PROPOSED METHODOLOGY ON USING FORESIGHT TO ANTICIPATE **EMERGING CRITICAL RISKS**

OECD PUBLIC GOVERNANCE WORKING PAPERS

JOSHUA POLCHAR

OECD

OECD Working Papers on Public Governance

Using foresight to anticipate emerging critical risks

Proposed methodology

Joshua Polchar

OECD

OECD Working Papers should not be reported as representing the official views of the OECD or of its Member countries. The opinions expressed and arguments employed are those of the authors.

This document, as well as any data and map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Abstract

This paper presents a methodology to help countries identify and characterise global emerging critical risks as part of the OECD's Framework on the Management of Emerging Critical Risks. It supports experts and policymakers tasked with anticipating and preparing for uncertain and evolving threats that transcend traditional national boundaries. The approach begins with horizon scanning to capture weak signals and unconventional data sources, including patent analysis, crowd forecasting, and the use of generative AI. It then applies structured foresight techniques, such as futures wheels, cross-impact analysis, and scenario-based "Risk-Worlds," to explore how risks might manifest and interact in multiple possible future contexts. The methodology emphasises understanding risks "at source," focusing on vulnerabilities, interconnectedness, and possible management strategies. Rather than predicting a single future, it seeks to broaden the range of possibilities, encouraging proactive adaptation, building collective understanding, and ultimately strengthening government capacity to navigate and shape an increasingly complex and uncertain global risk landscape.

Table of contents

FIGURES

1 Introduction and specifications

In 2023, the OECD High-Level Risk Forum (HLRF) developed a Framework on the Management of Emerging Critical Risks (OECD, 2024a). This Framework is part of a broader OECD Horizontal Foresight Initiative on Anticipating and Managing Emerging Global Transformations. The Framework provides countries with a structured approach to managing emerging critical risks. The Framework comprises seven steps, the first of which relates to identifying the emerging critical risks countries might face.

To support countries in this first step, this paper outlines a methodology for building an assessment of emerging critical risks. It is not intended as a toolkit or a pedagogical resource; rather, it is a starting point for experts in strategic foresight and risk management to craft effective interventions.

Definitions

Global, for the purpose of this document, means risks where the hazards, vulnerabilities, or exposures occur simultaneously on at least two continents.

Emerging Risks as defined in the OECD Framework on Management of Emerging Critical Risks are "either new risks or familiar risks that evolved due to new or unfamiliar conditions or changes in the threat or vulnerability or exposure environment". These risks lack historical precedent and can be a specific threat or a condition ripe for exploitation. Emerging risks stand in contrast to "familiar risks", which are defined here as "risks with historical precedent and/or a deep knowledge base, for which authorities and capabilities already exist."

Critical Risks are considered to be "threats and hazards that pose the most strategically significant risk, as a result of (i) their probability or likelihood and of (ii) the national significance of their disruptive consequences, including sudden onset events (e.g. earthquakes, industrial accidents, terrorist attacks), gradual onset events (e.g. pandemics), and steady-state risks (notably those related to illicit trade or organised crime)." (OECD, 2014)

Emerging Critical Risks are any risks that meet those criteria and are also "either new risks or familiar risks that are evolving due to new or unfamiliar conditions".

Methodology overview

This methodology includes the following main steps.

1. Horizon scan (including prioritisation of signals)

- **Identify** signals of what could significantly impact the future. Engage experts from various fields and hold external consultations to explore unknown areas. Incorporate unconventional sources such as patent analyses, crowd- and AI forecasting and use generative artificial intelligence (AI) tools to aggregate data from diverse platforms, accounting for potential biases. Consider signals

of both specific emerging risks and signals of trends or developments that may impact the broader risk landscape and global context.

- **Prioritise** the identified signals based on strength, familiarity, potential to challenge existing risk management processes, potential disruptiveness, scope, and subjective probability assessments to focus on truly emerging critical risks.

2. Exploration and reframing cycle

- Use structured foresight techniques, such as the futures wheel method (Glenn, 2009), to map the direct and indirect consequences of each signal. Develop alternative descriptions of future contexts to enhance understanding of how risks might emerge under different conditions. Consider further refining the assessment with cross-impact analysis, application to real-world conditions, and causal layered analysis (see below for methodological explanations).

3. Risk characterisation

Characterise each risk that may emerge, expand, or evolve based on the signals identified. Make the assessment actionable by evaluating conditions for emergence, speed of emergence (how quickly the risk could materialise), potential for becoming chronic, potential impacts, vulnerabilities and resilience, interconnectedness, management strategies, probability, and knowledge gaps.

Intended outputs and outcomes

The methodology is designed to produce a set of emerging critical risks, characterised in a way that reflects their uncertain and evolving nature, in terms of their origin, potential impact, uncertainties, speed of emergence, interconnectedness with other drivers and risks, associated vulnerabilities and resilience, and potential strategies to manage them.

The global emerging critical risks produced by the assessment will be accompanied by the signals that indicate their potential emergence and the descriptions of contexts, creating a set of Risk-Worlds (Wilkinson and Eidinow, 2016) in which they may emerge.

Box 1. What are Risk-Worlds?

Risk-Worlds are a set of multiple, alternative, contrived snapshot descriptions of possible different future contexts in which risks could emerge (Ramírez and Wilkinson, 2016).

The hazards, vulnerabilities, and exposures that compose risks are a result of multiple contextual factors. These factors include the society, technology, economy, environment, and politics of the place and time where a risk arises. For example, a densely populated place with heavy use of public transport may be more vulnerable to a particular kind of infectious disease spreading than a sparsely populated place with mainly private vehicles.

As contexts vary over time, so do the risks that can arise. For example, as the world has become more digitally connected, the potential consequences of a data breach are much more serious than twenty years ago. Understanding these contextual changes may help to understand where, when, and how new risks could emerge.

Due to the volatility, uncertainty, complexity, and ambiguity of the factors, it is not possible to fully accurately predict or forecast the entire future context; something will always be left out. Hence it is necessary to consider multiple ways in which the future could be different from today (Larson, 2019).

How are they used?

Risk-Worlds are used to identify early signs of oncoming disruptive change, reframe and broaden the scope of what is considered relevant in risk assessment, stress-test existing risk management practices to see if they would still perform as intended under different conditions, and inspire new ways to anticipate and manage risk that would not have been considered in the present day (Polchar and Diaz Plaja, 2023).

Risk-Worlds can be presented and explored in different ways, such as simply reflecting on the conditions described, simulating risk events in tabletop exercises, or structured 'serious game' settings (Bontoux et al., 2020).

Risk-Worlds may be analysed further to explore how risks might interact, creating cascading threats. The methodology also uses Risk-Worlds to test how emerging risks could behave in alternative future policy contexts, ensuring the usefulness and actionability of the insights gained through the assessment.

A significant positive output of this assessment process is the dialogue it fosters among participants. This dialogue is instrumental in shaping a collective understanding of emerging critical risks, encouraging participants to expand and reframe their existing mental models and learn from a broader array of possibilities and scenarios. By fuelling discussion of the Risk-Worlds developed, the assessment will allow countries to identify and overcome the common assumption that 'all other things remain equal' when risks emerge, and potentially broaden and strengthen their understanding and ability to manage risks in advance.

The outputs generated from the assessment of emerging critical risks are designed to be directly applicable for governments, particularly the members of the OECD High-Level Risk Forum (HLRF). Since 2011, the HLRF has provided a platform for policymakers and private sector experts to exchange risk management policies, practices, and perceptions to improve global risk preparation.

The insights and methodologies outlined in the outputs can also be incorporated into education and training programmes for government officials. This helps build internal capacity to anticipate, identify, and manage emerging risks using the discipline of rigorous strategic foresight.

These outputs are not just informational resources but practical instruments that can significantly enhance governmental effectiveness in navigating the complex landscape of emerging risks. Their application across various levels of government ensures that nations are not only prepared for potential future challenges but are also actively shaping their risk management landscapes in a strategic, informed, and collaborative manner.

Principles

Building on a foundation laid by the analytical report on a previous online pilot mapping exercise undertaken by the HLRF in 2022, the following principles of effective practice have been identified for this methodology:

Anticipation

- **Weak signals and non-trend data**: Early indicators of risk are often subtle, requiring a focus on weak signals and non-trend data to catch risks before they fully emerge.
- **Maps designed with navigation in mind**: Risk assessment should guide decision-making, supporting risk managers in responding to policymakers' needs. This means taking into account not only the changing global context, but also how policymakers interpret it.

Diversification

- **Harnessing multidisciplinarity**: A multidisciplinary approach is used for mapping emerging critical risks, combining knowledge from various disciplines, for example environmental sciences, technology assessment, and behavioural insights.
- **Mixed methods**: A combination of analytical methods is favoured, including surveys, literature reviews, and methods of strategic foresight such as futures wheel and scenario planning.
- **Highlighting constructive disagreements**: discrepancies in risk perception should be viewed constructively, providing depth to understanding and avoiding reliance on singular narratives.
- **Top-down and bottom-up**: Integrating both high-level strategic views and insights from working-level technical leads, academics, and researchers ensures a broader view of risks, capturing both macro trends and early-warning signals from the field.
- **Unconventional and unorthodox sources**: Consulting sources not traditionally associated with government risk assessment, such as anthropologists, civil society actors, or science fiction authors, may reveal lines of inquiry that might have otherwise been overlooked.

Learning

- **Value in process**: The process of engaging in assessment of emerging critical risks enables participants to actively shape their understanding of what might emerge, rather than producing a single definitive prediction about an inherently uncertain future.
- **Ongoing benefits**: By focusing on how risks are identified, and not just which risks are identified at any given moment, the assessment goes beyond simply listing risks and aims to develop ever greater awareness, mental flexibility, responsiveness, and understanding among participants. This dynamic engagement with knowledge of the emerging future helps in constructing more adaptable and resilient strategies.

Systems thinking

- **Cross-impacting**: Participants can envisage and understand the complex interplay of risks. The methods used facilitate the exploration of direct and indirect consequences of each risk in combination with others, revealing how they might influence each other in a cascading manner.
- **Multiple interpretations of where risks come from**: Acknowledging that mapping risks is subjective and complex, the assessment will explore risks in multiple Risk-Worlds, each offering different viewpoints.

Ongoing process

- **Repeating the exercise**: Emerging risks are like moving targets, needing ongoing attention to capture their dynamic nature. The methodology is designed in such a way that it can be updated and iterated on by following the same steps.
- **Iterative**: The proposed assessment is meant to follow an iterative process. Outputs such as a report offer an opportunity to take stock and share what has been achieved, keeping in mind that the risk landscape is constantly changing, and no analysis of emerging risks can ever be considered definitive.
- **Follow-up**: The outputs include a list of emerging critical risks, demonstrating tools and methods which governments can use to further update their awareness of emerging critical risks, and remain engaged with the transnational benefits of the assessment.

Approach and limitations

An assessment of global emerging critical risks should be expected to differ in numerous ways from a typical government assessment of risks considered ‘familiar’, reflecting the different nature of the risks themselves.

Defining, identifying and assessing emerging critical risks is a complex task, with multiple considerations and a degree of subjectivity (OECD, 2003). Emerging risks can only ever be partially known. The value of the assessment therefore is not to predict a single ‘correct’ future, but to consider a broader range of possibilities and enhance effectiveness of risk management in the present. The key point of complementarity in the present methodology is in characterising risks by their possible future context. This approach positively explores and learns from uncertainty, ahead of trying to avoid or reduce it.

2 Method

This section presents the methods and tools to be deployed in creating the assessment in a step-by-step manner. It should be noted that in practice some of these steps will coincide, as befits the iterative nature of the assessment. It contains three phases:

- **Horizon scanning**: This is an umbrella term for a wide range of methods for identifying present changes ('signals') that could be highly significant in the future. It is a fundamental component of any futures research (Policy Horizons Canada, 2013).
- **Exploration and reframing**: Understanding the multidimensional and potentially cascading impacts of emerging critical risks requires methods that can:
  - Explore interconnected causalities
  - Situate emerging critical risks in the context (Risk-World) in which they emerge (identification at source)
  - Apply the knowledge gained to the context of government risk managers
- **Outputs**: Drawing a set of meaningful lessons from the process requires a further, more in-depth analysis, connected as closely as possible to concepts and processes already at the disposal of risk managers, while still providing an opportunity to consider changes.

Figure 1 outlines the phases of the process and how they fit together.

Box 2: Horizon Scanning in Public Policy

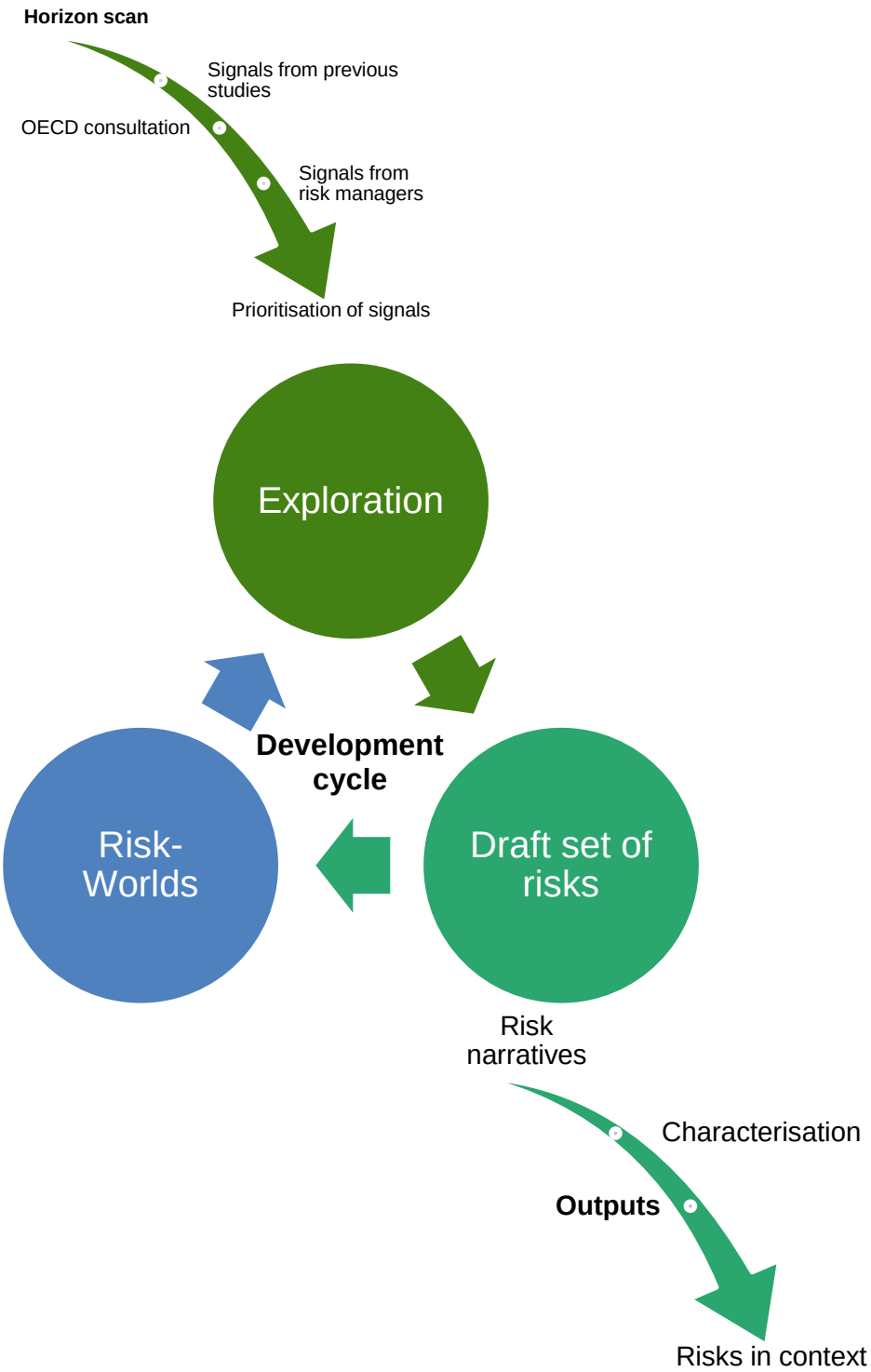
Widespread in public policy and beyond, horizon scanning:

- Identifies early signs of change not yet on the policy radar or addressed adequately.
- Relies on collective sense-making sessions of the scanned signals and validation through further research.
- Helps organisations detect emerging issues that could have significant future implications for policy. (European Commission, 2023)

Examples include the "Emerging Issues for EU Policymaking" briefs published periodically by the European Strategy and Policy Analysis System, looking at trends and issues that may appear marginal today but could become important in the future. Over three months of scanning and sense-making workshops, participants identified nineteen signals of change most relevant for EU policymaking, with reports exploring such possible disruptions as de-dollarisation, AI-generated worlds, or in-space manufacturing (European Strategy and Policy Analysis System, 2023).

Other users include the OECD Expert Group on AI Futures (OECD, 2024b), the Government of Canada (Policy Horizons Canada, 2015), Japan's National Institute for Science and Technology Policy (NISTEP, 2015), and the UK Government Office for Science (UK Government, n.d.).

Figure 1 Overview of methodology for assessment of global emerging critical risk



Horizon scan

This section outlines the methodology employed in the horizon scanning process, as it relates to the identification of emerging critical risks.

Engagement with experts: The initial phase involves a selection of internal and/or external experts from diverse fields. Each expert contributes insights reflective of their specialised knowledge and sectoral experience. Through structured interviews and surveys, a comprehensive collection of expert perspectives on potential emerging critical risks is compiled.

Unconventional and innovative sources: The methodology extends to incorporate sources not traditionally associated with government risk assessment, such as patent analysis or collective intelligence. Patent analysis involves a comprehensive review of recent patent filings to discern emerging technological trends that may pose new risks. This analysis is conducted with a view to understanding the broader context and potential implications of these technological developments. Collective intelligence methods use structured processes to aggregate insights from a wide range of individuals and can include methods like prediction markets and crowd forecasting.

Generative AI: The horizon scanning process may be further augmented by AI tools. Such tools could scrape the web, encompassing news portals, academic journals, and social media platforms, to aggregate data pertinent to emerging critical risks. The tools' capabilities would enable them to process and synthesise this information, thus identifying key emerging trends and potential risks. The result is an overview of potential emerging critical risks identified from a wide array of digital sources. As with all research methods, AI tools are subject to bias and hallucinations. These should be accounted for by reviewing the origin of the source data, the algorithm used to select it, and the inputs used to prompt the system.

Prioritisation of Signals

In the case of emerging critical risks, traditional quantification of probability and impact based on past frequency is not possible due to the characteristics of the risks which are evolving and lack precedent. As these risks are yet to fully materialise or be understood comprehensively, established methods of assessment based on historical data and established patterns are insufficient. The prioritisation of signals of risk identified during the horizon scanning phase involves the following components:

Exclusion of signals outside the scope of enquiry: Elimination of signals pointing to risks that are national in nature, already familiar, or certain. This categorisation aids in focusing on truly emerging and critical risks. Signals pointing to risks classified as national, familiar, or moderately or highly certain are redirected to traditional risk management processes, where they are better suited for established assessment and response strategies.

Rating and ranking of signals: The remaining signals are then subjected to a systematic process of rating and ranking based on specific criteria:

- **Strength**: differentiating between weak and strong signals, where weak signals might indicate nascent risks that are less apparent, while strong signals are those supported by well documented evidence and trend data
- **Familiarity**: assessing signals on a spectrum from highly familiar to highly unfamiliar from the government's perspective, allowing focus on those less understood or entirely new

- **Potential Disruptiveness**: speculating on multiple ways in which a signal has the potential to disrupt existing systems or critical functions, including potential to challenge existing risk management processes[1]
- **Potential Scope**: considering the scope of impact, from localised to worldwide, prioritising those with broader implications
- **Probability:** considering what is known about the probability of this risk materialising. This will be a subjective rather than frequentist probability assessment

This rating and ranking process may be undertaken using an online collaborative platform. The output is a set of signals, each of which can be developed in the cycle below.

Exploration and reframing cycle

As mentioned above, the exploration and reframing cycle is an iterative process, ideally involving one complete cycle through some or all the steps shown. The signals developed in the previous phase are taken individually and developed through an exploration of their potential consequences, using the futures wheel. They are also taken as a whole in developing Risk-Worlds.

Exploration

The futures wheel exercise (Glenn, 2009) supports the exploration step, enabling a comprehensive exploration of direct and indirect consequences that these risks might produce.

Figure 2. Example of a futures wheel

Source: OECD High-Level Risk Forum

[1] This is different from impact assessment as it is intentionally more speculative.

The futures wheel exercise is a systematic approach that guides exploration of multiple orders of consequences of potential risks, thereby aiding in the anticipation and understanding of their broader implications. It consists of exploring a present signal's consequences, and then in turn their consequences, and so on to multiple orders of consequence, arranging each order of consequence on a larger concentric circle (see Figure 2).

The futures wheel exercise can draw on the explorations and knowledge of numerous contributors, including:

- **Expert panel members**: Through either workshops or an online collaborative platform, they engage in mapping out the consequences of identified risks. This collective effort ensures a diverse range of perspectives and expertise are brought to the table, enriching the analysis and depth of the futures wheel exercise.
- **Other studies**: The inclusion of knowledge from prior studies enhances the exercise by introducing more insights and specialised knowledge. These studies can provide alternative viewpoints and contribute to a more holistic understanding of how emerging critical risks might unfold.
- **Generative AI**: This technology can extend the depth of the analysis by suggesting additional potential outcomes and interconnections between risks. Biases in the AI (its source data and processing algorithm), as well as technical and ethical considerations, should be accounted for, as in any human-led research.

Draft set of risks

From here it may now already be possible to distil a list of global emerging critical risks from the futures wheel exercises. The next stage involves using Risk-Worlds to test the validity and comprehensiveness of that list and add context.

Cross-impacting

Building on the futures wheel, cross-impacting is an exercise exploring how different risks might interact with and influence each other. Cross-impacting analysis helps in understanding the interconnected nature of risks, providing insights into complex risk scenarios that might emerge. Cross-impacts may also expand considerations about likelihood of occurrence, speed of emergence, scale of impacts or compound challenges by drawing on knowledge of other risks, including familiar risks. Like the futures wheel, this exercise can be undertaken by risk managers, other experts, and generative AI.

Future Risk-Worlds

Risk-Worlds are what-if-style snapshot descriptions of alternative possible future contexts. Building mental flexibility and diversity of knowledge benefits from constructing and using potential future Risk-Worlds, a process focused on drivers that could shape future risk emergence.

Two of the key benefits of Risk-Worlds include:

- **Earlier warning by identifying risks at source**: By picking up on where risks emerge *from*, which could be different in a different future context, chances are higher of anticipating them sufficiently in advance to manage them effectively.
- **More effective responses by situating risks in context**: Responses that take crucial interrelated contextual factors into account are likely to be more effective.

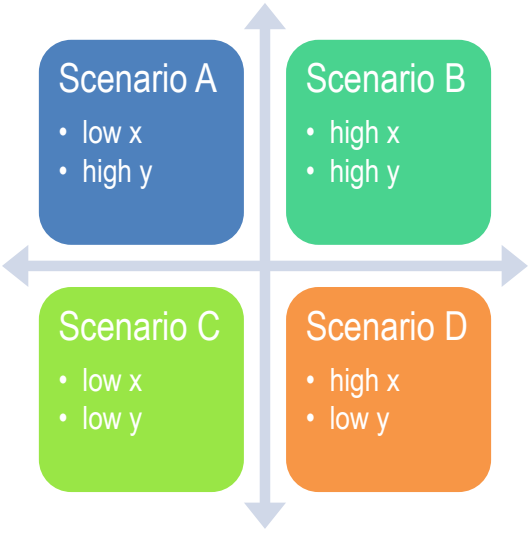
To develop the Risk-Worlds, multiple methods are possible. A comprehensive review of the various methods and their pros and cons is beyond the scope of this document, but can be found in the extensive

literature on the topic (Fergnani, 2023). Among the main options are inductive or deductive methods (Ramírez and Wilkinson, 2014).

If an inductive method is chosen, the process involves creating fragments of potential future contexts from the outputs of the exploration phase. These fragments are designed to emerge from current trends and signals, providing a grounded yet imaginative exploration of how the future might unfold. This includes scenarios where risks might have emerged by a future date, as well as descriptions of how the contextual environment could have radically changed. Inductive approaches allow for a broad range of relevant factors to be included, but the high complexity of their interplay can inhibit the development of clear, coherent depictions of a future world that a reader would readily grasp.

Alternatively, deductive methods use a structured approach, often a 2x2 matrix to juxtapose two plausible extreme outcomes of an area identified as a blind spot in the exploration phase. By exploring their extreme outcomes, these methods produce four distinct combinations, each representing a unique future scenario. This approach aids in understanding the dynamics between different uncertainties and how they could combine to shape the future landscape (Ramírez and Wilkinson, 2014) for the emergence of risk. Deductive methods offer clarity and traceability of the scenarios they generate; however, potential pitfalls include oversimplification, and implausible combinations of outcomes, particularly if the two axes are poorly chosen.

Figure 3. Simplified 2x2 scenario matrix using critical uncertainties x and y



Source: author.

The process of creating Risk-Worlds intentionally speculates about some of the characteristics of the world of the future. Building out a picture to create a comprehensive description of the risk context is a process known as upframing (Ramírez and Wilkinson, 2016).

Applied reframing for risk management

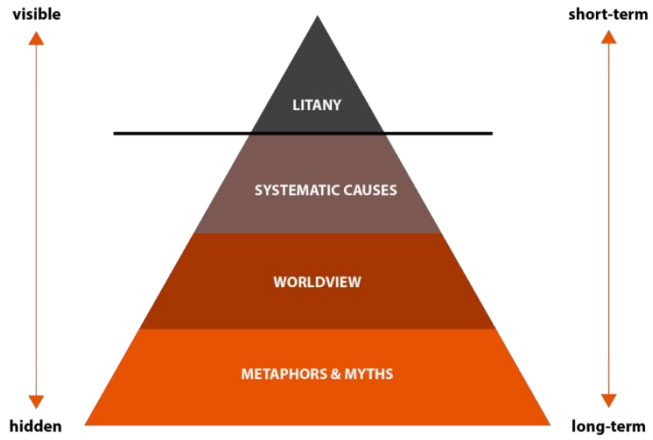
Once a draft list of risks has been produced, it can be tested and made more robust and applicable to its intended use by asking risk managers to consider what use and value the risks individually and as a set would be in their work—an applied research method known as downframing (Ramírez and Wilkinson, 2016). Downframing involves mapping the duties and actions of the risk manager (from day-to-day tasks to multi-year strategies) and exploring how they would fare in the different conditions described in different Risk-Worlds. This process has two main benefits:

1. Increasing the usefulness of the assessment of emerging critical risks by connecting it more comprehensively with its intended uses.
2. Revising and improving the Risk-Worlds (further upframing) by focusing on further developing the parts which during downframing proved the most informative for the intended audience.

Deepening understanding of risks emerging at source

To understand and anticipate emerging critical risks at source in an ongoing and long-term way, it is important to delve deeper than surface-level manifestations and explore underlying drivers. This is achieved through causal layered analysis (CLA) (Inayatullah, 2004) of emerging critical risks, a process that uncovers the foundational layers shaping risk perceptions and outcomes.

Figure 4. Causal layered analysis representation



Source: Institute for the Future (Lipsett, 2020).

CLA is a methodological approach that surfaces the often-hidden drivers that influence future changes such as emerging critical risks. The use of CLA in the assessment process adds depth to the understanding of risks as they emerge at the source.

CLA has been used to understand how policy issues such as tuberculosis, immigration, obesity, and food insecurity gain salience and are dealt with as risks with connotations of war, plague, and crime (Vallis and Inayatullah, 2016). Surfacing and deconstructing these connotations allows for risk management strategies to be evaluated and reshaped where they can be made more appropriate and effective.

The intention in applying CLA to the downframed list of risks is to reveal the assumptions, worldviews, and other cognitive processes governing which risks are considered worthwhile to imagine and prepare for. These underlying assumptions, once made explicit, can be replaced with alternatives, forming the foundations of new Risk-Worlds to be developed in the way described above. The output of this phase is not intended for publication; it provides the implicit logic to be used in the next step.

Risk characterisation

The final step in the procedure is to characterise the risks identified. This is needed to make the knowledge created as concrete and actionable as possible. It involves examining the risks, gathering evidence and assigning for each one an assessment of:

1. **Conditions for emergence**: the circumstances in which the risk becomes more likely to occur, including early warning signals to take into consideration.
2. **Speed of emergence**: the degree to which the risk could materialise suddenly, and its potential to be a chronic risk.
3. **Potential impacts**: the human, economic, social, natural, or other losses that could occur if the risk materialised.
4. **Associated vulnerabilities and resilience**: the potential severity of the losses and the reasons for this.
5. **Interconnectedness**: other drivers and risks, including multiple occurrences of the same risk, which could have compounding consequences
6. **Potential strategies to manage**: steps that could reduce exposure or vulnerability—or even stop the hazard from materialising—through prevention, mitigation, recovery, and insurance.
7. **Probability:** what is known about the probability of this risk materialising, characterising the bounds of the uncertainty about the risk.
8. **Uncertainties**: areas of knowledge missing around all of the above.

In the case of emerging critical risks, it is often not possible to reliably quantify these characteristics. Therefore, qualitative descriptions and principles of strategic foresight such as multiple concurrent possibilities may be applicable.

Conclusion

The assessment methodology outlined in this note, underpinned by collaborative efforts from HLRF members, OECD experts, and a range of expertise, furthers a commitment to enhance global risk management. Employing innovative methodologies from strategic foresight, such as horizon scanning and participatory platforms, the process responds to the need to equip risk managers with enhanced capabilities needed to better anticipate and manage emerging critical risks.

The assessment fosters a dynamic understanding of risks and prepares members to perceive, make sense of, and act on future changes as they emerge in the present. This approach, emphasising anticipation, diversification, and systems thinking, not only yields practical tools for current use but also cultivates a culture of continuous learning and adaptation, positioning governments at the cutting edge of navigating and shaping an uncertain future.

References

Bontoux, L., Sweeney, J.A., Rosa, A.B., Bauer, A., Bengtsson, D., Bock, A.-K., Caspar, B., Charter, M., Christophilopoulos, E., Kupper, F., Macharis, C., Matti, C., Matrisciano, M., Schuijer, J., Szczepanikova, A., van Criekinge, T., Watson, R., 2020. A Game for All Seasons: Lessons and Learnings from the JRC's Scenario Exploration System. World Futur. Rev. 12, 81–103. https://doi.org/10.1177/1946756719890524

European Commission, 2023. Horizon Scanning [WWW Document]. Competence Cent. Foresight. URL https://knowledge4policy.ec.europa.eu/foresight/topic/horizon-scanning_en (accessed 3.18.24).

European Strategy and Policy Analysis System, 2023. Horizon Scanning (No. 4), Horizon Scanning. European Commission.

Fergnani, A., 2023. 4 Archetypes, Shell, 2x2: Three Scenario Planning Methods Explained and Compared. Predict. URL https://medium.com/predict/4-archetypes-shell-2x2-three-scenario-planning-methods-explained-and-compared-d2e41c474a37 (accessed 10.17.24).

Glenn, J.C., 2009. Futures research methodology Version 3.0. The Millennium Project, Washington, D.C.

Inayatullah, S., 2004. Causal Layered Analysis: Theory, historical context, and case studies, in: The Causal Layered Analysis Reader: Theory and Case Studies of an Integrative and Transformative Methodology. Tamkang University Press.

Larson, E.V., 2019. Force Planning Scenarios, 1945–2016: Their Origins and Use in Defense Strategic Planning.

Lipsett, I., 2020. Using Causal Layered Analysis for Transformational Change [WWW Document]. IFTF. URL https://www.iftf.org/insights/using-causal-layered-analysis-for-transformational-change/ (accessed 12.21.23).

NISTEP, 2015. The 6th International Conference on Foresight: its impacts and possible contribution for policy making [WWW Document]. Natl. Inst. Sci. Technol. Policy. URL http://www.nistep.go.jp/en/?p=3510 (accessed 7.22.16).

OECD, 2024a. Framework on management of emerging critical risks. OECD, Paris. https://doi.org/10.1787/2f2eddd8-en

OECD, 2024b. Assessing potential future artificial intelligence risks, benefits and policy imperatives (No. 27), OECD Artificial Intelligence Papers. OECD Publishing, Paris. https://doi.org/10.1787/3f4e3dfb-en

OECD, 2003. Emerging Risks in the 21st Century: An Agenda for Action. OECD. https://doi.org/10.1787/9789264101227-en

Polchar, J., Diaz Plaja, R.-E., 2023. Don't fight the future, decide it! NATO Rev.

Policy Horizons Canada, 2015. MetaScan 4 - the future of Asia: implications for Canada, a foresight study.

Policy Horizons Canada, 2013. Scanning and Foresight [WWW Document]. URL http://www.horizons.gc.ca/eng/content/scanning-and-foresight-0 (accessed 6.14.16).

Ramírez, R., Wilkinson, A., 2016. Strategic Reframing: The Oxford Scenario Planning Approach. OUP Oxford, Oxford, United Kingdom.

Ramírez, R., Wilkinson, A., 2014. Rethinking the 2×2 scenario method: Grid or frames? Technol. Forecast. Soc. Change 86, 254–264. https://doi.org/10.1016/j.techfore.2013.10.020

UK Government, n.d. Horizon Scanning Programme Team [WWW Document]. URL https://www.gov.uk/government/groups/horizon-scanning-programme-team (accessed 7.22.16).

Vallis, R., Inayatullah, S., 2016. Policy metaphors: From the tuberculosis crusade to the obesity apocalypse. Futures, SI: Metaphors in FS 84, 133–144. https://doi.org/10.1016/j.futures.2016.04.005

Wilkinson, A., Eidinow, E., 2016. Risk-World Scenarios Case Study, in: Ramírez, R., Wilkinson, A. (Eds.), Strategic Reframing: The Oxford Scenario Planning Approach. Oxford University Press, p. 0. https://doi.org/10.1093/acprof:oso/9780198745693.005.0006

During the preparation of this work the authors used ChatGPT to brainstorm ideas and improve language and readability. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.