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How to ensure our future – prevention of low-chance
or far-off catastrophes by states

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Of Critical Importance: Toward a quantitative probabilistic risk assessment framework for critical infrastructure

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There is no scientific evidence that a qualitative approach to risk assessment, based on e.g. ordinal risk scoring and the risk matrix, actually works. On the contrary, there is significant evidence that it does not. Researchers have claimed this qualitative approach to risk assessment to be *"worse than useless"* (Cox & Popken, 2007, 440; Cox, 2008, 500) and urge to avoid its usage (Thomas, Bratvold & Bickel, 2013)*.* Even so, it is still considered 'best practice' by many risk managers. In cybersecurity for example, aspects of the qualitative approach, such ordinal risk scoring, are promoted in about every standards organization, consulting group, and security technology vendor (Hubbard & Seiersen, 2016, 84). It is being used to assess every kind of risk, ranging to even national and global scale. This article deconstructs and suggests an (quantitative) alternative for one particular example of the qualitative approach to risk assessment: the Dutch National Risk Assessment (DNRA) method for critical infrastructure.

When decomposing the DNRA, critical comments can be made regarding its usage of a subjective concept of risk, dependency on subjective risk experts, the use of risk matrices, and the absence of decision rules. To combat these criticisms and move towards a better form of national risk assessment, this article introduces five design principles, which a methodologically justified risk assessment method for critical infrastructure should meet. It should use a (1) objectified concept of risk, (2) scientifically-sound risk calculation method, (3) fixed risk criteria, (4) cost-benefit analysis, and (5) democratic decision making

Next, a proposal is made for an alternative risk assessment method that meets these conditions. This new quantitative method is probabilistic in nature. It uses a Bayesian approach, a standardized measure for negligible risk in the form of a yearly mortality probability of *10-6* , and Disability Adjusted Life Years (DALYs) to quantify human life years for social cost-benefit analysis. Finally, the proposed quantitative method is demonstrated in a case study: a lengthy disruption of the Dutch power supply.

Cox, K. A., & Popken, D. A. (2007). Some Limitations of Aggregate Exposure Metrics*. Risk Analysis, 27*(2)*,* 439-445*.* https://doi.org/10.1111/j.1539-6924.2007.00896.x

Cox, T., & Lowrie, K. (2013). From the Editors. *Risk Analysis, 33*(2), 945-947.

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Why states are not keeping us safe in the long run: the theory and practice of preventing future societal destabalization

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Over the past century, material discomforts of and immediate risks to the average peace-time inhabitant of a developed country have decreased significantly. Simultaneously (and, perhaps, confoundedly), our tools for scientific assessments of future risks have improved drastically. As a consequence, most developed nations now have analytical capacities, financial means and political space to deal with long term risks such as climate change, the emergence of malign artificial intelligence and future pandemics. How have nations organized themselves to make effective use of our increased powers of prediction to mitigate risks? And how have they used that knowledge to achieve better outcomes?

In this paper, we will establish a framework for explaining why modern, developed states with remarkable scientific capability at their disposal remain woefully underprepared to mitigate potential destabilizing risk to societies. We have drawn on literature on state risk management, long-term policy investment and game theory to identify the most poignant causes for this state failure. We will test this framework against the semi-destabilizing event of Covid-19, and especially the track record of states in preparing for an epidemic outbreak prior to 2020. We will demonstrate that there is no statistical relation between preparation indices and actual outcomes, most likely because almost all countries were almost entirely unprepared for an epidemic event of Covid-19's scope – as was the international framework for handling such a crisis.

We will conclude that this lack of preparation fits the framework that wdeveloped in the first section of the paper – states are indeed generally not very good at preparing for long-term destabilizing risk, even when they are highly predictable and also in fact predicted, and the reasons why they are not are both understandable and to a large degree surmountable.