EPICENTERS OF CLIMATE AND SECURITY: THE NEW GEOSTRATEGIC LANDSCAPE OF THE ANTHROPOCENE

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Tools for Understanding Systemic Risks Like Climate Change

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Our world is more interconnected than ever: information and communication technologies have made it easier to connect with people around the world; modern transportation systems have made it simpler and faster for people to move to new locations; and global food systems have enabled the production and trade of crops and staples across hemispheres. While this interconnectedness has brought benefits to many, it also has exposed a new set of complex and systemic risks. Systemic risk can be defined as t "risks imposed by inter-linkages and interdependencies in a system or market, where the failure of a single entity or cluster of entities can cause a cascading failure, which could potentially bankrupt or bring down the entire system or market."[3] The greater the linkages and interdependencies in society and economies, the higher the likelihood that a shock to any one part of a system could lead to unforeseen, cascading consequences that might even trigger the collapse of entire systems.

At the same time, society is facing unprecedented challenges associated with climate change. Climate change is increasing the frequency, severity, duration, and timing of extreme weather events, including heat waves, floods, droughts, and wildfires. Climate-related events can have numerous direct and indirect impacts, including loss of crops, displacement of people, damage to infrastructure, and outbreak of disease. As global economic and social systems are more deeply intertwined, society is more vulnerable and exposed to climate-related disruptions. These disruptions can also lead to systemic risk by affecting supply chains, transportation systems, and trade networks.

There have been significant efforts aimed at understanding place-based and sector-specific climate risks. Climate assessments at local, national, and regional levels are being conducted on an ongoing basis and are designed to consider climate risks to specific geographic locations as well as a range of sectors, including food, energy, water, health, and transportation.[4] However, risks to one sector or to one region, can cascade through networks and across multiple regions. In fact, a study commissioned by the UK government as part of its first national climate change risk assessment found that, "Climate change impacts around the world will multiply existing threats to the UK, and some of these could be an order of magnitude greater than threats from domestic climate impacts."[5] Thus, understanding the breadth of current and future risks – particularly under conditions of climate change and growing inter-dependencies – will be an important component for building resilience of communities, governments, and businesses and for increasing human, national and potentially international security.

Despite the difficulty of assessing climate-related systemic risks, there are a number of tools and methods that can be employed to imagine possible future scenarios, identify patterns and networks, and demonstrate through narratives how climate-related systemic risks might manifest.

Foresight tools and methods: Gaming and Scenario Planning

Serious gaming and scenario planning are foresight tools that have been used by businesses, military, intelligence, and emergency planners to help think creatively about the future, inform strategy, and prepare for risks. These methods can provide a venue to bring together perspectives from across different sectors and aid decision-makers in developing a set of plausible narratives for the future.

- **Serious games** are "games that do not have entertainment, enjoyment, or fun as their primary purpose."[6] These games – based on real or fictionalized situations and contexts – lead participants to make decisions in early stages of the game that will influence both the direction and outcome in the later stages. Such games have long been used by military and intelligence, as part of war gaming, and by city and health planners as part of emergency preparedness simulation efforts. They can be tailored to allow for different degrees of complexity, from the number of actors involved to the geographies included, as well as how far into the future they reach. Outcomes of serious games can help decision-makers test out policies and increase preparedness to a range of possible futures.

- **Scenario planning** was popularized in the early 1970s to help inform decision-making for businesses and is a tool regularly used by the military. Scenario planning is not intended to develop predictions or probabilistic futures, but rather to create plausible narratives for the future. As a professor at

the Wharton School of Business described, "Scenario planning is a disciplined method for imagining possible futures by attempting to capture the richness and range of possibilities, stimulating decision makers to consider changes they would otherwise ignore... Above all, however, scenarios are aimed at challenging the prevailing mind-set."[7] One study that surveyed nearly 80 companies that use scenario planning found that formal strategic foresight efforts add value through (1) an enhanced capacity to perceive change, (2) an enhanced capacity to interpret and respond to change, (3) influence on other actors, and (4) an enhanced capacity for organizational learning."[8]

When trying to understand and anticipate a complex chain of climate-related risks, including human behavior and decision-making, gaming and scenario planning offer complementary ways to integrate multiple perspectives on environmental, social, economic, and political conditions to develop plausible futures that explore potential systemic risks. Examples of where these types of foresight tools have been used for climate risk include:

- In 2015, Lloyds of London commissioned a group of scientists to develop a scenario for an acute but plausible scenario of disruption to global food production. This scenario, published in the report "Food System Shock,"[9] aimed to assist the insurance sector in thinking about the implications of a global food production shock.

- In 2014, the Skoll Global Threats Fund (SGTF) worked with CNA to develop a serious game for South Asia focused on transboundary rivers. Participants from the countries represented – Pakistan, India, Bangladesh, and China – spent two days playing out a game in which decisions on water allocations affected economic productivity, political acceptance, and social stability in the months and years ahead.[10] The game allowed participants to negotiate among different parties and sectors within countries, and among neighboring countries, in an environment simulating many of the existing challenges in the region.

- In 2015, SGTF and the UK's Foreign and Commonwealth Office partnered with CNA to both develop a game and use scenario planning to look at long-term and systemic climate risks over the course of the next century. The game helped to surface a number of trends, including migration, xenophobia, and the rise of nationalist parties months before the events in Europe and the Mediterranean basin unfolded.[11] The experience from this foresight activity contributed to a chapter on systemic risk in the UK's Climate Risk Assessment,[12] released later in the year.

These examples illustrate how foresight tools can be used to actively and creatively engage decision-makers and subject matter experts, test strategy and policies, and surface systemic risks. As demonstrated by various sectors, foresight tools can be a valuable way to explore the broader implications of climate-related risks in an interconnected world. Further enhancing the utility of these approaches are the innovations taking place in the digital age, which may provide additional opportunities for considering climate-related systemic risks.

Digital age: Machine Learning and Collective Intelligence

The digital age has influenced our social, economic, and political systems in countless ways – from enabling rapid communication across continents, to the way in which news is generated and distributed, and even to how social movements are built. Likewise, new technologies have both generated and enabled the collection of an unprecedented amount of information. For example, it is estimated that 2.5 quintillion bytes of data are produced each day (as an illustration, there are 6,000 tweets each second, on average). Remote sensing, crowdsourcing, and big data analysis all allow decision-makers to see changes taking place in the biophysical environment as well as patterns and trends in social, economic, and political systems. Indeed, both machine learning and collective intelligence also could provide opportunities to anticipate climate and systemic risks, both by improving our understanding of those risks and recognizing where and how they emerge.

Machine learning

The unprecedented rate of data generation, storage, and processing power is giving way to the ability to integrate and analyze unstructured and disparate data. For example, advances in machine learning – simply defined as enabling computers to learn from data – enable the processing of large amounts of data and provide insight into interactions and patterns occurring across the globe, including real-time and predictive analytics. The application of machine learning ranges from identifying disease outbreak, to monitoring the potential for mass atrocities, to mapping out illegal wildlife trade. The EMBERS program (short for Early Model Based Recognition using Surrogates) at Virginia Tech has demonstrated the power of publically available open source data to generate predictive analytics about human behaviors. Since launching in 2012, 80-90 % of EMBERS forecasts have been accurate – from protests, to disease outbreaks, to mass migrations.[13]

Yet, the use of machine learning to identify systemic risks from climate change is in its infancy. Hence, the opportunity is ripe for processing large amounts of data to understand the physical dynamics of the planet, identify the interconnections between countries and regions, and surface the attitudes and trends within a society to identify emerging risks from climate shocks.

Collective intelligence

Collective intelligence, also referred to as the wisdom of the crowd, has a long tradition dating back to Aristotle, who said, "When there are many who contribute to the process of deliberation, each can bring his share of goodness and moral prudence… some appreciate one part, some another, and all together appreciate all."[14] Collective intelligence can draw on the insights from across a company, a group of scientists or the general public. As demonstrated by Wikipedia, collective intelligence can also become a source of information, filling the role that encyclopedias once held.

One of the best known experiments using collective intelligence is the Good Judgment Project,[15] which has the aim of "harnessing the wisdom of the crowd to forecast world events." The results have been impressive, albeit surprising. By asking questions on topics including geopolitics and financial markets, the 5,000 volunteers from the general public recruited for the project have been able to better predict international events than U.S. intelligence analysts, including those with access to classified information.[16]

While the Good Judgment Project aims to generate predictions, collective intelligence can be used as a tool to engage with experts, develop ideas, and facilitate collaboration across sectors and geographies. MIT's Center for Collective Intelligence has been a pioneer at exploring how new communications technologies are changing the way people work together around complex climate risks. Its Climate CoLab aims to engage large numbers of people around the world to address climate change through an online platform, while its Resilience Dialogues facilitate conversations between scientists, practitioners, and community leaders to build climate resilient communities.

Drawing on individuals from diverse backgrounds, collective intelligence can facilitate interactions among cross-sector and cross-regional expertise from around the world. Applying this approach to understanding climate-related systemic risks may help decision-makers at local, national, regional and global levels identify where vulnerabilities to those risks may lie, and be better prepared to address or prevent worst-case scenarios. Likewise, innovations in both communications and data technologies can transcend both financial and geographic barriers that may have previously constrained these critical interdisciplinary collaborations.

Conclusion

Despite what appears to be a growing global trend toward inward-facing, nationalist and isolationist beliefs and policies, the world continues to be connected in deeper and more complex ways. Against this backdrop, climate change presents a unique challenge, one in which direct and indirect risks can manifest across borders and through networks. Addressing climate-related risks – particularly in the face of a more interconnected world – will require new approaches and new ways of thinking to

understand, prepare for, and manage these systemic risks. Fortunately, we have tools and methods, some old and others new, that can help decision-makers get ahead of these risks.

Notes

1 Program Officer, Water, Skoll Global Threats Fund

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3 Steven L. Schwarcz, "Systemic Risk." Duke Law School Legal Studies Paper No. 163; Georgetown Law Journal, Vol. 97, No. 1, 2008. Accessed at SSRN: https://ssrn.com/abstract=1008326

4 Examples include the U.S. National Climate Assessment, the California Climate Assessment, and the Intergovernmental Panel on Climate Change Assessments.

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8 Angela Wilkinson and Roland Kupers, "Living in the Futures," *Harvard Business Review*," May 1, 2013, citing study by René Rohrbeck, of Aarhus University, and Jan Oliver Schwarz, of Germany's EBS Business School, accessed at https://hbr.org/2013/05/living-in-the-futures

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13 Leah Mcgrath Goodman, "The EMBERS Project Can Predict the Future with Twitter," *Newsweek,* March 7, 2015, accessed at http://www.newsweek.com/2015/03/20/embers-project-can-predict-future-twitter-312063.html

14 Cass R. Sunstein and Reid Hastie, "Making Dumb Groups Smarter," *Harvard Business Review*, December 1, 2014, accessed at https://hbr.org/2014/12/making-dumb-groups-smarter

15 The Good Judgment Project was created by Philip Tetlock, Barbara Mellers, and Don Moore and funded by IARPA – the Intelligence Advanced Research Projects Activity

16 Naomi Larsson, "The 'Supers' Who Can Predict the Future: Can We Learn How to See Disaster Coming?" *The Guardian*, March 6, 2017, accessed at https://www.theguardian.com/global-development-professionals-network/2017/mar/06/forewarned-is-forearmed-learning-how-to-predict-the-future