated by a Chief Risk Officer or Parliamentary Commissioner for Extreme Risks tasked with overseeing and advising on the systematic national approach to risk, including regulation (see Figure below).
9. There should be a public discussion, including government, media, and crowdsourcing of possible solutions, that explicitly addresses the trade-off between standard of living and security in the face of catastrophic risk, with clear options on the table for addressing resilience, and funding these investments.
10. People today and in the future deserve equitable protection from risks, so investment in resilience should occur immediately, financed by borrowing, and paid for across the lifetime of the resilient infrastructure by all of those who benefit.
11. The distinction made between 'survival infrastructure' and 'merely critical infrastructure', should leave government responsible for investing in, and maintaining survival infrastructure where it is not economic for the market to do so.

12. Any 'minimum standards' should be informed by analysis of second (and higher) order impacts, for example using a NZ digital twin for plausible risks and using downward counterfactual analysis of previous events.
13. We need to better understand the risks before contemplating minimum standards in the face of those risk conditions. However, minimum standards should include mandatory cooperation among providers/sectors/government and pre-catastrophe simulation/scenario exercises.
14. The Government should be transparently clear with the public about the overarching framework for systematically approaching national risk, and employ a legislative and governance structure that does not omit key risks (ie includes clear responsibilities for addressing such risks as Northern Hemisphere nuclear war, bioweapon pandemic, climate altering volcanic eruption, severe solar storm, and other similar risks, all of which originate overseas, and none of which is a 'malicious threat to NZ').

One possible wider legislative and governance structure



Preamble

Firstly, congratulations on establishing this consultation process on a very timely and important topic.

In the following, we cover:

1. Critical background to our submission
2. Responses to the specific questions posed in the Discussion Paper
3. Some final comments

Please note we would very much like to meet with the wider DPMC national risk team to present our research on national risk and resilience and to discuss more in-depth the points we raise below. There is an opportunity through this process to take a cooperative, systematic, and effective approach to important national risks.

Background to our submission

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 (eg, future pandemics). Each could cause persistent medium to long-term disruptions, significantly altering life in New Zealand. The risk of many 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 21st Century. The same is true for harm to industry and the economy, where occasional catastrophes cause most of the damage. We are concerned that much risk mitigation activity in New Zealand addresses only smaller more common risks (eg, local floods and earthquakes) and therefore leaves most of the actual future harm to New Zealanders unaddressed. It is possible that populations might tolerate some smaller risks, in order that resources can address the truly unbearable risks (this is an important topic for future consultation).

Our key critical infrastructure-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)

A systematic and public National Risk Assessment

It would be wise and prudent if the Government of Aotearoa New Zealand performed 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 2023

publication on this topic in an international journal, in which we explain the shortcomings of many national risk assessments to date and how to overcome them:
https://onlinelibrary.wiley.com/doi/full/10.1111/risa.14123

A systematic National Risk Assessment would then inform where regulation might be needed and 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 wellbeing, 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/

The major concern common to many of the GCRs identified above is trade and/or service isolation for New Zealand and any mitigation strategies needed to address the issue of (potentially protracted) trade and/or service isolation (and the accompanying difficulties in obtaining parts or expertise necessary for infrastructure functioning). New Zealand's 'critical infrastructure' therefore is that which provides for essential goods and services in these scenarios, in particular those essential for survival.

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 listed above.

Any catastrophe resilience perspective should prioritise and ensure the continued supply of basic services to maintain basic human needs.

We further note that DPMC could use the present inquiry as an opportunity to recommend that the general lack of systematic assessment of GCRs and their impact on New Zealand be addressed and we refer DPMC to the recent United States Global Catastrophic Risk Management Act 2022, which provides a well-designed framework for approaching this global problem at the country level.

See here: https://adaptresearchwriting.com/2023/02/05/us-takes-action-to-avert-human-existential-catastrophe-the-global-catastrophic-risk-management-act-2022/

Responses to specific questions

Prelude & principles

Does more need to be done to improve the resilience of New Zealand's critical infrastructure system?

Yes, New Zealand's critical infrastructure system is highly vulnerable to risks, in particular those of a catastrophic and global nature. New Zealand needs to systematically identify critical infrastructure, including infrastructure that presently underpins functioning of essential basic services (such as water, food, shelter, heating, communications, transport, etc) and identify the global dependencies of such infrastructure (eg on imported liquid fuel, cloud/internet providers, global shipping, industrial and agricultural inputs, etc)

New Zealand also needs to identify infrastructure that ought to be developed because it does not yet exist but would be critical in important, plausible, and catastrophic risk scenarios. Achieving these aims would require a systematic and inclusive national assessment of risks to New Zealand, which includes cross-border risks such as the suite of potential global catastrophes, rather than merely responding in ad hoc fashion to recently experienced, or familiar local hazards. This would allow identification of needed *resilience* infrastructures.

We have previously published on the need for systematic and public national risk assessment in an international journal, here: https://onlinelibrary.wiley.com/doi/full/10.1111/risa.14123

Have you had direct experience of critical infrastructure failures, and if so, how has this affected you?

As typical NZ citizens we have personally frequently experienced the impacts of natural hazards eg, disrupted access to property in Hawkes' Bay due to roading damage from Cyclone Gabrielle in 2023, or electricity outages due to storms in the upper South Island. But we urge DPMC to avoid being too biased by these natural hazards, which NZ weathers well, as the truly big concerns are the highly neglected and potentially devastating GCRs.

How would you expect a resilient critical infrastructure system to perform during adverse events?

The highest priority for a resilient critical infrastructure system is to ensure basic population needs can be supplied under any circumstances. This means ensuring water supply, food production, transport and food distribution, heating/shelter, sewerage systems, and information sharing about the adverse events, among other functions. Ensuring that basic functions continue may involve a layered approach to resilience, with redundancy, and emergency infrastructure that allows a pivot from business-as-usual functioning to new ways of doing things under adverse conditions, especially if such conditions persist for a long time (weeks, months, years, decades [for GCRs]). It would be expected that expert understanding of catastrophe and resilience can be deployed to oversee the supply of basic needs during such events, and cooperative plans formulated under scenario exercises ahead of time are put into effect.

Would you be willing to pay higher prices for a more resilient and reliable critical infrastructure system?

The real question is not whether we as individuals would be 'willing to pay higher prices', it is whether there is a compelling argument for investment in resilience. As the discussion paper notes,

the key arguments are that investment in resilience protects wellbeing and tends to reduce overall costs. These facts make such investment compelling.

The costs ought to be paid by those who benefit, in the case of critical national infrastructure (especially survival infrastructure), the beneficiaries are the entire population. Furthermore, given that the risks exist already, and threaten the present population today, resilience of critical national infrastructure should be developed as fast as possible with immediate investment. If the entire nation benefits from resilient water supply and sewerage disposal, food production and distribution, heating and shelter, and communication of important risk information, etc, then the entire nation should pay.

Since investment is required immediately, but the benefits persist across time, then there is an argument that national borrowing should help pay for the investments, and ongoing taxation should be balanced to ensure equitable repayment burden across time and ensure maintenance of resilience in the future. **Basic needs are a security that citizens expect the state to ensure, and from which all citizens benefit. Security of basic needs should not be traded for arbitrary public debt ratios, nor should any population (present or future) be burdened with a disproportionate cost of ensuring basic resilience**. Appropriate borrowing, taxation and timeframes can balance these requirements equitably, so everyone pays their fair share.

The work programme's objective is to enhance the resilience of New Zealand's critical infrastructure system to all hazards and threats, with the intent of protecting New Zealand's wellbeing, and supporting sustainable and inclusive economic growth. Do you agree with these objectives? If not, what changes would you propose?

The focus on all hazards and threats is commendable and essential. However, implementation of this approach needs to ensure that large sources of risk are not omitted. As we noted in our introductory remarks, almost all the risk resides in relatively rare but devastating scenarios. We elaborate on this point in our paper on the need for improved National Risk Assessment methodology, see here in an international journal:
https://onlinelibrary.wiley.com/doi/full/10.1111/risa.14123

All hazards and threats must include the suite of risks collectively referred to as global catastrophic risks, and which are defined in the new US Global Catastrophic Risk Management Act 2022. We note that the new definitions of New Zealand's National Security Risks that came out of Cabinet in 2022 deliberately moved these definitions away from 'all hazards, all risks', so we are very happy to see this framing in the present Discussion Paper, but it must be seriously actioned. Given the omission of many global catastrophic risks from previous New Zealand risk assessment work, we recommend a systematic, and publicly facing, National Risk Assessment before settling on the final list of 'all hazards, all risks'.

There is some misalignment in the Summary document and the Discussion paper, with the Summary using the phrase 'sustainable, inclusive, and productive growth' rather than the phrase in the question above, 'sustainable and inclusive economic growth'. 'Productivity' is probably the better term, with the addition of 'growth' being more controversial in the present global energy and climate context. The objectives can be achieved with a focus instead on 'wellbeing, and sustainable, inclusive productivity'.

Do you agreed with the proposed criteria for assessing reform options? If not, what changes you would propose?

We agree that criteria for assessing options should take seriously the effectiveness and the cost-burden (and therefore cost-effectiveness) of options.

We agree that there is some role for refining the regulation of current infrastructure that is operated by current providers, and we agree that such regulation should not be unnecessarily burdensome or complex.

However, we also emphasise that regulating current providers and current infrastructure is insufficient to mitigate the relevant risks. There is a need for regulatory approaches and indeed new legislation that ensures that risks are: (a) systematically and inclusively assessed, and (b) appropriate mitigation measures are devised. Such legislation might include a US-style 'NZ Global Catastrophic Risk Management Act' or a 'NZ National Risk Assessment and Response Act', requiring government to conduct a regular comprehensive, publicly facing, systematic assessment of national risks, including cross-border global catastrophic risks, and to engage with the public, experts, and other stakeholders on these risks and possible solutions.

Such risk assessment might identify critical infrastructure that would be required to ensure basic needs and which New Zealand presently lacks. The legislation ought to then require that such shortcomings be addressed, by investing in this *resilience* infrastructure, to ensure security for New Zealanders.

Section 1: Background and context

The paper discussed four megatrends: i) climate change, ii) a more complex geopolitical and national security environment, iii) economic fragmentation, and iv) the advent and rapid uptake of new technologies. Do you think these pose significant threats to infrastructure resilience?

Yes, all these megatrends pose risks to New Zealand's infrastructure through potential disruptions to trade or climate, and through conflict and major societal transformation. Impacts on New Zealand's critical infrastructure may be felt via disruptions to food and energy security, transportation, communications, digital services, and other key sectors.

Are there additional megatrends that are also important that we haven't mentioned? If so, please provide details.

There are additional likely megatrends, such as:

- The increasing likelihood of catastrophic biological threats due to habitat destruction, poorly governed biological research, and the intersection of AI and biological technologies.
- The increasing polarisation and fragmentation of social cohesion being seen in high-income nations such as NZ (with social media contributing to this).
- Increasing difficulty of governments achieving stated goals (eg climate commitments), locally and with respect to cross-border risks (partly due to the trend immediately above) – it is important to consider risks that stem from operational processes themselves when considering 'all hazards, all threats'.
- 'Complex geopolitical environment' is mentioned in the Discussion Document, but emphasis on possible large-scale conflict is relegated to one phrase under 'economic fragmentation', yet with an increasingly unstable Russia/Ukraine nexus and eg, China/Taiwan situation,

coupled with the development of autonomous military technologies there is likely a trend towards more conflict and more devastating conflict. Most nuclear weapon states are either expanding their nuclear arsenals or improving their weapon delivery systems (missiles etc).

In addition to megatrends, there are other megarisks that ought to be explicitly contemplated. These include devastating solar storms, super volcanic eruptions, and all the global catastrophic risks we've alluded to above. We have published on one major volcanic winter event and its impact on NZ and other islands (the Tambora eruption 1815): https://www.nature.com/articles/s41598-023-30729-2

Do you think we have described the financial implications of enhancing resilience accurately? If not, what have we missed?

We note paragraphs 65 and 66 are not the only options, focus on providers and direct customers, and omit consideration many of the second and third order benefits of resilient infrastructure. It is not only direct customers of service providers who benefit from resilient systems. The focus on 'shareholders' and 'employees' misses the point that there are basic rights to needs such as water, food, and shelter and resilience of infrastructure essential for providing basic needs provides benefits to all citizens. Solutions will likely require systematic and cost-effective government investment and support. This could be mediated by higher taxes on those able to pay. Where appropriate, tax policy can also add to collective resilience by helping to overcome poverty and reduce social inequities.

Probably, an important national conversation needs to take place, in public, in the media, where a systematic national risk assessment is presented, options for resilience are discussed, and the costs and benefits of investment are debated. The conversation should cover the trade-off between tax revenue, standard of living, and security and wellbeing in an increasingly risky environment. It is a missed opportunity to see that the Discussion Paper specifically states it is targeted at infrastructure providers when this conversation should be wider.

That said, we draw a distinction between two levels of resilient infrastructure:

(1) **Survival infrastructure**: that infrastructure necessary to ensure people have access to water, food, shelter/heating, sewerage systems, energy, and communications during disaster. Such critical infrastructure might plausibly include things like:
   a. A domestic biodiesel refinery to provide the minimum liquid fuel to sustain agriculture during a prolonged catastrophe that ended liquid fuel imports;
   b. Seed stock for frost resistant crops in case of a nuclear/volcanic winter;
   c. More coastal shipping assets to ensure transport of commodities around New Zealand during a collapse in global shipping;
   d. A functional onshore cloud and local area network for transactions that can function during global cloud outages (as examples).

   Government could commission such infrastructures. Our own work on minimal food supplies for NZ post nuclear winter is published in an international journal here: https://www.nature.com/articles/s41598-023-35354-7

(2) **Merely critical infrastructure**: that infrastructure that is highly desirable to protect core economic and societal functions over and above survival-level needs.

Understanding what might be needed under (1) will depend on a systematic National Risk Assessment across all hazards and all threats, with a focus on common impacts and solutions across these risks. Citizens would expect such survival infrastructure to be guaranteed by the state.

Section 2: Potential barriers to infrastructure resilience

If you are a critical infrastructure owner or operator, what additional information do you think would best support you to improve your resilience?

Critical infrastructure operators need to be able to refer to a systematic all hazards, all threats, National Risk Assessment, and public Risk Register, which has been developed transparently, according to wide-ranging legislated specifications, in consultation with diverse risk experts outside of government, and overseen by an office charged with anticipatory governance of large-scale risks such as a Chief Risk Officer, or Parliamentary Commissioner for Extreme Risks. This risk assessment should avoid the shortcomings of historical National Risk Assessments, including omission of most of the actual risk, as we detail in our peer-reviewed paper published in an international journal: https://onlinelibrary.wiley.com/doi/full/10.1111/risa.14123

We have detailed the structural governance options for such a proposal for New Zealand in our published research paper here: https://ojs.victoria.ac.nz/pq/article/view/7313

The National Risk Assessment could be in cooperation and coordination with Australia so that global cross-border risks are agreed (there has been criticism that European National Risk Assessments disagree over likelihood and consequences of cross-border risks), and information about cooperative mitigation options is disseminated.

What do you think the government should do to enable greater information sharing with and between critical infrastructure owners and operators?

Develop a systematic all hazards, all threats, National Risk Assessment, and public Risk Register, which has been developed transparently, according to wide-ranging legislated specifications, in consultation with diverse risk experts outside of government, and overseen by an office charged with anticipatory governance of large-scale risks such as a Chief Risk Officer, or Parliamentary Commissioner for Extreme Risks (as immediately above).

The work of entities such as the Lifelines Council (or whatever comes next), and NEMA/CDEM, and the development of a set of critical national plans for: food security, energy security, communications continuity, transport security, and so on, all need to be guided by the systematic nature of a National Risk Assessment, which exists as a living document accessible by all, and is regularly updated in accordance with enabling legislation that mandates an appropriate budget for this process.

One major advantage of a National Risk Assessment is that it provides information about the common consequences across a wide range of risks, and therefore can help individuals and businesses, industries, and sectors to target their own resilience measures in the most cost-effective ways. It also assists in these sectors best advising what central and local government need to do.

But crucially, don't leave the public out of this. This issue is mentioned in the Discussion Document, but we reiterate it here. **Comprehensive risk information needs to be publicly available and discussed publicly**. **Without understanding the suite of risks, and the risk environment, the consequences, likelihoods, and mitigation options, the public cannot fully authorise any major level of government investment in resilience**. The UNDRR notes that one of the largest risks, is the lack of publicly available high quality risk information.

Would you support the government being able to set, and enforce, minimum resilience standards across the entire infrastructure system? If so:

- *what type of standard would you support (eg. requirement to adhere to a specific process or satisfy a set of principles)?*
- *do you have a view on how potential minimum resilience standards could best complement existing approaches to risk management?*

We support minimum resilience standards that compel providers (and central and local government) to contemplate a wide range of risk scenarios, including at a minimum, the set of global catastrophic risks that probably contain most of the actual risk to New Zealand.

The US Global Catastrophic Risk Management Act 2022 provides just one example of how such risk assessment can be mandated, at least in the context of Federal Interagency Plans.

An important resilience standard for an isolated island nation like New Zealand is minimum functioning in a trade isolation scenario. Providers ought to be able to continue a minimum service without being dependent on imported commodities, parts, expertise, or overseas infrastructure, including digital infrastructure or liquid fuels. This rationale applies equally to regions within New Zealand, where local units of service provision should be able to operate independently.

Minimum service level standards for survival can be researched and calculated. For example, we have calculated the minimum land area of canola crop to provide a minimum volume of biodiesel to support minimum agricultural activity to feed the New Zealand population (it turns out it's approximately 1% of currently cropped grainland [an online pre-print of this study will be available by September 2023]). It is unlikely to be commercially viable to cultivate this quantity of canola for biofuel, build the biofuel refinery, and sustain this during normal times, so calculating such minimums (across all 'survival infrastructures') will provide guidance on the level of government investment required to protect citizens lives.

Planning for this kind of disruption and estimating quantitatively how much (fuel, transport volume, industrial inputs, and so on) are essential should be bread and butter anticipatory management of risks, undertaken cooperatively across industries, sectors, and government. **This could involve development, at a minimum, of a set of systematic resilience strategies and plans across each critical sector, for example a National Food Security Strategy and Plan. Such strategies *are* critical infrastructure and entities should be directed to cooperate with each other on them.**

Would you support the government investing in a model to assess the significance of a critical infrastructure asset is, and using that as the basis for imposing more stringent resilience requirements? If so:

- *what options would you like the government to consider for delivering on this objective?*
- *what criteria would you use to determine a critical infrastructure asset's importance?*

Yes, this is the sort of thing a comprehensive New Zealand national digital twin could be used for. Scenario modelling could be red-teamed, and previous disasters could be examined using the 'downward counterfactual' technique to identify ways in which they could have been worse. We give an example of this technique applied to Cyclone Gabrielle in our briefing here: https://www.phcc.org.nz/briefing/embracing-downward-counterfactual-analysis-navigate-future-cyclones

Another approach is to identify survival level needs and then work 'upwards' identifying the infrastructures required to provide them, by working backwards from the level of individual needs up to what minima industries (or government) need to provide.

We note that the holistic model presented in the Discussion Document (Appendix B) suffers from a lack of discrimination at the high consequence end. For example, '10 deaths' is considered 'extreme'. Yet Covid-19 has now killed 3000+ New Zealanders and the 1918 influenza pandemic killed 9000 New Zealanders. Prioritisation processes will need to discriminate among risks across these orders of magnitude. This criticism has also been made recently against European National Risk Assessments (along with their non-alignment on the likelihoods of cross-border risks).[1]

Do you think there is a need for the government to have greater powers to provide direction or intervene in the management of significant national security threats against a critical infrastructure? If so:

- *what type of powers should the government consider?*
- *what protections would you like to see around the use of such powers to ensure that they were only used as a last resort, where necessary?*

There is a need for the state to have stronger emergency powers given the existential threat potentially arising from some GCRs eg, a pandemic from an engineered bioweapon. But of course, Parliamentary oversight must allow for the complete ending of emergency powers once the threat has been resolved.

Do you think that there is a need for a government agency or agencies to have clear responsibility for the resilience of New Zealand's critical infrastructure system? If so:

- *do you consider that new regulatory functions should be the responsibility of separate agencies, or a single agency?*
- *do you consider that an existing entity should assume these functions or that they should be vested in a new entity?*
- *how do you see the role of a potential system regulator relative to sectoral regulators?*

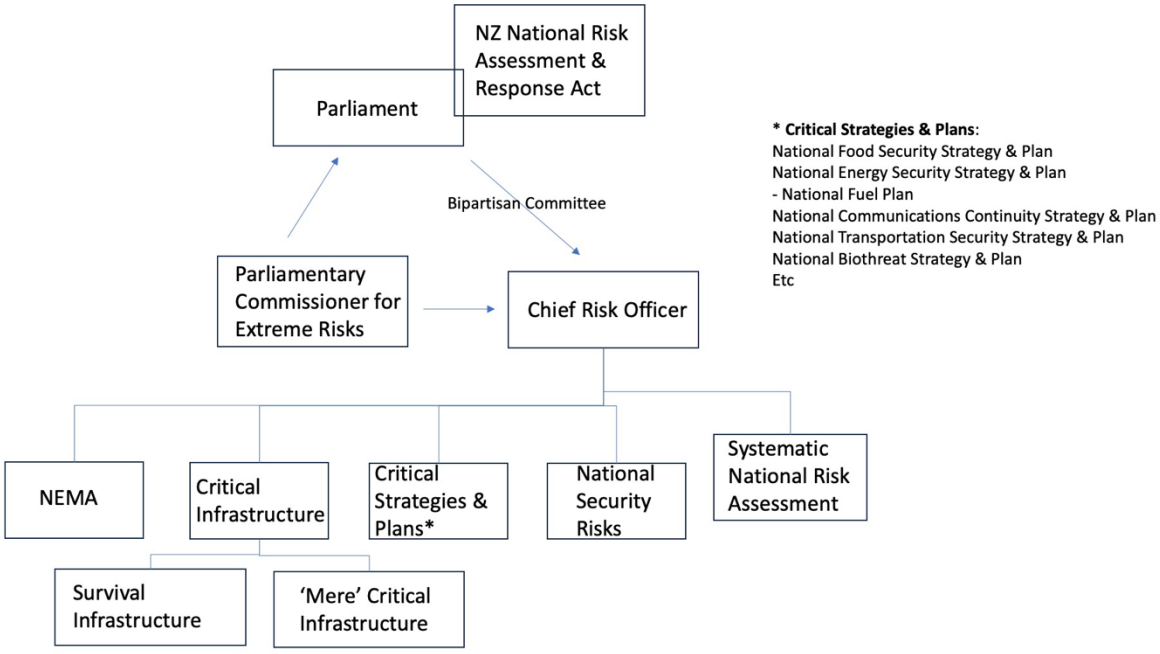
We lay out the case for anticipatory governance of extreme risks affecting New Zealand in our paper here: https://ojs.victoria.ac.nz/pq/article/view/7313

In the paper, **we conclude that a new entity is necessary, because no present entity is sufficiently anticipatory, central/aggregating, coordinating, apolitical, transparent, adaptive, and accountable**.

We favoured a Parliamentary Commissioner for Extreme Risks (supported by a well-resourced office), though a National Chief Risk Officer tasked with undertaking a systematic National Risk Assessment and coordinating across all risk-relevant activities (including coordinating sectoral regulators) would also work. A possible governance structure would look like this (see figure below):

[1] Kohler, K. 2023. National Risk Assessments of Cross Border Risks: https://css.ethz.ch/en/center/CSS-news/2023/02/national-risk-assessments-of-cross-border-risks.html

One possible governance structure for ensuring NZ's resilience to national risks



Do you think that there is a need for compliance and enforcement mechanisms (eg. mandatory reporting, penalties or offences) to ensure that critical infrastructure operators are meeting potential minimum standards? If so:

- *do you consider that legal obligations should be applied to the entity, to the entity's directors/executive leadership, or a mix of the two?*

We would argue that rather than try to force entities to act, where infrastructure is truly critical, then the Government could provide resources to nurture resilience. In this way rights to basic needs are universally preserved and those who benefit (everyone) pay for this security.

Final comments

Overall, we feel that the definition of critical infrastructure needs to be determined appropriately. It is far from clear that the Emergency Management Bill has yet achieved this. The definition should include needed 'resilience' infrastructure, and it should consider 'criticality' in the context of very long-lasting catastrophes that leave New Zealand isolated.

A focus on 'retaining essentially the same level of functioning' is unlikely to be appropriate in a severe catastrophe, hence our preference for the survival/critical infrastructure distinction.

We agree that leadership, planning, expertise, culture, and relationships are all a part of critical resilience and should be invested in as part of this infrastructure.

We emphasise the apparent ad hoc nature of risk and resilience work in New Zealand to date and would prefer to see a systematic approach starting with a National Risk Assessment, rather than a responsive approach in the wake of particular events such as floods, cyclones, or the last pandemic.

We are in the middle of 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 a policy agenda for adaptive strategies and plans that might mitigate these effects, to lower the risk that our digital and industrial society collapses.

We have been doing the following:

- Developing hazard profiles for major global catastrophes
- Conducting impact and gap analysis of NZ after major nuclear war (also relevant to other sun-blocking catastrophes such as "volcanic winter")
- Preparing a policy agenda for NZ resilience to global catastrophe

Using Swiss National Risk Assessment methodology, we 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 DPMC to this event but unfortunately the staff who agreed to come became too busy to attend).

The Hazard Profile was then used as the basis for a survey across multiple sectors that we prioritised as critical in the aftermath of a GCR. The survey asked about impacts but had a focus on solutions. Survey results can be read here: https://adaptresearch.files.wordpress.com/2023/07/230704-nzcat-nuclear-war-impacts-resilience-survey-report.pdf

We are currently following-up the survey with targeted in-depth interviews with sector experts about vulnerabilities and resilience to global catastrophe. We will report on these, as well as publish our consolidated recommendations, by the end of 2023. This timeframe means that the DPMC could consider using these findings in their present inquiry.

We can present our work to DPMC

We would be happy to present our findings to the Critical Infrastructure Resilience Team and the wider DPMC risk governance officials (eg, preliminary findings now or else end-of-project findings in early 2024).

Relevant to the present consultation, we made a submission to the Productivity Commission's Economic Resilience Inquiry. In that submission we made 12 clear recommendations for reducing risk to New Zealand. You can read the submission here: https://adaptresearchwriting.com/2023/04/13/nz-economic-resilience-submission-to-the-productivity-commission-focus-on-global-catastrophic-risks/

Here are further 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.proquest.com/docview/2809560267/fulltextPDF/659D0E1FE5924218PQ/1?accountid=14700
  - https://www.nature.com/articles/s41598-023-35354-7
- "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

We commend the Government for initiating this work, and hope that a productive and effective wider systematic approach to risk evolves.

Yours sincerely,

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