

Transforming Future Defence Capabilities through Anticipatory Innovation

Anthony J Masys PhD
Centre for Security Science
Defence R&D Canada
CANADA

Anthony.masys@forces.gc.ca

ABSTRACT

In today's defence and security landscape we find ourselves confronted with problems of dynamic complexity, uncertainty, and ambiguity with the emergence of disruptive technologies challenging peace and prosperity nationally, regionally, and globally. Modelling and Simulation plays a key role in this problem space to support development of future cost-effective capabilities to enable the right operational decisions in a complex multi-domain future operating environment.

Moving towards the development of solutions to this complex problem space depends on the lens we use to examine them and how we frame the problem. The application of futures thinking is a strategic initiative that can have influence across the tactical, operational, and strategic domains. With applied futures thinking, the future becomes a creative landscape in which to influence and shape the future through anticipatory innovation. Futures thinking is about exploring uncertainty, considering multiple futures, exploring intended and unintended consequences, seeking out multiple perspectives, and exploring assumptions. Futures thinking is not about predicting the future but recognizes that there are a range of possible futures. These futures can be shaped and influenced by the decisions and actions we take today. The intersection of Futures Thinking, Systems Thinking and Design Thinking figure prominently in informing NATO's ability to understand how emerging technologies and global security influencers are shaping the future operating environment and how they can be exploited by M&S through the advent of Anticipatory Innovation. This paper introduces Anticipatory Innovation as a key enabler in the application of M&S to meet the challenges of the future operating environment.

1.0 INTRODUCTION

There are many events (both natural and man-made) that have stressed tested the resilience of our societal systems. Events such as Hurricane Katrina (2005), Hurricane Harvey (2017), Hurricane Maria (2017), Hurricane Haiyan (2013), wildfires in Europe, Australia, US and Canada, extreme weather flooding and extreme heat experienced globally, regional and global health crisis (H1N1, H5N1, Ebola, COVID -19) all have stress tested our national and global systems. The WEF Global Risk Reports highlight trending and forecast risks that will impact societal functions. Such risks include climate related events. More and more evidence has demonstrated the serious implications of a changing climate for peace and security. There is a growing awareness of the security dimensions of natural and man-made disasters. For example, The World Climate and Security Report (IMCCS) 2021 emphasized that a transition to more robust implementation of climate security practices is critical.

As noted in the World Bank Report (2020): 'The global fragility landscape has worsened significantly in recent years, impacting both low and middle-income countries. Violent conflicts have increased to the highest levels observed over the past three decades. The world is also facing the largest forced displacement crisis ever recorded. Rising inequality, lack of opportunity, discrimination, and exclusion are fuelling

grievances and perceptions of injustice. Climate change, demographic change, migration, technological transformations, illicit financial flows, and violent extremism are often interconnected, posing risks that transcend borders. Many countries also suffer from chronically poor governance. These factors can increase vulnerability to shocks and crises and can create regional and global spillovers’.

Climate Security has emerged as a key influencer in defence, security and safety planning and is shaping the risk landscape. As noted in the NATO Report (2022):

This year, the Euro-Atlantic area is experiencing profound instability and urgent security threats. But even as we address these pressing challenges, we cannot ignore the inexorable, global reality of climate change, and the security implications thereof. Climate change is already a ‘threat multiplier’; one that will worsen as the world warms further.

An existential threat, climate change is a wake-up call for the safety, security and defence communities across operational, and capability dimensions signalling for the requirement of an applied futures thinking posture in order to anticipate, prepare for and prevent security challenges stemming from the impacts of climate change. This anticipatory innovation posture is about future proofing to enable strategic capabilities supporting enhanced situational awareness, early warning, and new mindsets to meet the challenges climate insecurity brings to the table.

1.1 The evolving security landscape

Threats to security are becoming complex and multifaceted, challenging traditional notions of security. The security calculus that is emerging is one characterized as ‘non-traditional security’ (Masys, 2016a, 2022a). We need look no further than the global impact of COVID-19 (UNDRR, 2022; Masys, 2022a). As described in Saha et al (2021:112) cited in Masys (2022a) ‘COVID-19 has firmly established itself as the single largest security disrupter of this century in the non-traditional sense. It has necessitated a recalibration of securitisation framework...’. Such events are shaping the security calculus across dimensions such as health security, economic security, environmental security, food security and energy security emerging as interrelated concepts that characterize the security landscape as complex. IRGC (2018) states that ‘external shocks to interconnected systems, or unsustainable stresses, may cause uncontrolled feedback and cascading effects, extreme events, and unwanted side effects, implying that the potential for cascading disruption is a growing and critical concern for many facets of daily life’. As described in Masys (2021, 2022a), such events challenge our sense and experience of security across the nontraditional security (human security, energy security, water security, food security, health security, environmental security, economic security).

Nontraditional security matters are of great concern to NATO given that such issues can lead to and emerge from humanitarian crisis, regional tensions and violence affecting and creating fragile regions and states and vulnerable populations. With this in mind, climate security thereby emerges as a key driver in shaping current and future capabilities. As a threat multiplier, climate change will shape geopolitical stability as well as the operating environment. As we experienced with the global effects of COVID-19 on societal systems (UNDRR, 2022), the convergence of climate change and other risks will compound security threats for states and societies.

The risk landscape presented by the WEF (2020) Report illustrates the interconnectivity, interdependency and complexity associated with risks across the following domains: Economic Environmental, Geopolitical, Societal, and Technological. The top 5 risks (WEF, 2020) associated with likelihood and impacts are:

Table 1: Top 5 Risks (WEF, 2020)

Top 5 Global Risks in Terms of Likelihood	Top 5 Global Risks in Terms of Impact
---	---------------------------------------

Extreme Weather	Climate Action Failure
Climate Action Failure	Weapons of Mass Destruction
Natural Disasters	Biodiversity Loss
Biodiversity Loss	Extreme Weather
Human-made environmental disasters	Water Crises

As depicted in table 1, these risks shape the security ecosystem and points to embracing a perspective that moves beyond traditional security to one that recognizes transborder and transnational vulnerabilities that resonate with nontraditional security concerns discussed. Shocks to the societal systems, whether exogenous or endogenous can act as threat ‘triggers’ that can initiate a cascading security threat within a nation and across borders. This is described in UNDRR (2022) pertaining to the global impacts of COVID-19.

Extreme weather events can create or exacerbate political instability and violence and create destabilizing effects causing mass migration thereby creating additional spillover risks and security challenges. Such complex security challenges within a complex risk network structure and behaviour can result in cascade-like events revealing the lack of preparation, insufficient vulnerability analysis and response. Weick and Sutcliffe (2007:2) highlight how such an event can be ‘...considered as an abrupt and brutal audit: at a moment’s notice, everything that was left unprepared becomes a complex problem, and every weakness comes rushing to the forefront’. Understanding the risk lens on security helps situate the concept of nontraditional security through a risk informed view of securitization and human security (Masys, 2022a).

Considering this mindset of societal systems, nontraditional security and exogenous and endogenous shocks is shaping our defence and security capability requirements. Hence understanding the complex threat landscape and navigating the capability solution space requires new ways of seeing and new ways of thinking. Here we introduce the application of anticipatory innovation emerging from the intersection of systems thinking, futures thinking and design thinking.

2.0 DISCUSSION

As described by Reez (2021), traditional mindsets and practices are inadequate to deal with disruptions characterized by VUCA (volatility, uncertainty, complexity, ambiguity) conditions. Anticipatory innovation is introduced as a gamechanger in addressing such disruptive effects as climate change on security. Even though foresight tools are increasingly integrated into policymaking, governments often lack a practical understanding of how to anticipate uncertain futures but also how to act on them today to achieve desired outcomes (Tönurist and Hanson, 2020).

As described in Tonurist et al. (2020:31) ‘Anticipation does not mean predicting the future, but rather it is about asking questions about plausible futures so that we may act in the present to help bring about the kind of futures we decide we want...It is a capacity connected to engaging with alternative futures, based on sensitivity to weak signals, and an ability to visualize their consequences, in the form of multiple possible outcomes ...’. With this in mind, anticipatory innovation in support of exploring the future defence capability space emerges from the intersection of futures thinking (exploring the possibility space), systems thinking (understanding the complex defence and security landscape) and design thinking (a problem-solving approach that is human centered, possibility driven, option focused and iterative). M&S figures prominently in this innovation space by making idea generation data-driven and more collaborative through

participative stakeholder engagement.

Anticipatory innovation is defined as:

Anticipatory innovation is the act of creating and implementing new, potentially value-shifting innovations in environments of deep uncertainty, particularly for the purpose of exploration and with emergent issues that might shape future priorities and future commitments (OPSI, 2021).

Anticipatory innovation is about helping to shape how the future might play out, rather than being forced to respond to it when it arrives. This is particularly pertinent to the impact of climate change on defence and security capabilities. Modelling and simulation (M&S) can provide a ‘sandbox’ in which to conceptualize and conduct sensitivity analysis on defence and security capabilities informed by anticipatory innovation. As noted in (Wilner, 2020) ‘Thinking through multiple future scenarios today, allows us to prepare, both mentally and institutionally, for emerging and alternative futures tomorrow’. This anticipatory lens supports an innovation mindset that is ‘...connected to engaging with alternative futures, based on sensitivity to weak signals, and an ability to visualize their consequences, in the form of multiple possible outcomes’ (Tönurist and Hanson,, 2020:31). Within the context of climate security and shaping defence and security capabilities, anticipation supports an opportunity to assess mental models, practice, rehearse, develop and validate capabilities. The conceptual development of such anticipatory innovation leverages M&S capability to support exploratory and capability development thereby ‘...introducing new technologies and innovations that can help them grapple with upcoming challenges. The main contribution of anticipation, hence, lies with the ability to shape people’s perceptions about the future and develop their capacity to make sense of novelty’ (Tönurist and Hanson,, 2020:31) .

2.1 Anticipatory Innovation Mindset and methodologies

To enable Anticipatory innovation calls for new mindsets, tools and approaches that taps into the creativity and imagination necessary to navigate the VUCA conditions that characterize the defence and security landscape associated with climate security. Figure 1 shows Anticipatory innovation at the nexus of futures thinking, design thinking and systems thinking.

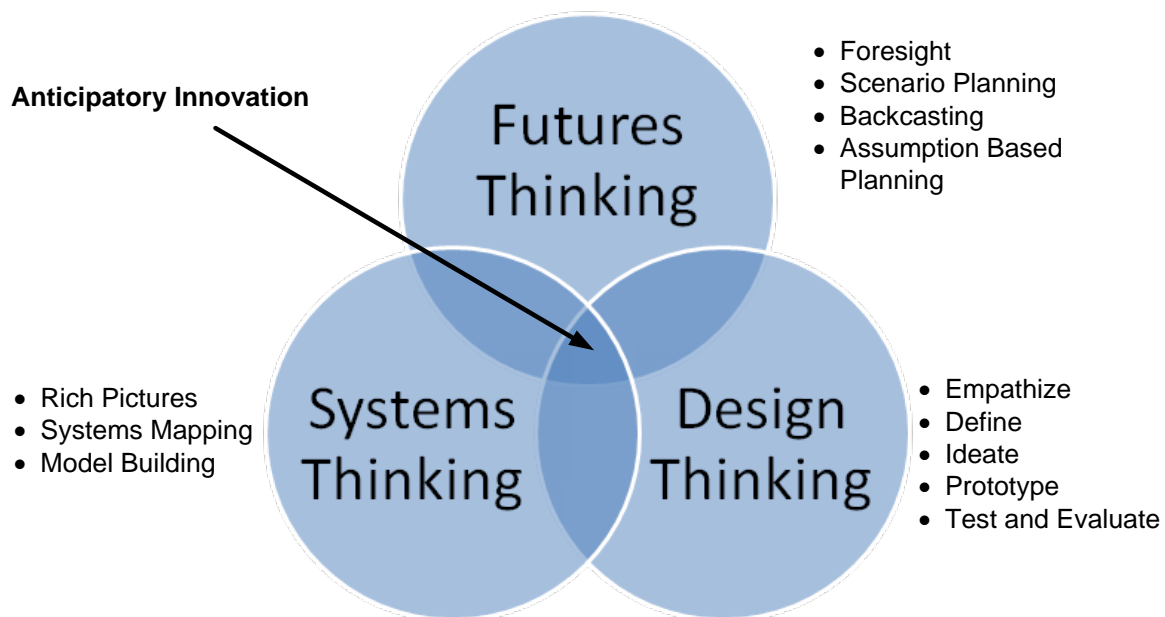


Figure 1: Anticipatory Innovation (Masys, 2022b)

Futures Thinking

Futures thinking explores the plausibility space (figure 2) associated with climate security and requires us to step into a space of strategic and creative thinking that leverages reflective practices, learning and knowledge creation. Cited in Masys (2022b), this requires applying such tools and approaches described in Reez (2021:330) as visioning, scenario building (Wright 2005), weak signals (Rossel 2009) wild cards (Taleb 2007), hidden influences, horizon scanning, action learning storytelling (Reez 2019). To operationalize futures thinking, Reez (2021:335) argues that ‘Effective foresight requires open mindedness, broad thinking, stakeholder dialogue, multiple communicative loops and abductive reasoning. ...Future oriented analysis therefore needs to emphasize processes that support insight, intuition, and innovation, instead of relying on historical data’.

Noted in Masys (2022b), ‘Futures thinking and foresight moves beyond just using historical data but leverages creativity, imagination and experimentation from across a wide range of perspectives’. As described in ADB (2020:3) ‘...it does not look only at what is possible but at what is desired. In this way, futures thinking and foresight are different from traditional forecasting, which is narrowly focused. Because they are participatory, futures thinking and foresight strengthen cross-sectoral links, encourage the emergence of integrated solutions, and empower people to create the future they desire’. Within the context of climate security, futures thinking will explore the possibility space and the future defence capabilities that would be required to operate in this new reality.

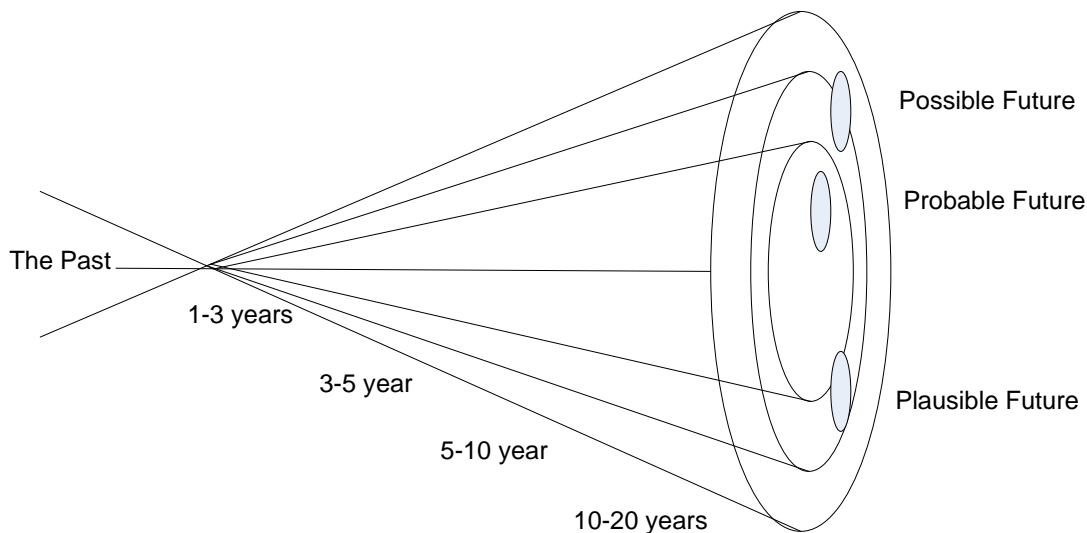


Figure 2: Cone of Plausibility.

For a detailed explanation of the cone see Wilner (2020).

Systems thinking

Angel Gurría, the OECD Secretary General declared in March 2019 that, ‘unless we adopt a systems thinking approach, unless we employ systems thinking, we will fail to understand the world we are living in’ (Jackson, 2019:641). Understanding complex causality, interconnectedness and relational analysis is inherent

in the application of systems thinking. This approach challenges traditional notions of linear and reductionist thinking. This is emphasized both by Senge (1990, 2006), Ackoff (1994) and described in Masys (2015).

Key from a systems lens analysis, feedback and feedforward loops emerge thereby giving insights into intended and unintended consequences from decision and actions that influence system behavior in response to exogenous and endogenous shocks. This is well demonstrated and explained within the context of the global impact of COVID-19 and system risks (UNDRR, 2022).

As cited in Masys (2022b), Jackson (2019:xx) argues ‘in its most advanced form, systems approaches encourages the employment of a variety of methodologies in combination to manage ‘messes’ and ‘wicked problems’. As described in Hynes et al (2020:145), ‘applying a systemic lens to complex problems can help map the dynamics of the system, explore the ways in which the relationships between system components affect its functioning, and ascertain which interventions can lead to better results.

With strategic interventions and initiatives being explored to support the future defence capabilities, systems thinking helps our conceptual understanding and development of M&S capabilities to enable decision making.

Design thinking

Design Thinking coupled with futures thinking and systems thinking is solution-oriented methodology used to solve complex problems (Masys, 2016b). In its most basic form, it involves a combination of imagination, analysis and creativity to bring about solution focused and action-oriented results. To facilitate this, the design thinking approach is rooted in a learning environment.

Through the phases of Inspiration, Ideation and Implementation, Design Thinking is operationalized through an iterative (not linear) 5 step process (figure 3). This process is described in detail (<http://dschool.stanford.edu/redesigningtheater/the-design-thinking-process/>)

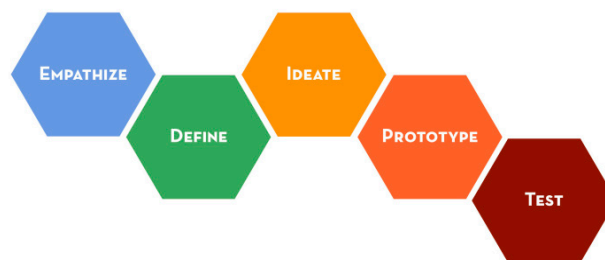


Figure 3: Design Thinking Process

EMPATHIZE: Work to fully understand the experience of disruptive circumstances across the societal, defence and security landscape. Do this through observation, interaction, and immersing yourself in the lived experiences.

DEFINE: Process and synthesize the findings from the empathy work in order to form a point of view that you will address with your design. This is essential problem framing. With this comes the understanding of the interdependencies that characterize the defence and security landscape.

IDEATE: Explore a wide variety of possible solutions through generating a large quantity of diverse possible

solutions, allowing you to step beyond the obvious and explore a range of ideas.

PROTOTYPE: Transform your ideas into an operational form so that you can experience and interact with them and, in the process, learn and develop more empathy.

TEST: Try out high-resolution concepts and use observations and feedback to refine prototypes, learn more about the defence and security problem space, and refine your original point of view.

The solution and action-oriented approach of design thinking makes anticipatory innovation come to life. This inherent nature of the design approach allows designers to ‘...produce novel unexpected solutions, tolerate uncertainty, work with incomplete information, apply imagination and forethought to practical problems and use drawings and other modelling media as means to problem solving. ... designers must be able to resolve ill-defined problems, adopt solution-focusing strategies, employ abductive/productive/appositional thinking and use non-verbal, graphic and spatial modelling media’ (Pourdehnad et al, 2011). The complex and dynamic nature of the future evolving threat landscape require this creative lens to support design of future defence capabilities.

The application of anticipatory innovation hence is all about fostering a learning organization/ network that is rooted in a strategic culture that fosters imagination, inquiry, analysis and creativity, thereby creating a ‘safe space’ for exploratory learning. A culture that embraces diversity and inclusion is necessary to support sensemaking across various perspectives in this social learning journey. (Masys, 2022b)

Reported in Masys (2022b) in support of the future of policing, Anticipatory Innovation (emerging at the intersection of futures thinking, systems thinking and design thinking) entails the defence community to:

- Foster a growth mindset that embraces creativity as part of the social learning journey
- Embrace non-traditional data sets, diversity and inclusion of perspectives
- Identify, challenge, and test the assumptions
- Explore beyond the assumed future
- Generate new insights
- Think through future intended and unintended consequences
- Innovate in real-time

3.0 CONCLUSION

Climate related crisis continue to influence and impact societies and is shaping the defence and security operating environment. What we have seen is that a climate crisis anywhere ends up being a climate crisis everywhere as a result of the global societal interdependencies that characterize the nontraditional security domain. Anticipation does not mean predicting the future, but rather it is about asking questions about plausible futures so that we may act in the present to help bring about the kind of futures we decide we want (Guston, 2014). Nontraditional security matters are of great concern to NATO given that such issues can lead to and emerge from humanitarian crisis, regional tensions and violence affecting and creating fragile regions and states and vulnerable populations. As a threat multiplier, climate change will shape geopolitical stability as well as the operating environment. Climate security thereby emerges as a key driver in shaping current and future capabilities.

The intersection of futures thinking, systems thinking and design thinking facilitates the defence and security communities with the mindset, tools and methodologies to explore, understand and prepare for the future defence and security operating environment in order to navigate, adapt, and shape the future.

Note: This paper was inspired and leverages the insights garnered from the research pertaining to the future of policing (Masys, 2022b).

REFERENCES

Ackoff R (1994) Systems thinking and thinking systems. *System Dyn Rev* 10(2–3):175–188

ADB (2020) Futures thinking in Asia and the Pacific Why Foresight Matters for Policy Makers. <https://www.adb.org/publications/futures-thinking-asia-pacific-policy-makers>

Guston, D. H. (2014). Understanding ‘anticipatory governance’. *Social Studies of Science*, 44, 218–242. doi: 10.1177/030631271350866

Hynes, W., M. Lees and J. Müller (eds.) (2020), *Systemic Thinking for Policy Making: The Potential of Systems Analysis for Addressing Global Policy Challenges in the 21st Century*, New Approaches to Economic Challenges, OECD Publishing, Paris, <https://doi.org/10.1787/879c4f7a-en>.

IMCCS (2021) The World Climate and Security Report 2021. Product of the Expert Group of the International Military Council on Climate and Security. Authors: Steve Brock (CCS), Oliver-Leighton Barrett (CCS), Laura Birkman (HCSS), Elisabeth Dick (HCSS), Leah Emanuel (CCS), Sherri Goodman (CCS), Kate Guy (CCS), Sofia Kabbej (IRIS), Tom Middendorp (Clingendael), Michel Rademaker (HCSS), Femke Remmits (HCSS), Julia Tasse (IRIS). Edited by Erin Sikorsky and Francesco Femia. Published by the Center for Climate and Security, an institute of the Council on Strategic Risks. June 2021.

IRGC (2018). Guidelines for the Governance of Systemic Risks. Lausanne: International Risk Governance Center (IRGC).

Jackson, M. (2019) *Critical Systems Thinking and the management of complexity*. Wiley & Sons.

Masys AJ (ed) (2016a) *Exploring the security landscape- non-traditional security challenges*. Springer

Masys, A.J. (2016b) Counter-terrorism and Design Thinking: supporting strategic insights and influencing operations. In A.J. Masys (ed) *Disaster Forensics: understanding root cause and complex causality*. Springer Publishing.

Masys, A.J. (ed) (2021) *Sensemaking in Security*. Springer Publishing.

Masys, AJ (2022a) Nontraditional Security: a risk centric view. In AJ Masys (ed) *Handbook of Security Science*. Springer Publishing.

Masys AJ (2022b in press) Digitizing Policing: from disruption to innovation through futures thinking and anticipatory innovation. In Reza and AJ Masys (ed) ‘Digital Transformation in Policing: The Promise, Perils and Solutions’. Springer Publishing.

NATO (2022) Climate Change & Security Impact Assessment. The Secretary Generals Report. https://www.nato.int/nato_static_fl2014/assets/pdf/2022/6/pdf/280622-climate-impact-assessment.pdf

OPSI (2021) Public Sector Innovation Facets ANTICIPATORY INNOVATION October 2021. <https://oecd-opsi.org/wp-content/uploads/2021/10/OECD-Innovation-Facets-Brief-Anticipatory-Innovation-2021.pdf>

Pourdehnad J, Wexler ER, Wilson DV (2011) Systems & design thinking: a conceptual framework for their integration. Working Paper #11-03, University of Pennsylvania. http://repository.upenn.edu/cgi/viewcontent.cgi?article=1009&context=od_working_papers

Reez, N. (2019) On the development of strategy formation through strategic foresight. Example storytelling. In G. Hellmann & D. Jacobs (eds) *The German White paper 2016 and the challenge of crafting security studies* (pp 40-47). Berlin, Germany: The Aspen Institute Deutschland E.V.

Reez, N. (2021) Foresight-based leadership. Decision making in a growing AI environment. In G Jacobs et al., (ed) *International Security Management: new solutions to complexity*. Springer.

Rossel, P (2009) Weak Signals as a flexible framing space for enhanced management and decision making. *Technology Analysis & Strategic Management*, 21(3), 307-320.

Saha, S., and Chakrabarti, S. (2021) The Non-traditional Security Threat of COVID-19 in South Asia: An Analysis of the Indian and Chinese Leverage in Health Diplomacy. *South Asian Survey* 28(1) 111–132, 2021

Senge P (1990) *the fifth discipline: the art and practice of the learning organization*. Doubleday Currency, New York

Senge P (2006) *The fifth discipline: the art and practice of the learning organization*. DoubledayCurrency, New York

Taleb, N. (2007) *The Black Swan: The impact of the highly improbable*. New York, US: Random House Trade Paperbacks.

Tönurist, P. and A. Hanson (2020), "Anticipatory innovation governance: Shaping the future through proactive policy making", *OECD Working Papers on Public Governance*, No. 44, OECD Publishing, Paris, <https://doi.org/10.1787/cce14d80-en>.

UNDRR (2022) Understanding and managing cascading and systemic risks: Lessons from COVID-19. <https://www.undrr.org/publication/understanding-and-managing-cascading-and-systemic-risks-lessons-covid-19>

WEF (2020) *The Global Risks Report*. <https://www.weforum.org/reports/the-global-risks-report-2020>
Weick, K.E. and Sutcliffe, K.M. (2007), *Managing the Unexpected: Resilient Performance in an Age of Uncertainty*, 2nd ed., John Wiley and Sons Inc, San Francisco, CA.

Wilner , A. (2020) *Cyber Futures: A Preliminary Scanning and Foresight Report*. <https://www.alexwilner.ca/other-publications/2020/10/30/cyber-futures-a-preliminary-scanning-and-foresight-report>

World Bank Report (2020) *World Bank Group Strategy for Fragility, Conflict, and Violence 2020–2025* (English). Washington, D.C. : World Bank Group

Wright, A. (2005) The role of scenarios as prospective sensemaking devices. *Management Decision*, 4(1), 86-101.

