

Funded by
the European Union

FUTUREPROOF-IE: Scanning
for Impact (S4I) Project

Scanning for Impact

Integrating Effective Risk Horizon
Scanning & Emergent Risk Forecasting
into Ireland's National Risk Assessment

Professor Caroline McMullan – PI
Niamh Reilly – Research Assistant
Dr Ann Largey
Gavin D. Brown





**Funded by
the European Union**

Contents

1.0	Introduction	6
1.1	Overview of the FUTUREPROOF-IE: S4I Project	6
1.2	Definitions	7
2.0	Horizon Scanning in Practice	9
2.1	Case Studies to Illustrate Innovative Practice	9
2.1.1	Vhi Healthcare.....	10
2.1.2	Unilever plc	12
2.1.3	Tesla Inc.....	14
2.1.4	Rentokil Initial plc.....	16
2.1.5	Next plc	18
2.1.6	Libraries NI	20
2.1.7	IDA Ireland.....	22
2.1.8	Flutter Entertainment plc.....	23
2.1.9	FIFA.....	25
2.1.10	Enterprise Ireland.....	27
2.1.11	Dublin City University (DCU)	28
2.1.12	Dublin Bus	29
2.1.13	Dublin City Council	31
2.1.14	Danone.....	32
2.1.15	Currys plc.....	34
2.1.16	Bupa Insurance Limited.....	36
2.1.17	Bank of Ireland Group plc	37
2.1.18	Bandai Namco Holdings Inc.	39
2.1.19	An Post	41
2.1.20	Allianz Darta Saving Life Assurance DAC.....	43
3.0	National Risk Assessment Methodologies in Practice	45
3.1	Canada	46
3.1.1	Overview/Introduction.....	46
3.1.2	Methodology.....	46
3.1.3	Components/Outputs	46
3.1.4	Conclusion.....	47
3.2	Croatia	47
3.2.1	Overview/Introduction.....	47

3.2.2 Methodology.....	47
3.2.3 Components/Outputs	48
3.2.4 Conclusion.....	49
3.3 Cyprus	49
3.3.1 Overview/Introduction.....	49
3.3.2 Methodology.....	50
3.3.3 Components/Outputs	51
3.3.4 Conclusion.....	51
3.4 Denmark.....	51
3.4.1 Overview/Introduction.....	51
3.4.2 Methodology.....	52
3.4.3 Components/Outputs	53
3.4.4 Conclusion.....	53
3.5 Finland.....	54
3.5.1 Overview/Introduction.....	54
3.5.2 Methodology.....	54
3.5.3 Components/Outputs	55
3.5.4 Conclusion.....	56
3.6 Netherlands.....	57
3.6.1 Overview/Introduction.....	57
3.6.2 Methodology.....	57
3.6.3 Components/Outputs	58
3.6.4 Conclusion.....	60
3.7 New Zealand	60
3.7.1 Overview/Introduction.....	60
3.7.2 Components/Outputs	60
3.7.3 Conclusion.....	61
3.8 Slovenia	62
3.8.1 Overview/Introduction.....	62
3.8.2 Methodology.....	62
3.8.3 Components/Outputs	63
3.8.4 Conclusion.....	63
3.9 UK.....	63
3.9.1 Overview/Introduction.....	63
3.9.2 Methodology.....	64
3.9.3 Components/Outputs	66

3.9.4 Conclusion	66
3.10 USA.....	66
3.10.1 Overview/Introduction	66
3.10.2 Methodology.....	67
3.10.3 Components/Outputs	68
3.10.4 Conclusion.....	68
3.11 Poland	68
3.11.1 Overview/Introduction	68
3.11.2 Methodology.....	69
3.11.3 Components/Outputs	69
3.11.4 Conclusion.....	70
3.12 Italy.....	70
3.12.1 Overview/Introduction	70
3.12.2 Methodology.....	70
3.12.3 Components/Outputs	71
3.12.4 Conclusion.....	71
3.13 Romania	72
3.13.1 Overview/Introduction	72
3.13.2 Methodology.....	72
3.13.3 Components/Outputs	73
3.13.4 Conclusion.....	73
4.0 Implementing Horizon Scanning in the National Risk Assessment Process.....	75
4.1 NRA Stage 1 – Determination of Key Risks.....	76
4.2 NRA Stage 2 – Consolidation.....	76
4.3 Stage 3 – Assessment.....	78
4.4 Stage 4 - Analysis.....	80
4.5 Stage 5 - Approval, Submission & Publication	80
5.0 Public Consultation: Identification of emerging risks in Ireland	81
5.1 Methodology.....	81
5.2 Results	81
5.2.1 Assessment of National Level Risks	82
5.2.2 A Comparison of Public and Expert Risk Ratings	84
5.2.2.1 Joint Distributions of Public Opinion Over Likelihood and Impact	86
5.2.2.2 Natural Risks.....	91
5.2.2.3 Transport Risks	92
5.2.2.4 Technological Risks.....	92

5.2.2.5 Civil Risks	93
5.3 Identification of Emerging Risks	96
6.0 Proposed Horizon Scanning Methodology: A 7-Step Process for the Identification and Management of Emerging Risks of National Significance	99
7.0 Embedding Horizon Scanning for Emerging Risks in Strategic Risk Management	101
7.1 Horizon Scanning: Phase One	101
7.2 Horizon Scanning: Phase Two	102
7.3 Horizon Scanning: Phase Three	103
7.4 Horizon Scanning: Phase Four	103
7.5 Horizon Scanning: Phase Five	103
7.6 Horizon Scanning: Phase Six	103
8. Implementation of Strategic Risk Management	104
8.1 Annual Review of Strategic Risks	104
8.2 Identification of Risks and Emerging Risks	105
8.3 Risk Monitoring and Management	105
8.4 Lead Government Department Training and Exercise Programme	106
8.5 Conclusion	107
9.0 Report References	108
9.1 Case Study References	109
9.2 NRA References	111
10.0 Appendices	113
Appendix 10.1 Bibliography: National Risk Assessment Methodologies Theory and Practice	114
10.2 Bibliography - Risk Horizon Scanning and Emergent Risk Forecasting Methodologies	125
10.3 Template for Reporting on Key National Risks from NRA Matrix	132
10.4 Template for Reporting on Emerging Risks to GTF	135

1.0 Introduction

1.1 Overview of the FUTUREPROOF-IE: S4I Project

Under the umbrella of FUTUREPROOF-IE, the S4I project at DCU Business School was established to enhance the Irish National Risk Assessment (NRA) process by integrating a horizon scanning methodology to identify emerging risks which could trigger a national-level emergency. Furthermore, it was agreed that the project's impact would be increased by sharing the project outcomes with other EU Member States for consideration in their NRA processes. The project is funded by the Office of Emergency Planning (OEP), Department of Defence, and the EU under the ECHO/SUB/2022/TRACK1/882660 FUTUREPROOF-IE project.

This report presents evidence-based recommendations for the enhancement of the Irish NRA through the addition of an horizon-scanning methodology and a risk management reporting system designed to embed the oversight of key and emerging risks in the annual programme of the Government Task Force for Emergency Planning (GTF).

The project recommendations are based on a systematic review of the current methodologies deployed in horizon scanning/emergent risk forecasting and an analysis of how these methods are operationalised in public, private and voluntary entities, and in other jurisdictions.

Systematic literature reviews are objective, systematic, transparent, and replicable. A systematic review will “identify, appraise and synthesize all the empirical evidence that meets pre-specified eligibility criteria to answer a given research question” (Cochrane, 2013). The Appendices to this report include an annotated bibliography of key papers on National Risk Assessment methodologies: Theory & Practice and an annotated bibliography of key papers on Horizon Scanning/Emergent Risk Forecasting methodologies.

Chapter Two of this report maps, using a series of mini case studies, how government departments and agencies, private sector organisations, and other entities complete horizon scanning for emerging risks in practice. Chapter Three reviews the NRA methodologies deployed in other jurisdictions. The

fourth chapter provides an account of how, based on the work completed under this project, horizon scanning was integrated into the National Risk Assessment for Ireland (2023). An overview of how public consultation was included in the Irish NRA (2023) is included in Chapter Five. Chapter Six sets out a 7-Step process for the identification and management of emerging risks which could trigger a national level emergency. Chapter *7.0 Embedding Horizon Scanning for Emerging Risks in Strategic Risk Management*, proposes how horizon scanning for emerging risks can be integrated into the existing national system. Finally, Chapter 8. *Implementation of Strategic Risk Management* provides an implementation guide designed to deliver an enhanced approach to strategic risk management oversight, which will be governed by the Government Task Force on Emergency Planning.

1.2 Definitions

Emerging risks are those not yet ready for full risk assessment but likely to emerge in the medium to long term. They are typically identified using horizon scanning techniques, which involve searching for the weak signals that may precede wild card events (Smith & Dubois, 2010). Van Rij defines horizon scanning as “the systematic examination of potential (future) problems, threats, opportunities and likely future developments, including those at the margins of current thinking and planning”. They determine that “Horizon scanning may explore novel and unexpected issues, as well as persistent problems, trends and weak signals” (van Rij, 2010, p.8).

The OECD High-Level Risk Forum explored the defining characteristics of emerging risks and found them to be:

- Unquantifiable: without historical precedent;
- Outliers due to their novel and unexpected nature;
- Not widely recognised or fully understood by all stakeholders due to lack of familiarity;

- Influenced by context: risks expand, evolve, or arise within specific contextual factors, such as technological advancements, geopolitical shifts, environmental changes, or socio-economic trends, which require a deep understanding of causal layers (Inayatullah, 2004) for accurate assessment and response;
- Reflect subjective judgments; beyond purely quantitative risk assessment.

2.0 Horizon Scanning in Practice

A review of how horizon scanning, or emergent risk forecasting, is completed by government departments/agencies, private sector organisations, and other entities was conducted to determine the key approaches adopted in various contexts. This research was undertaken to inform the recommended approach to horizon scanning for emerging risks within the Irish NRA. Care was taken to include organisations operating in highly regulated and less regulated sectors.

Horizon scanning/emerging risk forecasting typically employs one of three methods: (i) desk research; (ii) automated or semi-automated review of news feeds or other data for changes or shifts; or (iii) interviews or workshops to explore emerging risks in the operating environment.



Desk research



Automation/Semi-automation



Face-to-face meetings, interviews, or workshops

2.1 Case Studies to Illustrate Innovative Practice.

A series of mini-case studies illustrating how horizon scanning/emerging risk forecasting fits into the broader risk management approaches adopted by a range of bodies/organisations were developed to illustrate horizon scanning in practice.

2.1.1 Vhi Healthcare

Organisational Overview:

Vhi, also known as Vhi Healthcare, is Ireland's largest health insurance company. It operates as a statutory corporation, with members appointed by the Minister for Health, and is regulated by the Health Insurance Authority. VHI offers a range of health insurance products, including dental and travel insurance, and has over 1 million members. The company's healthcare business model focuses on paying the bills of its members for consultant and hospital services directly. Additionally, VHI has expanded its products into homecare services and operates minor injuries treatment centres through partnership agreements.

Risk Methodology:

Vhi's risk management approach is multifaceted and designed to navigate various challenges while seizing opportunities that align with short and long-term strategic objectives. Vhi employs a 'three lines of defence' approach to ensure a robust risk management system. This system allows Vhi to identify current and emerging risks, establish a clear risk appetite, mitigate and manage risks, continuously monitor and report the status of risks, undertake scenario analysis for capital requirements, and make informed risk-based decisions across the business.

Oversight is provided by Non-Executive Directors at both the Group Board and Subsidiary Board levels. The Group Risk Committee (GRC) oversees a Risk Management Framework across the organisation and recommends the appropriate level of risk appetite to the Board. Each subsidiary is overseen by a local Board Risk Committee, ensuring adherence to the Risk Management Framework.

Vhi's processes examine future risks and their potential emergence or evolution. This process includes consideration of technological evolution, the future of health and healthcare,

societal changes, including ageing populations, and geopolitical and economic considerations.

Vhi also manages risks associated with climate change using the Risk Management Framework.

Vhi policies contain key risk control standards for conducting business. These are implemented by business units and are overseen by policy owners to ensure compliance. Vhi Group's risk tolerance levels are documented in the Risk Appetite Statement, approved by each Subsidiary Board and the Board of Vhi Group. Vhi has established reporting systems to identify, escalate, manage, and mitigate major business risks. This system includes detailed reviews, in-depth analyses of risks, and a stress and scenario testing program for key risks.

Risks and Emerging Risks Identified by Vhi:

1. Stagflation: Slow economic growth with persistently high inflation.
2. Strategy Not Resonating with Customers: Misalignment between VHI's strategic decisions and customer preferences or needs.
3. Healthcare Disruption: Disruptions in the healthcare sector impacting operations.
4. Digital Engagement: Challenges in engaging customers digitally in the healthcare industry.
5. Finance and Capital Risks: Risks leading to capital loss or affecting business solvency, including claim cost uncertainties, pandemic surges, financial risks from new ventures, and volatile financial markets.
6. Strategic Risks: Failure to achieve strategic objectives due to internal and external factors.
7. Operational Risks: Risks of financial loss or reputational damage from inadequate or failed internal processes, people, or systems.
8. Customer Value and Conduct Risks: Threats to the objective of treating customers fairly and with due skill, care, and diligence.
9. People and Culture Risks: Risks from employee behaviours and/or non-adherence to policies and procedures.
10. Clinical Risks: Risk of causing preventable harm to patients through healthcare service provision.

2.1.2 Unilever plc

Organisational Overview:

Unilever plc is a British multinational company specializing in fast-moving consumer goods. It was established in 1929 through the merger of Lever Brothers and Margarine Unie. Headquartered in London, it is a leading global manufacturer with a wide product range, including food, beverages, cleaning agents, and personal care items. Unilever is noted for its large brand portfolio, including Axe, Ben & Jerry's, and Dove, and it operates through five business groups. The company has a significant international presence, with products available in over 190 countries and multiple research and development centres across the world. Over the years, Unilever has expanded through various acquisitions and has shifted its focus towards health and beauty brands. It is listed on the London Stock Exchange and Euronext Amsterdam.

Risk Methodology:

Unilever's comprehensive risk management approach is aligned with its long-term strategic goals. This integrated system, covering every aspect of operations, ensures that evaluating risks and opportunities is a fundamental part of their agenda. Key elements influencing Unilever's risk appetite include:

- Enduring growth.
- Proactive measures in areas such as the use of plastics and climate change.
- Adherence to business principles and policies.
- Operational efficacy.
- Maintaining a strong credit rating.

The organizational design pinpoints well-defined responsibility for principal risks across various sectors, with the Board overseeing the effectiveness of risk management and evaluating emerging risks in environmental, social, and governance spheres. Unilever's method for identifying and managing emerging risks includes:

- Consistent Board assessments.
- Integrating its purpose and values in operations.
- A network of Business Integrity Officers.
- A detailed risk management framework.
- Functional standards as essential controls.
- Assessing immediate and future risks.

Key and Emerging Risks Identified by Unilever:

Unilever has identified 11 key risks, which are managed through targeted strategies:

1. **Brand Risk:** Ensuring brand relevance and innovation in line with changing consumer trends is managed by observing market developments, investing in digital communication, and tailoring brand messages to consumer expectations.
2. **Portfolio Management and Climate Change:** Addressing strategic investments and the impacts of climate change involves focusing on long-term potential in Business Group strategies and adapting to environmental norms.
3. **Plastic Usage:** The extensive use of plastic in packaging demands reducing virgin plastic, enhancing recyclability, and improving recycling infrastructure. This is achieved through collaborations with industry and governments.
4. **Talent and Business Operations:** Challenges in talent acquisition and maintaining a flexible workforce, along with supply chain risks, are managed through developmental programmes, performance evaluations, and embracing agile methodologies.
5. **Safe and High-Quality Products:** Product safety and quality are managed through widespread quality control processes, continuous monitoring, and incident management teams.
6. **Systems and Information:** Dependence on IT systems and data management, with risks like cyber-attacks and privacy issues, are countered by stringent policies, security standards, and compliance measures.
7. **Business Transformation:** Effectively implementing business transformation projects, including digitalization, requires proficient project management overseen by senior executives and expert teams.
8. **Economic and Political Instability:** Global economic and political instabilities are mitigated by a flexible business model and regular revision of business forecasts.
9. **Treasury and Tax:** Financial risks related to currency fluctuations and exchange risks are managed through financial hedging and a Tax Risk Framework.
10. **Ethical Practices:** Maintaining ethical standards is ensured through strict adherence to business principles, fostering ethical behaviour, and safety initiatives in supply chains.
11. **Legal and Regulatory Compliance:** Specialized legal and regulatory teams achieve compliance with laws and regulations, preventing potential legal challenges.

Emerging risks like biodiversity loss and keeping pace with technological advancements are identified and mitigated through strategic actions and continual updates to the risk management framework. This comprehensive risk management approach highlights Unilever's commitment to sustainable and ethical operations amid global challenges.

2.1.3 Tesla Inc.

Organisational Overview:

Tesla Inc. is an American multinational automotive and clean energy company specializing in electric vehicles, battery energy storage, and solar products. Founded in 2003 by Martin Eberhard and Marc Tarpenning, Tesla was later joined by Elon Musk, who became its CEO. Known for models like the Roadster, Model S, X, 3, Y, the Semi truck, and the Cybertruck, Tesla is recognized for its influential role in the electric vehicle market. As of 2023, it is the world's most valuable automaker, leading in battery electric vehicle market share.

Risk Methodology:

The risk management approach adopted by Tesla is not outlined in their annual report, however, the risks facing the company are presented in the form of an umbrella under which many different risk scenarios may unfold. A series of risk scenarios that may affect the company, its financial condition, and future results are described, but how these scenarios are constructed is not specified.

Key and Emerging Risks Identified by Tesla:

The main risks and their associated scenarios highlight the various challenges Tesla faces in its operations, market positioning, regulatory compliance, and strategic growth initiatives:

1. **Macroeconomic Conditions Resulting from the COVID-19 Pandemic:** This includes the impact of government regulations, shifting social behaviours, port congestion, supplier shutdowns, and labour shortages. For instance, COVID-19 cases in Shanghai led to the temporary shutdown of Gigafactory Shanghai, affecting car delivery times.
2. **Delays in Launching and Ramping Production:** Challenges with suppliers and in implementing new manufacturing processes can lead to delays and increased costs. An example is the delay experienced during the initial ramp of Model X.
3. **Supplier Issues:** Tesla's reliance on numerous suppliers, including single-source suppliers, makes it vulnerable to component shortages, price fluctuations, and supplier solvency issues. For example, the global semiconductor shortage impacted Tesla's supply chain.
4. **Construction and Production Ramps at New Factories:** Uncertainties in constructing new factories and ramping up production can affect Tesla's ability to meet production goals and maintain cost efficiency.
5. **Global Sales, Delivery, Installation, Servicing, and Charging Network Expansion:** Expansion challenges include accurately forecasting demand, managing delivery logistics, adding servicing capacity, and expanding charging infrastructure.

6. **Dependency on Lithium-Ion Battery Cells:** Tesla depends on external suppliers for battery cells and faces challenges in developing and manufacturing its own cells. Fluctuations in raw material prices also affect battery cell costs.
7. **Consumer Demand for Electric Vehicles:** The market for electric vehicles is influenced by perceptions of EV features, range, competition, government regulations, and economic incentives.
8. **Competition in the Automotive Market:** Tesla faces competition from established and new manufacturers in the electric and alternative fuel vehicle markets, which could impact sales and market share.
9. **Operational Risks at Gigafactories:** Production bottlenecks, competition for resources, and safety issues at Gigafactories can affect the production and profitability of Tesla's products.
10. **International Operations:** Tesla faces risks related to regulatory, political, economic, tax, and labour conditions in various jurisdictions.
11. **Product Defects and Delays in Functionality:** Design or manufacturing defects and delays in enabling features like autopilot could affect product performance and lead to recalls or legal claims.
12. **Product Liability Claims:** Tesla faces the risks of product liability claims in case of accidents involving its vehicles, especially those using autopilot or full self-driving features.
13. **Public Confidence in Business Prospects:** Maintaining stakeholder credibility and confidence is crucial for business growth.
14. **Financing Programs and Credit Risks:** Tesla's vehicle and energy system financing programmes expose it to risks related to residual value forecasting, customer credit, and regulatory compliance.
15. **Compliance with SUNY Foundation Agreement:** Obligations related to Gigafactory New York include meeting employment targets and investment commitments.
16. **Attraction and Retention of Key Employees:** The loss of key employees or the inability to attract skilled personnel can impact Tesla's operations and product development.
17. **Dependency on Elon Musk:** Tesla's success is viewed as dependent on Elon Musk, who is involved in multiple ventures.
18. **Cybersecurity and Data Privacy Risks:** Potential cyber-attacks and data breaches can disrupt operations and lead to legal liabilities.
19. **Government Investigations and Proceedings:** Ongoing government investigations and potential legal actions could impact Tesla's operations and reputation.
20. **Direct Vehicle Sales Model:** Regulatory limitations on Tesla's ability to sell vehicles directly to consumers can affect sales and operations.
21. **Stock Price Volatility:** Tesla's stock price is subject to fluctuation due to various factors, including market conditions and investor perceptions.
22. **Fluctuating Operating Costs and Financial Results:** Variations in operating costs and revenues can impact Tesla's financial performance.
23. **Guidance and Business Expectations:** Failing to meet publicly announced guidance or business expectations could negatively impact the stock price.
24. **Elon Musk's Financial Obligations:** Musk's sale of Tesla stock to satisfy personal loan obligations could affect the stock price.
25. **Anti-Takeover Provisions:** Provisions in Tesla's governing documents and applicable laws could deter acquisition attempts.

26. **Currency Exchange Rate Fluctuations:** Tesla's global operations expose it to currency exchange risks, impacting revenues and costs.
27. **Intellectual Property Infringement Claims:** Tesla may face claims and legal actions related to intellectual property rights.
28. **ESG Practices:** Scrutiny related to environmental, social, and governance practices could lead to additional costs or impact business operations.
29. **External Events:** Natural disasters, wars, and health epidemics, such as COVID-19, can disrupt Tesla's operations and supply chains.
30. **Government and Economic Incentives:** Changes in government incentives for electric vehicles and energy products can impact demand and costs.
31. **Evolving Laws and Regulations:** Compliance with environmental, manufacturing, health, safety, and other regulations can impose substantial costs and operational changes.
32. **Privacy and Consumer Protection Laws:** Non-compliance with privacy and data protection laws can result in legal liabilities and reputational harm.
33. **Governmental Investigations and Legal Proceedings:** Ongoing and potential future investigations and proceedings can impact Tesla's financial and operational status.
34. **Direct-to-Consumer Sales Restrictions:** Regulatory challenges to Tesla's sales model can affect its ability to sell vehicles directly to consumers.

2.1.4 Rentokil Initial plc

Organisational Overview:

Rentokil Initial is a British business services group founded in 1925 and based in Crawley, England. Initially a pest control business, the company expanded under Sir Clive Thompson's leadership in the 1980s and 1990s and through the acquisition of BET plc in 1996. It now offers a broad range of facilities management services. Rentokil Initial is listed on the London Stock Exchange and is part of the FTSE 100 Index. Its divisions operate under four global brands: Rentokil, Initial, Steritech, and Ambitus, and it also maintains local brands like Western Exterminator and Terminix.

Risk Methodology:

Rentokil Initial plc adopts a thorough approach to risk management, identifying and addressing both current and potential risks. Central to this is a frequently reviewed risk register, essential for managing emerging risks. The company evaluates risks regularly at Group Risk Committee meetings. In senior management meetings, it conducts in-depth

reviews of key risks, such as changing demographics and cyber security, showcasing its awareness of diverse challenges.

In 2021, the company refined its risk management, enhancing the risk register's review process and deepening its focus on critical risk areas. This demonstrates a commitment to a robust risk management framework. The Board, relying on regular reports, plays a crucial role in overseeing this process and evaluating the risks impacting the company's strategy and stability. Rentokil Initial's business model, with its low capital intensity and strong market presence, helps mitigate geopolitical and exchange risks.

Key and Emerging Risks Identified by Rentokil:

Rentokil Initial plc has identified several principal risks in its operations, each with specific impacts and mitigating actions:

1. **Failure to Grow Business Profitably:** Rentokil Initial plc faces risks from macroeconomic changes impacting profitability and recruitment. Mitigation involves capital allocation reviews, regulatory collaborations, low-cost models, and strategic pricing and procurement.
2. **Financial Market Risks:** Exposed to foreign exchange and liquidity risks, the company mitigates these through strict financing and treasury policies, including cash pooling and credit facilities.
3. **Legal and Regulatory Compliance:** The risk of non-compliance with laws leads to potential fines and impacts growth. Mitigation strategies include legal oversight, annual tax strategy reviews, and compliance training.
4. **Business Continuity:** Risks like cyber-attacks and natural disasters threaten customer retention and reputation. Mitigations include business continuity plans, enhanced data security, and disaster recovery strategies.
5. **Fraud and Data Security:** Internal and external collusion risks lead to regulatory penalties and reputational damage. The company counters these with compliance programs, data privacy teams, and anti-fraud measures.
6. **Safety, Health, and Environment (SHE):** Operational hazards pose risks of injury and reputational damage. Mitigation includes SHE policies, officer appointments, and environmentally friendly practices.
7. **Service Delivery:** Challenges in service delivery affect customer retention and financials. The company's response includes HR development, customer satisfaction tracking, and operational excellence initiatives.

The company's hierarchical risk assessment process includes bottom-up risk identification and internal audits, ensuring risks are efficiently escalated and managed. The Board's oversight ensures effective internal controls. A key session in May 2021, facilitated by EY, highlighted

strategic risks, such as engaging Generation Z and responding to climate change, aligning with the company's goals to meet evolving customer needs and financial objectives.

2.1.5 Next plc

Organisational Overview:

Next plc, a British multinational, is a prominent clothing, footwear, and home products retailer headquartered in Enderby, England. It operates approximately 700 stores globally, with around 500 in the UK and 200 in Europe, Asia, and the Middle East. Next is the UK's largest clothing retailer by sales, surpassing Marks & Spencer. The company is listed on the London Stock Exchange and is part of the FTSE 100 Index. Next's business includes retail branches, a home shopping catalogue and website (Next Directory), and international stores (Next International). It also runs Next Sourcing and Lipsy, own-brand products, operates stores and e-commerce for Victoria's Secret in the UK, and has a joint venture with Gap.

Risk Methodology:

Key drivers of NEXT PLC's risk management include the imperative to remain profitable and a commitment to proactive identification of emerging risks. This approach involves monitoring external factors such as economic, geopolitical environments, and environmental, social and governance (ESG) issues, particularly carbon emissions reduction.

NEXT PLC's strategy involves a multi-layered approach to risk management, blending continuous review (identifying and mitigating business risks, including emerging threats), internal audits (aligning with the Group Risk Register, addressing emerging issues and implementing improvements in risk management processes), corporate oversight (Board and Audit Committee supervision of risk management and internal control systems, review of emerging and principal risks to maintain a robust framework) and the proactive identification of emerging risks. This strategy is crucial for maintaining profitability and adapting to changing external factors.

NEXT PLC's risk management approach is based on the three lines of defence model:

- **First Line:** Executive/Business Risk Owners bi-annually review existing and emerging risks.
- **Second Line:** The Risk Steering Group develops the Risk Universe, and the Risk Management Function enhances risk management frameworks.
- **Third Line:** Internal Audit.

Risk identification is a bottom-up process within the Enterprise Risk Management Universe, involving:

1. Discussions with operational area owners to identify business risks.
2. Mapping business risks to the Risk Universe components.
3. Linking these components to executive-owned corporate risks and principal risks.

Key and Emerging Risks Identified by NEXT Plc:

The Principal Risks Identified by Next PLC and their management strategies are:

1. **Business Strategy Development and Implementation:** Next PLC faces risks in strategy development and implementation, which they manage through regular Board reviews and updates from the Chief Executive. They ensure diversification through their International Online and third-party LABEL business, maintaining a disciplined approach in sales budgeting, stock control, investment returns, and cost control.
2. **Product Design and Selection:** The company's success is contingent on aligning product design and selection with customer preferences. Management involves continuous review and assessment by executive directors and senior management, with provisions for adjusting to significant trends and underperforming ranges.
3. **Key Suppliers and Supply Chain Management:** Next PLC depends on its supplier base for timely, quality product delivery. Management strategies include improving product availability post-pandemic, continuously reviewing stock availability, developing the supplier base, adhering to the NEXT Code of Practice, and conducting regular supplier audits.
4. **Warehousing and Distribution:** Risks in warehousing and distribution are managed by implementing new warehouse facilities, planning for future handling capacity, monitoring service levels and costs, and maintaining business continuity plans.
5. **Business Critical Systems:** The company faces risks associated with maintaining efficient software and hardware. This is managed through continued technology investment, development of websites, regular system performance reviews, and customer feedback analysis.
6. **Management of Long-Term Liabilities and Capital Expenditure:** Risks related to long-term liabilities and capital expenditure are managed by actively overseeing the leased store portfolio, reviewing lease commitments, and ensuring healthy returns on capital invested.
7. **Information Security, Data Protection, Business Continuity, and Cyber Risk:** These risks are addressed through the operation of an Information Security and Data Privacy

Steering Committee, investment in security programmes, regular system testing, and maintaining data protection policies.

8. **Financial, Treasury, Liquidity, and Credit Risks:** Risks in financial, treasury, liquidity, and credit are managed by operating a centralised Treasury Function, regularly monitoring the debt position and liquidity, and implementing rigorous procedures for credit account customers.
9. **Legal, Regulatory, and Ethical Standards Compliance:** Next PLC manages compliance risks by maintaining policies and training, having a dedicated financial regulatory compliance team, managing conduct and compliance risks, and continuously reviewing data protection laws and climate risk regulatory changes.

2.1.6 Libraries NI

Organisational Overview:

The Northern Ireland Library Authority, known as Libraries NI, is a regional entity responsible for public library services in Northern Ireland. Under the Libraries Act (Northern Ireland) 2008, its main objective is to offer a comprehensive and efficient public library service to those living, working, or studying in Northern Ireland. The organization is governed by a Board comprising a Chairperson and 18 Members, primarily local councillors, appointed by the Department for Communities. Its operational activities are led by a Chief Executive and an Executive Team, divided into two strategic units. Libraries NI operates through a network that includes branch libraries, heritage libraries, mobile libraries, and a homecall service, offering a range of free services.

Risk Methodology:

The Risk Management Strategy of Libraries NI, as of June 2023, is built around a comprehensive framework designed to identify and manage risks inherent in delivering high-quality services. This strategy is crucial for anticipating uncertainty and preparing successful responses. The framework includes a Risk Management Strategy, a Risk Assessment, a Risk Appetite statement, and a Corporate Risk Register.

In this dynamic and structured approach, operational risks are identified by line managers, such as Heads of Service and Heads of Department. Each Directorate maintains its own risk register, reflecting core operational objectives and informing the overall Corporate Risk

Register. Risks are quantified using a 5 × 5 Likelihood × Impact matrix, and a formal risk review is conducted in each Directorate biannually.

The Horizon Scanning process is a key aspect of the Libraries NI strategy, playing a crucial role in identifying emerging risks. It involves continuously reviewing potential challenges and threats that could impact the organization's future risk profile. The Risk Management Group (RMG) within Libraries NI is pivotal in this process. The RMG, meeting formally four times a year, is responsible for identifying key risks to core objectives, as outlined in Libraries NI Corporate Strategy and Operational Business Plans. This group regularly reviews the Corporate Risk Register, identifying necessary changes and ensuring that risk management is responsive to evolving circumstances.

The Senior Management Team and the Audit and Risk Assurance Committee review the RMG's findings and recommendations. This ensures that the process is dynamic, based on good practice guidelines, and subject to continuous review. Key documents, like the Governance Statement, align with corporate governance best practices. The strategy is further reinforced by an independent review of its effectiveness by Internal Audit.

In preparing the Governance Statement for inclusion in the Annual Report and Accounts, the Accounting Officer assesses the risks facing the organisation and the mitigation actions taken. This Risk Management Strategy supports effective risk management and the completion of the Governance Statement.

Risk Appetite is a central element of the risk strategy. It ranges from 'Averse,' focusing on avoiding risk and uncertainty, to 'Hungry,' where there is a preference for innovative options despite the greater level of inherent risk. Intermediate levels include 'Cautious,' preferring safe options with low to moderate residual risk, and 'Open,' considering all options with moderate residual risk and acceptable rewards.

Libraries NI's Risk Management Strategy is a proactive, hierarchical approach that incorporates regular reviews, horizon scanning, and involvement of key groups like the RMG. It addresses current risks and prepares for emerging risks, ensuring the organisation's resilience and readiness for future challenges.

2.1.7 IDA Ireland

Organisational Overview:

IDA Ireland is a key agency for attracting and retaining foreign direct investment (FDI) in Ireland. Established in 1949 as the Industrial Development Authority, it became a non-commercial autonomous state-sponsored body in 1969. As a semi-state body, IDA Ireland significantly influences Ireland's engagement with foreign investors. The agency facilitates multinational corporations, which contribute to employment and exports in Ireland. It supports investors in establishing or expanding their operations in Ireland, offering funding for research and development projects, along with various direct support mechanisms like employment and training grants. Despite its autonomous status and independent governance, IDA Ireland's funding primarily comes from the Irish State.

Risk Management Methodology:

The IDA's Risk Management approach, steered by the Audit Finance and Risk Committee (AFRC), which encompasses four Board members and an external finance and audit expert, showed notable activity in 2022. The AFRC convened five times to formulate a comprehensive risk management policy. This policy encompasses:

- Detailing the organisation's risk appetite.
- Establishing risk management processes.
- Clarifying the roles and responsibilities of staff in risk management.

IDA's risk management strategy includes an outsourced internal audit function that reports directly to the AFRC. At the core of IDA's risk management system is its ability to identify and report key risks, along with management actions aimed at addressing and mitigating these risks as much as possible.

Staff involvement at all levels is a pivotal aspect of the IDA approach. Employees are expected to:

- Adhere to IDA's risk management policies.
- Alert management about emerging risks and control weaknesses.
- Assume responsibility for risks and controls within their area of work.

Moreover, the AFRC is responsible for overseeing the implementation of the risk policy, which includes:

- Development of a risk register.
- Monitoring of budgeting and banking arrangements.

The risk register is used to identify, evaluate, and grade key risks according to their significance. It undergoes an annual review and approval by both the AFRC and the Board.

In compliance with the Code of Practice for the Governance of State Bodies (2016) and guidance from the Department of Public Expenditure and Reform, IDA Ireland maintains an effective system of internal control. This system aims to provide reasonable assurance in several key areas:

- Safeguarding of assets.
- Proper authorization and recording of transactions.
- Prevention or timely detection of material errors or irregularities.

2.1.8 Flutter Entertainment plc

Organisational Overview:

Flutter Entertainment plc, formerly known as Paddy Power Betfair plc, is a key player in the global sports betting and gaming industry. Registered on the London Stock Exchange and a constituent of the FTSE 100 Index, the corporation has an extensive portfolio of brands, including Betfair, FanDuel, Paddy Power, PokerStars, Sky Betting & Gaming, and Sportsbet. Flutter Entertainment's operations are segmented into four distinct divisions: Online, Retail, Australia, and the United States, each responsible for specific strategic business units and regional market operations. The company's also holds a majority stake in Jungle Games, a prominent skill gaming provider based in India.

Risk Methodology:

Flutter Entertainment plc employs a sweeping approach to risk management, focusing on both material and emerging risks across its various divisions and the wider group. This involves the identification of risks and continuous monitoring and reassessment, taking into account the effectiveness of existing mitigation strategies. This process is supported by the Group's assurance and audit programmes, which play a key role in evaluating the design and effectiveness of the controls in place.

A significant component of the company's risk management strategy is horizon scanning, which involves gathering perspectives on emerging risks from relevant divisions, corporate subject matter experts, and leadership to create a comprehensive Group-wide view. In 2022, Flutter Entertainment enhanced this process by conducting a series of workshops across different risk categories, aimed at providing a deeper understanding of emerging risks and opportunities and reaching a consensus on the company's response strategies. Examples of such emerging risks include accelerated digitalization, technological advances, and evolving requirements for skills and competencies.

Key and Emerging Risks Identified by Flutter Entertainment plc:

Through this structured approach, Flutter Entertainment effectively manages risks and ensures the ongoing success and resilience of its business operations. The company has identified several key risks in its operations, each with specific management and mitigation strategies:

1. **Changing Legal and Regulatory Landscape:** Managed by internal and external Legal, Regulatory Compliance, and Tax teams across all regions, focusing on adapting to regulatory changes and reducing exposure to high-risk jurisdictions.
2. **US Growth Execution and Competition:** Managed by maintaining strong commercial relationships and investing in people, products, brands, and in-house technology stack.
3. **Cyber Resilience:** Managed by significant investment in cybersecurity resources, external security specialists, and a Group-wide cyber policy.
4. **Third Parties and Key Suppliers:** Managed by regular business and quality reviews, and efforts to reduce reliance on single suppliers.
5. **Leadership and Talent Pipeline:** Managed by implementing a talent framework, proactive management of executive plans, and leveraging diverse talent.
6. **International Technology Transformation:** Managed by restructuring leadership teams and investing in resources for stability and technology.

7. **Compliance with Existing Legal and Regulatory Landscape:** Managed by dedicated Divisional Compliance teams and overarching policies and programs.
8. **Technology Resilience:** Managed by investment in proprietary technology and regular monitoring of critical systems and platforms.
9. **Safer Gambling/Performance Against Play Well Strategy:** Managed by implementing a safer gambling strategy and investing in problem gambling initiatives.
10. **Global Talent Management:** Managed by the Global People Strategy focusing on nurturing critical skills and engaging colleagues.

The Risk Management Framework is cyclic in nature, encompassing identification, assessment, mitigation, monitoring and reporting, and continuous review. This framework is part of a hierarchical Risk Governance Structure employing the Three Lines of Defence Model. The company also recognises climate change as a longer-term emerging risk, monitored to track its development and identify any changes in risk exposure. The Group's risk appetite statement and risk profile will be based on identified climate-related risks, with a more formal component of horizon scanning for climate change and ESG regulation planned.

2.1.9 FIFA

Organisational Overview:

The Fédération Internationale de Football Association (FIFA), established in 1904 and headquartered in Zurich, Switzerland, serves as the authoritative body for global association football, beach soccer, and futsal. Comprising 211 national associations divided across six regional confederations, FIFA's primary objectives are the international development of football, promoting accessibility, and upholding principles of integrity and fair play. It is renowned for organizing prestigious tournaments such as the FIFA World Cup and the FIFA Women's World Cup. Additionally, FIFA is a member of the International Football Association Board, responsible for formulating the laws of the game, and generates substantial revenue from its tournaments and sponsorship deals.

Risk Methodology:

FIFA's Risk Management approach operates through a structured process of monitoring, testing, and assessment. This approach is particularly focused on managing risks related to economic sanctions and operational challenges.

1. **Monitoring:** FIFA's risk management involves ongoing monitoring of key performance and risk indicators. This continuous oversight allows for the identification of patterns and issues, forming a regular part of the reporting cycle.
2. **Testing:** In addition to monitoring, FIFA conducts periodic reviews of its products, services, training, and communication. The purpose of this testing is to evaluate their effectiveness. The responsibility for this testing falls primarily under the Compliance team. Due to the vast range of areas to be covered, an annual schedule of testing is set. Post-testing, any changes made are validated to ensure their effective implementation.
3. **Identifying Emerging Risks:** A specific example of how FIFA's risk management approach is applied to identify emerging risks can be seen in its response to the COVID-19 pandemic. All COVID-19 funding grants were governed by specific regulations, requiring reporting on their usage as part of an expanded central review process.
4. **Enhanced Framework for Conflicts of Interest:** FIFA has recently enhanced its approach to managing conflicts of interest. All team members are now required to complete annual declarations, which are then thoroughly reviewed and assessed. This step indicates a proactive approach to identifying and mitigating potential risks that might arise from conflicts of interest.

Additionally, FIFA employs the Three Lines of Defence model to ensure comprehensive risk management:

- **First Line of Defence:** Involves the allocation of responsibilities.
- **Second Line of Defence:** Focuses on risk management oversight and compliance responsibilities.
- **Third Line of Defence:** Entails Group Internal/External Audit, depending on the size of the club.

Through these methods, FIFA's risk management system operates not only to manage existing risks but also to proactively identify and respond to emerging risks in a dynamic and global environment.

Key Risks and Emerging Risks Identified by FIFA:

The FIFA Compliance Handbook identifies several key risks to the organization:

1. **Gifts and Hospitality:** The practice of giving and receiving gifts and hospitality is common in many cultures but should never influence business decisions.
2. **Anti-Bribery and Corruption:** FIFA strictly prohibits any form of bribery and corruption.
3. **Conflict of Interest:** Conflicts of interest can occur when individuals have personal interests, activities, or relationships that might impact their responsibilities towards football.
4. **Reputational Risk:** Every team member is responsible for ensuring their member association does not become involved in criminal activity.
5. **Data Protection:** The processing of personal data is heavily regulated.
6. **Restricting Cash Payments:** Many payments related to funding are made in cash, but using cash makes it harder to keep accurate records and increases the risk of inaccurate reporting.

2.1.10 Enterprise Ireland

Organisational Overview:

Enterprise Ireland, an agency of the Irish state, specializes in the economic development of Irish-owned businesses, focusing on the enhancement of their export capabilities. Its core mission encompasses aiding these enterprises in initiation, expansion, innovation, and the realization of export sales in international markets. The agency particularly supports technology firms, with an emphasis on the software industry, offering both financial and advisory assistance. Furthermore, it invests in Applied Research Enhancement Centres and has initiated programmes such as the "New Frontiers" programme in 2012, aimed at fostering entrepreneurial talent in Ireland.

Risk Methodology:

Enterprise Ireland operates a thorough risk management approach through its Audit Finance and Risk Committee (AFRC), which is composed of four board members with relevant expertise. In 2022, the AFRC convened seven times, reflecting its active role in overseeing the organisation's risk management. This committee is supported by:

- A robust internal audit function.
- Independent external expertise. These elements ensure a comprehensive approach to risk management.

Central to Enterprise Ireland's risk management strategy is the "Statement on Internal Control," a directive all employees are required to follow. This statement:

- Acknowledges the pivotal role of the AFRC.
- Outlines the organization's risk appetite.
- Details the processes in place for managing risks.
- Specifies the roles and responsibilities of staff concerning risk.

The AFRC's risk management policy, disseminated to all staff members, mandates them to:

- Proactively identify emerging risks and control weaknesses.
- Take responsibility for risks and controls within their work areas. This policy ensures that all levels of the organization are engaged in the risk management process.

Enterprise Ireland's risk register identifies and reports key risks, grading them based on their significance (though the methodology for this is not specified). The AFRC reviews and updates the risk register quarterly, using the outcomes of these evaluations to plan and allocate resources effectively. This approach ensures that risks are managed to an acceptable level within the organization. Additionally, the risk register details specific controls and actions required to mitigate identified risks and assigns responsibility for these controls to designated staff members.

2.1.11 Dublin City University (DCU)

Organisational Overview:

Dublin City University (DCU), established in 1975 and gaining university status in 1989, is based in North Dublin, Ireland. Its expansion in 2016 included the incorporation of four other Dublin-based institutions. As of 2020, the university has a student population of 17,400, an alumni network of over 80,000, and approximately 1,200 online students. The university, led by President Professor Daire Keogh as of 2020, offers various programmes across five faculties and focuses on areas including business, engineering, education, technology, health, social sciences, and humanities. It is distinguished by its strong connections with industry and respected applied research outputs.

Risk Methodology:

DCU's risk management policy is designed to support the University in achieving its strategic objectives, safeguarding staff, students, and assets, ensuring financial sustainability, and

adhering to governance requirements. It is applicable across all university units, including academic and central services, as well as wholly-owned subsidiaries. The risk management system is overseen by the University's Governing Authority and its Risk Committee (GARC). The Executive is tasked with developing and maintaining this process, which includes continuous monitoring of risks within the University. The Chief Operations Officer (COO) is responsible for the ongoing development and maintenance of the Risk Management Function, while Heads of Unit are responsible for day-to-day risk management within their areas, ensuring regular risk assessments. The Risk and Compliance Officer oversees the updating and maintaining of the University's Risk Web page, ensuring the transparency and accessibility of risk management information.

At the core of this process is the maintenance of a Strategic Risk Register (SRR), which is reviewed annually. The process adopts a 'Bottom-Up' approach, wherein various units across the University identify and document current and emerging risks. These risks are then aggregated into 'Functional Area Risk Registers' and eventually integrated into the SRR. This "Bottom-Up" approach is complemented by a "Top-Down" approach, with the Executive of the University proposing risks which could impact the achievement of DCU's strategic objectives.

DCU's strategy for identifying emerging risks also involves both 'Bottom-Up' and 'Top-Down' evaluations. Executive and individual units document emerging risks that could impact them directly or the University at large. These risks are then reviewed by senior management and monitored by the Office of the COO.

2.1.12 Dublin Bus

Organisational Overview:

Dublin Bus, a state-owned bus operator in Dublin, Ireland, is a subsidiary of Córas Iompair Éireann. Founded in 1987, it is the largest bus operator in the city. In 2019, Dublin Bus carried 138 million passengers. The company experienced a significant technological upgrade in September 2011 with the introduction of real-time passenger information.

Risk Methodology:

Dublin Bus implements its risk management system using the OpRiskControl software, aligning with ISO 31000 Risk Management standards. This system allows for the definition of risks at a manageable level, ensuring accurate appraisal of their potential likelihood and impact, and facilitating the implementation of appropriate mitigating actions.

The Risk Management Policy at Dublin Bus assigns the initial responsibility for risk management to the Chief Risk Officer, with the Board of Directors approving the Risk Management Framework. This framework adheres to the Three Lines of Defence Model, comprising:

1. **First Line of Defence (Risk Ownership):** Functions owning and managing risks as part of day-to-day activities.
2. **Second Line of Defence (Risk Supervision):** Functions overseeing risks and providing robust challenges to management teams.
3. **Third Line of Defence (Risk Oversight):** Functions providing independent assurance.

Newly identified or emerging risks are assigned to a Risk Owner, usually the Head of the Department, who may delegate the risk management to an Action Owner. This delegation is crucial for the analysis, evaluation, and treatment of the risk, ensuring integration into the daily activities of each department.

The system features ongoing monitoring and review mechanisms. Key risks and related controls are identified, with processes established to monitor these controls and report deficiencies. Risk Owners use risk criteria tables to evaluate risks, especially those which fall outside the organization's risk appetite, and assign appropriate risk ratings. These risks are then escalated for oversight, and periodic reports are generated, which include principal risks and any emerging risks. These reports are subject to peer review by the executive team and further escalated to relevant management and boards.

Updates from the IT risk register, an overview of the risk universe, and assessments of risks breaching the risk appetite are included in these reports. Moreover, the risk status against the risk appetite and performance against Key Performance Indicators (KPIs) are escalated to the Audit Finance and Risk Committee (AFRC) and the CIÉ Executive Board quarterly.

An external review of the risk management framework's effectiveness is conducted periodically, with a view to ensuring compliance with the Code of Practice for the Governance of State Bodies. The AFRC, instrumental in overseeing these processes, met six times in 2022, reflecting its active role in managing and reviewing the organisation's risk management activities.

2.1.13 Dublin City Council

Organisational Overview:

Dublin City Council is the local authority for Dublin, Ireland. Governed by the Local Government Act 2001, it was known as Dublin Corporation until 2001. The Council, which is the largest in Ireland, has various responsibilities, including public housing, roads and transportation, urban planning and development, and cultural and environmental matters. It consists of 63 elected members, with elections every five years based on the single transferable vote system.

Risk Methodology:

DCC's Risk Management approach, deeply embedded in its culture and values, is designed to align with the organisation's growth. It is built around a three-line defence model, facilitating risk-informed strategic planning and decision-making.

Key Components of DCC's Risk Management Approach:

1. **Board Oversight and Policy Setting:** The Board approves a Risk Appetite Statement and a Risk Management Policy, and ensures the effectiveness of risk management and internal control systems.
2. **Risk Management Framework:** This includes:
 - **First Line:** Subsidiary and Divisional Management, responsible for day-to-day risk management, maintaining risk registers, identifying emerging risks, and implementing controls.
 - **Second Line:** Functions like Group Sustainability, Legal and Compliance, and IT, ensuring key management processes and controls.
 - **Third Line:** Group Internal Audit, reviewing risk management and control processes, providing independent assurance.
3. **Risk Management Process and Registers:** Identifying and assessing various risks, maintaining risk registers at multiple levels, and regularly updating them.

4. Emerging Risks: Recognizing and monitoring risks with potential future impacts, maintaining a watchlist, and updating the Group Risk Register as necessary.
5. Integrated Assurance Reporting: Maintaining an Integrated Assurance Report to identify assurance activities across the defence lines addressing key risks.
6. Climate Change Risk Management: Assessing the impact of climate change through scenario analysis and estimating its impact on the Group's activities.

DCC's approach integrates risk management at all operation levels, emphasizing emerging risks and climate change, ensuring risk management is integral to strategic planning and decision-making.

Key and Emerging Risks Identified by Dublin City Council:

The principal risks identified by DCC are outlined below:

1. Attracting and Retaining the Right People.
2. Major HSE or Environmental Incident.
3. Global Pandemic.
4. Acquisitions and Project/Change Management.
5. Compliance with Legal and Ethical Standards.
6. Climate Change.
7. IT System Failure/Cybercrime Data Security.
8. Corporate Reporting.
9. Changing Markets and Supply Chains.
10. Continued Effects of the Pandemic.
11. Climate Change and Energy Transition.

2.1.14 Danone

Organisational Overview:

Danone S.A., a French multinational corporation specializing in food products, was established in Barcelona, Spain, in 1919 and is headquartered in Paris. The corporation is a notable entity on the Euronext Paris and is a constituent of the CAC 40 stock market index. In the United States, the company's products are marketed under the brand name Dannon. As of the year 2018, Danone's operations extended to 120 markets globally, generating sales of €24.65 billion, predominantly from specialized nutritional products, branded bottled water, and dairy and plant-based offerings. The company's brand portfolio encompasses both internationally

recognized and local brands, supported by a diverse investment base, including substantial American and French stakeholders.

Risk Methodology:

Danone's risk identification and management system is comprehensive, encompassing strategic, operational, financial and accounting, and compliance risks.

1. **Strategic Risks:** Managed by the Strategic Planning Department, this process includes coordinating risk maps and monitoring global risks that impact Danone at a macro level.
2. **Operational Risks:** Related to various business functions, the Internal Control Department oversees these risks.
3. **Financial and Accounting Risks:** Involves risks in the preparation and processing of financial and accounting information.
4. **Compliance Risks:** Cover risks related to corruption, anti-competitive practices, and non-compliance with personal data protection laws and international trade sanctions laws.

The Risk Committee, consisting of senior executives, plays a crucial role in detecting emerging risks, integrating external inputs into the risk management process, and conducting in-depth analyses of specific risks. Danone's strategic risk mapping, a key aspect of their risk management strategy, forms a hierarchy based on the likelihood and estimated impact on the Group.

Main risks are classified into Strategic, External Environment, and Operational categories, each evaluated based on occurrence probability and expected negative impact. This assessment considers the effectiveness of the implemented risk management measures.

Key and Emerging Risks Identified by Danone:

Danone has identified several main risk factors, along with their management measures and risk ratings:

1. **Packaging:** Emphasis on reducing plastic use and aiming for circular packaging by 2030, with a strong risk rating.
2. **Fast Changes in Consumer Preferences:** Focus on evolving product range and supply chain in response to consumer health awareness, rated as strong.
3. **Retail Shift:** Modifying value proposition in response to post-Covid retail changes and inflation, with a medium risk rating.
4. **Raw Materials and Energy Price Volatility & Availability:** Diversified sourcing and hedging against price volatility, categorized as a strong risk.

5. **Legal and Regulatory:** Navigating dynamic regulatory environments and integrating compliance, rated as a medium risk.
6. **Impact of Climate Change on Value Chain:** Commitment to reducing emissions and engaging in climate initiatives, rated medium in the short term and high in the long term.
7. **Currency Volatility:** Managing foreign exchange rate fluctuations is considered a medium risk.
8. **Unpredictability of the COVID-19 Pandemic:** Focus on agile decision-making and supply chain management, with a medium risk rating.
9. **Cybersecurity:** Comprehensive cybersecurity strategy to mitigate risks of cyberattacks and data breaches, rated as strong.
10. **Food Safety & Product Quality Issues:** Implementing global food safety standards to address potential contamination risks, rated medium.
11. **Shortage of Talent:** Emphasizing continuous learning and diversity to attract and retain talent, rated as a medium risk.
12. **Business Transformations:** Overseeing organizational transformations to prevent disruptions, also rated medium.

2.1.15 Currys plc

Organisational Overview:

Currys plc, a British multinational corporation in the electrical and telecommunications retail and services sector, is headquartered in London, England. Formed on August 7, 2014, via the amalgamation of Dixons Retail and Carphone Warehouse Group, it is listed on the FTSE 250 Index on the London Stock Exchange. The company's operates across Europe, trading under several brand names including Currys in the UK and Ireland, Elkjøp in Norway, Elgiganten and Gigantti in the Nordic countries, and Kotsovolos in Greece and Cyprus.

Risk Methodology:

Currys PLC's risk management strategy, particularly its horizon scanning process, is designed to anticipate and manage both current and future risks over the medium to longer term. The approach involves:

1. **Conducting Reviews of External Thought Leadership:** Analysing insights from external thought leaders to understand market trends and potential disruptions.
2. **Obtaining Views of Key Business Stakeholders:** Gathering opinions from internal stakeholders about emerging risks, ensuring a well-rounded perspective on challenges.

3. **Semi-Annual Updates:** Updating the horizon scanning exercise semi-annually to maintain vigilance and responsiveness.
4. **Review by the Group Risk and Compliance Committee:** The Group Risk and Compliance Committee critically reviews and classifies risks as Principal Risks if needed.
5. **Integration into Risk Management Processes:** Integrating this process into the broader risk management framework, with each business unit actively identifying, assessing, and managing risks, contributing to a comprehensive risk landscape overview.

Key and Emerging Risks Identified by Currys PLC:

Principal Risks identified by Currys PLC include:

1. **Breach of Financial Services:** Mitigation involves board oversight and compliance monitoring.
2. **Business Continuity/IT Data Recovery:** Addressed by detailed strategies and a crisis team.
3. **Business Transformation:** Focused on enhancing digital capabilities and omnichannel strategies.
4. **Crystallisation of Legacy Tax:** Managed through board oversight and expert advice.
5. **Data Protection Compliance:** Ensured through a Data Management Function and Data Protection Office.
6. **Failure of IT Systems and Infrastructure:** Addressed through IT transformation and recovery plans.
7. **Financial Liquidity and Treasury:** Managed through cash monitoring and strategic CapEx prioritization.
8. **Health and Safety:** Comprehensive strategies to minimize risks.
9. **Information Security:** Mitigated through investments in security and dedicated committees.
10. **Macroeconomic Environment:** Managed through adaptable forecasts and business planning.
11. **Commitment to Sustainability:** Highlighting the significance of integrating climate change considerations into business operations to mitigate physical, financial, and reputational risks.
12. **Product Safety:** Managed through audits, inspections, and governance reviews.
13. **Supply Chain Resilience – Logistics/Sourcing:** Addressed by reviewing global sourcing and implementing automation strategies.

These risks are managed through various methods, including regular assessments, compliance monitoring, and assurance activities across the business, with a strong emphasis on communicating the management of these risks to external stakeholders, industry bodies, and regulators. Currys PLC's approach is proactive and integrated, focusing on ongoing

identification and management of risks and ensuring risk management is integral to the company's strategic planning and operational model.

2.1.16 Bupa Insurance Limited

Organisational Overview:

Bupa, officially known as the British United Provident Association Limited, is a British multinational company specializing in health insurance and healthcare services. With its global headquarters in the United Kingdom, Bupa operates in several countries including Australia, Spain, the UK, Chile, Poland, New Zealand, Hong Kong, Turkey, Brazil, Ireland, Mexico, and the United States. It also has a presence in Latin America, the Middle East, and Asia, with joint ventures in Saudi Arabia and India. Bupa is a private company limited by guarantee without shareholders and reinvests its profits. The company provides health insurance to over 24.4 million customers and health provision services to 19.2 million customers worldwide, including hospitals, clinics, dental centres, and digital services. Additionally, Bupa runs aged care facilities in the UK, Australia, Spain, and New Zealand.

Risk Methodology:

Bupa Insurance Limited manages risks and addresses emerging risks via a robust Risk Management Framework, adhering to a structured three lines of defence model for risk governance. This model includes frontline management and staff, a second line of risk management professionals led by the Chief Risk Officer (CRO), and an Internal Audit (IA) function for independent assurance.

Key components of the Risk Management Framework are:

1. **Risk Governance:** Bupa's framework relies on a three-tiered approach, ensuring comprehensive oversight and management of risk at multiple levels.
2. **Risk Appetite and Management:** The Board sets the Group's Risk Appetite and Management Framework, defining principal risks and acceptable risk levels. These guide the company's strategic objectives and business planning.

3. **Framework Principles:** Principles include identifying and understanding risks, establishing clear risk appetites, using risk information for decision-making, and promoting a risk-aware culture.
4. **Regular Reporting and Review:** The company regularly reports risks against set limits, reviews policies annually, and tests the framework's effectiveness through governance reviews and internal assessments.
5. **Stress and Scenario Testing:** A programme of stress and scenario testing helps in identifying, measuring, managing, monitoring, and reporting risks, with detailed reviews undertaken as needed.

Emerging Risks Identified by Bupa Insurance Limited:

The list of risks and mitigation strategies includes:

1. **Underwriting Risk:** Potential deviations from actuarial assumptions in premium rate setting are mitigated through regular actuarial analysis and flexible premium rate adjustments.
2. **Pricing Risk:** Addressed by revising premium rates in response to changes in customer risk profiles and market dynamics.
3. **Claims Risk:** Managed by pre-authorizing claims, setting outpatient benefit limits, and using consultant networks to control medical inflation and claim variations.
4. **Reserving Risk:** Ensured through continuous review of development patterns and maintaining valid assumptions.
5. **Catastrophe Risk:** Although health insurance contracts typically exclude reimbursement for expenses post-catastrophe, the company remains vigilant to such risks.
6. **Concentration of Risk:** Mitigated by diversifying the company's risk portfolio across different countries and product types.
7. **Market Risk:** Managed by investing in highly rated financial instruments and adhering to a strict Treasury Policy.
8. **Foreign Exchange Risk:** Mitigated through hedging and regular reviews of currency exposures.
9. **Interest Rate Risk:** The company holds variable rate assets and liabilities to mitigate this risk.

2.1.17 [Bank of Ireland Group plc](#)

Organisational Overview:

Bank of Ireland Group plc, a major commercial bank operation in Ireland. Headquartered in Dublin, the bank operates in the Republic of Ireland, Northern Ireland, Great Britain, and other regions. Bank of Ireland provides a range of financial services to various sectors. The bank expanded in Great Britain through the takeover of the Bristol and West Building Society and

offers services in several countries, including the United States, through its Corporate Banking division.

Risk Management Approach

The Bank of Ireland has a robust risk management framework to identify and assess various risks, including those related to climate. This approach gives significant weight to environmental, social, and governance (ESG) factors and their impact on the group's risk types. In 2021, climate risk was formally integrated into the Group's risk management process. The Bank of Ireland categorizes climate-related risks into short-term (less than 3 years), medium-term (3-5 years), and long-term (more than 5 years) horizons, aiding in the comprehensive assessment of risks and opportunities related to climate changes. In 2022, the Bank conducted an annual assessment of these risks and opportunities, which was presented to the Group Sustainability Committee (GSC) and the Board Risk Committee (BRC), ensuring high-level oversight. The Bank is also developing methodologies for measuring and monitoring climate risk, aiming to align it with other key risk types. Collaborative efforts include participation in the UNEP FI TCFD Working Group and European Banking Federation Working Groups, as well as involvement in the 2022 European Central Bank climate stress testing exercise.

The Bank employs a three-line defence model for Health and Safety, consisting of responsibility allocation (first line), risk oversight and delivery of awareness programs (second line), and Group Internal Audit (third line). As part of its commitment to the UN Principles of Responsible Banking (UN PRB), the Group undertook its inaugural Materiality Assessment in 2020 to identify material sustainability topics. This involved horizon scanning exercises, peer reviews, and reviews of trends, media, and relevant research, resulting in a shortlist of 25 topics.

The Bank aligns with the European Central Bank (ECB) guidelines on climate risk management, including strategy, risk governance, and measurement. A detailed multi-year Climate Risk Implementation Plan (2021-2024) addresses the ECB's guidance on managing climate-related and environmental risks. In 2022, a key objective was obtaining ISO45001 accreditation for Health and Safety Management, extending the accreditation to cover all Republic of Ireland and Great Britain offices and retail locations.

The Bank plans to continue investing in climate data capabilities and ESG risk management, expanding in 2023 to include non-climate environmental risks. Climate scenario analysis has been integrated into the Bank's Internal Capacity Adequacy Assessment Process (ICAAP), marking a key development in data modelling and risk management capabilities for managing climate-related risks.

2.1.18 Bandai Namco Holdings Inc.

Organisational Overview:

Bandai Namco Holdings Inc., established in 2005 from the merger of Bandai and Namco, is a Japanese multinational conglomerate headquartered in Minato, Tokyo. This entity operates in diverse entertainment sectors, including toys, video games, arcades, anime, restaurants, and amusement parks. The corporation's American operations are overseen by Bandai Namco Holdings USA, which was formed in 2008 and is headquartered in Irvine, California. Since 2017, Bandai Namco has held the distinction of being the world's foremost toy company in terms of revenue, amassing annual sales of approximately \$6.4 billion.

Risk Methodology:

The risk methodology deployed by Bandai Namco Holdings Inc. is not available. Rather than listing the principal risks facing the company, Group-wide themes that present both risks and opportunities are listed. Further details of Bandai's risk management strategy are provided in excerpts from a roundtable discussion with five external directors. They discuss the need to implement information-gathering measures to permit rapid information acquisition and implement counter-measures. The Independent Directors Committee provided the opinion that understanding overseas risks is an issue. One way of improving overseas risk monitoring is through the production of detailed regional reports. According to Outside Director Koichi Kawana: One major risk is a situation where “you don't know what you don't know.” Based on the assumption that there are areas that we do not know much about, it is necessary to focus on those areas in some way. To that end, connections with diverse people of differing genders, nationalities, and ages are important. That is because if a group of people all have similar backgrounds, their view of the world will naturally be limited.

The main driver behind this risk management approach is to remain relevant, described under "The Purpose", and express the meaning of Bandai Namco's existence for society, the reason why they conduct business operations and corporate activities, and the significance of their working at Bandai Namco. Bandai Namco recognises that their fan base is essential to remaining viable. Forging connections with fans worldwide is highlighted as a key strategy.

Key and Emerging Risks Identified by Bandai Namco Holdings Inc.:

Major Group-wide Risks and Opportunities identified by Bandai Namco Holdings Inc. are:

1. **Items Accompanying the Spread of COVID-19:** Bandai Namco Group is impacted by COVID-19 through retail closures, event disruptions, and operational challenges in product development and distribution. They address these by enhancing hygiene, adapting to government guidelines, deploying business continuity plans, and embracing digital technologies and new working styles.
2. **Advancement of the IP Axis Strategy:** The group faces challenges such as rapid market shifts, IP dependency, and competition. To combat this, they focus on cross-regional collaboration, brand enhancement, strategic IP management, and balanced portfolios alongside strategic investments.
3. **Changes in the Natural Environment (e.g., Climate Change):** Environmental regulations and natural disasters pose risks like increased costs and supply chain disruptions. The group responds with energy-saving initiatives, low-carbon energy use, recycling efforts, and investments in new technologies and materials.
4. **Items Accompanying Other External Factors:** External factors like political changes, legal revisions, and cyber threats impact the group. They counteract these risks through business continuity planning, robust risk management, cybersecurity systems, and community engagement.
5. **All Businesses (Network Environment and Technological Progress):** The expanding network environment and technological advancements offer opportunities for customer engagement through digitalization. The group leverages online platforms, new technologies, and digital initiatives to enhance IP recognition.
6. **Entertainment Unit (Digital Business):** Challenges in digital business include platform diversification and increased development investment. The group addresses these by adapting to new platforms, enhancing technical research, and prioritizing development quality.
7. **Entertainment Unit (Toys and Hobby Business):** The toys and hobby business faces demographic shifts, cost increases, and production concentration. Bandai Namco Holdings Inc. expands its customer base, reforms its value chain, promotes recycling, and diversifies manufacturing bases in response.
8. **IP Production Unit:** Intense competition in IP creation is a challenge. The group consolidates studio functions, invests in production technologies, and focuses on developing and retaining talent to strengthen its position.
9. **Amusement Unit:** The diversification of entertainment in real venues presents both challenges and opportunities. The group strengthens its foundation by collaborating with group resources and stabilizing its business foundation.

2.1.19 An Post

Organisational Overview:

An Post, the state-owned postal service provider in Ireland, was established in 1984 under the Postal & Telecommunications Services Act of 1983. The organisation emerged from the division of the Department of Posts and Telegraphs into An Post and Telecom Éireann (now Eir). An Post operates as a member of the Universal Postal Union, offering a range of services including letter post, parcel service, deposit accounts, and express mail services both nationally and internationally. Additionally, An Post is involved in various joint ventures and has several subsidiaries, including full and partial ownerships in entities like the An Post National Lottery Company and the Prize Bond Company Limited.

Risk Methodology:

An Post's risk management approach is designed to enhance decision-making and strategic planning, integrating key methods and principles:

- **A Robust and Dynamic Risk Process:** It is integral to An Post's strategic planning, focusing on decision-making.
- **Oversight and Effectiveness:** The Board Audit and Risk Committee (ARC) and senior management oversee risk control and assurance matters, employing a multilayered defence strategy. This includes management controls, risk management functions, compliance assurance, and internal audit processes.
- **Risk Assessment:** Key risks are biannually assessed by the Board, involving a top-down assessment of risk, risk appetite, and evaluation of the external business environment. This includes reviews within business units and corporate functions to identify emerging risks.
- **Audit and Risk Committee (ARC):** Comprising board members with financial and audit expertise, the ARC shapes the risk management policy, including risk appetite, management processes, and staff responsibilities. Staff are expected to adhere to these policies, alerting management to emerging risks and weaknesses.
- **Risk Register:** An essential tool for identifying, evaluating, and grading key risks, which is reviewed and updated biannually by the ARC. It details controls and actions for risk mitigation and assigns responsibilities for control operations. The register ensures the maintenance of a control environment with documented business process procedures, financial responsibilities, and a regularly reviewed budgeting system.

Supplementing this approach, An Post employs the "Three Lines of Defence" model:

1st Line of Defence: Management Controls and Internal Control Measures.

2nd Line of Defence: Risk Management and Compliance Measures.

3rd Line of Defence: Internal Audit, providing independent assurance to the Board and Senior Management on the adequacy and effectiveness of risk management processes.

This model sits within an External Audit framework, with specialist risk management and compliance assurance functions responsible for independent risk-based monitoring.

The principal drivers for this approach are the achievement of strategic objectives and the avoidance of damage to long-term performance and development. An Post continually monitors internal and external developments to identify emerging risks and assesses individual risks by considering the external environment and existing controls. Each risk is evaluated based on the likelihood and potential impact of occurrence, considering the effectiveness of existing preventative controls.

Principal Risks and Uncertainties:

1. **Global Economic & Political Environment Uncertainty:** Managed by monitoring economic and political trends.
2. **IT Risk:** Addressed through an IT Technology Roadmap and cybersecurity investments.
3. **Mails Universal Service Obligation:** Sustainability challenges countered by engaging with shareholders and regulators.
4. **Inflexible and Inefficient Cost Structure:** Managed by partnering with Trade Unions.
5. **Loss of Significant E-Commerce Customers:** Mitigated by meeting customer service and pricing expectations.
6. **Stakeholder Support - Delays to Key Initiatives:** Managed through regular stakeholder communication.
7. **Retail Network Sustainability:** Addressed by collaborating with the government.
8. **Customs 2020:** Managed through collaboration to address EU Customs changes.
9. **Unsustainable Level of Absenteeism:** Managed with internal and external staff supports.
10. **Expansion of Major Online Retailer:** Mitigated by maintaining service standards.
11. **Financial Services Regulatory Compliance:** Managed by a compliance framework.
12. **Financial Services Profitability:** Addressed by reviewing infrastructure and business models.

2.1.20 Allianz Darta Saving Life Assurance DAC

Organisational Overview:

Allianz Darta Saving Life Assurance DAC, trading as Allianz Darta Saving, is an Irish life assurance company established in 2003 and headquartered in Dublin. It operates as a fully owned subsidiary of Allianz SpA of Italy, forming part of the global Allianz Group. The company specializes in offering innovative savings and investment products across the European market, adhering to the EU Freedom of Services directives. It also provides tailored services to high-net-worth customers, with a focus on flexible products and sophisticated service. Allianz Darta Saving prides itself on a competitive cost base and operates within a strongly regulated insurance environment.

Risk Methodology:

Allianz Darta Saving Life Assurance DAC employs a robust horizon scanning process for identifying and evaluating emerging risks, which is an integral part of its broad risk management framework. This framework includes the Top Risk Assessment Process, utilized at both the business operation and company levels. Additionally, the organisation undertakes a Quarterly Review of Emerging Risks, ensuring new risks are promptly recognized and addressed. The Risk Appetite Strategy and Risk Policies are aligned with the company's strategic objectives and business plan, ensuring that risks taken are consistent with the business strategy and that the returns are balanced against these risks. This strategic alignment guarantees that the capital required and delegated authorities are in line with the company's overall risk capacity and strategy.

The company identified several "Material Risks" in their Risk Profile for 2022, including:

Life Underwriting risk, which encompasses:

1. Expense Risk: involves potential loss or adverse change in the value of insurance liabilities due to changes in expenses incurred in servicing policies.
2. Lapse Risk: the risk of loss or adverse change in policy value due to changes in policy lapse rates.
3. Mortality Risk: the risk of loss or adverse change in insurance liabilities due to changes in mortality rates

4. Life Catastrophe Risk: defined as a sudden increase in mortality rates affecting technical provisions calculations.

Additionally, **Market Risk, Credit Risk (Counterparty Default), Liquidity Risk, and Operational Risk** form integral components of the risk profile, each with its unique assessment and mitigation strategies.

Key points regarding the organization's method include a regular assessment of **Own Risk and Solvency needs (ORSA)** using a 4-component risk management framework. This framework includes:

1. Risk identification and assessment
2. Risk Appetite Strategy and policies
3. Risk reporting and monitoring
4. Communication and transparency

Emerging risks are identified and discussed at least quarterly, with projections aligned with a three-year planning horizon. The risk reporting and monitoring system includes emerging risk radars as part of the qualitative and quantitative risk-reporting framework, providing Senior Management and Directors with transparent risk indicators. The company implements a Three Lines of Defence model in its Risk Management Framework, comprising:

- Business Operations
- Oversight and Challenge; and
- Independent Assurance.

3.0 National Risk Assessment Methodologies in Practice

This chapter identifies the methods underpinning the production of National Risk Assessments in EU member states and beyond. For EU members, the choice of methods has been left to the individual states. This flexibility allows governments to choose methods which reflect national risk governance, the resources available to complete the NRA, and the risk profile of the country.

NRAs are typically based on one of four methods: (i) expert focus groups; (ii) analysis of quantitative data; (iii) scenario analysis by specialists (often reasonable worst-case scenarios); or (iv) based on a “writing” group of risk management experts; or a combination of these methods.

To illustrate the range of methods deployed, case studies on Canada, Croatia, Cyprus, Denmark, Finland, Netherlands, New Zealand, Slovenia, UK, USA, Poland, Italy, and Romania are presented. The choice of countries was based on providing a range of risk contexts, a diversity of geographic locations, and the availability of relevant materials in English. Appendix 9.2 NRA References, includes the sources on which the NRA profiles were based and may be used to gain a more detailed understanding of the approach followed in each country.

In general, NRAs were carried out under Article 6. 1 (d) of Decision 1313/2013/EU of the Council of the European Union and the European Parliament on a Union Civil Protection Mechanism (UCPM), which requires Member States to submit a summary of national risk assessments to the Commission every 3 years, and/or the UN Sendai Framework for Disaster Risk Reduction 2015-2030, which contains guidelines on national disaster risk assessment (NDRA) and supports disaster risk awareness. While all the nations surveyed are signatories

to the Sendai Framework, only Poland, Cyprus, Romania, and Canada cite the Framework as the driver behind undertaking the NRA.

3.1 Canada

3.1.1 Overview/Introduction

The 2023 National Risk Profile (NRP) is Canada's first strategic, national-level risk assessment.

The NRP focuses on the 3 most costly risks to the nation: earthquakes, wildfires, and floods.

It also contains a chapter covering how pandemics impact effective disaster management. The

NRP provides government (at all levels), stakeholders and the public with an evidence-based assessment of Canada's key risks and gaps in the emergency management system.

3.1.2 Methodology

Twelve virtual risk assessments were conducted with 294 cross-societal experts, stakeholders and representatives (with particular care taken to include members of indigenous communities). Following an initial briefing on the hazard, location, hypothetical series of events, and preliminary estimates of the scenario, each impact category (People, Economy, Environment, Social Function, Government) was reviewed. Impact was assessed on a 6-point scale from 0 (None) to 6 (Catastrophic). After a facilitated discussion, a vote was taken to evaluate the near-term (within the next five years) risk of the hazard.

Experts led a discussion and then assigned a likelihood rating to each scenario. The likelihood rating was based on historical data, predictive models, and expert judgment. Likelihood values were based on each scenario, and the location and magnitude of the event were considered. The likelihood scale ranged from 0 – None - less than 0.01% per year (once per 100,000 years) to 5 – Catastrophic – 63% change per year or more.

3.1.3 Components/Outputs

The report focuses on the three costliest hazards:

- earthquakes
- wildland fires
- floods

providing an overview, cost and loss analysis, risk assessment, and identifying disaster management capability gaps. Changing climate, increasing population density and projected changes in demographics were identified as drivers that will exacerbate the risks in the future.

3.1.4 Conclusion

This initial NRP report is a foundational step in understanding Canada's disaster risks and building national resilience. It does not propose policy solutions but aims to support a whole-of-society approach to emergency management. In the future, the NRP will expand to consider other disaster risks, including human-induced hazards such as terrorism and cyber-attacks.

3.2 Croatia

3.2.1 Overview/Introduction

The Croatian Government, adhering to the Union Civil Protection Mechanism, issued a comprehensive Disaster Risk Assessment to enhance understanding and management of risks stemming from natural hazards, technical-technological disasters, and major accidents. The Croatian Assessment set out to standardize risk assessments, consolidate data for future planning, and address the social and economic impacts of disasters.

3.2.2 Methodology

Building on a previous 2015 risk assessment, a Main Working Group consisting of state administration bodies/NGO representatives identified 28 risks distributed in 11 groups. Each risk group is assigned a coordinator/ministry/other state body, while each risk is assigned a bearer(s) and executor(s). Separate working groups of relevant experts create two scenarios for each risk:

1. The most likely adverse event.
2. An event with the worst possible consequences.

Based on consequences and likelihood, these are plotted on two separate matrices. The impact of each scenario, from insignificant (1) to catastrophic (5), is evaluated based on the consequences for:

- Life and health of people
- Economy
- Social stability and politics

The likelihood (probability) score is also rated a 5-point scale:

- 1 = 1 event in 100 years or less often
- 2 = 1 event in 20 to 100 years
- 3 = 1 event in 2 to 20 years
- 4 = 1 event in 1 to 2 years
- 5 = 1 event per year or more often

The working group assessed the reliability of the NRA on a 4-point scale from 1 (very low unreliability) to 4 (very high unreliability), based on their knowledge of the available data, experts, and selected methodologies. The unreliability score for each risk is visualised on an unreliability triangle. Croatia's NRA utilises a cartographic display of risk levels for each risk within its borders.

3.2.3 Components/Outputs

The key risks identified are:

- Diseases of plants
- Animal diseases
- Extreme temperatures
- Epidemics and pandemics
- Industrial accidents
- Floods caused by the spilling of terrestrial bodies of water
- Earthquake
- Open fires

- Snow and ice
- Drought
- Land salinity
- Complex risk
- Nuclear accident
- Radiological accidents
- Landslides
- Sea pollution

While no emerging risks were identified in the Croatian NRA, a special working group was set up to study the impact of climate change on each risk. This working group included experts from the Ministries of Environmental Protection and Energy, the State Hydrometeorological Institute, and the Ministry of the Interior. Based on their findings, the Main Working Group then reported on the impact of climate change on each individual risk.

3.2.4 Conclusion

The Croatian NRA emphasises the importance of continuous adaptation and improvement in risk assessment methodologies and data collection. It acknowledges the evolving nature of risk assessment processes and aims for future revisions to incorporate changes in conditions, methodologies, data, and emerging risks, highlighting a shift towards strengthening risk management and reduction strategies.

3.3 Cyprus

3.3.1 Overview/Introduction

The NRA for Cyprus (2018) is a comprehensive study conducted to evaluate the risk from predefined hazards such as earthquakes, tsunamis, floods, water scarcity, large-scale technological accidents, forest fires, sea level rise, coastal erosion, and marine pollution. Coordinated by the Cyprus University of Technology, this report aims to provide an integrated risk matrix and develop strategies for risk mitigation based on the NRA.

3.3.2 Methodology

The methodology adheres to the Sendai Framework, EU risk assessment guidelines, and ISO standards on risk management (ISO 31000) and risk assessment techniques (ISO 31010).

Scenario analysis is used to identify the hazard scenarios and to execute the impact analysis using risk indices and a scoring approach in accordance with ISO 31010. Fault tree analysis and event tree analysis of specific applications (e.g., large-scale technological accidents) is also used. The methodology used is delineated into four tasks:

Task 1: Hazard scenario identification:

Hazard scenarios are identified based on historical data, reports from governmental departments, scientific reports, and research reports prepared by Cypriot (public and private) universities.

Task 2: Exposure and vulnerability of socioeconomic parameters:

For every hazard, using a numerical rating scale, exposure and vulnerability are assessed in four categories:

- human
- economic
- environment
- political/society

Task 3: Probabilistic scenarios analysis

The probability of each hazard scenario occurring is determined. The Likelihood scale used is:

- 1 event in more than 150 years = 1 = Very unlikely
- 1 event in 50 to 150 years = 2 = unlikely
- 1 event in 10 to 50 years = 3 = possible
- 1 event in 2 to 10 years = 4 = likely
- At least every 2 years = 5 = very likely

Task 4: Quantification of existing treatment measures and suggestions for adaptation and mitigation measures

The risks are plotted on an overall National Risk Matrix, and suggestions for risk treatment/mitigation are presented.

3.3.3 Components/Outputs

The 2018 Cypriot NRA produced the following risks:

- Earthquake
- Tsunami
- Floods
- Water shortage
- Technological accidents
- Forest fires
- Sea level rise
- Sea pollution
- Complex/cascading incidents

3.3.4 Conclusion

The Cypriot NRA serves as a crucial step toward understanding and mitigating the risks facing Cyprus. By providing detailed analyses and recommendations, it aims to enhance disaster preparedness and resilience. The integration of independent studies on climate change and desertification further enriches the assessment, offering a broader perspective on the environmental challenges faced by Cyprus.

3.4 Denmark

3.4.1 Overview/Introduction

The 2022 National Risk Profile (NRP) for Denmark assesses risks to Danish society with a medium-to-long-term perspective. It focuses on creating awareness about known risks and is intended as a tool for preparedness planning.

3.4.2 Methodology

Experts from the Danish Emergency Management Agency (DEMA) identify incident types, how these risks occur, and the requirements necessary for their management. The NRP has a medium-to-long-term perspective and outlines the incident types that DEMA assesses as warranting the most attention within the next five years from a preparedness perspective.

Their initial selection is based on whether the incident types can:

- Manifest as incidents, understood as limited events (in time and space).
- Create serious and immediate negative consequences within Denmark's borders.
- Trigger an acute need for coordination and crisis management at a level that is not merely local.

The initial list is narrowed down to 14 incident types based on assessments of possible direct or residual consequences on six parameters: life, health, environment, economy, property, and vital societal functions.

The NRP 2022 consists of one chapter for each of the 14 incident types, broken down by characteristics, occurrence, and consequences. Further, each incident type is illustrated with past examples and a "What if?" (Realistic Worst Case Scenario).

A risk matrix is not presented, and incident types are not given a likelihood rating, instead they are rated according to the challenges and consequences associated with them. The following aspects of each are rated individually, then amalgamated into a single score:

Challenges

- Duration
- Geographical extent
- Frequency
- Indication/warning

Consequences

- Life
- Health (injury, illness, infection/contamination, anxiety, insecurity, etc.)

- Environment (contamination of land and water environments, damage to animal and plant life)
- Economy (monetary loss)
- Property
- Vital societal functions

The scores, as presented in the NRP, are in part an assessment of the RWCS for each incident type and, in part, a weighted average from the underlying analysis. The figures are presented in intervals rather than being assigned a specific value.

3.4.3 Components/Outputs

The Danish NRP identifies the following risks to the nation:

- Heat waves and drought
- Storms and hurricanes
- Coastal flooding
- Extreme rain
- Highly virulent diseases
- Animal diseases
- Water and foodborne diseases
- Nuclear accidents
- Accidents with chemical substances
- Maritime accidents
- Transportation accidents
- Cyber incidents
- Terrorist acts
- Space incidents

3.4.4 Conclusion

The Danish NRP emphasizes the importance of continuous preparedness and learning from past experiences, such as the COVID-19 pandemic. It calls for a collaborative, cross-sectoral approach to managing the identified risks and strengthening societal resilience.

3.5 Finland

3.5.1 Overview/Introduction

The NRA of Finland, the most recent iteration of which was produced in 2023, is conducted by the Ministry of the Interior and designed to anticipate relatively sudden incidents requiring non-standard responses from authorities or even the solicitation of international assistance. The assessment identifies risks with a broad national impact, evaluating their effects on the vital functions of society.

3.5.2 Methodology

The methodology, based on the Union Civil Protection Mechanism outlined in Decision No 1313/2013/EU of the European Parliament and Council, involves a cross-sectoral preparatory group comprising representatives from various ministries and organizations. This consists of expert "writing groups", at which experts drawn from the relevant branch of government administration come together to write their own threat scenarios and disruptions. The writing groups' efforts are then combined and edited into their final form by the national risk assessment working group, led by the Ministry of the Interior, and supported by the Secretariat of the Security Committee.

The process builds on previous assessments, with the threat scenarios and disruptions from the 2018 edition checked (in cross-sectoral cooperation) to ensure they are up to date. The competent ministry or the representative of the administrative branch is responsible for writing new threat scenarios and disruptions. Expert opinions from the ministries' respective branches of administration are also used in the revision. The outputs of different administrative branches are combined and edited into their final form in the national risk assessment working group.

For the previous 2018 edition, the changing trend of a risk's likelihood was assessed (i.e., whether the likelihood of it happening is predicted to increase, decrease or remain the same) and whether it has a direct or indirect impact on the vital functions of leadership, international and EU activities, defence capability, internal security, economy, infrastructure and security of supply, functional capacity of the population and services, and psychological resilience, while the direct/indirect magnitude of the impact was assessed on a three-point scale from minor to severely compromising. For the most recent 2023 edition, this approach was adapted so that Likelihood is no longer assessed, only the extent of a risk's impact - minor (*), significant (**), severely compromising (***) or no impact (-) - on the same seven vital functions.

3.5.3 Components/Outputs

A large number of risks are identified in the Finnish NRA:

- Information influence activities
- Political, financial, and military pressure
- Use of military force
- Mass influx of migrants and instrumentalisation of migration
- Terrorist act or another violent act targeting the structures of society or large crowd
- Violent civil disturbances involving large crowds, groups or communities or actions compromising social order
- Disruption of the public economy
- Disruption of the financial system
- Major disruption in power supply
- Severe disruption in the availability of fuels
- Disruptions in information and communications networks and services
- Disruptions in the continuity of transport
- Antimicrobial drug resistance
- Pandemic or similar widespread epidemic
- Animal disease epidemics
- Disruptions in water supply
- Disruptions in food supply and deterioration of food and nutrition security
- Maritime multi-sector accident
- Severe nuclear power plant accident in Finland or Finland's neighbouring areas
- Several simultaneous extensive wildfires
- Extremely strong space weather storm

Finland has identified an extensive number of emerging risks (termed stressors):

- Biodiversity loss
- Risks that are reflected in Finland from outside the country's borders (e.g., industrial supply chains, increase the likelihood of large-scale immigration and influence the financial market, economy and the national security of supply)
- Transition risks refer to risks arising from the transition towards a low-carbon society. (FL)
- Cybercrime
- Societal inequality
- Polarisation
- People's physical functional capacity
- Misinformation
- Digital marginalisation
- Armed conflict
- Attractiveness of populist movements
- Global value and supply chains
- Market functionality
- Security of supply

3.5.4 Conclusion

The conclusion to the Finnish NRA highlights the period during which the risk assessment was prepared, marked by Finland's NATO accession process and the ongoing between Ukraine and Russia. It underscores the new uncertainties facing the security of society due to changes in the operating environment, the shortened advance warning period of security threats, and the challenges these pose for preparedness measures, decision-making, and operational capabilities of authorities. The document emphasizes the importance of understanding the interdependencies within society and the potential for cascading impacts from simultaneous disruptions, illustrating the complexity of managing and preparing for national risks.

3.6 Netherlands

3.6.1 Overview/Introduction

The Dutch NRA establishes a framework for analysing a broad spectrum of threats, leveraging scenarios to assess their potential impact and likelihood. This foundational document supports national security strategy development and resilience assessments.

3.6.2 Methodology

The National Network of Safety and Security Analysts (ANV), which consists of a permanent core of seven organisations, forms the Task Group, which produces the National Risk Profile (and underlying studies). The Task Group is supported by a "Ring" of other organisations (consultancy firms, research agencies, etc.) The Task Group and the Ring adopt the following approach:

- All hazard collection of developments and accompanying risks and threats.
- Translation to scenarios (possible ways of manifestation).
- Scoring of Impact, and Likelihood based on case studies, literature review and expert consultation sessions. This produces an overall risk assessment.
- Apply an integrated perspective (cross-cutting links, connections, etc.)
- Risk assessment of an integrated nature.

A potentially disruptive impact on society is determined if at least one of the six national security interests is seriously affected:

- Territorial security
- Physical safety
- Economic security
- Ecological security
- Social and political stability
- International legal order

This impact is then classified into one of 5 severity classes from A-E:

- A = Limited
- B = Substantial
- C = Serious
- D = Very serious
- E = Catastrophic

Likelihood is captured on a 5-step scale:

- Very unlikely = Less than 0.05% chance incident will take place in the next 5 years = No specific indications; inconceivable
- Unlikely = 0.05 to 0.5% chance incident will take place in the next 5 years = No specific indications; somewhat conceivable
- Somewhat likely = 0.5 to 5% chance incident will take place in the next 5 years = No specific indications; conceivable
- Likely = 5 to 50% chance incident will take place in the next 5 years = Indications; very conceivable
- Very likely = More than 50% chance incident will take place in the next 5 years = Specific indications that scenario is going to happen

3.6.3 Components/Outputs

The 2022 iteration of the Dutch NRA identified risks:

- Flooding from the sea
- Pandemic caused by a virus transmissible from human to human
- IS seizes power in Morocco
- Deployment of nuclear weapons in the Iran and Saudi Arabia conflict
- Induced earthquake
- Chain effects of a power outage
- Reunification of China and Taiwan
- Temporary occupation of an EU Member State
- River flood
- Flu pandemic
- Collapse of the Venezuelan state
- Disintegration of NATO
- Systemic actor in the finance sector facing great difficulty
- Hurricane
- Heat/drought
- Import of fossil energy
- Attack on a cloud service provider
- Borssele nuclear plant

- Train disaster with flash fire
- Ransomware attack on telecommunications provider
- Trade war involving Europe
- Multiple terrorist attacks
- Disruption of payments
- Foreign state acquiring a stake in a major telecommunications provider
- Infiltration of public administration
- Snowstorm
- Crisis in the South China Sea
- Rift within the EU
- Criminal violence targeting media and government
- Foreign interference in diaspora communities
- Assault on and hostage-taking in parliament
- Nationwide blackout
- (Covert) Influencing by China
- Social polarisation surrounding conspiracy theories
- Break-up of Bosnia-Herzegovina
- Hybrid operations by Russia – exploiting societal debate
- Flu epidemic
- Trade disruption due to production issues abroad
- Wildfires
- Radiation accident in Europe
- Failure of an ammonia storage tank
- European debt crisis
- ICS cyber attack – chemical industry
- Ransomware attack in the healthcare sector
- Terrorist attack using a bioweapon
- Disintegration of the OSCE
- Attack on pride event
- Naturally occurring earthquake
- Escalation of violence by right-wing extremists
- Anarcho-extremism
- Foreign regulation of tech companies
- Subversive enclaves
- Cyber espionage target at public authorities
- Organised crime throughout the Netherlands
- Outbreak of foot and mouth disease among cows
- Traditional state espionage
- Innovation of nuclear delivery systems
- Adjustment of the value of financial assets
- Misconfiguration at major ISP
- Criminal interference in business
- Anti-government extremism
- Collateral damage

The following, referred to as latent threats that do not have a direct major impact on national security but could certainly create considerable impact in the long term, are also listed:

- Antimicrobial resistance (AMR)
- Food crises
- Foreign influencing (hybrid threats)
- Organised crime
- Technological developments, e.g., AI and quantum computing
- Shortages in the labour market
- Climate change

3.6.4 Conclusion

Emphasizing the dynamic nature of threat assessment, the document highlights the importance of periodic reviews to adapt to emerging threats. It calls for an holistic approach to resilience and crisis management, considering the interdependencies among various risks.

3.7 New Zealand

3.7.1 Overview/Introduction

The risks listed in New Zealand's classified National Risk Register are determined by Risk-Coordinating Agencies who are responsible for leading the assessment of risks (e.g., Earthquakes - National Emergency Management Agency; Wildfire - Fire and Emergency New Zealand). These agencies draw on relevant evidence and subject matter expertise to identify opportunities to reduce risk and improve resilience.

3.7.2 Components/Outputs

New Zealand's Nationally Significant Risks, as outlined on the website of the Department of the Prime Minister and Cabinet (DPMC), are:

Natural and environmental hazards

- Drought
- Earthquake
- Coastal hazards
- Floods
- Severe weather

- Space weather
- Tsunami
- Volcanic activity
- Wildfire
- Biodiversity loss
- Ecosystem disruption (soil)
- Resource depletion (marine fisheries)

Biological and human health hazards

- Pests and diseases
- Communicable diseases
- Vector-borne diseases
- Food safety incident

Technological hazards

- Global navigation satellite system (GNSS) disruption
- Critical infrastructure failure
- Critical infrastructure failure
- Fire and explosions
- Hazardous substances emergency
- Major oil spill
- Radiological incident
- Major transport incident

Economic crises

- Commodity/energy price shock
- Major trade disruption
- Financial crisis

Malicious threats

- Armed conflict
- Weapons proliferation
- Civil unrest
- Corruption
- Foreign interference and espionage
- Pacific Regional Instability or emergency
- Mass arrivals
- Major cyber incident
- Maritime territorial incursion
- Terrorism
- Transnational organised crime
- Border incursion

3.7.3 Conclusion

New Zealand's comprehensive assessment of nationally significant risks underscores the multifaceted nature of the challenges it faces. The need for a concerted effort from government agencies, communities, and international partners to mitigate these risks through

evidence-based strategies, enhanced preparedness, and adaptive management is emphasised.

3.8 Slovenia

3.8.1 Overview/Introduction

The Slovenian NRA (2018) is based on the EU Civil Protection Mechanism and national legislation, aiming to enhance disaster risk understanding and management. The NRA document serves as a public reference for risk assessments and also supports various activities including planning, prevention, readiness, and risk management across different sectors.

3.8.2 Methodology

In the Slovenian NRA risks are ordered onto 4 matrices, one per impact category, and an overall ranking.

Impact is assessed based on:

- Influences on people
- Economic and environmental influences and influences on cultural heritage
- Political and social influences

The overall (united) impact of a risk on the final risk matrix is the average of its impact across the 3 categories, scored as follows:

- 1 = average value of 1.00 – 1.49
- 2 = average value of 1,50 – 2,49
- 3 = average value of 2,50 – 3,49
- 4 = average value of 3,50 – 4,49
- 5 = average value of 4,50 – 5,00

Likelihood is assessed on a 5-point scale:

- 1 = once above 250 years (annual probability to 0.4 %)
- 2 = once in 100 to 250 years (annual probability from 0.4 to 1%)
- 3 = once in 25 to 100 years (annual probability from 1 to 4 %)
- 4 = once in 5 to 25 years (annual probability from 4 to 20 %)

5 = once or several times in 5 years (annual probability above 20 %)

3.8.3 Components/Outputs

The risks identified in the Slovenian NRA are:

- Earthquake
- Floods
- The dangers of biological, chemical, environmental and of unknown origin for human health (after 2017 Epidemics or pandemics contagious diseases in humans)
- Particularly dangerous diseases animals
- Nuclear or radiological accident
- Railway accident
- Aviation accident
- Wildfires
- Terrorism
- Drought
- Snow
- Accidents with dangerous substances
- Accidents on the sea
- Cybernetic risks
- Diseases and pests in forest trees

3.8.4 Conclusion

The Slovenian NRA document underscores the importance of continuous risk assessment improvement and adaptation to changing conditions. It highlights the collaborative approach to risk assessment and the integration of climate change considerations into the national risk assessment framework.

3.9 UK

3.9.1 Overview/Introduction

The 2023 UK National Risk Register (NRR) is an external version of the National Security Risk Assessment (NSRA), assessing the most serious risks facing the UK, including threats to life, health, society, critical infrastructure, economy, and sovereignty. It identifies 89 risks across 9

themes and emphasizes a reasonable worst-case scenario approach for planning and response. The UK NRR is produced at two/three-year intervals.

3.9.2 Methodology

Risks were identified for inclusion in the NSRA by consulting a wide range of experts from across UK Government departments, the devolved administrations, the government scientific community and outside of government (for example, partner agencies, academic institutions and industry). Risks are owned by departments or other government organisations, who are responsible for assessing the impact and likelihood of their risks.

To ensure that the assessment process is robust, risks are reviewed by a network of experts. These include professionals from industry, charities, and academia, as well as subject matter experts within government.

Risks in the NSRA and NRR are assessed as reasonable worst-case scenarios. The scenarios for each risk were produced in consultation with experts, and data was collected from a wide range of sources.

While the UK NRR has always utilised a Risk Matrix, the nature of this has evolved across iterations. Up to and including the 2017 edition, risks identified were split into 2 categories: (1) hazards, diseases, accidents, and societal risks and (2) malicious attack risks. The first group of risks were placed on a risk matrix according to the traditional impact by likelihood scores, while the second group were placed on a risk matrix according to impact and plausibility scores. The likelihood and plausibility scales were not directly comparable.

This approach was revised in 2020 so that no distinction is made between hazards, diseases, accidents, and societal risks and malicious attack risks - all risks are plotted on the one matrix.

This alteration has been retained for the 2023 NRA.

The Impact and Likelihood scoring system has also changed in response to the shifting risk landscape. Likelihood had been measured on a scale of 1-5, with 1 being a 1 in 20,000 chance of the risk occurring in the UK in the next five years and the probability of the risk increasing roughly tenfold for every step on the scale (2017 edition). This was later altered to the probability of the reasonable worst-case scenario occurring in the next year (2020) and further changed in the 2023 edition to the percentage chance of the reasonable worst-case scenario occurring at least once in the assessment timescale (5 years for non-malicious risks, 2 for malicious risks).

Impact is assessed according to how the reasonable worst-case scenario affects a set of indicators, with these scores being combined to provide a single overall impact score. The

2020 indicators were:

- Economic impacts
- Fatalities in the UK
- Evacuation and shelter
- Public perception
- Environmental damage or contamination
- Essential services
- Electricity supply
- International relations

The 2023 indicators are:

- Human welfare
- Behavioural impacts, including changes in individuals' behaviour or levels of public outrage
- Essential services
- Economic damage
- Environmental impact
- Security
- International impacts

3.9.3 Components/Outputs

The UK national risk assessment includes detailed risk assessments across terrorism, cyber threats, state threats, geographic and diplomatic risks, accidents and systems failures, natural and environmental hazards, health concerns, societal issues, and conflict and instability. Each risk is evaluated for its likelihood and impact, with emergency response requirements outlined. In addition, four "long-term trends" that will influence the evolution of risks and that merit monitoring are highlighted in the 2023 report:

- Climate change
- Geopolitics
- Technology
- Health and demographics (including antimicrobial resistance (AMR))

3.9.4 Conclusion

The document underscores the UK's evolving risk landscape, highlighting the importance of transparent, informed planning and resilience building across government and society. It stresses a collective approach to tackling acute and chronic risks, aiming for a safer, more secure, and prosperous nation.

3.10 USA

3.10.1 Overview/Introduction

The Disaster Recovery Reform Act of 2018 (DRRA) requires the United States Federal Emergency Management Agency (FEMA) to "complete a national preparedness assessment of capability gaps". To meet this requirement, FEMA is developing a suite of assessment products, known collectively as the National Risk and Capability Assessment (NRCA), that will measure risk and capability across the Nation in a standardized and coordinated process.

The 2019 National Threat and Hazard Identification and Risk Assessment (THIRA) is FEMA's approach to national-level risk assessment, focussing on the most challenging threats and

hazards, setting capability targets, and measuring national capabilities to handle these challenges.

3.10.2 Methodology

FEMA's methodology for the 2019 National THIRA consists of a **4-stage process**:

Stage 1: A literature review of 55 sources (including modelling data of relevant threats and hazards, national-level catastrophic plans, FEMA Region THIRAs, historical data from previous incidents, National Planning Scenarios, private and non-profit sector risk assessments, and National Planning Frameworks) and engagement with 43 offices and programs across the Federal Government to develop a preliminary list of 59 threats and hazards.

Stage 2: Consultation with subject-matter experts (SMEs) and a review of a preliminary list of threats and hazards to develop a refined list of nine scenarios spanning six threats and hazards—including natural and human-caused incidents—that would most challenge the Nation's capabilities.

Stage 3: Development of a set of 29 standardized scenario impacts, based on a review of catastrophic plans (all 216 models and modelling tools in the Modelling and Data Inventory, which catalogues data and models used across the Federal interagency) to identify the most common types of impacts and engagement with 43 Federal interagency stakeholders and over 100 community stakeholders. These standardized impacts represent key metrics that emergency managers use to understand the magnitude of a disaster, such as fatalities or the number of people requiring shelter.

Stage 4: Finalization of 22 specific, quantifiable capability targets, composed of:

- An impact, which represents the size of the capability requirement.
- A critical task, which represents the specific action needed to achieve the capability target.

- A timeframe metric, which represents the timeframe in which the action must be performed.

3.10.3 Components/Outputs

FEMA eschews the traditional likelihood assessment and instead relies upon expert opinion and stakeholder feedback to determine which risks should be prioritised. The risks identified include:

- **Earthquake:** Affecting areas nationwide, including a specific focus on Washington, Oregon, California, Idaho, and a 600,000 sq. km region in the Midwest/East.
- **Hurricane:** With scenarios ranging from Galveston, Texas to the Midwest, and from Fort Lauderdale, Florida to Alabama, as well as impacts in Hawaii.
- **Pandemic:** Considered a nationwide threat.
- **Space Weather:** Also a threat on a nationwide scale.

FEMA removed context descriptions and data for two scenarios that were deemed too sensitive for inclusion in the public version of this document. Risks are not presented in a matrix, nor are emerging risks identified.

3.10.4 Conclusion

The 2019 National THIRA is an evolving process aimed at improving the nation's preparedness for catastrophic incidents. Future iterations will continue to refine the approach, incorporating new data and insights to enhance the nation's risk management and capability assessment efforts.

3.11 Poland

3.11.1 Overview/Introduction

Poland's National Crisis Management Plan (KPZK) is a biennial process split across 3 documents:

1. The National Crisis Management Plan Part A (Risks and Risk Matrix)

2. The National Crisis Management Plan Part B (crisis management and threat monitoring tasks)
3. Procedure for preparing a partial report (Methodology)

It aims to cover all phases of crisis management, integrating prevention, preparation, response, and reconstruction efforts. Part A of the plan includes risk and threat assessments, safety nets outlining tasks and responsibilities in crisis management, and a catalogue of projects aimed at threat prevention and effect limitation. It also incorporates GIS-based maps for planning and potential cooperation. Furthermore, it captures experience gained from managing the SARS-CoV-2 epidemic, updating procedures for international cooperation and managing strategic reserves.

3.11.2 Methodology

The Polish approach considers all scenarios, not adopting a single Reasonable Worst Case Scenario (RWCS).

3.11.3 Components/Outputs

The Polish risks identified are:

- Epidemic
- Flood
- Disruption of the functioning of IT systems and networks
- Hybrid activities
- Drought/heat
- Epizootics
- Disruption in the energy system
- Strong wind
- Disruption in the fuel system
- Large-scale fire
- Epiphytoza
- Disruption of telecommunications systems and services
- Chemical contamination on land and sea
- Disruption in the gas system
- Maritime disaster
- Terrorist event
- Radioactive contamination
- Collective disturbance of public order
- Heavy frost/heavy snowfall
- Disinformation

3.11.4 Conclusion

The National Crisis Management Plan Part A serves as a vital tool for the Prime Minister, the Council of Ministers, and other key public administration entities. It is designed to be detailed, adaptable, and responsive to the needs of participants in crisis management. The plan incorporates learnings from past crises, emphasizing the importance of preparedness, rapid response, and resilience building against a wide array of threats, ensuring the safety and security of the nation and its citizens.

3.12 Italy

3.12.1 Overview/Introduction

The Italian NRA documents Italy's comprehensive assessment and management of various risks, including seismic, volcanic, hydrogeological, and climatic threats. It is produced under the EU's framework, specifically Decision 1313/2013/EU, aiming to enhance risk management capabilities across member states. The report emphasizes the need for an integrated approach to assessing and mitigating risks, highlighting Italy's geographical vulnerabilities and the importance of cross-border cooperation in disaster risk reduction.

3.12.2 Methodology

The Italian methodology encompasses a detailed risk assessment process, including the identification, analysis, and mapping of risks, leveraging scientific advances, data from recent events, contributions from expertise centres, Italian bodies, and universities. The methodology also outlines the procedural framework for risk management, including legal, procedural, and institutional aspects at national and sub-national levels.

Probability scenarios for the risks discussed are generated in a purely quantitative manner. These are produced using various computer simulations; there is no expert consultation. Risks are not assigned impact/likelihood scores and are not plotted onto a matrix.

3.12.3 Components/Outputs

Components and outputs include comprehensive risk assessments for seismic, volcanic, tidal, hydrogeological, and climatic risks, with specific focus on the impacts of climate change. The report details the development of risk models, mapping of hazard areas, identification of vulnerable infrastructures, and assessment of emergency response capabilities. It also outlines priority prevention and preparedness measures, emphasizing the importance of early warning systems and public awareness campaigns.

The risks identified are:

- Earthquakes
- Tsunamis
- Volcanic activity
- Hydrogeological/hydraulic, extreme weather events
- Droughts
- Forest fires

3.12.4 Conclusion

The 2018 Italian NRA underscores the critical need for ongoing risk assessment and management efforts in Italy, given its susceptibility to a wide range of natural disasters. It highlights the achievements in creating a robust framework for disaster risk reduction but also points out areas needing further improvement, especially in terms of cross-border cooperation and adapting to the escalating challenges posed by climate change. The report calls for sustained commitment to risk management practices to safeguard communities and assets against future disasters.

3.13 Romania

3.13.1 Overview/Introduction

The 2018 National Risk Assessment Report for Romania addresses the increasing intensity and scope of natural or human-caused risks threatening the nation's citizens, infrastructure, and natural resources. Highlighting that emergencies sometimes exceed the response capacity of intervention structures; the report underscores the need for continuous improvement in public services to manage disasters effectively. Romania has adopted an integrated emergency management system, comprising permanent and temporary structures, to ensure efficient emergency management and to fulfil international obligations, especially as a European Union member.

3.13.2 Methodology

The methodology utilised involves two phases.

Research Phase: Conducting sociological research, comparative analyses of legislation, and various studies to identify good practices in European countries.

Consultation phase:

- Surveying citizens and representatives of various institutions regarding risk acceptance thresholds, impact indicators for various risks.
- Interviews with representatives of the institutions involved in risk assessment and management - identifying the best approach to different components of the methodology
- Workshops: The first draft of the methodology was discussed in several expert workshops to reach a consensus regarding the thresholds and main components of the methodology, including the approach to scenario development and selection.

3.13.3 Components/Outputs

The Romanian NRA includes a detailed assessment of major risks such as earthquakes, floods, fires, hazardous substances accidents, and nuclear accidents. Each risk section describes the nature of the risk, the specific scenarios constructed to evaluate the risk and the risk assessment. The methodology emphasises scenario development, impact analysis (physical, economic, and socio-psychological), and the use of a risk matrix to compare and convey relative risk.

The risks identified are:

- Floods
- Drought
- Earthquakes
- Epidemics
- Epizoonotic diseases and zoonosis
- SEVESO accidents
- Forest fires
- Landslides
- Major accidents involving dangerous substances
- Nuclear and radiological accidents

A supplementary document, Summary of Management Disaster Risks Romania (2020), identifies an additional set of risks:

- cyber security, including the protection of personal data in the online environment
- hunger/lack of food and water
- the phenomenon of mass migration
- religious terrorism

3.13.4 Conclusion

The report concludes by emphasizing the importance of the national risk assessment in guiding Romania's emergency management and disaster risk reduction strategies. It highlights the need for ongoing research, collaboration, and adaptation of methodologies to address the dynamic nature of risks and their impacts. The report serves as a foundational document for

improving Romania's resilience to natural and man-made disasters, ensuring a coherent and efficient response to emergencies.

4.0 Implementing Horizon Scanning in the National Risk Assessment Process

The NRA for Ireland, in line with EU policy, is completed on a three-year cycle. The process for delivery of the NRA Process is captured in Figure 1: National Risk Assessment Process Diagram.

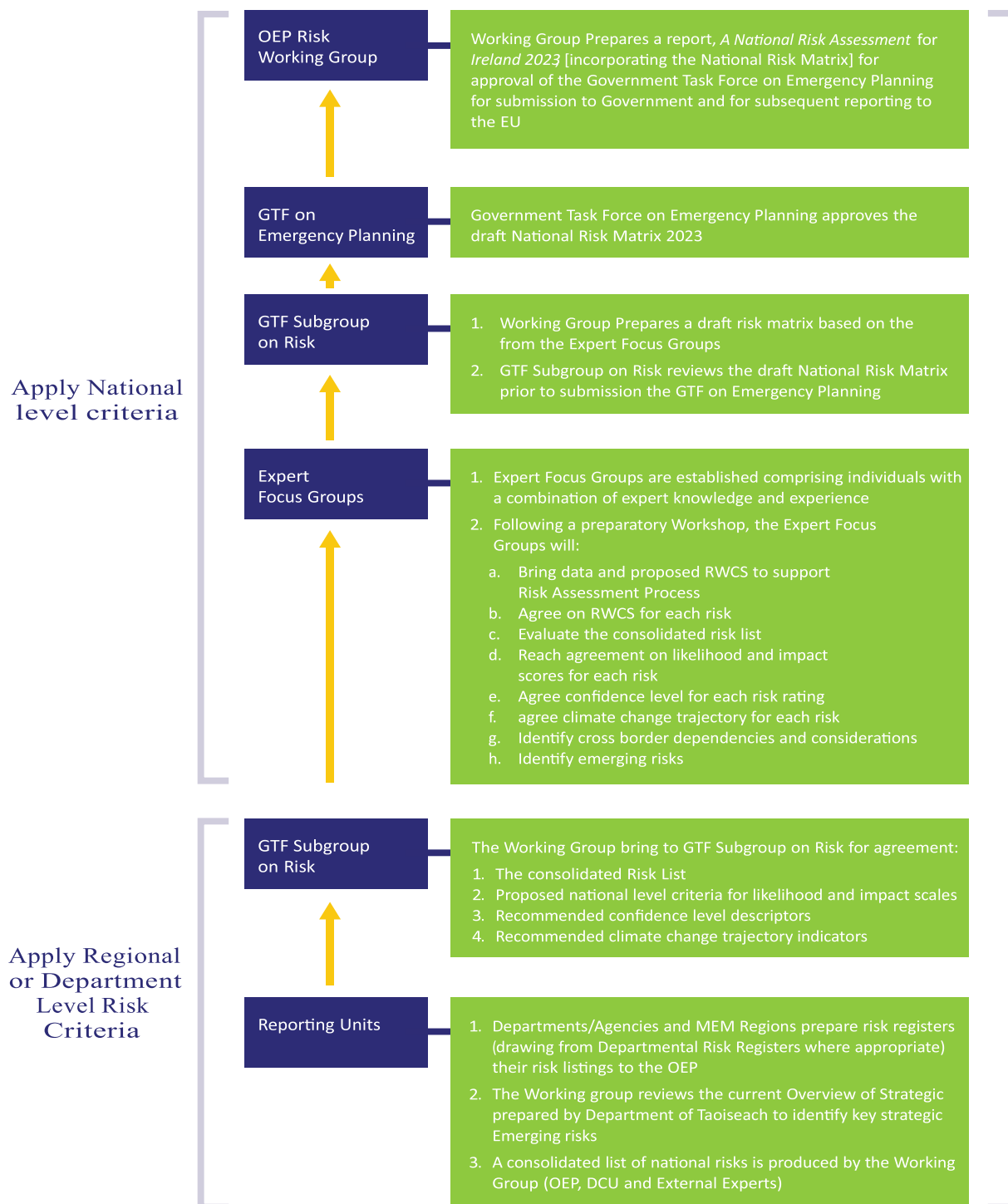


Figure 1: National Risk Assessment Process Diagram

The 2023 process was informed by the initial findings from FUTUREPROOF-IE, with enhanced horizon scanning integrated into the methodology to test validity and compatibility with the mature NRA process. The Irish NRA 2023 process may be divided into five key stages.

4.1 NRA Stage 1 – Determination of Key Risks

All government departments and their relevant agencies submit, to the Office of Emergency Planning, a listing of risks which, in their expert view, have the potential to trigger a national-level emergency. In addition, the risks identified in the Overview of Strategic Risks (2023) prepared by Department of Taoiseach are taken into account. Added to these, the risks contained in the Regional Major Emergency Risk Registers are considered. These registers are prepared by the Principal Response Agencies under the Framework for Major Emergency Management. They are reported via the National Directorate for Fire and Emergency Management. This allows for a comprehensive top-down and bottom-up approach to risk identification. All the risks are reviewed by the NRA Working Group. In an initial step, duplicate or overlapping risks are eliminated. The NRA Working Group prepares a consolidated list of risks with the potential to trigger a national-level emergency.

4.2 NRA Stage 2 – Consolidation

The Working Group then complete a deeper review of the risks to ensure compliance with EU guidelines requiring a focus on key risks. Risks judged as low probability risks with a high impact are removed from the risk list at this point in the process. The risks which emerge from Stage 1 are then grouped into four categories per EU guidance:

- Natural
- Transportation
- Technological
- Civil

This consolidated list is reviewed by the Government Task Force on Emergency Planning Subgroup on Risk. Risks judged to be lower tier risks, capable of being managed at departmental, agency or regional level are removed as they fall below the threshold for inclusion at a national level. Following this

review, the remaining risks are approved as the consolidated list of key risks for assessment by the Expert Focus Groups.

The Government Task Force on Emergency Planning Subgroup also approves any revisions to the criteria for assessing the impact of each risk by the Expert Focus Groups. The criteria approved in 2023 are included in Table 1: Likelihood Criteria (2023) and Table 2: National Impact Criteria (2023).

Rating	Classification	Average Recurrence Interval*
1	Extremely Unlikely	100 or more years between occurrences
2	Very Unlikely	51 - 100 years between occurrences
3	Unlikely	11 – 50 years between occurrences
4	Likely	1 - 10 years between occurrences
5	Very Likely	Ongoing/Less than one year between occurrences

Table 1: Likelihood Criteria (2023)

Impact Category 2023	1 Very Low Impact	2 Low Impact	3 Moderate Impact	4 High Impact	5 Very High Impact
People Population 5.1m (CSO, 2022) <i>Injury or illness levels are determined by the extent of medical treatment required. Critical injuries pose an immediate threat to life. Serious injuries require significant medical care but are not expected to progress to life threatening status. Minor injuries require basic medical aid.</i>	Deaths less than 1 in 250,000 people for population of interest (<20) OR Critical injuries/illness less than 1 in 250,000 (<20) OR Serious injuries less than 1 in 100,000 (<51) OR Minor injuries only	Deaths greater than 1 in 250,000 people for population of interest (>20) OR Critical injuries/illness greater than 1 in 250,000 (>20) OR Serious injuries greater than 1 in 100,000 (>51)	Deaths greater than 1 in 100,000 people for population of interest (>51) OR Critical injuries/illness greater than 1 in 100,000 (>51) OR Serious injuries greater than 1 in 40,000 (>128)	Deaths greater than 1 in 40,000 people for population of interest (>128) OR Critical injuries/illness greater than 1 in 40,000 (>128) OR Serious injuries greater than 1 in 20,000 (>255)	Deaths greater than 1 in 20,000 people for population of interest (>255) OR Critical injuries/illness greater than 1 in 20,000 (>255)
Environment <i>Environmental criteria are based on the EPA Environmental Impact Assessment Criteria</i>	Simple, localised contamination.	Simple, regional contamination, effects of short duration	Heavy contamination localised effects or extended duration	Heavy contamination, widespread effects or extended duration.	Very heavy contamination, widespread effects of extended duration
Economic Budget 2023 €91.1bn <i>A Percentage (%) of Government Annual Budget was adopted as the most suitable "Proxy" for economic impact.</i>	Up to 1% of Annual Budget <€0.9bn	Greater than 1% of Annual Budget >€0.9bn	Greater than 2% of Annual Budget >€1.8bn	Greater than 4% of Annual Budget >€3.6bn	Greater than 8% of Annual Budget >€7.3bn
Essential Services	Very low disruption to the delivery of services essential for the maintenance of vital societal functions or economic activities	Low disruption to the delivery of services essential for the maintenance of vital societal functions or economic activities	Medium disruption to the delivery of services essential for the maintenance of vital societal functions or economic activities	High disruption to the delivery of services essential for the maintenance of vital societal functions or economic activities	Loss of delivery of services essential for the maintenance of vital societal functions or economic activities
Social <i>Evacuation/Quarantine; Property/Housing; Medicines; Civil Unrest; Public dissatisfaction</i>	Limited disruption to community	Community functioning with considerable inconvenience	Community only partially functioning	Community functioning poorly	Community unable to function without significant support

Table 2: National Impact Criteria (2023)

4.3 Stage 3 – Assessment

For each risk category (civil, natural, transportation, technological), the Expert Focus Groups of specialists drawn from the relevant Government Departments and State Agencies are established. A

training session is provided for all participants in advance of the Focus Groups. Before attending the Focus Groups, each participant was required to consult with appropriate colleagues to gather data and expert opinions relevant to the identified key risks. For each key risk, the Expert Focus Group carry out the following tasks:

1. Agree on the reasonable worst-case scenario for each risk;
2. Assess the likelihood (probability) of the scenario occurring;
3. Determine the impact of the RWCS on people, the environment, the economy, essential services and society.

The impact and likelihood criteria, outlined in Table 1: Likelihood Criteria (2023) and Table 2: National Impact Criteria (2023), are used as the basis for decision-making with respect to each key risk. All assessments are made taking account of the mitigation measures already in place. The level of confidence associated with the outcome of each assessment is determined in accordance with the criteria outlined in Table 3: Confidence Level Descriptors.

Confidence Level	Criteria
High ***	Assessment based on expert knowledge of the issue and/or reliable, relevant, current data. Consistent agreement among assessors.
Moderate **	Assessment informed by significant knowledge of the issue and/or limited reliable, relevant, current data. Broad agreement among assessors.
Low *	Assessment informed by limited knowledge of the issue and/or insufficient reliable, relevant, current data. Limited agreement among assessors.

Table 3: Confidence Level Descriptors

In line with EU Reporting Guidelines on Disaster Risk Management, Art. 6(1)d of Decision No 1313/2013/EU, the Expert Focus Groups consider the potential impact of climate change (climate change trajectory), the interdependent nature of elements of critical infrastructure (the domino

and/or cascading effect), and any cross-border considerations or dependencies. Within each Expert Focus Group, consideration is also given to horizon scanning, with each group considering emerging risks within their specialist areas.

4.4 Stage 4- Analysis

Following an analysis of the data from each of the Expert Focus Groups, the NRA Working Group plots each risk on category-specific risk matrices, noting the confidence level for each assessment. An overall National Risk Matrix, incorporating the climate change trajectory for each key risk, is prepared along with a short narrative capturing qualitative data from the Expert Focus Groups including cross-border dependencies and emerging risks.

4.5 Stage 5- Approval, Submission & Publication

The final stages in the process involve the approval of the *National Risk Assessment for Ireland* by the Government Task Force on Emergency Planning and subsequent submission to the Government and the EU Commission, before being published at: www.defence.ie and emergencyplanning.ie.

It is into this process that the proposed horizon scanning for emerging risks process will be integrated.

5.0 Public Consultation: Identification of emerging risks in Ireland

In line with EU guidance, public awareness of the NRA was an important consideration since 2020 when participation was first built into the Irish NRA process. The level of participation was further enhanced as part of the continuous improvements designed into the 2023 methodology under the FUTUREPROOF-IE: S4I project.

5.1 Methodology

Using a survey designed, administered, and analysed by the project team at DCU Business School, the public was asked to assess the 22 risks key national level risks identified during the risk identification phase of the NRA process. This meant that both the public and the focus groups of subject matter experts were asked to provide their assessment of the same national-level risks. The public survey and the Expert Focus Groups both took place during the summer of 2023. The public was also asked to identify any additional or emerging risks which Ireland could face in the future so that their views could be taken into account as part of the horizon scanning for emerging risks element of the NRA process. Social media was used to promote the survey and data was gathered, using the online data collection software “Qualtrics”, from a statistically significant sample of the public.

5.2 Results

The results from the research completed under the FUTUREPROOF-IE: S4I project are reported in three sections. The first reviews the public assessment of the key national level risks, the second compares the public risk assessment against that made by the Expert Focus Groups under the NRA process, and the third examines the emerging risks proposed by the public. The data gathered from the public will be used to enhance risk communication in relation to risk perception, build national resilience, and raise awareness of the NRA process.

5.2.1 Assessment of National Level Risks

The output from the research conducted with the Irish public is plotted on the Risk Matrix in Figure 2:

Public Rating of National Level Risks.

Public Rating of National Risks (2023)

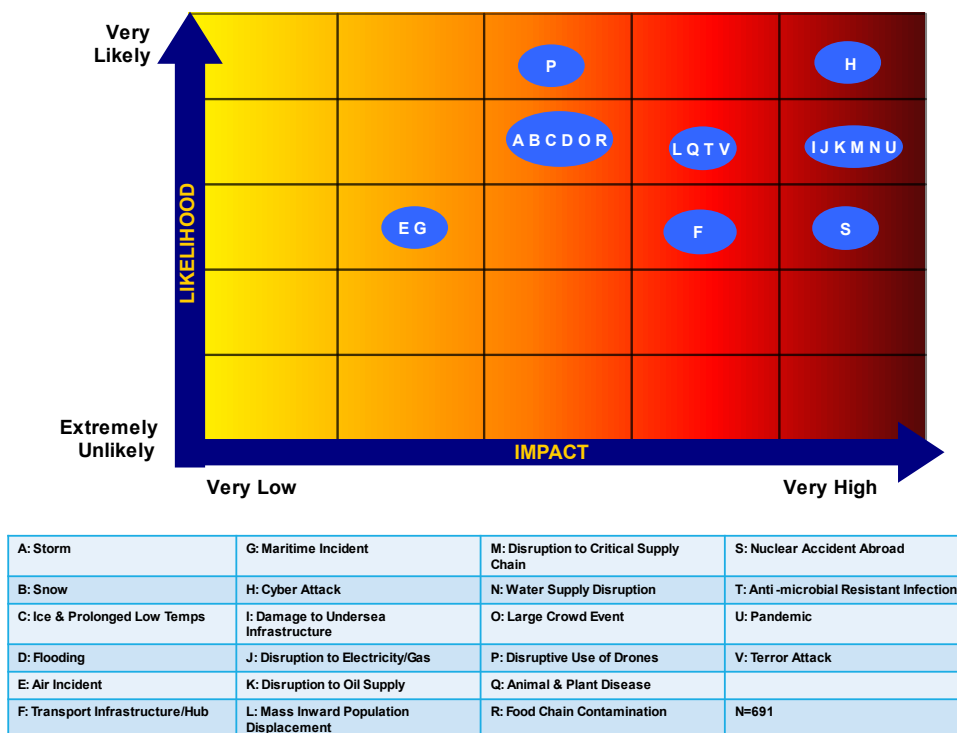


Figure 2: Public Rating of National Level Risks

The public rated cyber attack as the highest rated key risk facing Ireland in 2023. After cyber attack, a cluster of six risks were rated as likely and having a very high impact. These were: damage to undersea infrastructure, disruption to electricity/gas, disruption to critical supply chain, disruption to oil supply, water supply disruption and pandemic. Air and maritime risks received the lowest rating by the public.

These results are summarised in Table 4: Public Top Ranked National Level Risks.

Rank	Risk
1	Cyber Attack
2	Damage to Undersea infrastructure
	Disruption to Electricity/Gas
	Disruption to Oil Supply
	Disruption to Critical Supply chain
	Water Supply Disruption
	Pandemic
8	Mass Inward Migration
	Animal & Plant Disease
	Anti-microbial Resistant Infection
	Terror Attack

Table 4: Public Top Ranked National Level Risks

Linear regressions were run to identify any differences in risk rating based on gender, age, geographic location, or urbanicity. The results revealed that the average risk rating is significantly lower for males (-1.9 difference from females), increases with age (+0.27 for each decade older), is significantly lower for those living in the border counties (-1 difference), and is not significantly impacted by urbanicity.

The public was asked, should any of the national emergencies occur, which would have the greatest impact on their households. The top 3 were: Disruption to Electricity/Gas (45.05%), Water Supply Disruption (44.14%), and Pandemic (43.22%).

The level of worry has been shown to drive the taking of preparedness action by the public. For this reason, the public was asked how much they worry about each of the 22 risks. The results are displayed in Table 5: Worry by Risk

Rank	Risk
1	Disruption to Electricity/Gas
2	Cyber Attack
3	Pandemic
4	Anti-microbial Resistant Infection
5	Disruption to Critical Supply Chain

Table 5: Worry by Risk

The public worried least about maritime incidents, with air incidents and large crowd events also rated in the bottom three risks for worry.

5.2.2 A Comparison of Public and Expert Risk Ratings

The expert rating of the likelihood and impact of each risk, together with the modal likelihood and modal impact ratings for the public are listed in Table 6: Modal Scores from Experts & Public Risk Rating. In line with normal practice in risks assessment, these are the results used to produce the NRA (2023) matrix and Figure 2: Public Rating of National Level Risks.

Risk		Expert Opinion		Public Modal	
		Likelihood	Impact	Likelihood	Impact
Natural	A Storm	4	2	4	3
	B Snow	3	3	4	3
	C Ice	4	3	4	3
	D Flooding	4	3	4	3
Transport	E Air Incident	3	5	3	2
	F Transportation Infrastructure/Hub	3	5	3	4
	G Maritime Incident	3	3	3	2
Technological	H Cyber Attack	4	5	5	5
	I Damage to Undersea Infrastructure	3	5	4	5
	J Disruption to Electricity/Gas	2	5	4	5
	K Disruption to Oil Supply	2	4	4	5
Civil	L Mass Inward Population Displacement	5	3	4	4
	M Disruption to Critical Supply Chain	4	5	4	5
	N Water Supply Disruption	4	4	4	5
	O Large Crowd Event	4	1	4	3
	P Disruptive Use of Drones	5	1	5	3
	Q Animal and Plant Diseases	3	4	4	4
	R Food Chain Contamination	4	3	4	3
	S Nuclear Accident Abroad	3	5	3	5
	T Anti-microbial Resistant Infection	5	4	4	4
	U Pandemic	4	5	4	5
	V Terror Attack	3	2	4	4

Table 6: Modal Scores from Experts & Public Risk Rating

Figure 2: Public Rating of National Level Risks shows that when using modal scores for likelihood and impact as the indicator of public opinion, the assessments for experts and the public align closely for many of the risks.

Figure 3: Comparison between Public and Expert Risk Rating illustrates the alignment and differences between the assessment made by the Expert Focus Groups and the modal risk rating from the public survey. The maximum differences are for air incidents, terror attacks and disruption to oil supply. For air incidents the public modal score for impact is three classifications below that of expert opinion; for terror attacks there is a one-classification difference for likelihood and a two-classification difference

for impact with the public score being higher for each, and for disruption to oil supply the public rates the likelihood two classifications higher and impact one classification higher. For all others, at least one of the likelihood or impact classifications match between the public and experts, and there is a maximum two-classification difference for the non-matching item.

In six of the twenty-two risks (two natural risks and four civil), the likelihood and impact classifications for experts and the public marginal modal scores coincide precisely. These are for ice, flooding, food chain contamination and nuclear accidents abroad, pandemics and disruption to critical supply chains.

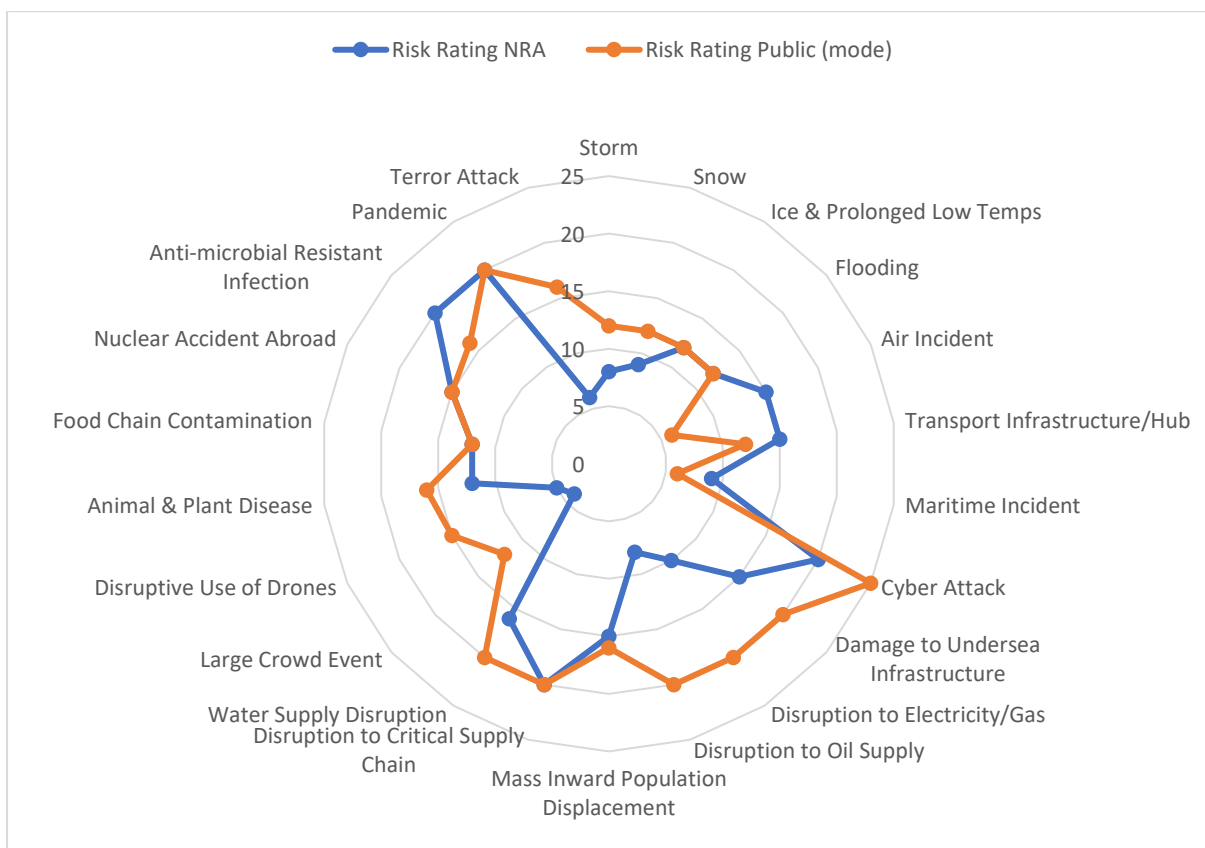


Figure 3: Comparison between Public and Expert Risk Rating

Probing beyond these modal scores to analyse public opinion provides a more nuanced picture regarding consensus between experts and the public and allows us to take account of the degree of dispersion in public opinion.

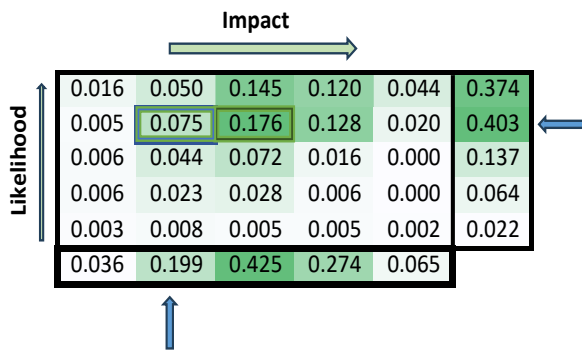
5.2.2.1 Joint Distributions of Public Opinion Over Likelihood and Impact

The joint distributions of the public's perception of the likelihood and impact of Natural, Transport, Technological and Civil risks are presented as heat maps in Figure 4: Natural Risks to Figure 7: Civil Risks respectively. The colour coding reflects the density of responses across likelihood-impact combinations, with deeper green indicating higher percentages of the sample having chosen that combination. The proportion of responses within each likelihood-impact combination is marked in the corresponding cell of the table. Perceived risk (likelihood*impact) is higher moving north-eastwards in the body of the table.

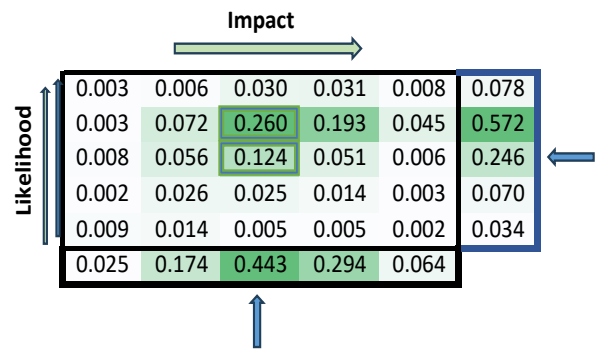
The right-hand column and bottom row of each table are the sample marginal distributions for the public evaluation of the likelihood and impact of events, respectively. The largest proportion (deepest green) is the modal score for the public. These correspond to the figures reported in Figure 2: Public Rating of National Level Risks, which represent the public's risk rating for each risk.

The expert opinion for each event is indicated in blue to facilitate comparison of the public's views with those of experts. The blue arrows indicate the expert assessment of the likelihood and impact of each reasonable worst-case scenario, and the cell marking the combination of likelihood and impact is bordered in blue. Therefore, the percentages in the blue-bordered cells are the percentages of the public who agree with experts on both the likelihood and impact of each risk.

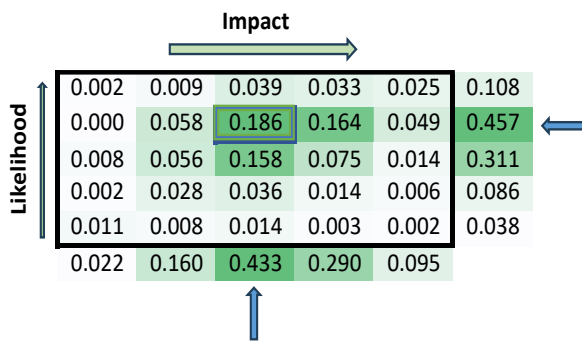
Storm



Snow



Ice



Flooding

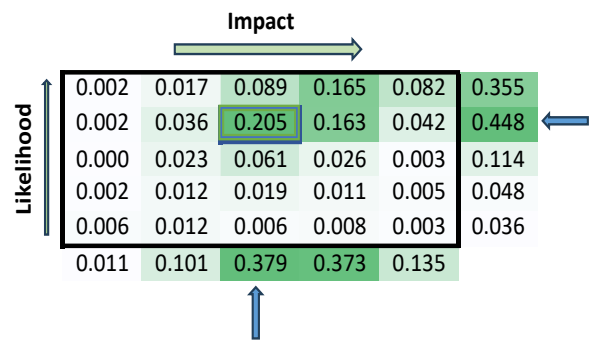
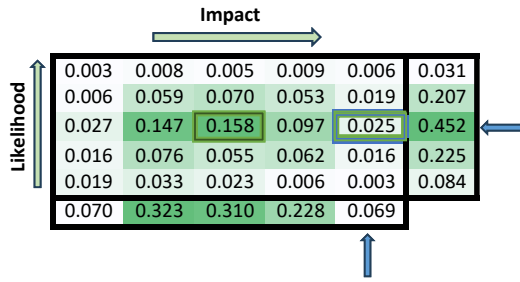
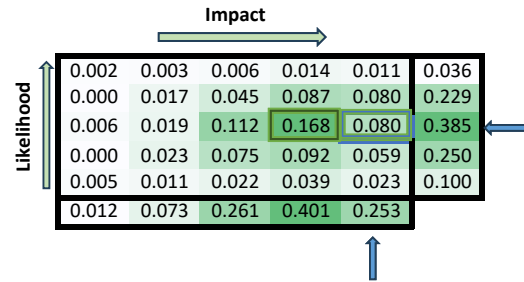


Figure 4: Natural Risks

Air Incident



Transport Infrastructure/Hub



Maritime Incident

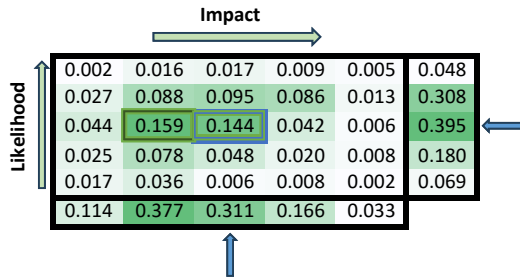
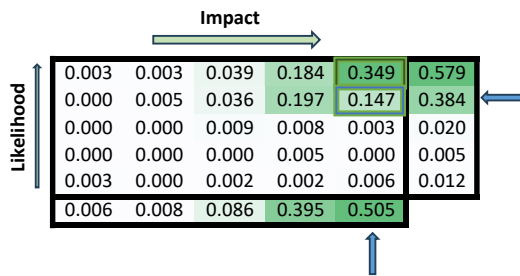
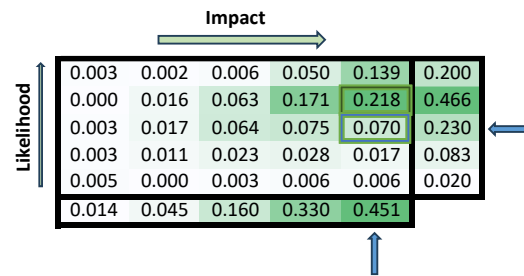


Figure 5: Transportation Risks

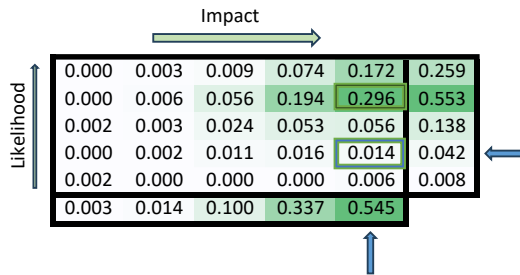
Cyber Attack



Damage to Undersea Infrastructure



Disruption to Electricity/Gas



Disruption to Oil Supply

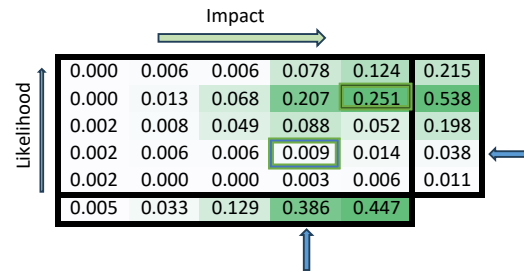


Figure 6: Technological Risks

L Mass Inward Population Displacement

	Impact →					
Likelihood ↑	0.003	0.009	0.059	0.128	0.100	0.300
	0.005	0.039	0.155	0.182	0.064	0.444
	0.003	0.023	0.067	0.053	0.013	0.160
	0.000	0.014	0.030	0.017	0.009	0.070
	0.002	0.009	0.006	0.005	0.003	0.025
	0.013	0.095	0.318	0.385	0.189	

M Disruption to Critical Supply Chain

	Impact →					
Likelihood ↑	0.000	0.002	0.011	0.078	0.137	0.228
	0.000	0.009	0.064	0.226	0.198	0.498
	0.002	0.006	0.039	0.092	0.069	0.207
	0.000	0.003	0.019	0.009	0.019	0.050
	0.002	0.000	0.003	0.005	0.008	0.017
	0.003	0.020	0.136	0.410	0.431	

N Water Supply Disruption

	Impact →					
Likelihood ↑	0.002	0.003	0.025	0.061	0.128	0.218
	0.000	0.017	0.081	0.162	0.196	0.456
	0.000	0.011	0.055	0.121	0.075	0.262
	0.003	0.009	0.009	0.009	0.016	0.047
	0.002	0.005	0.002	0.003	0.006	0.017
	0.006	0.045	0.171	0.357	0.421	

O Large Crowd Event

	Impact →					
Likelihood ↑	0.009	0.025	0.036	0.025	0.016	0.111
	0.031	0.100	0.171	0.061	0.033	0.396
	0.044	0.149	0.119	0.050	0.009	0.371
	0.013	0.042	0.025	0.011	0.003	0.094
	0.013	0.014	0.000	0.002	0.000	0.028
	0.110	0.330	0.351	0.149	0.061	

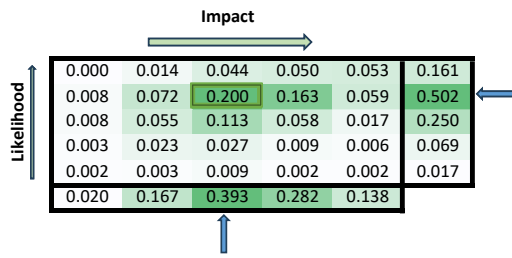
P Disruptive Use of Drones

	Impact →					
Likelihood ↑	0.022	0.075	0.180	0.122	0.041	0.440
	0.019	0.091	0.166	0.072	0.016	0.364
	0.013	0.053	0.053	0.005	0.003	0.127
	0.009	0.024	0.014	0.003	0.000	0.050
	0.011	0.003	0.002	0.003	0.000	0.019
	0.074	0.246	0.415	0.205	0.060	

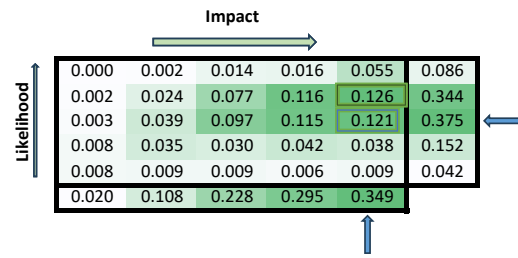
Q Animal and Plant Diseases

	Impact →					
Likelihood ↑	0.002	0.002	0.028	0.071	0.058	0.160
	0.000	0.038	0.199	0.262	0.088	0.587
	0.005	0.024	0.086	0.066	0.024	0.204
	0.002	0.005	0.014	0.016	0.000	0.036
	0.006	0.000	0.003	0.002	0.002	0.013
	0.014	0.068	0.331	0.416	0.171	

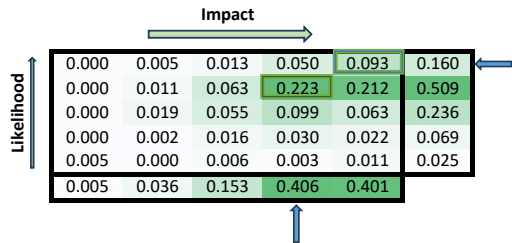
R Food Chain Contamination



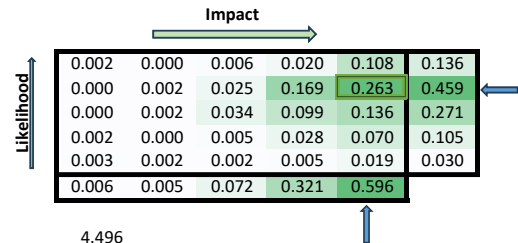
S Nuclear Accident Abroad



T Anti-microbial Resistant Infection



U Pandemic



V Terror Attack

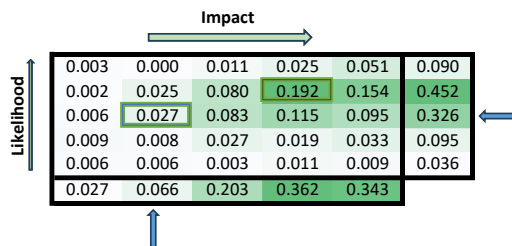


Figure 7: Civil Risks

Table 7: Summary Statistics presents the summary statistics corresponding to Figure 4: Natural Risks to Figure 7: Civil Risks. For each risk, it lists the average assessment of likelihood and impact by the public and the average deviations from expert opinions. Given the ordinal nature of the data on likelihood and impact, the deviation figures indicate the number of classifications above or below the experts' assessment that the average public risk rating lies. Green indicates a higher, and red a lower, evaluation by the public on average.

The column "Agreement" reports the percentages of the public that agree precisely with the expert view of risk, i.e., with both the expert likelihood and expert impact assessments. These figures reveal less alignment between the public and expert risk assessments than when modal scores are used.

Table 7: Summary Statistics also provides a measure of dispersion of responses to assess the spread of public responses around the public's modal cell. For each risk, dispersion is calculated as:

$$\sum_{i=1}^5 \sum_{l=1}^5 p_{il} \sqrt{(I_{il} - I_0)^2 + (L_{il} - L_0)^2} \quad (i)$$

Where I_{il} is the impact score corresponding to cell il ,
 L_{il} is the Likelihood score corresponding to cell il
 I_0, L_0 are the impact and likelihood scores corresponding to the modal cell
and p_{il} is the proportion of the sample choosing combination il

A lower value for the dispersion measure indicates that responses are more densely distributed around the modal cell, with a minimum value of zero indicating complete agreement among the public on the likelihood and impact of a risk. For ease of reference, expert assessment of the likelihood and impact of risks are also stated in Table 7: Summary Statistics.

Risk		Expert Opinion		Public Average		Deviation (Public Average - Expert)		Agreement	Dispersion
		Likelihood	Impact	Likelihood	Impact	Likelihood	Impact	%	
Natural	A Storm	4	2	4.044	3.134	0.044	1.134	7.50%	0.905
	B Snow	3	3	3.589	3.198	0.589	0.198	12.40%	0.693
	C Ice	4	3	3.512	3.277	-0.488	0.277	18.60%	0.747
	D Flooding	4	3	4.037	3.521	0.037	0.521	20.50%	0.951
Transport	E Air Incident	3	5	2.877	2.902	-0.123	-2.098	2.50%	1.222
	F Transportation Infrastructure/Hub	3	5	2.852	3.808	-0.148	-1.192	8.00%	1.192
	G Maritime Incident	3	3	3.088	2.627	0.088	-0.373	14.40%	1.303
Technological	H Cyber Attack	4	5	4.512	4.385	0.512	-0.615	14.70%	0.925
	I Damage to Undersea Infrastructure	3	5	3.743	4.158	0.743	-0.842	7%	1.263
	J Disruption to Electricity/Gas	2	5	4.013	4.408	2.013	-0.592	1.40%	0.961
	K Disruption to Oil Supply	2	4	3.909	4.239	1.909	0.239	0.90%	1.098
Civil	L Mass Inward Population Displacement	5	3	3.925	3.643	-1.075	0.643	5.90%	1.171
	M Disruption to Critical Supply Chain	4	5	3.869	4.245	-0.131	-0.755	19.80%	1.002
	N Water Supply Disruption	4	4	3.812	4.140	-0.188	0.140	16.20%	1.928
	O Large Crowd Event	4	1	3.468	2.721	-0.532	1.721	3.10%	1.279
	P Disruptive Use of Drones	5	1	4.157	2.931	-0.843	1.931	2.20%	1.319
	Q Animal and Plant Diseases	3	4	3.846	3.662	0.846	-0.338	6.60%	0.981
	R Food Chain Contamination	4	3	3.721	3.349	-0.279	0.349	20.00%	1.158
	S Nuclear Accident Abroad	3	5	3.279	3.843	0.279	-1.157	12.10%	1.674
	T Anti-microbial Resistant Infection	5	4	3.711	4.162	-1.289	0.162	6.30%	1.048
	U Pandemic	4	5	3.567	4.496	-0.433	-0.504	26.30%	1.062
	V Terror Attack	3	2	3.467	3.930	0.467	1.930	2.70%	1.205

Table 7: Summary Statistics

5.2.2.2 Natural Risks

Complete information for natural risks is illustrated in Figure 4: Natural Risks. The percentages of the public sample whose assessment of both the impact and likelihood of risks correspond precisely with that of the experts range from 7.5% for storms to 20.5% for flooding. The public tends to overestimate the impact of each natural risk. That is, the public mean score for impact is slightly higher than the score attributed by the Expert Focus Groups. The likelihood scores for storm, snow, and flooding are

also somewhat overestimated. Only in the case of ice is the average public assessment of likelihood lower than the expert assessment. The public risk assessments have relatively low dispersion for all natural risks. The evaluations of likelihood and impact are relatively concentrated around the modal cell.

5.2.2.3 Transport Risks

The joint distributions of public opinion about transport risks are illustrated in Figure 5: Transportation Risks. There is a wider and more symmetric dispersion of public assessment of likelihood and impact for transport risks than for natural risks. The percentages of the public who assess both the likelihood and impact of risks in line with experts range from 2.5% for air incidents to 14.4% for maritime incidents. The impact of each risk is, on average, under-assessed by the public. The maximum deviation between public and expert opinion is for Air Incidents, where the average public impact assessment is 2.902 compared to the expert assessment of 5.

5.2.2.4 Technological Risks

Figure 6: Technological Risks shows that the public generally assesses technological risks as both high impact and high likelihood; in each case, the mass of the distribution of public opinion lies in the northeast corner of the tables. The measures of dispersion of public opinion for technological risks are moderate, with the greatest variation in public opinion being for damage to undersea infrastructure. The percentages of the public whose assessment of impact and likelihood are in agreement with the Expert Focus Groups range from only 0.9% for Disruption to Oil Supply to 14.7% for Cyber Attack. The deviation between expert and public opinion is mainly due to differences in the assessment of likelihoods, with the public overestimating the likelihood of each risk. Overestimation of likelihoods is particularly evident for disruption to electricity/gas and disruption to oil supply, where the public estimates are approximately two classifications higher than the experts.

5.2.2.5 Civil Risks

Of all categories of risk, the level of consensus among the public on the likelihood and impact of risks is lowest in the case of civil risks. The measures for dispersion of opinion are moderate or high for most civil risks. The exceptions, with relatively low dispersion, are animal or plant diseases, disruption to critical supply chains, anti-microbial resistant infections, and pandemics. Of all twenty-two risks, the highest dispersions in public opinion are evident for water supply disruption and nuclear accidents abroad.

Differences between the expert and average public likelihood and impact assessments are also higher for many civil risks. The public, on average, significantly underestimates the likelihood of anti-microbial resistant infections and mass inward population displacements. They tend to overestimate greatly the impacts of disruptive use of drones, terror attacks and large crowd events.

Table 8: Summary of the Dispersion provides a summary of the dispersion of public opinion from the expert assessment of risk, calculated with formula (i) above but replacing I_o, L_o with the impact and likelihood scores corresponding to the Expert Focus Group's assessments. 100% of the public in agreement with the assessment of the experts would produce a dispersion value of zero. Risks are ranked from 1 to 22 in order of lowest to highest dispersion from the expert assessment.

Risk		Expert Opinion		Dispersion (from Expert)	Rank
		Likelihood	Impact		
Natural	A Storm	4	2	1.357	9
	B Snow	3	3	1.370	10
	C Ice	4	3	0.747	1
	D Flooding	4	3	0.951	2
Transport	E Air Incident	3	5	2.331	21
	F Transportation Infrastructure/Hub	3	5	1.690	15
	G Maritime Incident	3	3	1.262	7
Technological	H Cyber Attack	4	5	1.093	4
	I Damage to Undersea Infrastructure	3	5	1.557	11
	J Disruption to Electricity/Gas	2	5	2.262	20
	K Disruption to Oil Supply	2	4	2.140	18
Civil	L Mass Inward Population Displacement	5	3	1.647	14
	M Disruption to Critical Supply Chain	4	5	1.151	5
	N Water Supply Disruption	4	4	1.849	16
	O Large Crowd Event	4	1	2.075	17
	P Disruptive Use of Drones	5	1	2.349	22
	Q Animal and Plant Diseases	3	4	1.356	8
	R Food Chain Contamination	4	3	1.158	6
	S Nuclear Accident Abroad	3	5	1.608	13
	T Anti-microbial Resistant Infection	5	4	1.589	12
	U Pandemic	4	5	1.062	3
	V Terror Attack	3	2	2.252	19

Table 8: Summary of the Dispersion

A high alignment between the Expert Focus Group’s risk assessment and that of the public requires a low dispersion of public opinion around that of the experts, which is consistent with the public’s representative scores for likelihood and impact (using the modal or mean scores) closely matching expert opinion and the dispersion of public opinion being low.

Ice, flooding, disruption to supply chains, and pandemics meet these criteria. These risks show a higher level of agreement between the public and experts on both the likelihood and impact (i.e. “Agreement” in Table 7: Summary Statistics). The highest percentage of agreement on both likelihood and impact is for pandemics, with just over a quarter of the public (26.3%) agreeing with the experts, followed by flooding (20.5%), disruption to critical supply chain (19.8%) and ice (18.6%). Public and

expert opinion is also well aligned for cyber attacks, although the figure for precise agreement on impact and likelihood is less than 15%.

While the percentage of agreement is relatively high for food chain contamination and water supply disruption, there is a larger variation in public opinion for these two risks. The mean deviation of public opinion from experts is moderate for nuclear accidents abroad, but the dispersion of opinion is high.

Alignment between public and expert opinion is lowest for disruption to electricity/gas, disruption to oil supply, anti-microbial resistant infection, air incidents, large crowd events, disruptive use of drones and terror attacks. Each of these is associated with a precise agreement between the public and experts on the likelihood and impact of less than 3.5%.

For disruption to electricity/gas and oil supply, the public greatly overestimates the likelihood of the risks, which could suggest survey respondents are considering their personal or home-based experience of the risk instead of taking a country-wide perspective. The impact of anti-microbial resistant infections is estimated accurately on average, and the dispersion in public opinion is relatively low overall, but the likelihood is severely underestimated. The national impact of an air incident is greatly underestimated on average, while the national impacts of disruptive use of drones, large crowd events and terror attacks are highly overestimated on average.

The closest alignment in assessment between the experts and the public is for risks that have been experienced regularly over large geographic areas (natural) or whose effects have been experienced relatively recently and forcibly for the entire country (as is the case for pandemics, supply chain disruptions related to COVID-19 and the Ukrainian war, and cyber attacks that have been reported widely eg. on health service systems). This suggests that shared experience of and exposure to nationwide risks leads to more densely distributed public opinions of risks, more accurately in line with those of experts.

5.3 Identification of Emerging Risks

When asked to identify any additional or emerging risks which Ireland could face in the near future, 310 risks were submitted by the public. Some of these were excluded as they were established risks assessed under the NRA process, included on the Low Probability High Impact risk list, or were below the threshold for inclusion as key national level risks. There were also many overlapping suggestions or duplicates. The 14 emerging risks noted in Table 9: Public: Emerging Risks represent the consolidated list of emerging risks proposed by the public.

Emerging Risks Identified by the Irish Public (2023)
Wildfires
Civil Unrest
Collateral damage from conflicts in other territories
Far-right extremism
Foreign interference in the political/national infrastructure
Nuclear incidents due to vessels transporting nuclear materials passing close to Irish coast
Unforeseen impacts of climate change
Inept governance
Sea level rise/coastal erosion
Inadequate public/emergency services
Outdated national infrastructure
Loss of satellites
Biodiversity loss
Loss of the Gulf Stream

Table 9: Public: Emerging Risks

The list of emerging risks which emerged from the horizon scanning and Expert Focus Groups recorded in the NRA 2023 are listed in column one of Table 10: Comparison of NRA & Public Emerging Risks and a comparison with those from the public is provided in column two.

Emerging Risk NRA 2023	Comparison with Emerging Risks Public 2023
<p>Invasive Species (Animal or Plant) Invasive species having the potential to cause harm to the environment, the economy, or to human health.</p>	<p>Could be covered by unforeseen impacts of climate change</p>
<p>Disruptive Technology - Artificial Intelligence (AI) While emerging technology will bring many opportunities for society and the economy, automation and emerging technologies could negatively impact social cohesion by exacerbating existing inequality, this may include the disruption of existing jobs or sectors, including sectors where Ireland may currently have a comparative advantage. (Department of the Taoiseach, 2023, p.31)</p>	<p>Not identified by the public</p>
<p>Biodiversity loss Loss of flora and fauna generally attributed to habitat loss, invasive species, overexploitation, pollution or climate change.</p>	<p>Biodiversity loss also identified by the public</p>
<p>Climate Change Adaptation Failure to adapt policies and legislation (such as building regulations) to take account of climate change.</p>	<p>Closely linked to Unforeseen impacts of climate change</p>
<p>Crowded airspace Complications arising from a more crowded airspace, including additional drone activity</p>	<p>Not identified by the public</p>
<p>Spread of Disease due to Climate Change Increase in the spread of arboviruses and vector-borne diseases due to climate change and the resulting movement of insects, bats and other vectors.</p>	<p>Closely linked to Unforeseen impacts of climate change</p>
<p>Vaccine Hesitancy Decreasing effectiveness of vaccine programmes as a result of a significant percentage of the population remaining unvaccinated.</p>	<p>Not identified by the public but could be linked to some campaigns by elements of far-right extremism in Ireland</p>
<p>Water Scarcity Lack of or deficiency in water sources linked to drought/climate change.</p>	<p>Closely linked to Unforeseen impacts of climate change</p>
<p>Electric Vehicle Related Fires New generation rechargeable batteries causing difficult to extinguish fires as a result of thermal</p>	<p>Not identified by the public</p>

runaway and presenting an extreme fire risk in high risk environments	
Impact of larger load HGVs Risk of larger loads being carried on HGVs putting greater strain on bridge/road infrastructure	Not identified by the public
Extreme and sustained heatwaves Significant increase in heat stress resulting from increasingly frequent and prolonged heatwaves as a consequence of climate change.	Closely linked to Unforeseen impacts of climate change

Table 10: Comparison of NRA & Public Emerging Risks

Wildfires, Civil Unrest, Collateral damage from conflicts in other territories, Far-right extremism, Foreign interference in the political/national infrastructure, Nuclear incidents due to vessels transporting nuclear materials passing close to Irish coast, Inept governance, Sea level rise/coastal erosion, Inadequate public/emergency services, Outdated national infrastructure, Loss of satellites, and Loss of the Gulf Stream will be integrated into the Horizon Scanning and Management of Emerging Risk processes which will follow the approval of the NRA 2023. Some are also already monitored by the Lead Government Department, for example under terrorist activity, or are a specific element of a risk already identified and rated under the NRA process, such as flooding.

6.0 Proposed Horizon Scanning Methodology: A 7-Step Process for the Identification and Management of Emerging Risks of National Significance

The identification, monitoring and management of emerging risks is a constant process. At some point in the future, all emerging risks will either cease to pose a threat or will transition to full assessment under National Risk Assessments. The seven-step process below is designed to support that transition and help governments manage the challenge of emerging critical risks. It is recommended that this approach to horizon scanning for emerging risks be added to the Strategic Emergency Management framework for Ireland.

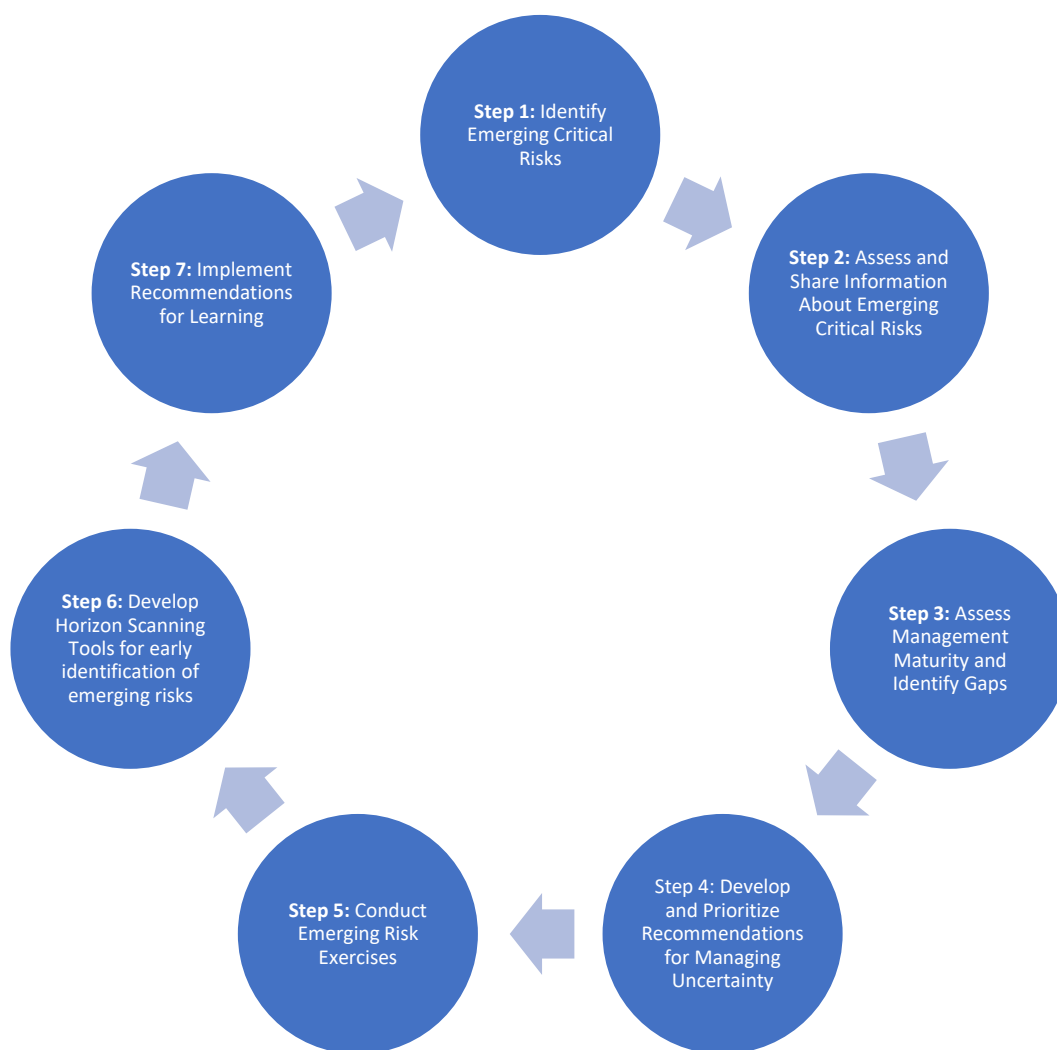


Figure 8: A 7-Step Process for the Identification and Management of Emerging Risks of National Significance

Based on the research conducted under this project, the 7-Step process outlined above is proposed for implementation in Ireland and was also proposed to the OECD High Level Risk Forum for rollout to all member states. The Forum is drafting guidance to bring relevant governments or government agencies through each step of the process. The comprehensive guidelines will be released later in 2024; for now, a brief overview of what each step should entail is provided.

Step 1: Identification of Emerging Critical Risks. Conduct horizon scanning and develop alternative futures to explore potential changes to the strategic operating environment. Identify emerging risks and prioritize a research agenda for further analysis.

Step 2: Assess and Share Information About Emerging Critical Risks. Assess risks on the research agenda to characterize the risk, identify possible conditions for emergence, explore implications for management and measure confidence in the assessment. The outputs from this process should be shared with responsible stakeholders.

Step 3: Assess Management Maturity and Identify Gap Areas. Assign responsibility for each emerging risk. Assess the capability to manage these risks and identify at what level/s (knowledge, responsibility, authority, capabilities) gaps exist.

Step 4: Develop and Prioritize Recommendations for Managing Uncertainty. Develop an all-hazards approach for managing under deeply uncertain conditions.

Step 5: Emerging Risk Exercise Series. Use tabletop exercises to explore the management of the risks identified in Step 1, drawing on lessons learned from the planning for and management of previous emergencies. Use the exercises to identify gaps and capture recommendations.

Step 6: Develop Horizon Scanning Tools for early identification of the emergence of the risk. Once emergence is confirmed transfer into the national risk assessment process.

Step 7: Implement Recommendations. To ensure continuous improvement, integrate lessons identified from each iteration of this process into the next emerging risk cycle.

This 7-step process should sit at the heart of the methodological approach to integrating horizon scanning for emerging risks into the current strategic emergency management framework. A proposed implementation guide that will build this methodology into the NRA process is provided in the next chapter.

7.0 Embedding Horizon Scanning for Emerging Risks in Strategic Risk Management

The proposed 6-phase process to embed horizon scanning for emerging risks into the Strategic Risk Management system governed by the GTF and managed by the OEP is summarised in Figure 9: Horizon Scanning for Emerging Risks.



Figure 9: Horizon Scanning for Emerging Risks

7.1 Horizon Scanning: Phase One

Phase One involves the completion of desk research to capture emerging risks which may be identified from published sources. The annual overview of Strategic Risks, prepared by the Department of the Taoiseach, is particularly important to this phase. The annual overview will be analysed to extract key national risks and emerging risks.

Once this national source is reviewed, attention will turn to international sources. Documents published by the EU and the OECD will be reviewed to identify emerging pan-national risks that could be relevant in an Irish context. Particular attention should be paid to outputs from DG ECHO (Directorate-General for European Civil Protection and Humanitarian Aid Operations) and the OECD High Level Risk Forum.

Finally, consideration should be given to the emerging risks identified by the NRAs prepared by other nations.

The list of emerging risks identified during Horizon Scanning – Phase One should be brought to the Government Task Force Subgroup on Risk for discussion and agreement that all meet the criteria for inclusion as emerging risks of national importance. Those which do not meet the criteria should be moved to the NRA process, if they are sufficiently mature, or be highlighted to the relevant Lead Government Department for monitoring and review if they fail to reach the threshold of being of national-level significance. The list of emerging risks from Phase One will be brought to the attention of the relevant Expert Focus Groups as part of the discussion on Emerging Risks.

7.2 Horizon Scanning: Phase Two

Phase Two involves providing an opportunity for the Irish public to propose national-level risks and emerging risks for inclusion in the NRA Process. The S4I project team, working under the FUTUREPROOF-IE project, designed an online questionnaire to gather these inputs during the NRA 2023 process. While the methodology could be changed over time, it is recommended that a questionnaire or focus groups be used to capture public inputs on the same 3-year cycle as the NRA.

The list of emerging risks identified during Horizon Scanning – Phase Two should be analysed by the NRA Working Group to ensure they meet the criteria for inclusion and be reported in the Public Section of the *National Risk Assessment for Ireland* report. Following the completion of the NRA, these emerging risks should also enter the Emerging Risk Management process.

7.3 Horizon Scanning: Phase Three

Phase Three focuses on specialists in government departments or agencies scanning their areas of responsibility or domains to identify emerging risks that could be of national significance. Those representing the Department or Agencies should draw together a list of all emerging risks for discussion at the relevant Expert Focus Groups.

7.4 Horizon Scanning: Phase Four

In Phase Four, the Expert Focus Groups will determine which emerging risks are key and of national significance. These will be collated by the NRA Working Group and considered for inclusion in the final *National Risk Assessment for Ireland* report and enter the Emerging Risk Management process.

7.5 Horizon Scanning: Phase Five

In Phase Five of the Horizon Scanning process, the NRA Working Group will bring the outputs from the previous phases together and develop a list of national-level emerging risks. These will be separated into those proposed by the Expert Focus Groups and those proposed by the Irish Public.

7.6 Horizon Scanning: Phase Six

Once the NRA process is complete, attention should turn to the monitoring and management of emerging risks. As outlined in Chapter 6.0 *Proposed Horizon Scanning Methodology: A 7-Step Process for the Identification and Management of Emerging Risks of National Significance*, a new process should be implemented as part of the assessment of the State's risk management capabilities and an appropriate template for reporting to the GTF, through the OEP, prepared. A sample reporting template is included in Appendix 10.4 Template for Reporting on Emerging Risks.

8. Implementation of Strategic Risk Management

Demonstrating the capability to manage the risks and emerging risks reported in the most recent NRA is a critical element of the Government Task Force on Emergency Planning. A strategic risk management cycle will help to capture all elements that come together to deliver this competence.



Figure 10: GTF on Emergency Planning Strategic Risk Management Lifecycle

8.1 Annual Review of Strategic Risks

Each year, the GTF should consider the Department of Taoiseach's *Overview of Strategic Risks* to determine if any of the risks included within the report do not appear on the current NRA matrix or emerging risks but require escalation into the NRA process. If such a situation arises, the Expert Focus

Group methodology deployed within the NRA should be activated, and an annexe to cover the newly identified risk(s) should be added to the current NRA documentation.

8.2 Identification of Risks and Emerging Risks

On a three-year cycle, the NRA process (as outlined in Chapter 4) should be followed to identify the key risks likely to trigger a national emergency and the emerging risks which could pose a national threat. Outputs from this process, as identified on the NRA Matrix and the list of Emerging Risks, will inform the programme of work for the GTF on Emergency Planning and the risk management activities of Lead Government Departments.

This element of the Strategic Risk Management Cycle will cover Step 1, Identification of Emerging Critical Risks, of the *7-Step Process for the Identification and Management of Emerging Risks of National Significance* outlined in Chapter 6.

8.3 Risk Monitoring and Management

To cover risk monitoring and risk management, the Lead Government Department for each risk should prepare a risk report for the GTF, submitted via the OEP. Based on the relative risk posed, an update on the capability to manage the risks identified in the NRA should be presented in sequence to the GTF. A schedule for each GTF should be published as part of the Assessment of Risk Management Capability process. The Appendix 10.3 Template for Reporting on Key National Risks from NRA Matrix may be used to report on the management of each key risk to the GTF.

At each GTF, the relevant Lead Government Departments should also be asked to report on any shift in each of the emerging risks with a view to removing it as an emerging risk, confirming it still poses a threat but still lacks maturity, or moving it into the risk assessment process. See Appendix 10.4 *Template for Reporting on Emerging Risks to GTF* for a proposed format which may be used for this purpose. As was the case under the Annual Review of Risks, should the emerging risk materialise, the Expert Focus Group methodology deployed within the NRA should be activated and an annexe to cover

the risk(s) added to the current NRA documentation. Finally, representatives from each Lead Government Department should report on any new emerging risks identified since the last meeting of the GTF.

The work undertaken by the relevant Lead Government Department to prepare this report for the GTF will cover Steps 2, 3, 4, and 6 of the Figure 8: A 7-Step Process for the Identification and Management of Emerging Risks of National Significance. The report should be shared with any relevant stakeholders not represented on the GTF.

8.4 Lead Government Department Training and Exercise Programme

Lead Government Departments should devise a 3-year training and exercise programme to cover the Reasonable Worst-Case Scenario(s) linked to each key risk for which they are responsible. The training and exercise programme should provide assurance that the arrangements in place to manage the key risks will work.

Individuals with a key role to play in risk or emergency management should receive training to prepare them for their role in advance of participating in scenario-based exercises. The programme should exercise the technical, logistical, administrative, procedural, and operational elements of the response and recovery; confirm the adequacy of arrangements and infrastructure – including roles, responsibilities, and incident management locations; and validate any technology and telecommunications on which response and recovery will depend. Exercises may include walk-throughs/workshops, tabletops, or live exercises that may be independent or delivered with a relevant third-party organisation.

With regard to the emerging risks listed in the NRA Report, as outlined in Step 5, the relevant Lead Government Department should use tabletop exercises to explore the management of the emerging risks, drawing on lessons learned from the planning for, and management of, previous emergencies.

The exercises should be used to identify gaps and capture recommendations for continuous improvement in national risk management.

8.5 Conclusion

The GTF, through the NRA Working Group, should ensure the provisions of Step 7, Implement Recommendations to Ensure Continuous Improvement, are delivered. At the beginning of each NRA cycle, as part of the drive for continuous improvement, any lessons identified from the previous iteration of the process should be integrated into the next NRA process.

9.0 Report References

Department of the Taoiseach, 2023, “National Risk Assessment: Overview of Strategic Risks”. Available at: <https://www.gov.ie/pdf/?file=https://assets.gov.ie/266493/8fef16b4-ea2c-4830-a6fc-4f6d2a393453.pdf#page=null>

European Union (2019) Commission Notice Reporting Guidelines on Disaster Risk Management, Art. 6(1)d of Decision No 1313/2013/EU2019/C428/07 C/2019/8929. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.C_.2019.428.01.0008.01.ENG&toc=OJ%3AC%3A2019%3A428%3ATOC

European Union (2019) Decision No 1313/2013/EU of the European Parliament, and of the Council of 17 December 2013, on a Union Civil Protection Mechanism, as amended by Decision No 2019/420. Available at: <http://eur-lex.europa.eu/eli/dec/2013/1313/oj>

Government of Ireland, 2020, “A National Risk Assessment for Ireland. Available at: <https://www.gov.ie/ga/preasraitis/5e685-national-risk-assessment-for-ireland-2020/>

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

OECD, 2023, Strengthening knowledge of emerging critical and existential risks: collective mapping and strategic foresight. GOV/PGC/HLRF(2023)5

Smith, J. C., & Dubois, A., 2010, “The ‘Wild Cards’ of European future: Planning for discontinuities?” *Futures* 42 (2010) pp.846-855.

UNISDR, U., Sendai Framework for Disaster Risk Reduction 2015-2030. 2015. United Nations Geneva. Available at: https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf

Van Rij, V., 2010, “Joint horizon scanning: identifying common strategic choices and questions for knowledge.” *Science and Public Policy*, 37(1), pp.7-18.

9.1 Case Study References

Allianz Darta Saving Life Assurance DAC (2022) *DARTA SAVING LIFE ASSURANCE DAC (trading as ALLIANZ DARTA SAVING) SOLVENCY AND FINANCIAL CONDITION REPORT*. Available at: <https://www.allianzdarta.ie/wp-content/uploads/2023/04/ALLIANZ-DARTA-SAVING-SFCR-31-December-2022.pdf>

An Post (2023) *Connecting our digital and physical worlds Annual Report 2022*. Available at: <https://www.anpost.com/getmedia/ee2c0ad2-5124-4aed-b34b-75b8aaa76ffa/M14248-AN-POST-Annual-Report-2022-Web.pdf>

Bandai Namco Group (2023) *Bandai Namco Group Integrated Report 2022*. Available at: https://www.bandainamco.co.jp/files/ir/integrated/pdf/en_2022_integrated_4.pdf

Bank of Ireland (2022) *Sustainability Report 2022 Bank of Ireland Group plc*. Available at: <https://investorrelations.bankofireland.com/app/uploads/BoI-2022-Sustainability-Report.pdf>

Bupa Insurance Ltd. (2019) *2019 Bupa Insurance Limited Solvency and Financial Condition Report*. Available at: https://www.bupa.com/~/_media/Files/B/Bupa/documents/financials/regulatory-information/bupa-insurance%20limited/bupa-insurance-limited-solvency-financial-condition-report-2019.pdf

Currys PLC (2022) *We help everyone enjoy amazing technology Annual Report & Accounts 2022/23*. Available at: <https://www.currysplc.com/media/fa4dn4ef/41183-currys-ar-2022-23-web.pdf>

Danone (2023) *2022 UNIVERSAL REGISTRATION DOCUMENT ANNUAL FINANCIAL REPORT*. Available at: <https://www.danone.com/content/dam/corp/global/danonecom/investors/en-all-publications/2022/registrationdocuments/danoneurd2022eng.pdf>

DCC plc (2022) *DCC plc: Enabling Progress - Annual Report and Accounts 2022*. Available at: https://www.dcc.ie/~/_media/Files/D/DCC-v2/documents/pdfs/dcc-annual-report-2022.pdf

Dublin Bus (2022) *Bus Átha Cliath Annual Report and Financial Statements 2022: The Route to Sustainability*. Available at: <https://www.dublinbus.ie/getmedia/2bd91550-fea3-4efd-890b-ba4981f93a4a/Dublin-Bus-Annual-Report-2022.pdf>

Dublin City University (2022) *Risk Management Policy*. Available at: https://www.dcu.ie/system/files/finance_editor/2022-07/112%20-%20risk_mgt_policy_coo_v4.0_0.pdf

Enterprise Ireland (2022) *Annual Report & Accounts 2022*. Available at: <https://www.enterprise-ireland.com/en/Publications/Reports-Published-Strategies/Annual-Reports/2022-Annual-Report-and-Accounts.pdf>

FIFA (2020) *Compliance Handbook October 2020 edition*. Available at: <https://digitalhub.fifa.com/m/4a1daee06e72f0c6/original/lp015yxfdqesvrleo6ii-pdf.pdf>

Flutter Entertainment plc (2022) *Leading betting and gaming into the future: Flutter Entertainment plc Annual Report and Accounts 2022*. Available at: <https://www.rentokil-initial.com/~media/Files/R/Rentokil/documents/annual-reports/rentokil-initial-annual-report-2021.pdf>

IDA Ireland (2021) *IDA Ireland Annual Report and Accounts 2021*. Available at: <https://www.idaireland.com/getattachment/a1e0578f-74a6-429f-af7a-f0f5ded03ad2/IDA->

Next PLC (2023) *ANNUAL REPORT & ACCOUNTS JANUARY 2023*. Available at: <https://www.nextplc.co.uk/~media/Files/N/Next-PLC-V2/documents/2023/annual-reports-and-account-jan-2023.pdf>

NI Libraries (2023) *Risk Management Strategy*. Available at: <https://www.librariesni.org.uk/media/131hlccy/risk-management-strategy-june-2023.pdf>

Rentokil Initial plc (2022) *Reshaping our business Rentokil Initial plc Annual Report 2021*. Available at: <https://www.rentokil-initial.com/~media/Files/R/Rentokil/documents/annual-reports/rentokil-initial-annual-report-2021.pdf>

Tesla (2023) *Tesla Annual Report 2023 Form 10-K (NASDAQ:TSLA)*. Available at: <https://stocklight.com/stocks/us/manufacturing/nasdaq-tsla/tesla/annual-reports/nasdaq-tsla-2023-10K-23570030.pdf>

The Health Service Executive (2022) *Health Service Executive Annual Report and Financial Statements 2022*. Available at: <https://www.hse.ie/eng/services/publications/corporate/hse-annual-report-and-financial-statements-2022.pdf>

Unilever (2022) *Delivering sustainable business performance: Unilever Annual Report and Accounts 2022*. Available at: <https://www.unilever.com/files/92ui5egz/production/0daddecec3fdde4d47d907689fe19e040aab9c58.pdf>

VHI (2022) *Vhi Annual Report and Accounts 2022*. Available at: <https://www.vhi.ie/annual-reports/english/annual-report-2022.pdf>

9.2 NRA References

Cabinet Office (2017) *National Risk Register Of Civil Emergencies*. Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/644968/UK_National_Risk_Register_2017.pdf

Cyprus University of Technology (CUT) (2018) NATIONAL RISK ASSESSMENT FOR THE REPUBLIC OF CYPRUS (NRA-CY). Available at: https://civildefence.com.cy/wp-content/uploads/NRA_CYPRUS_2018.pdf

Danish Emergency Management Agency (2022) *National Risk Profile 2022*. Available at:

<https://www.brs.dk/globalassets/brs---beredskabsstyrelsen/dokumenter/krisestyring-og-beredskabsplanlagning/2022/-national-risk-profile-2022-.pdf>

Department of the Prime Minister and Cabinet (2024) *New Zealand's National Risks*. Available at:

<https://www.dpmc.govt.nz/our-programmes/national-security/national-risk-framework/new-zealands-national-risks>

FEMA (2019) *2019 National Threat and Hazard Identification and Risk Assessment (THIRA)*. Available at: https://www.fema.gov/sites/default/files/2020-06/fema_national-thira-overview-methodology_2019_0.pdf

Government of Canada (2024) *National Risk Profile A national emergency preparedness and awareness tool First Public Report – May 2023 (Revised in January 2024)*. Available at:

<https://www.publicsafety.gc.ca/cnt/rsrscs/pblctns/2023-nrp-pnr/2023-nrp-pnr-en.pdf>

Government of the Republic of Slovenia (2018) *STATE EVALUATION RISK FOR ACCIDENTS: Version 2.0*.

Available at: https://www.gov.si/assets/organi-v-sestavi/URSZR/Datoteke/Ocene-tveganja-za-nesrece/drzavna-ocena-tveganj-za-nesrece-2.0_2018_za-splet.pdf

Government Security Center (2022) NATIONAL PLAN FOR CRISIS MANAGEMENT Update 2021/22.

Available at: <https://www.gov.pl/attachment/1181eb1b-365f-4736-9479-8b3fb94cd670>

HM Government (2020) National Risk Register 2020 edition. Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/952959/6.6920_CO_CCS_s_National_Risk_Register_2020_11-1-21-FINAL.pdf

HM Government (2023) National Risk Register 2023 edition. Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1175834/2023_NATIONAL_RISK_REGISTER_NRR.pdf

Ministry of the Interior (2019) *National risk assessment 2018*. Available at:

https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161351/9_2019_National%20risk%20assessment.pdf?sequence=1&isAllowed=y

Ministry of the Interior (2023) *National risk assessment 2023*. Available at:

https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/164629/SM_2023_6.pdf?sequence=1&isAllowed=y

National Civil Protection Department (2018) National risk assessment: Overview of the potential major disasters in Italy: seismic, volcanic, tsunamis, hydro geological/hydraulic and extreme weather, droughts and forest fire risks. Available at:

https://www.protezionecivile.gov.it/static/5cffe32c9803b0bddce533947555cf1/Documento_sulla_Valutazione_nazionale_dei_rischi.pdf

National Civil Protection Department (2021) Summary Report Italy REPORT PURSUANT TO ARTICLE 6 (1) (D) OF DECISION 1313/2013/EU. Available at: https://civil-protection-humanitarian-aid.ec.europa.eu/document/download/9700c341-6899-4564-b5cb-c25da9fc5f7d_en?filename=Summary-Report-Italy-art-6_1-d-Decision-1313-2013_EN.pdf

RAND Corporation (2018) *Homeland Security National Risk Characterisation: Risk Assessment Methodology*. ISBN: 978-0-8330-9968-6. Place of publication: Santa Monica, Calif. Available at: <https://apps.dtic.mil/sti/pdfs/AD1085831.pdf>

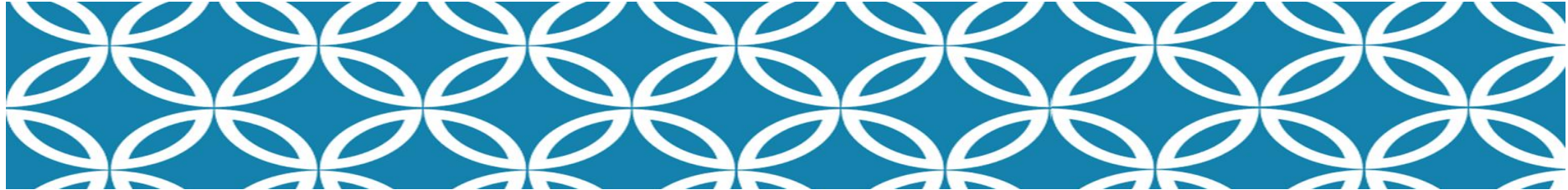
Republic of Croatia (2019) *Disaster Risk Assessment for Republic of Croatia*. Available at: https://civilna-zastita.gov.hr/UserDocsImages/CIVILNA%20ZA%C5%A0TITA/PDF_ZA%20WEB/Procjena_rizika%20od%20katastrofa_2019.pdf

RO-RISK (2018) 2018 National Risk Assessment Report. Available at: <https://www.igsu.ro/Resources/COJ/RapoarteStudii/Raport%20privind%20evaluarea%20riscurilor%20la%20nivel%20na%C8%9Bional%20final%202018%20Mec%20PR%20Civ.pdf>

The National Network of Safety and Security Analysts (2019) *National Risk Assessment*. Available at: <https://english.nctv.nl/documents/publications/2019/09/18/dutch-national-risk-assessment>

The National Network of Safety and Security Analysts (2022) *National Risk Assessment of the Kingdom of the Netherlands 2022*. Available at: <https://www.government.nl/binaries/government/documenten/reports/2022/09/26/national-risk-assessment-of-the-kingdom-of-the-netherlands-2022/National+Risk+Assessment+of+the+Kingdom+of+the+Netherlands+2022.pdf>

10.0 Appendices



Appendix 10.1 Bibliography: National Risk Assessment Methodologies Theory and Practice

Scanning for Impact (S4I) Project at DCU Business School

Professor Caroline McMullan – PI
Niamh Reilly – Research Assistant
Dr Ann Largey
Gavin D. Brown

This research is funded by the Office of Emergency Planning (OEP), Department of Defence, and the EU under the ECHO/SUB/2022/TRACK1/882660 FUTUREPROOF-IE project.



Introduction

A structured literature review focused on the completion of National Risk Assessments was undertaken in order to identify the methodologies utilized to determine the key risks which could trigger a national emergency. The process typically involves risk identification, risk rating and the production of a risk matrix to convey the relative risk posed by each key risk.

As outlined in the NRA for Ireland (2023), risk identification and assessment are accepted internationally as essential steps in the process of identifying the challenges that may have to be addressed by society, particularly in the context of emergency management. An effective NRA will contribute to creating a shared understanding of the national-level challenges to be addressed; allow for the comparison and prioritisation of risks against pre-agreed criteria; provide the basis for establishing priorities with regard to risk mitigation; and inform the development of enhanced national and community resilience.

The literature search was undertaken using Google Scholar following the PRISMA methodology (Moher et al.,2009). The search, with a relevance filter applied, was completed using the keyword string:

"National Risk Assessment" AND Method OR Methodology

All papers included in the first five pages of the Google Scholar search were then screened in compliance with the PRISMA methodology, as illustrated in **Figure 1** below. Beyond the fifth page of the results, the relevance of the papers reduced sharply.

PRISMA Summary of Results

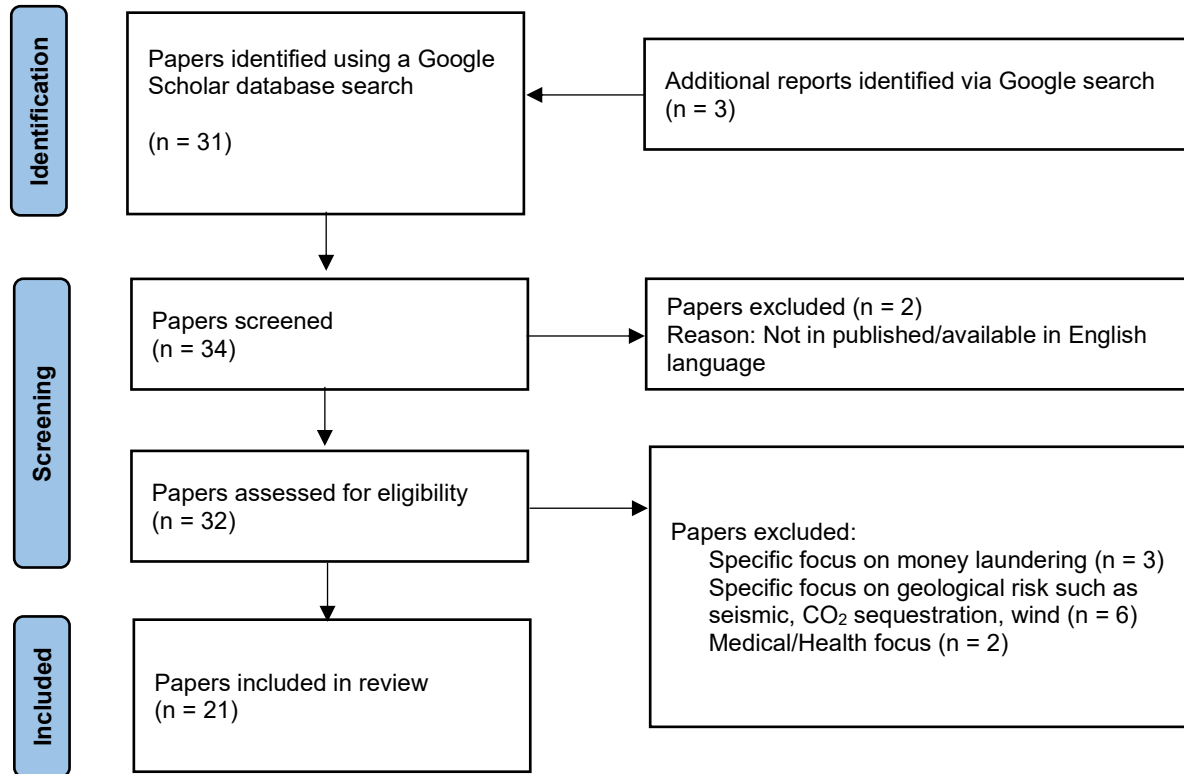


Figure 1: Adapted from PRISMA (Moher et al.,2009).

Papers Screened for Relevance

The following papers were screened for relevance to the research question, **what methodologies are deployed when completing National Risk Assessments?** The table includes a citation for each paper, records if each was included in the SLR and, if not, the rationale for its exclusion.

Table 1: Papers Screened

Title	Harvard Reference	Included in the SLR	Reason for Exclusion
Application of the SP-BELA methodology to RC residential buildings in Italy to produce seismic risk maps for the national risk assessment.	Borzi, B., Faravelli, M. and Di Meo, A., 2021. Application of the SP-BELA methodology to RC residential buildings in Italy to produce seismic risk maps for the national risk assessment. <i>Bulletin of Earthquake Engineering</i> , 19, pp.3185-3208	✓	
Homeland security national risk characterization: Risk assessment methodology	Willis, H.H., Tighe, M.P., Laland, A., Ecola, L., Shelton, S.R., Smith, M.L., Rivers, J.G., Leuschner, K., Marsh, T. and Gerstein, D.M., 2018. <i>Homeland security national risk characterization: Risk assessment methodology</i> (p. 0080). RAND.	✓	
Dealing with future risks in the Netherlands: the National Security Strategy and the National Risk Assessment.	Mennen, M.G. and Van Tuyl, M.C., 2015. Dealing with future risks in the Netherlands: the National Security Strategy and the National Risk Assessment. <i>Journal of Risk Research</i> , 18(7), pp.860-876.	✓	
A financial monitoring methodology: national risk assessment.	Edronova, V.N., 2016. A financial monitoring methodology: national risk	x	Not in English.

Title	Harvard Reference	Included in the SLR	Reason for Exclusion
	assessment. <i>Finansy i kredit= Finance and Credit</i> , (16), pp.27-39.		
National risk assessment in the Netherlands: A multi-criteria decision analysis approach.	Pruyt, E. and Wijnmalen, D., 2010. National risk assessment in the Netherlands: A multi-criteria decision analysis approach. In <i>Multiple Criteria Decision Making for Sustainable Energy and Transportation Systems: Proceedings of the 19th International Conference on Multiple Criteria Decision Making, Auckland, New Zealand, 7th-12th January 2008</i> (pp. 133-143). Springer Berlin Heidelberg.	✓	
Quantification of key long-term risks at CO2 sequestration sites: latest results from US DOE's national risk assessment partnership (NRAP) project.	Pawar, R., Bromhal, G., Carroll, S., Chu, S., Dilmore, R., Gastelum, J., Oldenburg, C., Stauffer, P., Zhang, Y. and Guthrie, G., 2014. Quantification of key long-term risks at CO2 sequestration sites: latest results from US DOE's national risk assessment partnership (NRAP) project. <i>Energy Procedia</i> , 63, pp.4816-4823.	X	Technical paper with specific focus on geological risk, i.e., CO ₂ sequestration, not within the remit of this study.
Identifying Money Laundering Risk in the United Kingdom: Observations from National Risk Assessments and a Proposed Alternative Methodology.	Hopkins, M. and Shelton, N., 2019. Identifying Money Laundering Risk in the United Kingdom: Observations from National Risk Assessments and a Proposed Alternative Methodology. <i>European Journal on</i>	x	Paper with a specific focus on money laundering, not within the remit of this study.

Title	Harvard Reference	Included in the SLR	Reason for Exclusion
	<i>Criminal Policy and Research</i> , 25, pp.63-82.		
Quantification of risk profiles and impacts of uncertainties as part of US DOE's National Risk Assessment Partnership (NRAP).	Pawar, R., Bromhal, G., Dilmore, R., Foxall, B., Jones, E., Oldenburg, C., Stauffer, P., Unwin, S. and Guthrie, G., 2013. Quantification of risk profiles and impacts of uncertainties as part of US DOE's National Risk Assessment Partnership (NRAP). <i>Energy Procedia</i> , 37, pp.4765-4773.	X	Technical paper with specific focus on geological risk, i.e., CO ₂ sequestration, not within the remit of this study.
An approach to the use of indices-based analysis subject to money laundering and terrorist financing national risk assessment.	Dmytrov, S. and Medvid, T., 2017. An approach to the use of indices-based analysis subject to money laundering and terrorist financing national risk assessment.	X	Paper with a specific focus on money laundering, not within the remit of this study.
A national risk assessment for intersex in fish arising from steroid estrogens.	Williams, R.J., Keller, V.D., Johnson, A.C., Young, A.R., Holmes, M.G., Wells, C., Gross-Sorokin, M. and Benstead, R., 2009. A national risk assessment for intersex in fish arising from steroid estrogens. <i>Environmental Toxicology and Chemistry: An International Journal</i> , 28(1), pp.220-230.	X	Technical paper with specific focus on environmental health, i.e., intersex in fish arising from steroid estrogens from sewage pollution. Not within the remit of this study.
Dealing with cascading multi-hazard risks in national risk assessment: The case of Natech accidents.	Girgin, S., Necci, A. and Krausmann, E., 2019. Dealing with cascading multi-hazard risks in national risk assessment: The case of Natech accidents. <i>International journal of disaster risk reduction</i> , 35, p.101072.	✓	

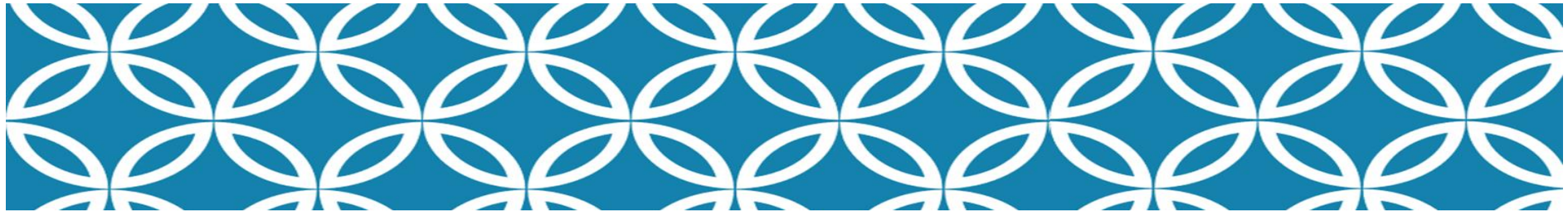
Title	Harvard Reference	Included in the SLR	Reason for Exclusion
Publicly available data-based flood risk assessment methodology: a case study for a floodplain in poland.	Bralewski, A. and Bralewska, K., 2021. Publicly available data-based flood risk assessment methodology: a case study for a floodplain in poland. <i>Water</i> , 14(1), p.61.	✓	
Actual problems of environmental factors risk assessment on human health and ways to improve it.	Rakhmanin, Y.A., Novikov, S.M., Avaliani, S.L., Sinitsyna, O.O. and Shashina, T.A., 2015. Actual problems of environmental factors risk assessment on human health and ways to improve it. <i>health (e-mail: sta05@mail.ru; tel.: 8 (499), 246</i> , pp.24-04.	X	Not in English.
Foundational issues in relation to national risk assessment methodologies.	Veland, H., Amundrud, Ø. and Aven, T., 2013. Foundational issues in relation to national risk assessment methodologies. <i>Proceedings of the Institution of Mechanical Engineers, Part O: Journal of Risk and Reliability</i> , 227(3), pp.348-358.	✓	
Potential CO2 and brine leakage through wellbore pathways for geologic CO2 sequestration using the National Risk Assessment Partnership tools: Application to the Big Sky Regional Partnership.	Onishi, T., Nguyen, M.C., Carey, J.W., Will, B., Zaluski, W., Bowen, D.W., Devault, B.C., Duguid, A., Zhou, Q., Fairweather, S.H. and Spangler, L.H., 2019. Potential CO2 and brine leakage through wellbore pathways for geologic CO2 sequestration using the National Risk Assessment Partnership tools: Application to the Big Sky Regional Partnership. <i>International</i>	x	Technical paper with specific focus on geological risk, i.e., CO ₂ sequestration, not within the remit of this study.

Title	Harvard Reference	Included in the SLR	Reason for Exclusion
	<i>Journal of Greenhouse Gas Control</i> , 81, pp.44-65.		
The impact of gender on risk perception: Implications for EU member states' national risk assessment processes.	Brown, G.D., Largey, A. and McMullan, C., 2021. The impact of gender on risk perception: Implications for EU member states' national risk assessment processes. <i>International Journal of Disaster Risk Reduction</i> , 63, p.102452.	✓	
Development of a method for national risk assessment based on heavy rain-induced multi-hazard scenarios.	YunYun, W., Ham, H.J., Choi, S.H. and Lee, S., 2018. Development of a method for national risk assessment based on heavy rain-induced multi-hazard scenarios. <i>Journal of the Korean Society of Hazard Mitigation</i> , 18(6), pp.325-333.	✓	
Toward the validation of a National Risk Assessment against historical observations using a Bayesian approach: application to the Swiss case.	Spada, M., Burgherr, P. and Hohl, M., 2019. Toward the validation of a National Risk Assessment against historical observations using a Bayesian approach: application to the Swiss case. <i>Journal of Risk Research</i> , 22(11), pp.1323-1342.	✓	
Seismic risk assessment of residential buildings in Italy.	Dolce, M., Prota, A., Borzi, B., da Porto, F., Lagomarsino, S., Magenes, G., Moroni, C., Penna, A., Polese, M., Speranza, E. and Verderame, G.M., 2021. Seismic risk assessment of residential buildings in Italy. <i>Bulletin of Earthquake Engineering</i> , 19, pp.2999-3032.	X	Technical paper with specific focus on geological risk, i.e., seismic risk, not within the remit of this study.
The validity of the preference profiles used for evaluating	Willis, H.H., Potoglou, D., Bruine de Bruin, W. and Hoorens, S., 2012. The	✓	

Title	Harvard Reference	Included in the SLR	Reason for Exclusion
impacts in the Dutch National Risk Assessment.	validity of the preference profiles used for evaluating impacts in the Dutch National Risk Assessment.		
Severe Wind Gust Risk for Australian Capital Cities-A National Risk Assessment Approach.	Nadimpalli, K., Cechet, R.P. and Edwards, M., 2007. Severe Wind Gust Risk for Australian Capital Cities-A National Risk Assessment Approach. <i>International Modelling and Simulation (MODSIM)</i> .	X	Technical paper with specific focus on geological risk, i.e., wind, not within the remit of this study.
Recommendations for national risk assessment for disaster risk management in EU.	Poljanšek, K., Casajus Valles, A., Marin Ferrer, M., De Jager, A., Dottori, F., Galbusera, L., Garcia Puerta, B., Giannopoulos, G., Girgin, S., Hernandez Ceballos, M. and Iurlaro, G., 2019. Recommendations for national risk assessment for disaster risk management in EU. <i>Publications Office of the European Union, Luxembourg</i> .	✓	
National risk registers: Security scientism and the propagation of permanent insecurity.	Hagmann, J. and Cavelty, M.D., 2012. National risk registers: Security scientism and the propagation of permanent insecurity. <i>Security Dialogue</i> , 43(1), pp.79-96.	✓	
How solid is the Dutch (and the British) national risk assessment? Overview and decision-theoretic evaluation.	Vlek, C., 2013. How solid is the Dutch (and the British) national risk assessment? Overview and decision-theoretic evaluation. <i>Risk Analysis</i> , 33(6), pp.948-971.	✓	

Title	Harvard Reference	Included in the SLR	Reason for Exclusion
Fatal venous thromboembolism associated with hospital admission: a cohort study to assess the impact of a national risk assessment target.	Lester, W., Freemantle, N., Begaj, I., Ray, D., Wood, J. and Pagano, D., 2013. Fatal venous thromboembolism associated with hospital admission: a cohort study to assess the impact of a national risk assessment target. <i>Heart</i> .	X	Part of the Medical/Health literature, not within the remit of this study.
Evaluating UK natural hazards: the national risk assessment.	Stock, M.J. and Wentworth, J., 2020. Evaluating UK natural hazards: the national risk assessment.	✓	
Learning from money laundering National Risk Assessments: the case of Italy and Switzerland.	Ferwerda, J. and Reuter, P., 2019. Learning from money laundering National Risk Assessments: the case of Italy and Switzerland. <i>European Journal on Criminal Policy and Research</i> , 25, pp.5-20.	x	Paper with a specific focus on money laundering, not within the remit of this study.
Seismic risk assessment as part of the National Risk Assessment for the Republic of Cyprus: from probabilistic to scenario-based approach.	Kazantzidou-Firtinidou, D., Kyriakides, N., Votsis, R. and Chrysostomou, C.Z., 2022. Seismic risk assessment as part of the National Risk Assessment for the Republic of Cyprus: from probabilistic to scenario-based approach. <i>Natural Hazards</i> , 112(1), pp.665-695.	x	Technical paper with specific focus on geological risk, i.e., seismic risk, not within the remit of this study.
Integrating risk assessment and business impact assessment in the public crisis management sector.	Hassel, H. and Cedergren, A., 2021. Integrating risk assessment and business impact assessment in the public crisis management sector. <i>International journal of disaster risk reduction</i> , 56, p.102136.	✓	

Title	Harvard Reference	Included in the SLR	Reason for Exclusion
Of critical importance: Toward a quantitative probabilistic risk assessment framework for critical infrastructure.	Nas, I., Helsloot, I. and Cator, E., 2023. Of critical importance: Toward a quantitative probabilistic risk assessment framework for critical infrastructure. <i>Journal of Contingencies and Crisis Management</i> .	✓	
Paper two. Methodology, process & outcomes: delivering the national risk assessment 2017.	McMullan, C., Brown, G.D., Tully, E. and Craven, T., 2018. Paper two. Methodology, process & outcomes: delivering the national risk assessment 2017.	✓	
OECD Economic Outlook, Volume 2023 Issue 1: Finland	OECD (2023), <i>OECD Economic Outlook, Volume 2023 Issue 1: Finland</i> , OECD Publishing, Paris, https://doi.org/10.1787/ce188438-en .	✓	
OECD Risks That Matter Survey 2022: Finland.	OECD (2023) <i>OECD Risks That Matter Survey 2022: Finland</i> . Available at: https://www.oecd.org/finland/RTM2022-Finland-fi.pdf	✓	
FORECAST FOR THE FINNISH ECONOMY – DECEMBER 2023: Finland’s economy is in recession and the recovery will be slow.	Bank of Finland (2024) <i>FORECAST FOR THE FINNISH ECONOMY – DECEMBER 2023: Finland’s economy is in recession and the recovery will be slow</i> . Available at: LINK	✓	



10.2 Bibliography- Risk Horizon Scanning and Emergent Risk Forecasting Methodologies

Scanning for Impact (S4I) Project at DCU Business School

Professor Caroline McMullan – PI
Niamh Reilly – Research Assistant
Dr Ann Largey
Gavin D. Brown

This research is funded by the Office of Emergency Planning (OEP), Department of Defence, and the EU under the ECHO/SUB/2022/TRACK1/882660 FUTUREPROOF-IE project.



Introduction

A structured literature review focused on risk horizon scanning methodologies and emergent risk forecasting was undertaken in order to delineate the approaches adopted by academic and policymaking entities in utilising these processes to identify potential future risks. Horizon scanning has been described as the identification of the weak signals which may precede Wild Cards, "a future event, the probability of which is very small, but the impact on the environment is as great as possible." (Smith & Dubois 2010, 847).

Horizon Scanning methods can be divided into three, often complementary, approaches:

- Desk research: collecting information from print and digital sources;
- Automation/Semi-automation: use of Artificial Intelligence (AI) - Natural Language Processing (NLP) to gather and analyse large volumes of news feeds or other data for changes or shifts. Human input is generally required to filter results at various stages of the process;
- Meetings, focus groups, interviews, or workshops at which members of an organization and/or external experts are asked to identify changes or forces in the operating environment indicating an emerging risk that could impact a community or the achievement of organisational objectives.

The literature search was undertaken using Google Scholar following the PRISMA methodology proposed by Moher et al. (2009). The search was completed using the keyword string:

"emergent risk forecasting" OR "risk horizon scanning"

This search produced a total of 12 papers. The most pertinent works cited within these papers were also reviewed for relevance to supplement the low number of results yielded by the original search string, increasing the number of papers to 18. All papers were then screened in compliance with the PRISMA methodology, as illustrated in **Figure 1** below.

PRISMA Summary of Results

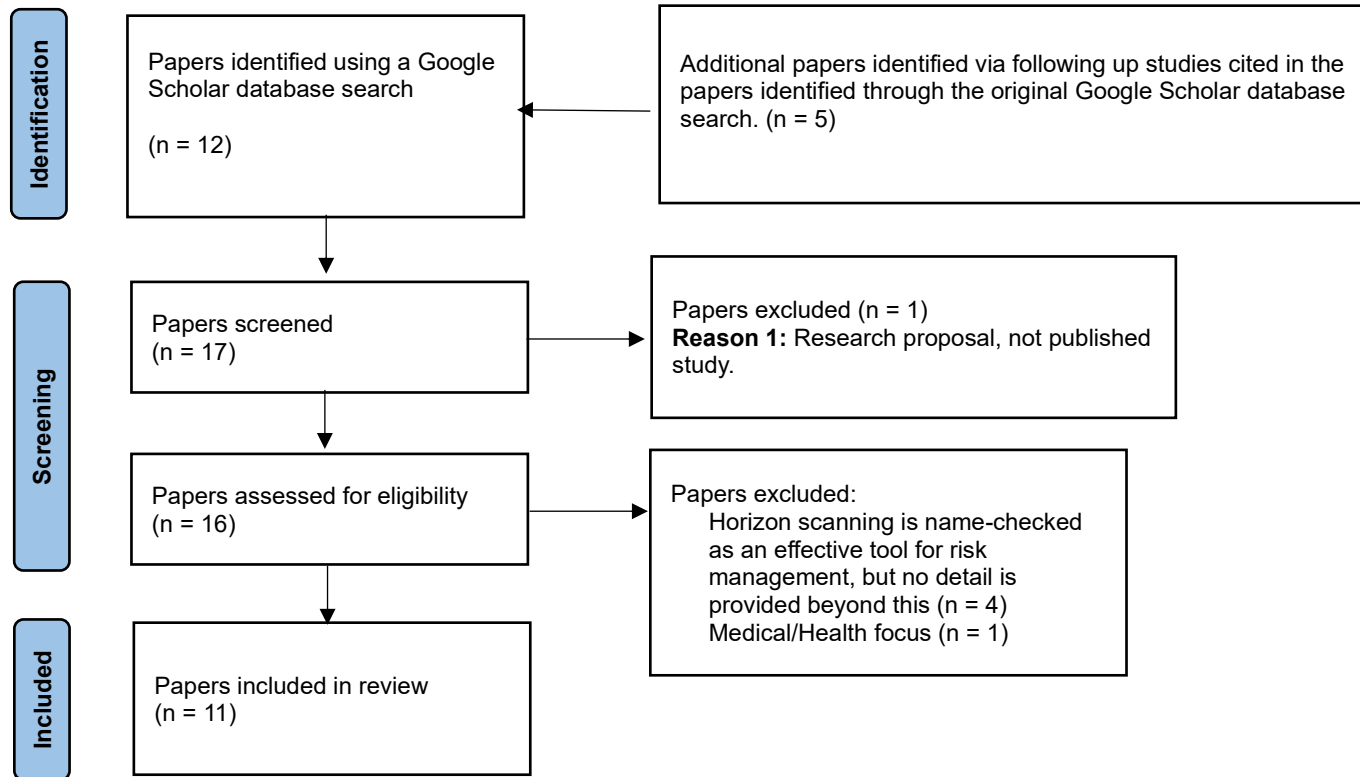


Figure 1: Adapted from PRISMA (Moher et al.,2009).

Papers Screened for Relevance

The following papers were screened for relevance to the research question: **What are the key methodologies employed in the processes of risk horizon scanning and emergent risk forecasting?** The table includes a citation for each paper, records if each was included in the SLR and, if not, the rationale for its exclusion.

Table 1: Papers Screened

Title	Harvard Reference	Included in the SLR	Reason for Exclusion
The European Emerging Risk Radar Initiative—a Chance for China?	Jovanovic, A., Balos, D. and Yan, L., 2012. The European Emerging Risk Radar Initiative—a Chance for China? <i>Procedia Engineering</i> , 43, pp.489-493.	✓	
Risk Research Trends in Horizon 2020: The Challenge of Implementation.	SALVI, O., 2014. Risk Research Trends in Horizon 2020: The Challenge of Implementation. <i>日本リスク研究学会誌</i> , 24(3), pp.165-168.	✓	
Hippisley, J., 2021. QResearch.	Hippisley, J., 2021. QResearch.	X	Research proposal, not published study.
COVID-19 and the effectiveness of ERM frameworks.	Grewal, J., Hababbeh, L., Acharyya, M., Aravind, R., Bhagaloo, S., Carey, M., Er, C., Farrugia, K. and Leung, K., 2022. COVID-19 and the effectiveness of ERM frameworks. <i>British Actuarial Journal</i> , 27, p.e23.	X	Horizon scanning is name-checked as an effective tool for risk management, but no detail is provided beyond this
STRATEGY FOR THE IMPROVEMENT OF MANAGEMENT QUALITY IN	Waldherr, M., Geyer, J. and Fleck, J., STRATEGY FOR THE IMPROVEMENT OF	X	Horizon scanning is name-checked as an effective tool for

Title	Harvard Reference	Included in the SLR	Reason for Exclusion
WORLD HERITAGE BEECH FOREST COMPONENT PARTS.	MANAGEMENT QUALITY IN WORLD HERITAGE BEECH FOREST COMPONENT PARTS.		risk management, but no detail is provided beyond this
Carbon Budgets to Inform Climate Action: A society-wide, integrated GHG quota and accounting perspective'.	Price, P.R., 2023. Carbon Budgets to Inform Climate Action: A society-wide, integrated GHG quota and accounting perspective'.	X	Horizon scanning is name-checked as an effective tool for risk management, but no detail is provided beyond this
DEVELOPMENT OF AN ONLINE, USER FRIENDLY PLANT HEALTH RESOURCE BANK FOR THE SCOTTISH NATURAL ENVIRONMENT.	Taylor, J. and Hayden, K., PHC2018/11. DEVELOPMENT OF AN ONLINE, USER FRIENDLY PLANT HEALTH RESOURCE BANK FOR THE SCOTTISH NATURAL ENVIRONMENT.	X	Horizon scanning is name-checked as an effective tool for risk management, but no detail is provided beyond this
A tool for prioritizing livestock disease threats to Scotland.	Bessell, P.R., Auty, H.K., Roberts, H., McKendrick, I.J., Bronsvoot, B.M.D.C. and Boden, L.A., 2020. A tool for prioritizing livestock disease threats to Scotland. <i>Frontiers in Veterinary Science</i> , 7, p.223.	X	Part of the Medical/Health literature, not within the remit of this study.
Anticipatory governance for preventing and mitigating catastrophic and existential risks.	Boyd, M. and Wilson, N., 2021. Anticipatory governance for preventing and mitigating catastrophic and existential risks. <i>Policy Quarterly</i> , 17(4), pp.20-31.	✓	
Futures of Civil Aviation Operations explored from the perspective of Finnair.	Ivanov, K.D., Futures of Civil Aviation Operations explored from the perspective of Finnair.	✓	

Title	Harvard Reference	Included in the SLR	Reason for Exclusion
Prepare for Change and ISO14001: 2015-the environment as a strategic issue? A cross-sectoral investigation of organisations in the South West, UK.	Nichols, M., 1917. Prepare for Change and ISO14001: 2015-the environment as a strategic issue? A cross-sectoral investigation of organisations in the South West, UK.	✓	
Bostrom, N., 2019. The vulnerable world hypothesis. <i>Global Policy</i> , 10(4), pp.455-476.	Bostrom, N., 2019. The vulnerable world hypothesis. <i>Global Policy</i> , 10(4), pp.455-476.	✓	
Horizon scanning in foresight–why horizon scanning is only a part of the game.	Cuhls, K.E., 2020. Horizon scanning in foresight–why horizon scanning is only a part of the game. <i>Futur Foresight Sci</i> 2 (1).	✓	
Rowe, E., Wright, G. and Derbyshire, J., 2017. Enhancing horizon scanning by utilizing pre-developed scenarios: Analysis of current practice and specification of a process improvement to aid the identification of important ‘weak signals’. <i>Technological Forecasting and Social Change</i> , 125, pp.224-235.	Rowe, E., Wright, G. and Derbyshire, J., 2017. Enhancing horizon scanning by utilizing pre-developed scenarios: Analysis of current practice and specification of a process improvement to aid the identification of important ‘weak signals’. <i>Technological Forecasting and Social Change</i> , 125, pp.224-235.	✓	
OECD Economic Outlook, Volume 2023 Issue 1: Finland	OECD (2023), OECD Economic Outlook, Volume 2023 Issue 1: Finland, OECD Publishing, Paris, https://doi.org/10.1787/ce18	✓	

OECD Risks That Matter Survey 2022: Finland.	OECD (2023) OECD Risks That Matter Survey 2022: Finland. Available at: https://www.oecd.org/finland/RTM	✓	
FORECAST FOR THE FINNISH ECONOMY – DECEMBER 2023: Finland’s economy is in recession and the recovery will be slow.	Bank of Finland (2024) FORECAST FOR THE FINNISH ECONOMY – DECEMBER 2023: Finland’s economy is in recession and the	✓	

10.3 Template for Reporting on Key National Risks from NRA Matrix

RISK REPORT TO GTF FOR EMERGENCY PLANNING	
THE CONTEXT	
Risk Name/Title:	<i>Brief description of risk</i>
Applicable Risk Grouping(s):	<i>Natural Hazards Transportation Hazards Technological Hazards Civil Hazards</i>
Relevant Secondary Risks:	<i>Relates to risks that have secondary effects, such as floods that occur after a hurricane.</i>
Lead Government Department	<i>Identify the Lead Government Department.</i>
Supporting Departments	<i>Identify key supporting Government Departments.</i>
Reference key information sources/ historical data used to inform the preparation of the risk description, reasonable worst-case scenario(s) & risk assessment	<i>List sources of qualitative and/or quantitative data – this helps to ensure the credibility and legitimacy of the risk assessment.</i>
Reasonable Worst-Case Scenario(s)	<i>Outline the reasonable worst-case scenario agreed at the NRA Focus Group & others proposed but not adopted.</i>
Control/Mitigation Measures	<i>Provide details of all control/mitigation measures currently in place.</i>
Planned Control/Mitigation Measures	<i>Provide details of planned control/mitigation measures.</i>
LIKELIHOOD ASSESSMENT	
Adopted Average Recurrence Interval	<i>Estimated Time Between Occurrences & Classification agreed at the relevant NRA Focus Group</i>
Proposed Average Recurrence Interval – if relevant and the reason for this report to GTF	<i>Please outline the proposed change and the rationale for this proposal</i>
IMPACT ASSESSMENT	

Impact: nature and scale	<i>Please record the overall assessment of impact – as agreed at the relevant NRA Focus Group</i>
1. People: Fatalities Critical/Illness Serious Injuries	<i>Outline the impact on people. Impact may be categorised by: Injury or illness levels are determined by the extent of medical treatment required. Critical injuries pose an immediate threat to life. Serious injuries require significant medical care but are not expected to progress to life-threatening status. Minor injuries require basic medical aid. Deaths.</i>
2. Environment	<i>Note environmental criteria based on the EPA Environmental Impact Assessment Criteria: Simple, localised contamination; Simple, regional contamination, effects of short duration; Heavy contamination localised effects or extended duration; Heavy contamination, widespread effects or extended duration; Very heavy contamination, widespread effects of extended duration.</i>
3. Economic Direct economic losses Indirect economic losses	<i>Captures the direct and indirect losses to the Irish Economy. Direct losses are immediate economic damage as a result of the reasonable worst-case scenario. Losses are measured based on repair or replacement costs to critical infrastructure. Indirect relates to the losses associated with the value of goods and services that will not be produced as a result of damage to productive systems. A Percentage (%) of Government Annual Budget was adopted as the most suitable “proxy” for economic impact.</i>
4. Essential Services	<i>Consider the level of impact on the delivery of services essential for the maintenance</i>

	<i>of vital societal functions or economic activities.</i>
5. Social	<i>Assess impact based on: Evacuation/Quarantine; Property/Housing; Medicines; Civil Unrest; Public dissatisfaction and the level of support required to ensure the functioning of society.</i>
Overall Risk Assessment	<i>Likelihood x Impact agreed at the relevant NRA Focus Group.</i>
Confidence Level in the risk assessment	<i>Note the confidence level* assessment as agreed at the relevant NRA Focus Group: *Refers to the reliability, relevance and currency of the evidence/data, input from appropriate experts, and the level of agreement among assessors.</i>
Other relevant information, notes or comments:	<i>Other relevant information relating to the risk.</i>
Updates since the last NRA	<i>Outline any proposed changes to likelihood, impact, preparedness, etc since the last NRA.</i>
Training and Exercising	<i>If yet to happen Outline the training and exercise plan relevant to this risk. Note the date of the training, the date of the exercise, type of exercise. If already delivered: Outline the training and exercise undertaken. Provide a brief overview of the key learnings captured and plan for implementation of findings.</i>
Overall Self-Assessment	
Conduct a capability self-assessment.	<i>Capability Self-Assessment: Assess the capability of the Lead Government Department to manage this risk. Identify any knowledge, responsibility, authority, or capabilities gaps which exist.</i>

10.4 Template for Reporting on Emerging Risks to GTF

EMERGING RISK REPORT TO GTF FOR EMERGENCY PLANNING	
Step 1: Identification of Emerging Risks	
Emerging Risk Name/Title:	<i>Brief description of risk</i>
Applicable Risk Grouping(s):	<i>Natural Hazards Transportation Hazards Technological Hazards Civil Hazards</i>
Reference key information sources used to identify the emerging risk:	<i>For example: Sources from Desk Research Public Research/Data Expert/Departmental Research/Data Expert Focus Groups</i>
Is the emerging risk on the current NRA Emerging Risk List?	<i>Yes/No</i>
Step 2: Assess and Share Information About Emerging Critical Risk	
Characteristics of the emerging risk:	<i>What is known about the emerging risk and the impact it may have?</i>
Possible conditions for emergence: Explore implications for management and measure confidence in the assessment.	<i>What conditions will increase the likelihood/impact of the emerging risk and how can this information inform mitigation or management of the risk?</i>
Identify stakeholders: The outputs from this process should be shared with responsible stakeholders.	<i>Which stakeholders should be aware of this emerging risk? How has the information from this process been shared?</i>
Step 3: Assess Management Maturity and Identify Gap Areas	
Assign responsibility for each emerging risk. Conduct a capability self-assessment.	<i>Lead Government Department: Supporting Departments: Capability Self-Assessment: Assess the capability of the Lead Government Department to manage this risk. Identify any knowledge, responsibility, authority, or capability gaps which exist.</i>
Step 4: Develop and Prioritize Recommendations for Managing Uncertainty	

Develop an all-hazards approach for managing under deeply uncertain conditions.	<i>Does the Department/Agency have a plan under which the emerging risk could be managed? If yes, provide details. If no, outline how this gap will be filled</i>
Step 5: Emerging Risk Exercise Series	
Use tabletop exercises to explore the management of this emerging risk.	<i>Outline the tabletop exercises which has been/will be used to explore the management of this emerging risk, drawing on lessons learned from the planning for and management of previous emergencies. Based on the exercise, identify gaps and capture recommendations.</i>
Step 6: Develop Horizon Scanning Tools	
Develop Horizon Scanning Tools for early identification of the emergence of the risk. Once emergence is confirmed, it will be transferred into the national risk assessment process.	<i>Outline the horizon scanning tools/processes which will be used to identify the emergence of the risk.</i>
Step 7: Implement Recommendations	
To ensure continuous improvement, integrate lessons identified from each iteration of this process into the next emerging risk cycle.	<i>Identify any lessons identified from each of the Steps above and how this learning will be integrated into this process and/or into the next emerging risk/NRA cycle.</i>



This research is funded by the Office of
Emergency Planning (OEP), Department
of Defence, and the EU under the
ECHO/SUB/2022/TRACK1/882660
FUTUREPROOF-IE project.



**Funded by
the European Union**

