The Climate Change-Conflict Nexus and national risk assessment exercises in the United Kingdom and Singapore
The University of Tokyo
Yee-Kuang Heng

Abstract

Adams and Ide (2018) have suggested that the sampling of postulated linkages between climate change and conflict tends to focus on places where there is already violence occurring in the first instance. As such, this study seeks to instead address questions relating to mapping, anticipating and preventing climate-related conflict from erupting in the first place. In doing so, it evaluates how national risk assessment and "futures" architectures in the United Kingdom and Singapore (two countries with well-established programmes) assess the potential interconnected linkages between climate change and conflict.

Introduction

Just as the world was plunged into the COVID-19 crisis in 2020, climate protesters at an event led by Greta Thunberg highlighted the continuing risks posed by another global risk: "It's pick your evil. Do you want to die from global warming or from coronavirus?" The protesters not only highlighted the myriad range of risks humanity currently grapples with, they also pinpoint the underlying angst over climate change. This is not surprising given the findings of the largest survey of public opinion ever conducted on climate change. With 1.2 million respondents from around the world, the UN Development Programme's "Peoples' Climate Vote" in January 2021 revealed that almost two thirds view climate change as an emergency. **"Failure of Climate Change mitigation and adaption"** was ranked as the number one long-term risk by impact in the 2020 World Economic Forum *Global Risk Report*. Climate anxieties were likewise highlighted when "severe weather" emerged the top everyday experienced risk in the Lloyds Register Foundation's *World Risk Poll 2019*.

The interconnected risks of a potential climate change-conflict nexus

Climate change is often seen as a threat multiplier (CNA Military Board 2007) or stressor that increases the potential for conflict. Regarding the uprisings in Syria and Egypt that have been linked to environmental degradation (with varying degrees of academic consensus), Werrell, Femia and Sternberg (2014) argued that "indices and predictive tools used by analysts to examine state fragility and the likelihood of state fragility, respectively, did not include sufficient attention to these natural resource dynamics". What tools and research methods are being employed in the UK and Singapore and should they be developed further to better map the potential linkages between climate change and conflict?

Conflict here is understood in a broad and multifaceted sense. As Quincy Wright (1951) suggested, "war is a species of conflict", just as street fights and legal contentions in court similarly constitute "conflict" in the sense of "inconsistencies in the motions, sentiments, purposes, or claims of entities, and sometimes to the process of resolving those inconsistencies". Certainly, armed or military conflict in a traditional sense has been widely discussed in terms of inter-state conflict over increasingly scarce water or other essential resources including territorial disputes over sinking islands. Taking a broader conflict perspective, furthermore, the growing concerns over internal climate refugees (World Bank 2018) may well intersect with deliberate manipulation of cross-border climate-induced migration against another state. Russia's alleged "weaponising" of refugee flows in Syria against the EU is an example (Sagar et al 2020). Conflict can also involve the use of non-military tools such as sanctions or reputation shaming to punish another state for climate intransigence (so-called green sanctions proposed by Nobel Laureate Joseph Stiglitz for the EU and China against the US under Trump). In case of a "disorderly transition from carbon" and potential rush to decarbonize that might be conflict-laden (Selby 2019), oil producing countries like Saudi Arabia or UAE could come under pressure for slower rates of adaptation compared to the fast movers such as the EU's new Green Deal. There have been discussions of tariff barriers targeting recalcitrant carbon-emitting states and separating them from free trade zones comprised of global Green Deal coalition states (Tucker 2019). As climate change intensifies, ideas such as "carbon border adjustments" – taxes on imported goods from countries with weaker climate laws or lagging emissions policies are being discussed. Major petroleum and petrochemical refining hubs like Singapore could also draw criticism: the "elephant in the room" is refining which generates half of the national greenhouse emissions (Hsu 2019). Domestically, that the inaugural Singapore Climate Rally drew a turn-out of 2000 suggests there is also a pool of potential societal angst and blame for the government. Protesters argued that "We just took a moment of silence for the climate. But the government has been silent for far longer"(Low and

Elangovan 2019), pointing to how the lights on Jurong Island, Singapore's petrochemical and industrial hub, never go off. Activist hedge funds and long-term impact investors focused on sustainability and climate change have already targeted oil major Exxon Mobil (Rosenbaum 2020).

Besides grassroots protest movements, stock purchasing Apps such as RobinHood could potentially be deployed by climate activists against a firm or government seen as not sufficiently "green", with a potential overlap and interconnection with emerging technology risks (The GameStop saga and so-called "Reddit rage" might in a climate emergency link up with "climate rage" activists). Domestic opposition from stakeholders may also come from the costs involved in switching to net zero carbon emissions. The gilets jaunes protests in France in response to petrol tax hikes may well be on the minds of UK policymakers contemplating a carbon emissions tax on carbon-intensive industries such as meat and cheese to meet its emissions targets. The UK and Singapore with major financial industries could also face disruption and instability from volatile indices and asset prices in event of a disorderly transition or severe weather events (Financial Stability Board 2020).

The COVID crisis coupled with Brexit has highlighted for the UK how food and critical supply chains could also be severely disrupted. Such stressors on food, water and energy are likely to increase with climate change, for countries like the UK and Singapore that have been seeking greater diversity of supplies (Scanlan 2018). Climate change may further intersect with populist leaders who deny climate change on one hand and so-called "avocado politics" that justifies hard right policy agendas such as anti-immigration policies on the basis of environmental crises (Gilman 2020). There are also questions of "inter-generational justice" being raised about future generations angry at choices made by current politicians for mitigation and adaption. The Extinction Rebellion movement and Greta Thunberg-inspired activism facilitated by digital online technologies comes to mind. Given the different inter-related vectors and pathways in which conflict may arise from climate change, this paper advocates for a focus on interconnected risks and key disrupters.

One oft-cited attempt to identify and map such complex interconnected risks is the annual World Economic Forum Global Risk Report. The 2018 report for instance identified failure of climate change mitigation measures as one of the Top Five risks that will have the biggest impact over the next ten years. The same report also highlighted the interconnectivity of climate change risks with others such as societal instability and the adverse consequences of technological advances, as shown below in its Risk Interconnection Map.
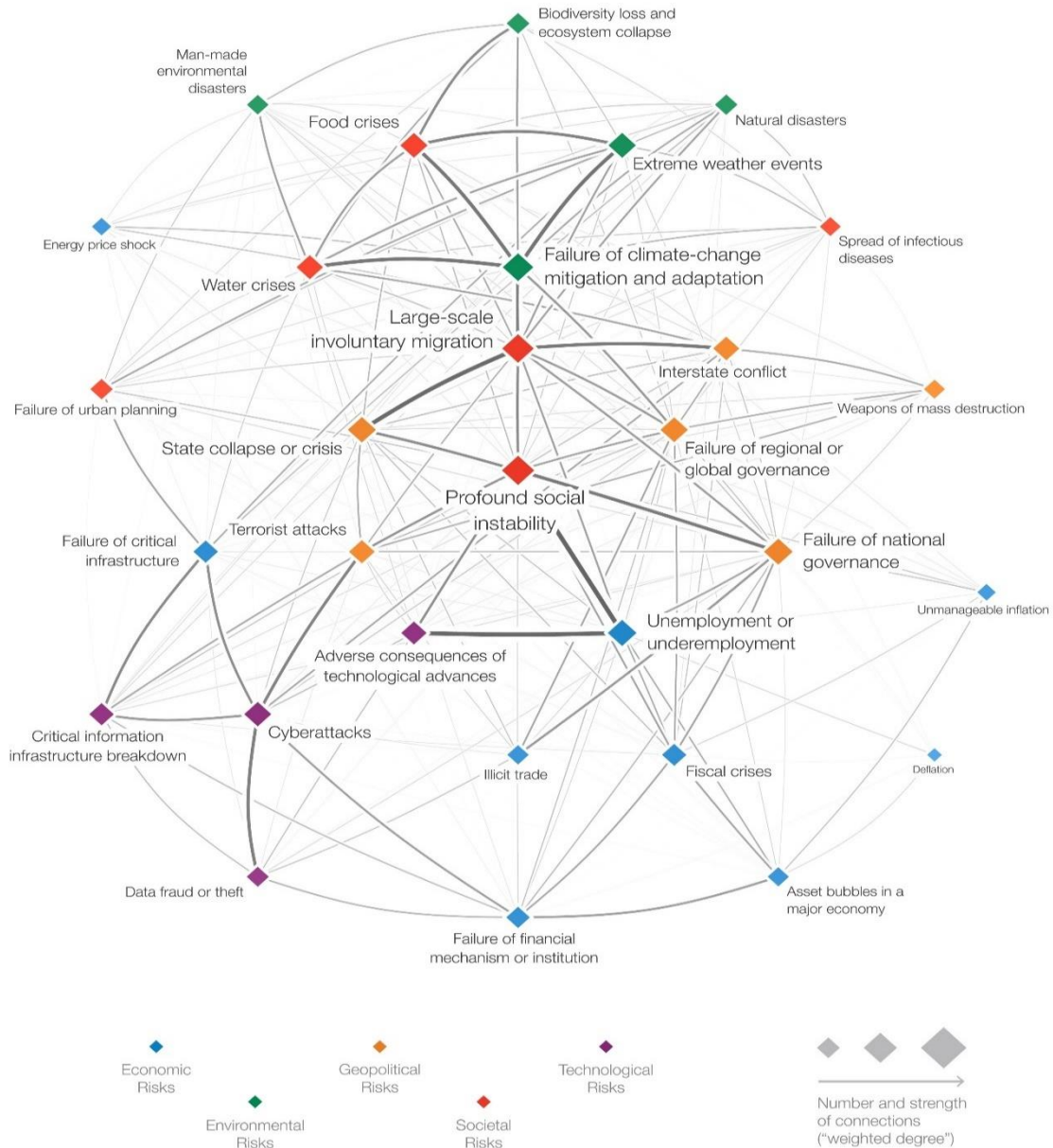
Source: World Economic Forum, Global Risks Report 2018, "Risk-interconnection map"

This report is widely discussed and its data is derived from perception surveys across the WEF membership. It must be noted that respondents may not necessarily be experts in the field of climate change or conflict, they are merely providing their impressions to questions asked. Respondents are drawn from WEF membership ranks, which are not necessarily representative of views and opinions "globally" so to speak. Regional and national variations and nuances in the data are also not provided. Furthermore, given its broad global scope, how are claims about interconnections between climate change, technology risks, and societal instability assessed and understood by national risk assessment exercises and policy-makers in a national context? Indeed, decision No. 1313/2013/EU of the

European Parliament and of the Council of 17 December 2013 on a "Union Civil Protection Mechanism" has led to many EU member states developing their own national risk assessments. This is indicative of a growing trend for EU member states such as Ireland, Finland, and the Netherlands to develop such capabilities. The UK before it left the EU was an early pioneer.

Research Question/Unit of Analysis

With this in mind, the following questions are posed in the following analysis:

How do national risk assessment exercises evaluate the interconnected nature of climate change risks that could extend to overlapping technological and societal instability risks?

How and to what extent have governments tried to institutionalise and map early warning signals of potential intertwined conflict risks from climate change?

What are the policy and governance implications and who are the key stakeholders, including the role of scientists?

What are the limitations of those research tools, capabilities, and methods and can they be improved upon?

Methodology

To address these questions, this paper deploys a case study of two countries that have developed risk assessment and foresight capabilities in their government institutions. The choice of the United Kingdom is driven by the suggestion that "the UK was one of the first countries to produce a national-level risk assessment and remains a world leader in this policy area" (Stock & Wentworth 2019). The UK government has also produced its National Risk Register based on a National Risk Assessment (NRA) exercise coordinated by the Cabinet Office since 2008. Meanwhile, the second case is based on Singapore's programmes built on over 30 years of prior experience in scenarios and foresight planning. The tiny city-state now touts a Centre for Strategic Futures based in the Prime Minister's Office, and what its proponents claim was the world's first Risk Assessment and Horizon Scanning

programme established in 2007 within its National Security Coordination Secretariat. Selecting the UK and Singapore as cases allows researchers to generate a cross-regional comparative analysis, accounting for differences in size, policy and governance structures as well as geo-political and strategic/security contexts.

Based on field interviews, document analysis and stakeholder mapping, this paper explores how both countries assess climate change and risks it poses for potential conflict. In terms of theoretical and conceptual frameworks, this paper evaluates how far risk assessment architecture in both countries exhibit features of the matrix system of government and whole-of-government approaches (Christensen and Per Lægreid 2006). It also asks how far assessment of risks should not be confined to governmental agencies only, but also extend to include other institutions concerned with the economic, financial, social and political ramifications of risk (Renn & Klinke 2014). A variety of methods were employed, relying on both secondary and primary data. In terms of primary data collection, it firstly utilizes document and archival analysis to uncover the methods, structures and tools and assumptions that underpin the assessment of climate change as a potential conflict risk. Stakeholder mapping was also conducted. Field research observations and interviews with policymakers, practitioners and academics constituted another source of primary data. Discussions were held both online and in person (before COVID) from 2019-2021 in related UK and Singapore government agencies and academic institutions. These anonymous semi-structured interviews were supplemented by secondary data drawn from existing literature.

Existing literature

The linkage between climate change and security is often stated and at the same time, remains contested. Scholars for instance have examined the oft-cited relationship between climate change and the Syrian civil war and the Arab uprising (de Chatel 2014; Selby et al 2017) and find the linkages to be either indirectly related or unconvincing. One difficulty is that these environmental stresses were largely overlooked by traditional security analysis (Femia cited in Holland 2015). As Adams and Ide (2018) demonstrated though a systematic large-scale review of the existing literature, sampling bias as well as failure to sample independent variables means that the links between conflict and climate change are often overstated. The tendency towards sharp divisions between those who argue for and against the climate change-conflict nexus is clearly reflected in how Adams and Ide have unsurprisingly received strong dissenting comments in the same journal (Gleick, Lewandowsky & Kelley 2018). The 2018 Global Risk Report has further highlighted interconnections between adverse

consequences of technological developments, societal instability and climate change impact. Disruptive technological advances may rapidly evolve and morph in complex ways to affect societal stability as societies perceive and respond to climate change. Yet, how are national security analysts and policymakers mapping and modelling these potential inter-connections and complex linkages between climate change and conflict?

Furthermore, the category of "existential risk" has gained growing prominence in recent years. Climate change inevitably features heavily on this agenda. Cambridge University Centre for Study of Existential Risks; Oxford University Future of Humanity Institute, and the Future of Life Institute all have projects studying such risks. Schubert (2019) has highlighted the psychological aspects of how laypeople think about human extinction. From a philosophical perspective, Ord (2020) proposed a moral framework to avoid falling over what he calls the "precipice". Moynihan (2020) outlined the intellectual history behind prognoses of human extinction. However, the existing literature remains largely silent on how governments and national risk assessment exercises might address this particularly alarming type of risk. Additionally, the existing literature has been largely critical of national risk assessment exercises (Blagden 2018; Hagmann & Cavelty 2012). Yet such exercises are becoming increasingly commonplace, the OECD (2018) published a comparative report analysing twenty OECD members NRA processes through a cross-country perspective. Cases and empirical evidence presented in this paper seek to contribute to these existing works on how NRA mechanisms and processes have evolved, especially with regard to evaluating complex interconnected risks such as climate change-conflict.

Stakeholder mapping and outline of the risk assessment architecture in the UK and Singapore on climate-related risks

Both the UK and Singapore share similarities in terms of the reasons why both governments decided to invest more resources and effort in risk assessment. It was the bitter experience of events or "strategic surprises/shocks" that prompted a desire to better forecast and understand risks for planning and resilience purposes. For the UK, it was the wildcat fuel strikes in late 2000, coupled with the foot and mouth disease outbreak among animal livestock and then the 9/11 terror attacks in the US (Tesh 2012). Likewise, in Singapore's case, 9/11 followed by the SARS outbreak in 2003 reinforced a need to better anticipate strategic surprises (Ho 2008).

The UK government conducts annually its classified National Risk Assessment (NRA) coordinated by the Civil Contingencies Secretariat (CCS) at the Cabinet Office. The Government

Office for Science (GOS) also runs a Futures, Foresight and Horizon Scanning programme. The Ministry of Defence's Development, Concepts and Doctrine Centre's (DCDC) itself has a Futures team which publishes the "Global Strategic Trends 2018" report, "elements of which have been used to develop the NRA" (UK MOD 2018, p.7). The outcomes of the NRA, which tended to focus on natural hazards, are presented as the National Risk Register NRR (an unclassified summary of NRA that is published online and available to the public). NRR is in turn different from the UK Climate Change Risk Assessment (CCRA), which is led by the Department for the Environment and Rural Affairs (Defra). Defra also maintains its own in-house team of Futures analysts. Meanwhile, since 2010, there had been a separate five-yearly National Security Risk Assessment (NSRA). This sought to identify and prioritize UK overseas risks for the coming five-yearly cycle in order to support the preparation of the National Security Strategy and Strategic Defence and Security Review.

Both NRA and NSRA were combined in 2019, and reset with a two year horizon. It has been suggested that there is "a lack of attention in the NSRA given to cascading, compound and linked risks" (Hilton and Baylon 2020). As Tesh (2012) has argued, "Britain's risk profile will be diverse, as now, with no single risk dominating, and complex and unpredictable, with links suddenly and apparently randomly emerging between events". The climate change-conflict nexus might well be representative of these types of risks. UK PM Boris Johnson has reversed his previous lukewarm position and now accepts that climate change is "devastating" and has called it "far more destructive than coronavirus".

The notion of scenario planning as a planning tool for the future has had a long genesis in Singapore government circles, going as far back as the 1980s with a unit in the Ministry of Defence (Ho 2008). However scenario planning per se has a drawback: it tends to extrapolate from linear existing trends and is less suited to identifying sharp, disruptive events such as the 9/11 terrorist attacks, the 2003 Severe Acute Respiratory Syndrome (SARS) crisis, or the Arab Spring in 2011 (Ho 2008). With the strategic shock of the 9/11 terror attacks in the US and discovery of a previously undetected terror cell in Singapore and the SARS outbreak hitting hard in 2003, this prompted the development of a horizon scanning programme to anticipate and prevent such nasty surprises. A Risk Assessment and Horizong Scanning (RAHS) programme was housed within National Security Coordination Secretariat at the Prime Minister's Office sought to foster a whole-of-government approach to strategic anticipation. Capacity-building is another key goal, to sensitize policy-makers to risk-based decision-making and use of non-linear thinking (National Security Coordination Centre, Singapore 2008). Like the UK set-up, the RAHS programme sought to provide warning of emerging surprises within the two-to-five year horizon. In a related development, the Centre for Strategic Futures (CSF) was established in 2009 within the PMO with a focus on issues that may be blind-spot areas, pursue open-

ended long-term futures research, and experiment with new foresight methodologies. As a foresight team, the 10-20 years time horizon appears longer than the two-five years of the RAHS programme.

Like the UK set-up, in-house "futures" units have been established in various Singapore ministries such as Ministry of Defence, Ministry of Trade and Industry (MTI), Ministry of the Environment and Water Resources (MEWR), Ministry of Education (MOE) and government agencies such as the Singapore Food Agency. Some 150 public officers were engaged in futures work by 2013 (Masramli 2013). On specific climate change-related issues, the National Climate Change Secretariat (NCCS) was set up to improve coordination amongst ministries and negotiate with international counterparts. While an enormously useful contact point for suggesting names, it does not appear to have very much analytical resources or capacity on its own (Interviews 2020) although it does provide input into climate related risk assessments. Other government ministries have futures teams that work on climate-related risks. The Singapore government does not at present release a publicly available unclassified assessment of security risks. If a classified version exists, it has not been seen by this author. Climate change has been described by Singapore's PM Lee Hsien Loong as an "existential" and "life and death" issue.

Preliminary Findings

This paper presents the following preliminary findings from its analysis.

1) Time horizons, mandate and legislation matters:

Initially, the UK set a 5-year legislated time frame for civil contingencies in its National Risk Register. Since the consolidation of the NRA and NSRA in 2019, however "the UK NSRA only considers risks over a two year time window, this excludes many emerging risks" and may well be driven by political short-termism linked to ministers' period in office (Hilton and Baylon 2020). Furthermore for the UK, there is a legislative requirement for publishing national risk assessments. As Tesh (2012) put it, "The NRR is common-sense risk assessment, based on legislation – the 2004 Civil Contingencies Act – which defines an 'emergency' as an event that threatens significant harm to human welfare". The previous NSRA five-year cycle fed into drafting processes of security-focused documents such as the UK National Security Strategy and the Strategic Defence and Security Review SDSR) and climate change features there more explicitly than in the NRR. Meanwhile, the NRA and NRR documents were designed for more immediate term and civil contingencies planning in case of an emergency (Interviews in London 2019). Climate change is NOT included in the NRR explicitly

because it is a "chronic" issue that requires continuous ongoing policy response and it is seen to cause "long-term" changes, it may drive events and extreme weather events but NRR is focused on the "NOW" and how to respond to severe contingencies as a planning tool for local government (Interviews in London 2019).

While the NRR is short-term focused on the "now", the potential for climate change-conflict is evaluated in the longer-range MOD Global Strategic Trends Report (MOD 2018, Interviews in London 2019). Described as a "trend" that might lead to certain consequences than a risk in and of itself, "increasing environmental stress"" in the UK Ministry of Defence "Global Strategic Trends" report 2018 could lead to changing behaviour and could lead to "disputes and possibly, conflict" (UK MOD 2018). This report which takes a **thirty-year long-term time horizon** devotes considerable attention to the consequences of climate change and environmental impacts. Climate change in this report seems to be more a cause and driver of inter-connected risks such as impact on water and food resources, supply chains, increasing migrations and tensions. Combined with increasing competition for scarce resources, the result may be "social disorder and violence, economic disadvantage and increased interstate and intra-state competition and conflict". Catches of tropical fish are likely to reduce, harming coastal communities and possibly leading to an increase in piracy (UK MOD 2018). Climate change may also exacerbate migration and security challenges. Criminal, or even terrorist, groups could thrive off the climate induced stresses, for instance shortages of water and food may drive individuals to join these gangs. The report warns that "tension over resources, possibly including military action to secure supplies, cannot be ruled out" (UK MOD 2018, 37). Climate change impact on food supplies may also have knock-on effects on worldwide stability as higher food prices raise potential for food riots, protests and conflict.

The UK Government is required, under the 2008 Climate Change Act, to publish a climate change risk assessment (CCRA) every five years. This means apart from the above-mentioned NRA and NSRA processes, there is a separate UK Climate Change Risk Assessment Report (CCRA) mandated every five years by Parliament. The CCRA provides the evidence base to inform Government-led national adaptation programmes and is primarily focused on Adaptation and mitigation. A consortium of government agencies is in charge of this document led by the Department for Environment, Food and Rural Affairs (Defra) and Devolved Governments advised by an independent Climate Change Committee (CCC) a statutory body established by the same Climate Change Act of 2008. In this report, Defra might be seen as the lead agency "owning" the climate change risk assessment process. This document is NOT integrated with the NRA (Stock 2019) which focuses on emergency response and civil contingencies. The latest 2017 CCRA report considers interdependencies between the various climate risks such as rainfall patterns and warming trends, there

is little indication of implications for societal instability or conflict. In its discussion of "cross-cutting issues", the report thus however highlight how "interactions among risks: climate change risks act together to impact upon natural capital, water security, food security, wellbeing, economic prosperity and ultimately global security". It also notes that in terms of "Risk assessment models and other tools: although there have been some advances in models, tools and other resources to support risk assessments, there are particular gaps that need further attention." (UK Climate Change Risk Assessment 2017) Defra has a "futures team" that also works on global catastrophic risks and potential impact on UK food supplies.

Under the auspices of research conducted by the CCC, there are several projects that may well touch on climate change-conflict risks. For instance, projects on "Interacting risks: led by WSP" and "Socioeconomic dimensions: led by Cambridge Econometrics" (Climate Change Committee undated). CCC also advises government and Parliament on the UK's emissions targets and carbon budgets. In 2017, the CCC also published an assessment of the risks to the UK's food security including a water deficit, flooding of agricultural land. An earlier 2010 Defra report assessed that in the "unlikely event of extreme isolation, the overall calorific potential of UK agriculture would be more than sufficient [to compensate for loss of food imports], assuming a very substantial reduction in livestock production". It is unclear if the 2017 report has prompted a reassessment of that confidence from 2010 (Scanlan 2018).

By comparison, Singapore does not appear to have a legislative requirement or time frame for climate risk assessments similar to the UK. The city-state's Inter-Ministerial Committee on Climate Change has however published its "Climate Change Strategy" in 2012 which set out the risks for the low-lying island from sea level rises and extreme weather to disruptions to its trading and food supplies. It does not set a specific time horizon and suggests that climate is already changing. The paper calls for "Long-Term and Integrated Planning" over the next 50 to 100 years (ICCC 2012) with a focus on mitigation such as reducing emissions and adaptation such as building sea walls, while finding new opportunities. The potential for conflict is not highlighted in this paper. More recent publications like the 2016 *Climate Action Plan: Take Action Today, for a Sustainable Future* adopt a similar focus. However, there are potential second-order conflict-related concerns on the radar for Singapore's National Security Research Centre at the Prime Minister's Office. These include "the rise of Gen i, today's highly connected, tech-savvy teenagers who grow up immersed in social media and mobile devices. For national security concerns, Gen i's world view and value systems are critical, especially as they begin to form the bulk of Singapore's population over the next 10 to 15 years. "What happens if a riot erupts and members of our security forces are sympathetic to rioters or even actively aid the rioters?" (Masramli 2013). The 2021 storming of the US Capitol has raised heightened concerns over

US security personnel potentially holding views aligned to those of pro-Trump rioters. These concerns may also relate to growing climate activism and the protest movements sparked by Extinction Rebellion and Greta Thurnberg. Such second -order risks and societal tensions might emerge from younger generations worried about climate futures and refusing to participate in state-imposed obligations such as conscription or protests against climate policy, although at this point such activism at the cost of sacrificing one's future prospects remains relatively low (Interviews in Singapore 2020). This may potentially in turn generate knock-on effects on manpower for conventional defence capabilities. The National Climate Change Secretariat focus listed on its website appears more towards "hard" challenges such as rising sea levels and building sea walls; reducing greenhouse gas emissions and increase energy efficiency. Supported by CSF, smaller specialist "Futures" teams of analysts embedded in various ministries have considered risks like food scarcity and second-order impacts such as climate refugees (Interviews in Singapore 2020). Futures teams now work within a broader mandate and understanding of "security" to focus on climate change risks. These included thinking about regional coordination in case of climate refugee flows and impact of rising sea levels on military training areas around the world. As Singapore has devoted considerable attention to minimize food supply disruption risks, some related, albeit long-shot risks from climate change might be food riots which might undermine legitimacy and confidence in government competency (interviews in Singapore 2020).

2) Mandate and Legislation Matters:

The publicly available UK National Risk Register focused on civil contingencies; whereas the Singapore Climate Change Secretariat and related climate plans have focused on adaptation and "hard" engineering solutions. Singapore's Climate Action Plan 2016 and other documents are not necessarily climate risk assessments per se, nor does it address specific concerns about conflict potential. Singapore does not appear to have a legislative requirement to publish climate risk assessments as the UK does. Instead there is a inter-ministerial committee coordinated through the NCCS which has "no levers" to implement policies. Instead its focus has been on resilience, adaptation, mitigation and coordination (Interviews 2020). UK legislation such as the UK Civil Contingencies Act 2004 led to a focus on contingency planning and consequence management and building local government resilience in the National Risk Register. Meanwhile the UK 2008 Climate Change Act is about adaptation. In the case of Singapore, there are various environment and climate-related laws such as the Carbon Pricing Act and Energy Conservation Act. These laws do not appear to require government to submit climate risk assessments but the Singapore Climate Action Plan provides these evaluations with a focus on adaptation. The document does not focus on potential conflict implications.

Singapore's latest Green Plan 2030 mainly highlights targets for reducing emissions and adaptation, with a notable focus on "resilience" and safeguarding food security. Beyond the mandate of these official documents however, conflict-related implications of climate change are being evaluated within the Futures units of ministries in the UK and Singapore.

3) Capacity matters:

From both cases, there is a clear and consistent emphasis on building what is known as "futures literacy"- the skills needed to decide why and how to use their imagination to introduce the non-existent future into the present (Miller 2018, p.15).

The UK Government Office of Science (GOS) has prepared a "Futures Toolkit" containing a set of tools including Horizon Scanning, 7 Questions (and the Issues Paper) and Delphi. The GOS "Futures Team" supports embedding these Futures tools and techniques across the Civil Service to support policymaking. Besides a strong focus on "capability development" through workshops and learning sessions, GOS also serves a "network" function building cross-government networks and events to coordinate Futures work, share learning and develop a 'Futures culture' in Government (all above taken from UK GOS). Resources are provided to help teams across government agencies start their own Futures work quickly and rigorously. GOS collaborates with the Cabinet Office through the Horizon Scanning Programme Team (HSPT), which coordinates Futures work across government to integrate Futures into policymaking (UK GOS). There is also a Heads of Department – Horizon Scanning meeting, where Permanent Secretaries get together to discuss the long-term impact of key Futures topics (UK GOS). Futures teams have been established at DEFRA, GOS, HM Revenues and Customs as well as DSTL, amongst others. Despite these laudable attempts to embed Futures thinking and toolkits across government, criticisms have still arisen about how "Insufficient fostering of long-term thinking, systems thinking, futures thinking and technical expertise across the civil service" remain a weakness of the UK NSRA process (Hilton and Baylon 2020). Fire-fighting driven by challenges of daily events is often listed as a barrier to more systematic futures work. To help ensure mechanisms for advice from outside government, the UK has a Cabinet Office Knowledge Exchange Fellowship for academics to provide input. Several such fellowships on climate change have been awarded where academics from universities are seconded to the Cabinet Office for a certain period of time. DEFRA's Climate Change Risk Assessment Report (CCRA) also involves the participation of the independent Committee on Climate Change established by law to advise the government.

By comparison with Singapore, there are lots of similarities in terms of cross-government structures as well as the terminologies used including "futures" and "horizon scanning" networks. Singapore has also focused on these capacity and education issues. Like the UK GOS "futures toolkit",

CSF runs a series of workshops dubbed "FutureCraft", which aims to introduce key skills and has developed its Scenario Planning Plus (SP+) toolkit relevant to government foresight work, at the Civil Service College. These tools include backcasting and sensemaking based on Driving Forces Analysis and Prioritisation in climate change risks. Other tools such as Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis are also found in the UK GOS futures toolkit. Similar to the UK Horizon Scanning network of Permanent Secretaries, Singapore also has a "Strategic Futures Network" meeting quarterly at Deputy Secretary-level. At the staff officer level, there is a bimonthly "Sandbox" meeting for futures officers across government to share ideas and projects (CSF website 2021). There are now "Futures" groups embedded across the different ministries, coordinated and supported centrally by the Centre for Strategic Futures in the PMO. CSF had also worked with the RAHS programme in the National Security Secretariat. RAHS has also had launched initiatives to foster a culture of futures planning and horizing scanning throughout ministries that are familiar with the methods and vocabulary of risk assessment. Indeed from interviews with various agencies this author conducted, there is a common lingo and vocabulary that analysts employ such as "sense-making". This suggests that roll-out of futures-related thinking and methods may be making an impact.

Singapore's National Climate Change Coordination Secretariat works closely with the CSF. NCCS serves a crucial coordination function across ministries for a whole-of-government effort after scenarios exercises have been conducted. Research appears largely in the hands of small "Futures" groups embedded in ministries or the CSF in the PMO. NCCS does not appear to have much assessment capacity on its own; and its work and responsibilities appear closer to economic agencies (reducing emissions; negotiating international goals and developing sustainability in the economy etc) than security ones. The Centre for Strategic Futures (CSF) describes one of its key missions as "Grow": Grow involves building capability and capacity for strategic foresight at all levels in the wider public service (Kwek and Parkash 2020). CSF helpfully provides also a glossary of key terms associated with "Futures" work such as black swan and wicked problems. The CSF has been described as a "mothership" in terms of its ability to provide contacts and connections with other Futures planning teams in the ministries (Interviews in Singapore 2020). Individual Futures teams appear small (some have only one staff officer or at most 1.5) and may require more manpower and resources. The Singapore Food Agency has also worked with academic institutions such as the Rajaratnam School of International Studies to research food security risks for Singapore. Engaging with other stakeholders such as the industry and associations is also essential to convince these partners of the potential security implications of food and supply chain disruptions: industry partners think in terms of profits margins and dollars and cents, more than security per se, and outreach forums usually turn into a session for complaints about regulations from industry (Interviews in Singapore 2020). In 2012,

an Inter-Ministry Committee on Food Security was formed to review and formulate strategies to address the country's food security risks and vulnerabilities. While it issued recommendations on reducing food wastage, research and development, and industry issues, potential challenges from knock-on effects such as societal instability or food riots were not discussed. One interviewee lamented this approach to food security should more fully consider social dimensions (interviews in Singapore 2020)

4) Composition of key inter-agency policy structures and stakeholders:

Singapore's NCCS supports the High–level Inter-Ministerial Committee on Climate Change (IMCCC) set up in 2007 which includes Foreign Affairs, National Development, Transport, Trade and Industry, Sustainability and the Environment. Security-related ministries that might have to deal with climate change-related conflict risks such as Home Affairs and Defence are NOT formally represented on the IMCCC. The Ministry of Health also appears under-represented. When asked why this was the case, it was suggested that perhaps the Chair of the IMCC, Senior Minister & Coordinating Minister for National Security Mr. Teo Chee Hean had held security and defence portfolios and would be able to provide input from those perspectives (interviews in Singapore 2020). Meanwhile, the 2012 Inter-Ministry Committee on Food Security features key ministries such as Ministry of national Development, Trade and Industry, Foreign Affairs. The committee was chaired by Deputy Secretary (Planning), MND, while security-oriented agencies such as Defence appear to play smaller roles. As for engaging local farmers on food security and climate change risks, Singapore's inter-ministry committee on food security as well as its university research centres have been called out for not being consultative enough by Singaporean countryside non-profit organisations (Kranji Countryside Association 2017).

Proponents of RAHS nevertheless are adamant that it 'has to be a whole-of-government approach. We do not know where the next major strategic surprise even may originate. ..critical to have departments like health and education in the RAHS…they are not traditional security partners but they will be in future' (Peter Ho cited in Quiggin 2007).

The new UK Cabinet Committee on Climate Change established in October 2019 had met once in March 2020. The Defence Ministry does not seem to be prominent. Non-governmental emergency responders such as disaster relief groups are generally confused by the absence of climate change-related risks in the NRR. There also appear to be limited opportunities for bottom-up engagement and input from local communities and frontline responders into the NRA. Meanwhile, the Civil Contingencies Secretariat in charge of the NRA and Committee on Climate Change (who advise the CCRA) do not routinely meet to discuss the two documents, the National Risk Register and the UK

Climate Change Risk Assessment report (Stock & Wentworth 2019). Besides such internal matters of inter-ministerial coordination, there are also questions being raised about the use of external experts in NSRA processes (Hilton and Baylon 2020). More input could be solicited from a wider range of academic risk experts. External researchers could receive security clearances to access sensitive security-related data. Development of the NRA and NRR in its early years had appeared to be a "top-down" process with limited involvement and influence of local authorities (UK House of Commons Science and Technology Committee - Third Report 2011).

Conclusion

Both the UK and Singapore share similarities in their determination to avoid strategic shocks through futures forecasting, risk assessments and early warning (BSE and wildcat fuel strikes in the UK; SARs and 9/11 JI cells in Singapore). With top leaders such as Boris Johnson and Lee Hsien Loong making positive speeches about tackling climate risks, their government agencies have correspondingly devoted a stronger focus to climate change. Having risk assessment structures in place however does not necessarily lead to desired outcomes. As the UK's painful experience with COVID-19 suggests, even a country with world-leading established risk assessment systems will still struggle to cope in a fast-moving and fluid emergency. This is particularly if some of the planning assumptions embedded in prior risk assessments may lead to decisions that may not be suited to a newly emerging situation. For instance, planning based on influenza pandemics are not customized for coronavirus outbreaks.

Futures work often begins with extensive reading to gather information on major trends, and also emerging strategic issues relating to climate change (Masramli 2013, Interviews in Singapore 2020). Besides the Futures toolkits and methods prepared by the UK GOS and Singapore CSF, these can also be supplemented by big data tools to sift through early warning signs of strategic surprises. It has been suggested that the Singapore RAHS programme was '**a big data tool** which was developed before the term big data was coined' (Peter Ho cited in Public Service Division 2015). Vendors may also be contracted to perform online scans of academic journals daily (Interviews in Singapore 2020). However, this is not to claim that automation is the solution. Human analysts will always need to remain in the loop and big data is only meant to inform assessment and judgment of the analyst. Preliminary results indicate that methodologies in risk assessments employed range from data-driven Big Data computer software; scenario and crowd-sourcing; perception surveys; to expert analysis and best-available science. The Singapore experience suggests that horizon scanning is using computer

software to detect weak signals, yet retaining an emphasis that automation and data only assists the human analyst to uncover blind spots. There remains a strong focus on risk communication and education amongst all government agencies. Raising awareness of the so-called black elephant metaphor (Ho 2017) was also important to complement the well-known Black swan effect. The British experience with national security risk assessment suggested that there were limited opportunities for bottom-up (i.e. non-governmental, local government, and frontline responders) engagement (Blagden 2018) and the exclusion of long-term trends, such as climate change, due to the particular focus on short time periods and legislative mandates for civil contingency response (Wentworth & Stock 2019; interviews in London 2020). Even within government, the CCC and Cabinet Office Civil Contingencies Secretariat do not meet to discuss the CCRA or NRR (Wentworth & Stock 2019). Smaller states with tightly knit bureaucracies and acute sense of vulnerability may alleviate some of these concerns and there appears to be integrated coordination mechanisms in Singapore through its CSF which has staff routinely seconded to or from various ministries. Nevertheless, grassroots campaigners have also complained of inadequate consultation (Kranji Countryside Association 2017). Given Singapore's long-standing Total Defence framework and its focus on "social defence" and "psychological defence", avoiding future civil disobedience climate movements like Extinction Rebellion would logically be a concern. It thus makes sense to include as many societal actors as possible in a whole-of-nation approach to climate change.

One positive commonality shared by both UK and Singapore cases was an emphasis on capacity building for "futures literacy" across government ministries and agencies. This was notable in the institutional structures built around in-house futures teams as well as central coordination with the Cabinet Office/Prime Minister's Office. A shared lingo, vocabulary and methodologies have notably developed around assessing climate change-conflict risks.

It should also be noted that risk mitigation measures for one risk (climate change), may be called upon for other risks and their knock-on effects. For instance, stockpiling of food essentials, local production of eggs and diversification of supply chains in Singapore in event of climate change disruption eventually proved useful when coronavirus outbreak lead to closure of borders and movement with Malaysia which provided much food supplies to Singapore. In the UK case, preparing for Brexit disruptions to trade and food supplies also fed into calculations of how to manage and reduce the impact of climate change risks. Risk communications and persuasion education also matters in conveying climate and food security risks to the public. At the same time there is an overlap and interconnection with other interlinked risks from fake news on these topics to geopolitical risks (eg US-China trade war) and technological developments such as social media and trading apps.

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