OECD Studies in Risk Management

INNOVATION IN COUNTRY RISK MANAGEMENT

OECD

Swiss Re

OLIVER WYMAN

INNOVATION IN COUNTRY RISK MANAGEMENT

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where the governments of 30 democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The Commission of the European Communities takes part in the work of the OECD.

OECD Publishing disseminates widely the results of the Organisation's statistics gathering and research on economic, social and environmental issues, as well as the conventions, guidelines and standards agreed by its members.

Corrigenda to OECD publications may be found on line at: *www.oecd.org/publishing/corrigenda*.

Table of contents

Introduction

The OECD Futures Project on Risk Management Policies aims to assist OECD countries in identifying the challenges of managing risks in the 21st century, and contributing to their reflection on how to best address those challenges. Its focus is placed on the consistency of risk management policies and on their ability to deal with the challenges, present and future, created by systemic risks.

This OECD report looks at innovative practices in the management of risk in six countries: the United Kingdom, Canada, the United States, Japan, the Netherlands and Singapore. It focuses on recent developments in risk management at central government level such as approaches to multi-risk identification and assessment, and methods to prioritise investments in mitigation activities. Recent reforms to reorganise ministries, create collaborative partnerships with the private sector and reshape financial assistance following disasters share the common purpose to enhance efficiency and effectiveness in the prevention, protection, response and recovery from large scale events and are here considered in light of previous OECD policy guidance.[1]

The call for this study comes amid rapid changes to the global risk landscape as evidenced not only by new sources of natural and man-made hazards, increasing frequency of disasters and rising magnitudes of damage, but also by new socio-economic trends such as rising population densities and value concentrations in geographic areas exposed to hazards. In 2005, economic losses from natural catastrophes hit a record high, with direct financial losses of about US $ 230 billion, representing 0.5% of total worldwide GDP, of which US $83 billion was covered by insurance.[2] Although unprecedented damage from Hurricane Katrina accounted for much of the costs in that year, 2008 ended up being the second highest year for economic losses from natural disasters (US $ 200 billion).[3]

A high degree of technical integration and economic interdependence in modern societies has also increased uncertainty regarding where risks begin and end, as seemingly minor events may cascade into full blown crisis. The current financial crisis illustrates that even robust regulatory approaches may fail to foresee how risks to one sector of the economy can carry global ramifications. Concerns have arisen over the capabilities of governments to respond adequately to large scale disasters and the continued ability of insurers to offer property and casualty coverage. Adapting to the new risk landscape raises the need for new forms of partnership between governments, the private sector and individuals to prepare for crises in advance and to redistribute the burdens they incur.

Government efforts to manage large scale risks often focus on a particular type of hazard, because they have been established in reaction to the consequences of specific events such as natural catastrophes. Over time highly defined areas of competence tend to develop in which numerous ministries, departments and regulatory agencies at various levels of government carry-out operations in parallel and separate silos. A modern networked society with increased connections and interdependencies may be exposed to unforeseen vulnerabilities when risks

arise that do not fit neatly within the remit of one particular department. Indeed, government departments might focus on one phase of what is actually a multi-layered risk management cycle comprising risk assessment, prevention, protection, response and recovery.

An integrated, all-hazards approach to risk management entails multifaceted interactions between public authorities at the national, regional and local levels of government and private parties such as operators of infrastructure and insurers. The challenge to improve country risk management is no easy task: the intricate web connecting these various groups may obscure lines of responsibility, allocation of resources, information flows and complicate the reception of effective input from interested parties. Indeed, efficient risk management may be compromised by the inability to deal effectively with bottlenecks in the exchange and analysis of information or to set priorities informed by the entirety of a country's risk portfolio. Policymakers, regulators and emergency services with narrow or short sighted focus on achieving their individual mandates may also miss opportunities, fail to leverage the expertise of colleagues in different government departments, compare different types of risks and share lessons learned. This report highlights programmes that integrate the work of various bodies into coherent and credible sources of information that can guide prevention and protection efforts.

Public investments to mitigate risks entail the expenditure of limited resources that need to be prioritised. When such projects are in competition for funds, decisions should be informed by risk assessments that provide comparable criteria; silo operations in risk governance are not conducive to such comparisons. This report illustrates innovative tools that help policymakers compare risks for the purpose of targeting mitigation investments to their greatest benefit and how these decisions are validated.

Such decisions are complicated by the reality that risk is a moving target. For this reason some countries use horizon scanning methods that provide a forward looking perspective on risk assessment to ensure investments made today are not irrelevant tomorrow. Only by understanding such complexities is it possible to understand, and so be ready for, the possible long-term consequences of damage to a system – including the potential domino effect of harm to other systems.

The scope of this report pertains to risk management of large scale events such as natural catastrophes, terrorist events and pandemic disease that pose grave consequences for a country's population and national assets. It does not pertain to operational risk management systems that some countries have implemented to prevent disruptions to the operations of government *per se*. In particular the report focuses on organisational improvements and challenges to the pre-event phases of risk management: risk identification, assessment, and mitigation activities (including both prevention and protection measures). Policymakers face the challenge to determine not only how damage may be reduced most efficiently through pro-active measures before disaster strikes, but also how cost burdens may best be met and equitably shared. Recognising that it is impossible to perfectly prevent and protect against all risks, the report looks to new and inclusive approaches to the risk and financial management of large scale events.

This pamphlet provides a synthesis view of all-hazards risk management institutions and policies in the six countries under study. It points out common approaches in country risk management, such as structures to improve channels of communication between policymakers and stakeholders, and illustrates innovative tools for the use and validation of risk assessment and mitigation. Conclusions are provided to highlight challenges that the six countries continue to confront in their efforts to implement recently adopted reforms as well as opportunities to further enhance efforts already underway.

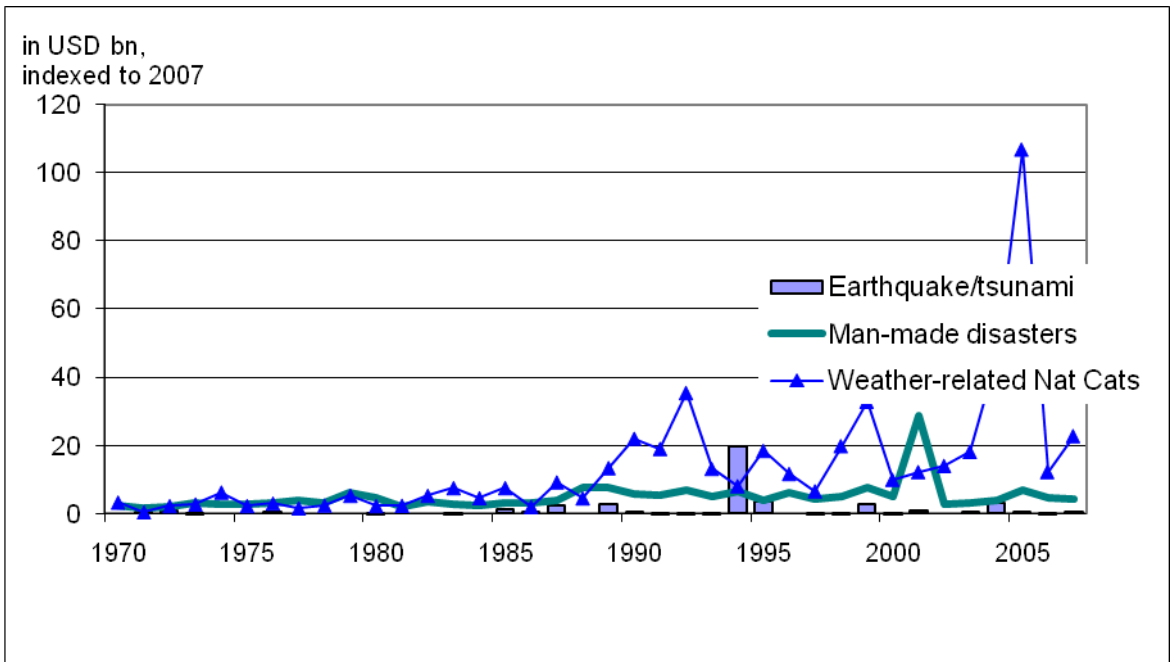
The full report, available separately from OECD, contains more detailed information about the countries under study. It profiles new approaches to all-hazards risk management as set-out in framework legislation and policies that define the roles, responsibilities and objectives of relevant central government departments. The full report also provides overviews of the main institutions involved in disaster risk management, assessment of certain natural and man-made hazards, the organisation of risk mitigation activities and mechanisms for financial management of disasters.

Barrie Stevens, Pierre-Alain Schieb and Jack Radisch collected information for this report through a questionnaire that was issued to the six countries under study and through interviews with their civil servants. Supplementary research was carried out to fill-in information gaps, including several consultations with Swiss Re and MMC/Oliver Wyman to obtain data on risk management strategies, the historic record of disaster damages and information on public private partnerships for the transfer of risk. The report was written by Jack Radisch and prepared with the assistance of Rossella Iannizzotto.

New developments in country risk management

Over the past twenty years, noticeable shifts have taken place in the risk landscapes of many OECD countries. Standing out among the key indicators is a stark increase in magnitude of disaster losses measured directly in property damage and indirectly as lost productivity. The economic impacts of disasters can be modelled approximately within an input-output framework, but insured losses provide precise, quantifiable measures for a portion of total losses, as shown in Graph 1 below.

Graph 1: Insured Losses 1970-2007[4]



Source: Swiss Re, sigma No 1/2008.

Country risk portfolios reveal not only recent growth in catastrophe losses, but also more diverse and perilous hazards that have prompted central governments to take a pro-active posture in risk management. Central governments in particular have had to adopt a broader view on risk; one that is organised to address multiple hazards and vulnerabilities, and seeks to understand their interconnections rather than addressing each hazard and consequence separately. Implementing a broader view on risk requires the mobilisation and coordination of expertise from various government bodies and the private sector to increase breadth and depth of risk analysis for the purpose of better prioritising resource allocation. Like the private sector, governments can not protect against all risks and need to focus on those that would be

the most costly, regardless of public pressure that may arise due to a distorted perception of risk immediately following a sensational event.

The governments of the countries under study recognise it is very challenging for any one organisation to take on responsibility for all risks, and impossible to achieve zero risk. New partnerships between central, regional and local governments have emerged to reduce, prevent and recover from large scale disruptions. Such innovative systems of country risk management comprise one or more of the following features: a framework policy or legislation for all-hazards risk management; a new central government body responsible for all-hazards risk management; an inter-ministerial committee or processes to promote and reinforce horizontal integration of risk policies; programmes to ensure public mitigation investments are meeting priority needs; protection of critical infrastructure to reduce the probability that industrial accidents or malicious acts will produce harmful cascade effects; reinforcement of community resilience and business continuity; public and private partnerships in the financial management of disasters; and risk transfer solutions.

Policy frameworks for all-hazards risk management

Table 1. All-hazards policy framework

Canada	Emergency Management Framework
Japan	Basic Disaster Management Plan
Netherlands	National Safety and Security Strategy
Singapore	Whole-of-Government Integrated Risk Management
United Kingdom	Civil Contingencies Act
United States	National Response Framework, National Preparedness Goal

Each one of the six countries under study has enacted an “all-hazards” framework policy for risk management that takes a comprehensive view on potential sources of risk, from natural disasters to technological accidents and intentional acts of terrorism. With limited resources at their disposal central governments are under pressure to prioritise interventions across the entire risk portfolio of their country. All-hazards approaches promote cooperation amongst the diverse actors involved in gathering information on a broad range of vulnerabilities. This enables policymakers to identify and analyse an acceptable level of risk for different types of assets and to prioritise investments that enhance protection when risk exceeds acceptable levels.

All-hazards risk analysis requires integrating information from a diverse set of government bodies and private actors. Such coordination has historically been a weakness in country risk management systems, because it is usually built on ad hoc cooperation between various agencies at different levels of government under the difficult circumstances of a major disruptive event. In the immediate aftermath of disastrous events, there has been recognition of the value in coordinating these bodies to prepare accurate risk analysis and cooperation

protocols before the next disaster strikes, but there was seldom any policy framework for such coordination. The all-hazards approaches in the countries under study are in various stages of implementation to address this, and the central government departments with primary responsibility generally recognise that the inherent complexities of multi-agency action implies iterative advancement.

A main benefit of all-hazards policy frameworks is the enhancement of multiple public bodies as flexible assets that may be used in a variety of situations, rather than rigidly managed resources whose utility is limited to response in specific disaster scenarios. For example, the field experience of first responders, who are the most familiar with the terrain of disasters, may be leveraged to inform the process of disaster preparation, including the assessment of risks, policy decisions on preventative measures and prioritisation of protective measures according to where they will contribute the greatest benefit. All-hazards approaches also provide a framework for governments to identify and produce synergistic capacities. For example, by improving vaccine distribution systems, public health is strengthened both against the risks of pandemic flu and bioterrorism attacks.

In the pre-event phases of planning, all-hazards policy frameworks promote interagency planning and coordination across ministries, regional and local governments, the private sector and non-governmental organisations. The six countries under study recognise the importance to achieve a high level of cooperation amongst the various actors involved in country risk management and to overcome their tendency to work in isolation. Such frameworks are given practical effect through a mix of formal agreements, periodic meetings, scheduled exercises and informal contacts. To achieve efficiencies in mitigation investments and response preparations it is key for governments to coordinate information channels across the complex web of responsible public bodies. This coordination ranges from meteorological and geological observation services to regulatory authorities and intelligence agencies, and requires integration of information gathered for use in short, medium and long-term risk forecasts.

Common challenges in this process are misinterpretation or misrepresentation of data, communication bottlenecks and logistics breakdowns, which may increase with every step taken between a source of information and its use by decision makers. Overarching, all-hazards policy frameworks promote coordination of highly specific expertise, development of information sharing arrangements, improvement of data integration capacity, investment in training civil servants and cooperation exercises across multiple agencies involved in country risk management.

In the event of disaster, all-hazards approaches may improve the efficiency of response systems by clarifying the roles of authorities at various levels of government and better enabling coherency of action. When disaster strikes, the chain of command between authorities has to be established quickly in order to take decisions in a timely and effective manner. In the countries under study, authority for emergency response is generally the domain of local authorities until the disaster exceeds their capacity to manage it; the determination being made by such factors as the severity of the event and the nature of its effects. All-hazards policy frameworks provide the opportunity to establish command and control protocols appropriate to the crucial stakes of the new risk landscape. When response

capacities of local authorities are surpassed, the next highest level of jurisdiction may assume command and control of the situation, and so on until the national level executive is requested to intervene.

This division of labour inevitably entails tension between local, regional and central governments over financial responsibility for the costs of pre-disaster mitigation and protection measures and recovery assistance. In essence, since the central government is responsible for the largest disasters it has an interest in promoting preventive and protective measures that reduce risks and any eventual disaster damages. Regional and local governments, for their part, have an interest in resisting mandates for expenditures they cannot afford. Several new all-hazards policies provide clarity in cost-sharing agreements by defining thresholds for national triggers and response levels, or incorporating them from previous legislation by reference.

In Singapore, the Whole-of-Government Integrated Risk Management (WOG-IRM) framework aims to improve the risk awareness of all government agencies. Though most agencies are already aware of most of the risks that fall within their remit, some agencies might not deliberately and systematically go about identifying the full range of risks, or may be under- or over-estimating the likelihood and/or impact of the risks they manage. Agencies may also lack an awareness of how such risks are affected by the action or inaction of other agencies, and vice versa. Moreover, specialised agencies often think in terms of risk avoidance i.e. making sure they have the capacity to deal with unwelcome events or developments. The tendency of a mindset heavily weighted toward risk avoidance in government agencies is failure to consider how much is lost by foregoing opportunities or by not creating them.

Singapore's WOG-IRM framework stands out as a best practice since it not only helps address gaps in risk management, it also identifies cross-agency risks that may have fallen through gaps in the system. It helps agencies to address their own vulnerabilities and to identify those that are contingent upon the vulnerabilities of others, while reinforcing the government's broader effort to evaluate and prioritise key risks in a holistic manner.

New governance models for all-hazards risk management

Table 2. Responsible bodies in central government

Canada	Public Safety Canada
Japan	Cabinet Office
Netherlands	Ministry of Interior and Kingdom Relations
Singapore	Ministry of Finance, Strategic Planning Office, National Security Coordination Secretariat, Homefront Crisis Management System
United Kingdom	Civil Contingencies Secretariat
United States	Department of Homeland Security, FEMA

Implementation of the above mentioned all-hazards policies are coordinated by new institutional structures. At least three models can be distinguished in this regard:

1) The merger of previously separate, central government departments to form a new super-ministry;

2) The creation of a relatively small and highly influential body under direct authority of the head of government;

3) The modification of an existing ministry's mandate to coordinate central government responsibilities related to country risk management.

These models present quite different approaches to essentially the same problem, namely; how best to ensure that the many relevant, yet dispersed actors involved in the various phases of country risk management are actually implementing the policies in a coherent fashion?

Several commonalities are found when comparing these models to one another:

1) They are intended to coordinate the many central, regional and local government bodies in their various efforts to implement national policy goals related to public safety and security;

2) They provide guidance to such bodies on how to conduct risk assessments;

3) They aim to streamline and standardise reporting requirements for risk assessment and emergency management plans through a common information sharing mechanism.

In 2001, Japan reorganised cabinet level ministries and agencies to streamline the central government, improve transparency and establish more effective political leadership. Two measures under this reform bear directly upon country risk management: the creation of the Cabinet Office (a policy advisory office to the government Cabinet and the Prime Minister, which is specifically tasked with ensuring effective interministerial coordination); and the merger of various ministries and departments into the Ministry of Land, Infrastructure and Tourism (MLIT), which is the largest Japanese ministry in terms of employees.[5] MLIT has reinforced efforts to promote and provide comprehensive disaster reduction measures against earthquakes, tsunamis, floods and landslides, especially as they pose a hazard to transport systems and other infrastructure.

Public Safety Canada (PSC) was created in 2003 to ensure coordination across all federal departments and agencies responsible for keeping Canadians safe from natural disasters, crime and terrorism. PSC assesses all potential hazards including natural disasters, cyber threats and terrorist incidents and provides assessments to the Prime Minister on a regular basis. PSC capitalises on its 'Government Operations Centre' as a tool to manage the data flow from various expert sources of information and to multiple partners involved in country risk management.

In 2002 the United States merged 22 separate agencies and over 180,000 employees to create the Department of Homeland Security (DHS); whose primary mission is to protect the country's domestic territory. Following the attacks of September 11, 2001, it initially emphasised a unified core for the vast national network of organisations and institutions involved in preventing, protecting, responding to and reducing the impacts of terrorism. Since Hurricane Katrina struck in 2005, however, the focus of DHS has diversified using a risk-based approach to manage the programmes it administers, thereby bolstering support for the full range of risks within its remit. DHS uses the Homeland Security Information Network, a computer-based communications system, to collect and disseminate information between federal, state and local agencies. This communications capability delivers to states and major urban areas real-time interactive connectivity with the National Operations Center (NOC), which provides situational awareness and monitoring of the homeland, coordinates incidents and response activities, and issues advisories and bulletins concerning threats. The NOC operates 24 hours a day, seven days a week, 365 days a year and coordinates information sharing to help deter, detect, and prevent terrorist acts and to manage domestic incidents.

In the wake of such events as the Y2K scare, fuel protests in 2000 and foot and mouth disease outbreaks in 2001, the United Kingdom established the Civil Contingencies Secretariat (CCS) within the Cabinet Office of the Prime Minister. Its mission is to improve the country's capacity to absorb, respond to and recover from disruptive challenges. CCS functions include monitoring the implementation by first responders of the Civil Contingencies Act and coordinating numerous government departments and stakeholders involved in building civil resilience. Its coordination activities aim to ensure that all first responder organisations have clear and effective risk assessment processes in place. CCS also works at all levels (central government, regional and local) to assess the risk of emergencies facing the whole country.

The consolidation of institutions with responsibility for managing country risk presents several potential benefits:

1) The improvement of horizontal policy coherence;

2) The enhancement of ability to coordinate and leverage the highly technical expertise of formerly separate departments; and

3) The pooling of resources to more efficiently allocate government funds during a period when many central governments are facing budgetary reductions.

On the other hand, certain countries expressed concern that attempts to centralize all risk management functions could have a downside, namely; departments not captured in a merger or reorganisation might neglect their risk management duties due to over reliance on a newly created super ministry. Whether departments are administratively related or not, it is important that governments instil a culture of risk management in every department that feeds into a centralised process of country risk analysis. Moreover, administrative reshuffling does not by itself break down barriers to efficient information exchange and policy coordination. Similar to corporate mergers, a pro-active programme of integration is needed to overcome

different working cultures, data standards, communication protocols and lack of familiarity in working together.

Interministerial processes to promote and coordinate all-hazards risk management

Table 3. Interministerial policy coordination bodies

Canada	FPT Ministers Committee
Japan	Central Disaster Management Council
The Netherlands	Government Cabinet
Singapore	Strategy Committee (Upstream), Homefront Crisis Management System (Downstream)
United Kingdom	Committee on Civil Contingencies
United States	Homeland Security Council

Each country under study has set-up a high level, interministerial committee to conduct strategic, upstream policy planning for large scale disasters. Such interministerial processes, some of which operate under the direct leadership of the head of government, are key to consensus building amongst ministers. This in turn should improve horizontal policy coherence and is designed to overcome the silo tendencies of separate ministries. In some countries these committees now draw on technical expertise from outside government by including representatives from the private sector and academia, which can improve public trust and cooperation. Their unified recommendations often carry great weight with institutions that ultimately arbitrate allocations of public funds, thereby directing expenditures to agreed priorities. In certain countries, such high level committees also have responsibilities that come to bear in the case of actual emergency management decisions.

Situated at the apex of Singapore's centralised-decentralised framework, a 'Strategy Committee' provides oversight and guidance by serving as the main platform to steer and review the overall progress of the WOG-IRM framework. The Strategy Committee, which meets quarterly, comprises Permanent Secretaries from the various ministries across government and is chaired by the Head of Civil Service. In addition, the Homefront Crisis Management system provides for a 'Ministerial Committee' that is responsible for all crisis situations in Singapore. The committee is chaired by the Minister of Home Affairs and is tasked with providing strategic and political guidance on handling crises. It is supported by the Homefront Crisis Executive Group, which comprises senior representatives from ministries and government agencies.

The Central Disaster Management Council in Japan is an interministerial body that brings together high level politicians and technical experts to formulate and execute the country's basic disaster management plan.[6] The Council deliberates specific issues on disaster reduction such as overall coordination of countermeasures in addition to operational matters including state of disaster declarations. In such events the Minister of State for Disaster Management

and Food Safety works closely with the Cabinet Secretariat to integrate information gathering and other emergency measures in direct liaison with the Prime Minister. Japan's numerous research centres receive and integrate data into elaborate hazard, consequence and vulnerability maps, however, they do not provide a common, holistic awareness and decision support system that can be used as a practical tool in collaborating and coordinating response activities. The central government perceives the need for a system of data collection that the national disaster management system could integrate as a common tool for risk analysis.

In Canada, Federal-Provincial-Territorial (FPT) Ministers responsible for emergency management established a permanent forum that meets annually to improve collaboration. Their eight-point work plan includes decisions related to implementation of the National Disaster Mitigation Strategy, which aims to reduce the risks, impacts and costs associated with natural disasters such as hurricanes, ice storms and floods. The forum meets in joint sessions with FPT Ministers responsible for Justice to discuss issues such as the current threat environment and parliamentary review of the Anti-Terrorism Act. The Canadian government follows a human resource policy of regularly rotating civil servants across ministries to foster their competence as generalists in policy analysis. This policy enhances interministerial cooperation, as civil servants can more easily navigate government structures through their networks of former colleagues.

In the United States, the Homeland Security Council advises the President on all aspects of homeland security, ensures coordination of homeland security-related activities amongst executive departments and agencies, and promotes the development and implementation of all homeland security policies.[7] It is presided over and meets at the discretion of the President. Originally it was conceived as a domestic policy counterpart to the National Security Council.

The prevalence of recently established interministerial committees whose goal is to promote preparation for the most important risks facing their country implies the need for analytical capacity to make distinctions between risks of more and less importance. These committees are instrumental to building consensus regarding which risks need to be addressed and justifying budget requests for adequate resources to carry out the programmes they have agreed upon.

Systematic approaches to mitigation planning

Table 4. Capabilities based programmes

Canada	-
Japan	-
The Netherlands	National Security Strategy
Singapore	National Security Coordination Secretariat
United States	National Protection Guidelines
United Kingdom	Capabilities Programme

Four of the six countries under study compliment their all-hazards approaches to country risk management with capabilities based planning; a systematic approach to guide mitigation investments for the full range of their country risk portfolios, from remote forest fires to catastrophic terrorist events. The benefits of a systematic approach are the improved ability to set specific preparedness goals and priorities, to compare the costs and benefits of investment choices, and to evaluate preparedness results. Capabilities based planning revolves around three axes:

1) The categorisation of specific means (capabilities) required to respond to a wide range of potential disruptive challenges;

2) The identification of the current level of capacity to deliver on response missions; and

3) Advice to policymakers in their decisions so that resources are directed to close the gap between the current and targeted capacities.

Three countries under investigation use capabilities-based planning based on threat intelligence, vulnerability analysis and strategic studies to describe potential future threats and specific event scenarios in terms of impact severity and likelihood. While attention is focused upon scenarios that rank high on both counts, they also pay close attention to those that rank high in impact only. Before these countries decide where specific investments are needed to better protect lives and assets, and to minimise the disruptive impacts of a specific scenario, they evaluate the current capacities to survive, respond to and maintain operational continuity in the event a scenario actually occurs.

In addition to the three countries referred to above, Singapore's Ministry of Finance created a master list of strategies and associated risks within the country's 'WOG-IRM framework', that are considered to have the potential to affect the Government's four 'Strategic Outcomes': Security, Opportunity, Community and Identity. Enumerating risks within the master list and consolidating outcome-centric risk maps is intended to enable different ministries to assume ownership of ensuing risk clusters and to propose mitigation strategies to the Strategy Committee. The implementation of WOG-IRM is tracked through the course of the year and aligned with the Annual Budget Cycle, where priority fund allocations are awarded to proposals which address the key risks identified in the WOG-IRM.

Capabilities based planning uses risk assessments to evaluate which capabilities should be further deployed, developed or maintained as they are. Evaluation of the affordability and sustainability of a particular capacity requires addressing its utility over time and periodically gauging tolerance for the risk. Ultimately, policymakers arbitrate capability tradeoffs and impacts, but have the benefit of drawing upon a wealth of risk assessments from multiple levels of government and various components of the private sector.

Government efforts to achieve cost effective risk mitigation

Preparation, response, recovery and rehabilitation for natural disasters, industrial accidents and terrorist events imply significant expenditures that seem poised to increase as a consequence of greater frequency and severity. The burden of these expenditures is unequally distributed between governments, insurers and individuals/ businesses; with governments carrying the greatest share of the overall burden, although in various proportions across different countries. The list of basic public services that citizens expect governments to provide includes: emergency evacuations, basic medical and public safety services, temporary shelter and food, re-establishment of utilities, clean-up of debris and corpses, financial support for reconstruction and helping disaster victims deal with their trauma. Beyond a certain level of preparedness and response capability, additional investment to further enhance response may save lives, but only after lives have been lost and property damaged in the primary impact of a disastrous event. Budgetary pressures are forcing governments to consider disaster prevention programmes more closely to see where they have greater marginal utility to prevent lost lives, reduce reconstruction expenses and diminish productivity losses than additional expenditure for emergency services.

Typically, government prevention and protection interventions either minimise exposure of the human-built environment to natural hazards (e.g. land use policies and dams), or they reduce vulnerability of the built environment to better withstand contacts that do occur (e.g. building codes). Governments may create incentives for individuals to improve their decision making in building location, construction methods and personal coping mechanisms through favourable tax treatment or granting eligibility for government sponsored insurance programmes. To the extent that government policies successfully buy down risk, they should also improve the prospects for availability of primary insurance.

Of particular interest are mitigation activities that studies have shown to present a high cost-benefit ratio in terms of reduced future losses or reduced need for government assistance. The basic principle underlying cost benefit analysis is whether a project results in an increase of economic welfare, i.e. whether the benefits generated by the project exceed the costs of it. For example in the United States, future savings (in terms of losses avoided) from hazard mitigation activities related to earthquake, wind and flood funded through three major Federal Emergency Management Agency grant programmes were calculated to yield a net present value of $ US 14 billion compared to $ US 3.5 billion of resources employed. That is, for every $ 1 spent on mitigation the federal government of the United States saves an average of $4.[8] The ‘Red River Floodway’, in Canada, was built at a cost of about $ CAN 60 million in the 1960’s. It is regarded as Canada’s best known example of a cost-effective structural measure for disaster mitigation. Estimates are that the floodway prevented approximately $ CAN 6 billion in potential flood damage during the 1997 Manitoba floods.

Following the 1989 Loma Prieta Earthquake in California, East Bay Municipal Utility District (EBMUD) performed an in-depth evaluation of the seismic vulnerability of its water treatment plants, reservoirs, buildings, pipelines, tunnels, pumping plants and communication facilities. The results showed that, for a magnitude seven earthquake on the Hayward fault, 63% of its customers would be cut-off from their water supply, one-third of the reservoirs and two-thirds of the pumping plants would interrupt service, 5,500 pipes could break, and four

out of six water treatment plants would suspend service. Estimates were that given such damage it would take approximately 6 months to restore partial service to one of the country's most dynamic economic centres, and repair costs would approach $ US 245 million.

EBMUD undertook a 10-year, $ US 189 million 'Seismic Improvement Programme' to minimize damage to the water system, improve fire-fighting capability and protect customers from long, disruptive water outages following a catastrophic seismic event. To date, it has completed seismic upgrades for 21 reservoirs and 5 five water treatment plants to ensure they withstand all but the most rare and violent earthquakes. Since its inception, the project has saved an estimated $ US 1.2 billion by avoiding losses due to fire, costs to rebuild the water distribution system, lost revenue to businesses in the region and flood losses; resulting in a cost-effectiveness ratio of more than six to one.[9]

The countries under investigation have learned that cost-benefit analysis can help justify politically unpopular mitigation decisions to the public. In the Netherlands for example, such economic analysis was key to pursuing a particular design of river dike improvements that had drawn considerable public protest. An independent commission on 'River dike reinforcement criteria testing' was established with the mission to identify policies that provide a high level of safety at acceptable expense while preserving the existing landscape, and cultural values along the Netherlands' rivers.

The commission assumed that flood protection policy should comprise an agreed safety level and a strategy for improving the quality of dikes and/or reducing the water level of the rivers to achieve the chosen level of safety. It considered both a minimum safety level of .005% chance of flood per year and a maximum level of .0008%, reflecting the legally enforceable standards. Improvements along the minimum safety level were found to entail € 300 million in capital costs, whereas improvements along the maximum standard would cost only an additional €75 million, representing an estimated present-value benefit of at least € 994 million. The commission's recommendation to maintain the safety-level in the river area on the level of 1/1250 [1/year] was followed by the government.[10]

In the United Kingdom, the Department of Health has used advanced supply contracts, a forward looking financial mechanism, to stimulate R&D in vaccines for a possible flu pandemic and to ensure their future provision. The contracts, worth £155.4 million over four years, are part of the government's continued work to prepare for and reduce the impact of a possible flu pandemic. Under these contracts the two awarded companies commit to reserve production capacity for the manufacture and supply of a pandemic influenza vaccine, as soon as the pandemic strain is identified and made available by the World Health Organization, in return for the Department of Health's support of R&D costs. This means that although the United Kingdom may not take delivery of vaccine until after a pandemic has started, it will nevertheless have a guaranteed supply of vaccine at a time when there will be significant international demand.

Protection of critical infrastructure

Table 5. Infrastructure protection programme

Canada	National Strategy and Action Plan for Critical Infrastructure[11]
Japan	-
The Netherlands	Critical Infrastructure Protection Programme[12]
Singapore	National Critical Infrastructure Assurance Committee
United States	National Infrastructure Protection Program[13]
United Kingdom	-

At least four countries under study have established comprehensive, national plans for the protection of critical infrastructure and services that are intended to deter or mitigate disruptive incidents caused maliciously (by terrorists or criminals), by accident or human error (chemical spills, accidental release of hazardous materials), or as the result of a natural disaster (hurricanes, tornadoes, earthquakes, floods). While there is no unanimous view across countries about what sectors of infrastructure and services are critical, there is a common recognised need to protect the physical and cyber-based systems essential to the minimum operations of government and their individual economies. Every country under study has thus conducted a thorough review to identify what it considers key assets in order to focus efforts that assess interdependent vulnerabilities.

In past such infrastructure systems operated separately both in location and function, but as a result of advances in information technology and the necessity of improved efficiency they have become increasingly automated and interdependent. While such arrangements are designed to create efficiencies, their interdependence can produce new vulnerabilities to equipment failure, human error, extreme weather and physical or cyber attacks. A single event might destroy energy utilities, transportation networks and communications facilities simultaneously, but it need only damage one of these to potentially disrupt the others and produce cascading effects across their operations.

Table 6. Critical Infrastructure Sectors [14]

Critical Infrastructure Sectors	Canada	Japan	The Netherlands	Singapore	United Kingdom	United States
Communications	X	X	X	X	X	X
Chemical	X	-	X	X	-	X
Commercial Facilities	-	-	-	X	-	X
Dams	X	-	X	-	-	X
Defence Industrial Base	X	-	-	X	-	X
Emergency Services	X	-	X	X	X	X
Energy	X	X	X	X	X	X
Finance and Banking	X	X	X	X	X	X
Food and Agriculture	X		X	X	X	X
Government and Public Services	X	X	X	X	X	X
National Monuments	X	-	-	X	-	X
Nuclear Reactors, Materials and Waste	X	X	X	-	-	X
Public Safety	X	-	X	X	-	-
Health	X	X	X	X	X	X
Transport	X	X	X	X	X	X
Water	X	X	X	X	X	X

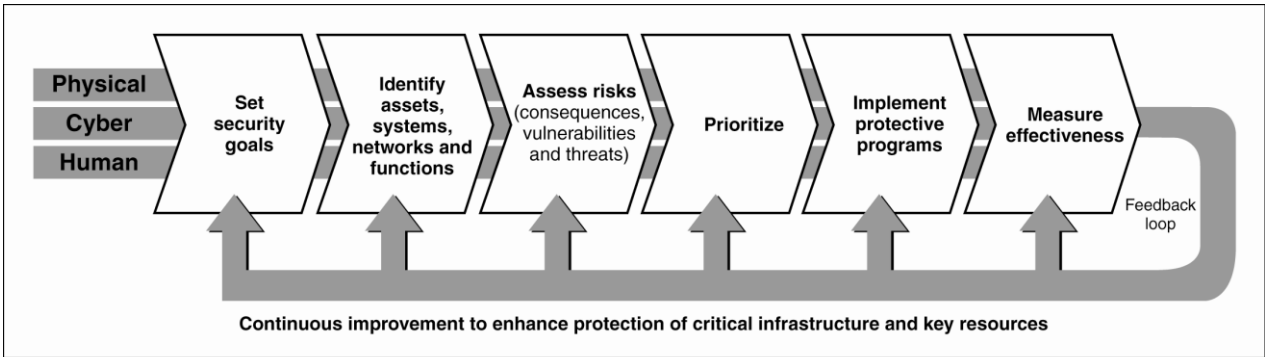
* The six countries do not categorize their critical infrastructure sectors under precisely these terms, and in some cases where there are gaps in the table the sector may be captured under a different category, e.g. Nuclear reactors in the United Kingdom would fall under its “Energy” category.

In addition to the interdependent features of critical infrastructure, at least 80% of it is privately owned and operated in Canada, the Netherlands, the United Kingdom and the United States. Extensive public-private sector cooperation is required to assess the need for protection investment and to provide such decisions with expert guidance. Indeed, the four national plans establish specific forums to improve coordination between regulatory agencies, national security and public and private sector operators. They hold periodic meetings to share information for the assessment of interdependent vulnerabilities, development of strategic plans and agreement on review procedures. A key issue discussed in these forums involves how to best divide responsibilities and authority between the public and private sector for the protection of critical infrastructure. If responsibilities are not clearly delegated, it may result in create major risks in crisis management. This key issue is decisive for the success or failure of the programmes, because the division of responsibility bears strongly on who will finance any additional protective measures. All-hazards risk management frameworks may help in the planning and response to disasters that impact several infrastructure sectors at once, and improve ad hoc coordination amongst multiple agencies that can easily lose track of who is responsible to perform what service, when, for whom and at whose expense.

In several of the countries under study, the cost of protection measures might constitute unmanageable expenditures at a time when public debt is rising. In Japan, the Ministry of Land, Infrastructure and Transport estimates that the government's current reduction in public investment will continue until 2020, at which time, its own infrastructure-related spending will be entirely devoted to reconstruction, renewal and maintenance of existing infrastructures. This underlies the need to compare benefits of alternative courses of action, such as disaster prevention, as a tool for directing resources towards the most productive uses in terms of saving lives and reducing economic and societal losses.

In the United States, the National Infrastructure Protection Program (NIPP) follows a partnership model under which a Government Coordinating Council and a Sector Coordinating Council (representing the private sector) have been created for each of the designated critical infrastructure sectors, to share data, best practices and support systematic risk-based planning. The model also consists of cross-sector councils to mix the private and public sectors. The Department of Homeland Security provides guidance, tools and support to assist the sector-specific groups devise a plan that promotes the protection of physical, cyber, and human assets; see Graph 2 below. The "NIPP Risk Management Framework" requires sector-specific plans to describe incentives for operators to carry out risk assessments voluntarily.

Graph 2: NIPP Risk Management Framework



Source: National Infrastructure Protection Plan, Risk Management Framework (2008).

National critical infrastructure protection programmes act invite private sector self–regulation as a complement to traditional control measures and may reinforce vertical integration of country risk management policies. However, not all sectors of critical infrastructure fall within government regulated activities, and some private operators of non-regulated infrastructure view government sponsored cooperation programmes as regulation in another guise. For companies to publicly share information about their vulnerabilities, especially as regards cyber attacks, may jeopardise commercial interests. Faced with an unclear risk it may be difficult, from an industry perspective, to justify the additional costs of upgrading privately held industrial control systems to higher security standards. Current off the- shelf industrial control systems have been designed for operational speed and

functionality, rather than for secure operation, and therefore may not have a high degree of operational security. Addition of security requirements may degrade the performance of these components to below operating standards.

On the other hand, owners and operators of critical infrastructure have an interest in supporting programmes that mitigate their risks, and sharing information is essential to the accurate assessment of threats and vulnerabilities to their systems. The benefits of cooperation seem to be well recognised in the Netherlands where information sharing between industry and the government is characterised by a high level of cooperation and trust that sensitive information and data will only be used for the purpose of improving national security and public safety. In contrast, industry's cooperation with government has not always been as forthcoming in the United Kingdom, where disaster risk assessments are only statutorily required of first responders, not operators of critical infrastructure.

In Canada, owners/operators of critical infrastructure are responsible for undertaking risk assessments. To support the assessment process, and as part of improving information development and sharing, sector-specific threat information is provided to each sector's network for distribution to its members. Public Safety Canada works with such partners as Defence Research and Development Canada, the Integrated Threat Assessment Centre and the Royal Canadian Mounted Police to provide tools and guidance for the development of risk assessments. Canada recently revised its 'Emergency Management Act', to give clear protection to information supplied to the Government of Canada which, if disclosed, would reveal the vulnerability of critical infrastructures belonging to the private sector.

The reluctance of some private owners of critical infrastructure to disclose information beyond what is required by industry regulations presents a challenge to country risk managers who are tasked with taking accurate account of the capabilities of critical infrastructure systems to withstand disasters. In some countries, however, it is the private operators who seek to circulate information to the public, but are prevented by public authorities who do not wish vulnerabilities to be exposed, as it might make them targets and/or create public anxiety. Critical infrastructure programmes face the challenge to identify what information should be shared, what should remain classified, and how to securely transfer and store the former to encourage the private sector's voluntary participation in partnership programmes.

Reinforcement of community resilience and business continuity

Governments recognise that certain low probability/ high consequence risks facing their national territories would surpass the capacity of first responders, and that the longer it takes to re-establish normal functions, the higher the disruptive impact will be to their population and economy. Each of the countries under study have taken pro-active measures to increase awareness of risks amongst communities, individuals and businesses, and to heighten the sense of urgency to prepare, mitigate and insure against such hazards at their own expense.

One such measure is to train local authorities and business representatives how to perform risk assessments on their own. The Civil Contingencies Secretariat in the United

Kingdom has set-up an 'Emergency Planning College' to provide short seminars, workshops and courses on an inter–agency basis in the field of crisis management and emergency planning, including risk assessment. The programme attracts in excess of six thousand delegates per year. First responders at the local level are statutorily required under the Civil Contingencies Act of 2002 to conduct risk assessments facing their communities and to publish them in local registers.

The reactions of citizens to risk management policies for large scale risks may vary from willing cooperation to grudging obedience to outright defiance. In particular, citizens tend to resist disaster prevention policies that dispossess them of their property or restrict its use such that it is devalued. The ever shifting risk landscape does not permit governments, however, to perpetually finance a consistent level of protection for people and property from risks that have substantially increased over time. The countries under study have attempted to improve public cooperation with vulnerability reduction policies by building a culture of risk awareness. One method increasingly used to improve local understanding of risks is to engage stakeholder groups and local leadership in community forums before undertaking a policy decision that adversely impacts upon property and business interests. Whether and where to invest in levy repairs, for example, entails important trade offs concerning the preservation of homes and industries located in a protected flood plain.

Some countries supplement community level outreach to build stakeholder buy-in for disaster preparation policies by making hazard maps available- if sometimes at a cost. Hazard maps are key tools that help communities, individuals and businesses conceive of risks in spatial and probabilistic terms and that illustrate the consequences of inaction. A frequent obstacle to the development of effective urban hazard maps is the illegality of identifying the location of vulnerable population groups, such as the elderly and physically handicapped. While these are precisely the citizens most commonly in need of government rescue services, some data protection laws do not provide exceptions for competing concerns of public safety. A commonly cited reason for restricting the distribution of hazard maps is fear of creating public panic or that the information could be deliberately misused to attack assets that protect vulnerable zones. The use of information risk assessment is not yet widely employed to determine what types of information is susceptible to misuse.

The United Kingdom is at the forefront of educating the public about risks, having published certain scenarios in its 'National Risk Register'[15] to better inform citizens of the hazards and threats facing the country. The purpose of making these scenarios available is to inform the public, and provide guidance on what the public can do to prepare for the consequences of the most likely risks, should they wish to do so. The publication of the National Risk Register is, therefore, the start of a dialogue with the public to not only provide details of what the Government and emergency services are doing to prepare for emergencies, but also to provide advice on how organisations, individuals, families and communities might better prepare for major emergencies, thereby helping to improve the United Kingdom's resilience. The Government is now considering what further contribution it could make to support the development of community resilience activity around the United Kingdom, building on the many local schemes already in existence.

In addition to releasing flood risk assessment scenarios, the Netherlands Ministry of Interior and Kingdom Relations has requested funding to reinforce the capacity of individuals living in areas 5-6 meters below sea level and in densely populated areas. Rescue services are insufficient in such areas to ensure evacuation in the event of a large scale flood. The proposed plan aims to improve information and communication capabilities for real time monitoring and alert services, to build evacuation roads and to augment emergency electricity capacity.

The Netherlands also reinforces public resilience by organising massive training exercises. For example, the 'Waterproof Drill' aims to prepare the country to cope with a major flooding disaster. In 2008 it involved tens of thousands of members of the emergency services, soldiers and public employees in carrying out simulations in 12 provinces and 443 municipalities to test how emergency services would cope with disaster scenarios such as breaches in sea dykes in combination with high water levels in rivers. The most serious scenario is thought to be a major and unexpected storm at sea, as there would be relatively little warning and too little time for evacuations to take place.

In a similar vein, Japan observes 'National Disaster Prevention Day' and 'National Disaster Prevention Week' every year to promote disaster reduction activities and to raise public awareness about disaster preparedness. Various activities are carried out during the week at national, local and community levels to enhance the general public's understanding of the need to further strengthen risk management capacities. The Ministry of Land, Infrastructure and Transport has organised comprehensive tsunami response drills involving central and local governments, businesses, volunteer organisations and residents to practice protocols for communication of information. In 2007, some 630,000 people took part in a massive earthquake drill organised by government officials who submitted reports on hypothetical damage to central government authorities to test information sharing networks and response procedures.

In each of the governments under study the government has worked closely with the private sector to make business continuity planning compliment its own efforts to enhance public resilience. Business continuity is not the same as business resumption planning; it endeavours to ensure that critical operations continue to be available even during a crisis. In the United States, the Department of Homeland Security has endorsed the Emergency Preparedness and Business Continuity Standard (NFPA 1600) developed by the National Fire Protection Association.[16] NFPA 1600 specifically requires business entities to carry out risk assessments for: natural hazards (geological, meteorological, and biological); human-caused events (accidental and intentional); and technological-caused events.

In the United Kingdom CCS formed the 'Business Advisory Group on Civil Protection' to provide a forum through which business representative groups and the government can meet to discuss civil protection issues. The group includes, inter alia, representatives of the British Bankers Association, the British Retail Consortium, the Institute of Directors, and the Federation of Small Business. Participants disseminate the outcomes of each meeting to their members. A key development in 2006 was the production, in cooperation with the British Standards Institute, of the British Standard on Business Continuity Management – BS 25999, part of which is subject to certification by independent audits.

Singapore's national standards body has been working with the Singapore Business Federation, industry and government agencies to develop a business continuity management standard for organisations to enhance corporate resilience. The Technical Reference 19 Business Continuity Management Standard is designed to facilitate an effective response by businesses in the event of a major disruption such as a terrorist attack.

Government approaches to disaster risk financing

Substantial increases in losses from natural and man-made disasters have mounted pressure on governments to develop strategies to reduce their impacts, and to consider alternative means to apportion who bears the risk of financial recovery. Most of the countries under study either maintain compensation funds or establish *ad hoc* funds after disasters strike to financially assist people who have suffered losses. The modalities and conditions for receiving benefits from either source are set by the government, for example the payments may be grants or loans, or they may be restricted to cover the cost of rebuilding a primary dwelling and essential living expenses. Generally, such financial assistance is meant to compensate victims for non-insurable losses only.

Payments from ex post compensation funds have been criticized on at least four grounds. First, they may suffice to cover only a portion of total damages and are often poorly targeted. Second, payments are not always conditioned upon taking pre-emptive risk reduction measures in future (such as securing a building's foundation or waterproofing). Third, such payments may contribute to moral hazard, for example, building or buying homes in proximity to earthquake fault lines or in flood plains. Fourth, the provision of disaster assistance may serve a social goal in time of crisis, but it reduces incentives to purchase private insurance.

The availability of property and casualty insurance are important alternatives to government sponsored, disaster assistance funds. Risk based insurance policies provide private parties incentives to invest in mitigation measures by reducing premiums accordingly, and co- payments help reduce certain types of construction and other vulnerable activities in potential disaster regions by encouraging individuals to consider the risks involved in their behaviour.[17] The capital required to support catastrophe insurance, however is much greater than the capital needed for insurance products directed at independent, non-correlated risks. Moreover, the corporate income tax reduces supply by raising insurers' costs of holding the large amounts of capital needed to ensure payment of catastrophe losses due to the double taxation on returns to such capital. Since catastrophic risks may pose insurability problems, some governments have entered into partnerships with the private sector to increase the availability of insurance for specific types of natural disasters, for example earthquakes and hurricanes. Generally these programs are created because homeowner coverage for catastrophic events is not available from private insurers at prices deemed affordable by insurance regulators.

Partnerships between governments and insurers can improve the ability to model hazards, identify effective policy measures to reduce disaster damages and increase the capacity of insurers to provide coverage. The Association of British Insurers and the British

Government recently reached an agreement on continued, wide scale availability of flood insurance. The agreement outlines actions that both Government and the insurance industry will take over the long term. For the government these include, inter alia: Environment Agency publication of a more detailed National Flood Risk Assessment in 2009 and an annual review thereafter; a long-term investment strategy to reduce river and coastal flood based on scenarios modelling of flood risk management to be in published in 2009; publication of the number of planning applications approved against Environment Agency advice; ensuring that the planning system prevents inappropriate development in flood- risk areas; encouraging property owners to take sensible precautions; providing more information about how to obtain flood insurance; and promoting access to home insurance for low-income households. For British insurers actions under the agreement include, inter alia: Making flood insurance for homes and small businesses available under household and commercial insurance, where the flood risk is no worse than a 1 in 75 [1.3%] annual risk; offering flood cover to existing domestic and small business customers at significant flood risk provided there are plans to reduce the risk to an acceptable level within five years.[18]

Several insurance programmes have been developed in OECD countries wherein the government collects a fee or part of the premium for providing insurance coverage. Often the private insurance industry is used to provide additional administrative services. In a catastrophe pool, for example, a government combines resources with insurance companies to form a fund, which provides financial protection against catastrophic risks. The amount paid into the pool by participating entities usually depends on their individual exposure to the covered hazards. In some cases the fund itself pays out to the individual pool members when claims are made; in others the fund is used to purchase additional insurance or reinsurance for all involved. In the former case if there are no claims, then no capital is lost and the capacity of catastrophe protection increases. In the latter, pooling helps lower the cost of (re)insurance, such that the coverage acquired is greater than could have been attained separately by each individual member.

Amongst the countries under study, several have adopted government programmes that provide some type of state guarantee. The designs of such schemes vary from country to country as a reflection of market specificities and exposure to risks, as well as technical and policy choices, regarding the scope of coverage targeted and the modalities of financing.[19] The most common approach is for the state to provide reinsurance to the private insurance industry. In this scenario, the private market sells catastrophe insurance, which is reassured to a government managed or funded reinsurance company. Generally, the catastrophe insurance is purchased by businesses or homeowners that purchase first party insurance: fire, homeowners', automobile, or property policies. The mandatory coverage extends to catastrophes as defined by the government and can include man-made catastrophes, natural catastrophes in general or specific natural hazards like earthquakes or hurricanes.

The cost of the catastrophe coverage is added to the premium for the standard insurance policy. Generally, the additional catastrophe premium is computed as a percentage of the premium for the property policy, and a sharing arrangement between the private market and the government is made concerning the catastrophe premium collected and the risk to be borne. In some cases, the government guarantees payment of all eligible claims even if the

premiums collected are not adequate to pay all claims. It is this additional guarantee of the government that provides the needed capital for the insurance to work.

In the United States, the state of California requires all insurers to offer earthquake insurance with every home-owners' policy. To relieve pressure on private insurers, the state legislature set-up a quasi-public agency (privately funded, publicly managed)- the California Earthquake Authority (CEA), which sells a "mini-policy" with a 15% deductible and coverage for structural damage only. Membership by insurers is voluntary and member companies satisfy the mandatory offer law by selling the mini policy. Premiums are paid to the insurer, and then pooled in the CEA to cover claims from homeowners with a CEA policy from member insurers. More recently, the CEA created a supplementary policy to broaden coverage. Nevertheless, only a small portion of the state's property owners buy earthquake insurance and the percentage appears to grow smaller as the time span since the last major earthquake increases.

The Florida Hurricane Catastrophe Fund is a state-run catastrophe reinsurance programme that is tax exempt. The Fund reimburses a fraction of insurers' losses caused by several hurricanes and is funded by premiums paid by insurers that write policies on personal and commercial residential properties. Its obligation to pay losses is limited to the sum of its assets and borrowing capacity. In addition to premiums, these programmes can use bonding and other financing arrangements, but policyholders would pay for the financing through assessments on their policies. If the funds are not adequate, claims are paid on a pro-rated basis so policyholders have no guarantee that claims for their losses will be fully covered.

The Mississippi Windstorm Underwriting Association (Mississippi Windpool) provides wind and hail insurance policies for high risk properties in six coastal counties. After Hurricane Katrina, Mississippi Windpool had incurred a net loss of $ US 473 million.[20] It sought a rate increase of almost 400%, but the state insurance regulator only granted a 90% increase. The state government will use US $ US 50 million in federal disaster recovery funds provided by the Department of Housing and Urban Development to offset the increased cost of coverage in 2007 and 2008. In addition, the state government created a special fund that uses state general revenue funds to offset the increased cost of coverage.

Japan has had an earthquake insurance programme covering residential properties since 1966 when the Earthquake Insurance Act came into force. Under programme, primary carriers sell earthquake policies with large deductibles on the voluntary market and then reinsure their risk 100 percent with the Japan Earthquake Reinsurance Company (JER), which in turn retrocedes part of the risk to the government and the private reinsurance market in accordance with a sharing arrangement established by the government. The remainder of the reinsurance liability is assumed on the basis of excess of loss insurance coverage and concluded between the government and the JER.

Some States argue that the benefit of government involvement in catastrophe reinsurance is its ability to fund losses over time through borrowing without holding a large amount of capital. On the other hand, some government programmes are criticised as providing significant and unevenly distributed subsidies to risk takers and have a tendency to expand coverage while disaster assistance programmes continue to operate. Because government

natural catastrophe insurance programs are often created to ensure the availability and affordability of natural catastrophe insurance, homeowner premiums for these programs--although risk-related--are generally set by statute and not based entirely on the homeowners level of risk.

A bill was approved by the U.S. House of Representatives in 2007 to establish a national reinsurance programme for natural disasters. Insurance companies in every state would contribute to a state or regional catastrophe pool that provides reinsurance for insurers doing business in the area, and a national mega-catastrophe fund would provide a federal backstop for large-scale insured losses. Opponents of this legislation point out that the programme amounts to providing incentives to live in high risk areas, and that residents of low risk areas carry an unfair burden to support the choices of others to assume such risks.

Risk transfer solutions

The potentially enormous size of catastrophe risks places strains on the financial capacities of insurers and reinsurers. Innovative financial products have been developed, however, to access an additional capital and diversification base that can help to overcome temporary or permanent capacity shortages. When cost of reinsurance is very high, capital market solutions may be appealing to major institutional investors since they stand to receive a high rate of return in exchange for the possibility of losing much of their principal or interest, or both, in the event a disaster occurs. As the countries under study place increasing emphasis on disaster risk reduction, there is growing interest in the potential of such risk financing solutions since they effectively increase the availability of insurance, which is important to help restore individuals, businesses and communities to the position they were in before a disaster and to provide incentives to take ex-ante actions to mitigate disaster losses. [21]

Insurance linked securities (ILS) are among the major product groups that transfer peak risks to capital markets. ILS issued as catastrophe (CAT) bonds are an excellent means to structure tailor made solutions and eliminate counterparty credit risk. CAT bonds enable insurers to transfer risks to capital markets through the issue of an interest bearing bond. Investors subscribe for shares in a special purpose vehicle, which uses the proceeds to back a conventional reinsurance policy to the insurer. If the event defined in the bond issue does not occur by the specified maturity date, the investors receive a return that includes a premium for the risk in addition to the principal. If the pre-defined event occurs and triggers the CAT bond, then the principal initially paid by the investors is instead used by the sponsor to pay its claims to policyholders.

There is a wide range of underlying loss triggers for such products. Among the innovative loss triggers are index-based insurance (also called parametric insurance), which hare distinguished from traditional indemnity-based insurance in that it pays out an agreed amount, not on the basis of actual losses incurred, but rather on a physical measurement of a hazard, such as rainfall, temperature, Richter scale magnitude or wind speed. Insured parties are compensated if the index reaches a certain measure or “trigger” regardless of actual losses. This type of trigger is best suited for risks that are difficult to assess.

The major advantages of index-based insurance are the immediate availability of funds after the triggering event, the absence of a time consuming loss settlement and the low administrative costs if the solution is properly set up. CAT bonds, for example, may entail little credit risk since the money paid upfront by investors is placed in escrow, a trust fund or invested in liquid securities and is therefore readily available. Index-based mechanisms are also more transparent, as they are based on a physical trigger and the payout is fixed in advance. The downside of index insurance is the basis risk: if the trigger is insufficiently correlated with the losses experienced then no payout may occur even if the losses are substantial.

These relatively new financial products have been made possible because of relevant improvements and developments in scientific studies, engineering analyses and information technologies. Today natural hazard risks and the potential losses of future disasters can be predicted with more accuracy than in the past: new risk assessment techniques have reduced the uncertainty associated with estimating the probabilities that certain disasters will occur in specific regions, while recent engineering studies have provided additional information on how structures and infrastructures perform under the stress of extreme environmental conditions.

An innovative CAT bond for USD 85 million linked to Central American earthquakes was in January 2008. The first two tranches of the issuance cover losses due to catastrophic hurricanes and earthquakes in the United States. The third tranche covers the non-peak perils of Guatemala and E Salvador earthquakes. The trigger is the first of its kind in that the index is based on the population exposed to certain levels of ground-shaking intensity as measured by the Modified Mercalli Intensity scale.

The goal of the CAT bond is to create a platform by which governmental relief organizations, charitable foundations and corporations can leverage donations or governmental/international funding to the benefit of developing nations affected by natural disasters. Such a program aims at helping these organizations in becoming more pro-active in planning and anticipating relief needs in areas of the world affected by severe catastrophes. In case of a triggering event, the funds will be quickly available for relief efforts rather than being raised after the event.

Innovative tools in country risk management

The government authorities who collectively share responsibility for country risk management have taken decisive actions to address the changing risk landscape. This section highlights some of the innovative tools and practices recently implemented in the countries under study and their benefits.

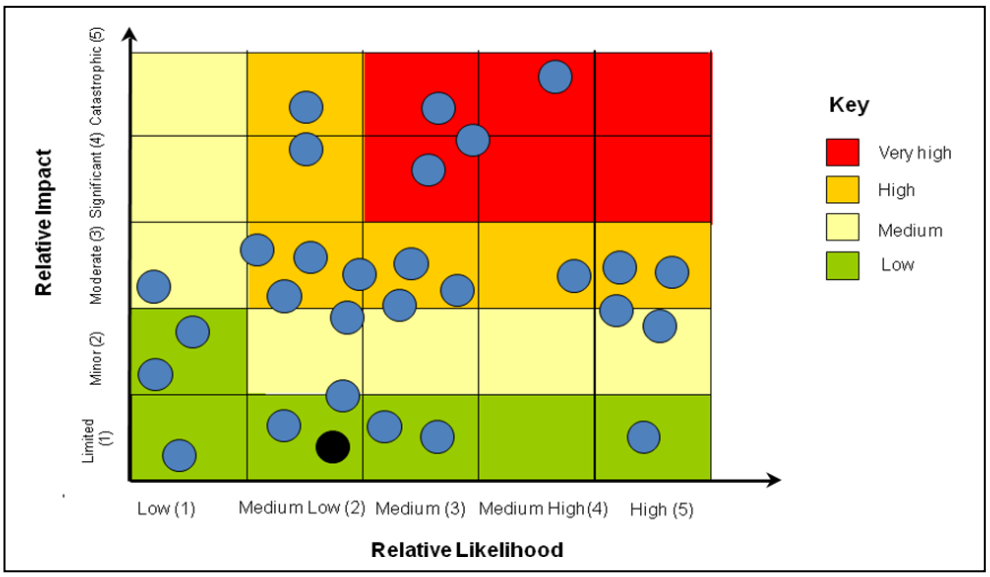
Consolidated risk assessment for all-hazards

The governments of the United Kingdom and the Netherlands have developed innovative tools to keep high level policymakers informed about the most pressing risks facing their countries, and to facilitate deliberation over investments to mitigate them.

In the United Kingdom, the Civil Contingencies Secretariat developed the 'National Risk Assessment' (NRA), to identify risks over a five year period and plot approximately eighty hazards and threats into a risk matrix (see Graph 3 below) that helps ministries in their policy decisions about emergency preparedness and capability planning. The tool introduces a systematic and all-inclusive approach to risk analysis wherein risk is defined as a function of the likelihood and impact of a given natural hazard or man-made threat.[22] This reflects, on the one hand the possibility of an emergency occurring which could adversely affect an organisation (e.g. flooding or nuclear accident), and on the other hand, the extent to which the event impacts upon the organisation (e.g. lack of staff, disruption to power supply, damage to facilities).

The NRA process comprises three stages: identification of risks; assessment of the likelihood of the risks occurring and their impact if they do; and comparison of the risks. The process entails consultation with a wide range of participants from government departments, agencies, devolved administrations, public, private and voluntary sector representatives. Provision is made to provide regular monitoring and updating mechanisms that take account of changes in the risk environment.

Graph 3: United Kingdom- National Risk Assessment- Illustrative Risk Rating Matrix[23]



Definitions of risk ratings in the UK National Risk Assessment

Very high (VH) risk – these are classed as primary or critical risks requiring immediate attention. They may have a high or low likelihood of occurrence, but their potential consequences are such that they must be treated as a high priority. This may mean that strategies should be developed to reduce or eliminate the risks, but also that mitigation in the form of (multi-agency) planning, exercising and training for these risks should be put in place and the risk monitored on a regular frequency. Consideration should be given to planning specific rather than generic risks.

High (H) risk – these risks are classed as significant. They may have a high or low likelihood of occurrence, but their potential consequences are sufficiently serious to warrant appropriate consideration after those risks classed as 'very high'. Consideration should be given to the development of strategies to reduce or eliminate the risks. Mitigation in the form of at least (multiagency) generic planning, exercising and training should be put in place and the risk should be monitored frequently.

Both these categories form the basis of the National Resilience Planning Assumptions which set the parameters for resilience planning in the UK at national, regional and local levels.

Medium (M) risk – these risks are less significant, but may cause upset and inconvenience in the short term. These risks should be monitored to ensure that they are being appropriately managed under generic emergency planning arrangements.

Low (L) risk – these risks are both unlikely to occur and not significant in their impact. They should be managed using normal or generic planning arrangements and require minimal monitoring and control unless subsequent risk assessments show a substantial change, prompting a move to another risk category.

Table 7. Impact scoring scale- qualitative measures for local risk assessment in the UK[24]

Level	Descriptor	Categories of Impact	Description of Impact
1	Limited	Health	Insignificant number of injuries or impact on health.
		Social	Social insignificant number of persons displaced and insignificant personal support required. Insignificant disruption to community services, including transport services and infrastructure.
		Economic	Insignificant impact on local economy.
		Environment	Insignificant impact on environment.
2	Minor	Health	Small number of people affected, no fatalities, and small number of minor injuries with first aid treatment.
		Social	Minor damage to properties. Minor displacement of a small number of people for < 24 hours and minor personal support required. Minor localised disruption to community services or infrastructure < 24 hours.
		Economic	Negligible impact on local economy and cost easily absorbed.
		Environment	Minor impact on environment with no lasting effects.
3	Moderate	Health	Moderate number of fatalities with some casualties requiring hospitalisation and medical treatment and activation of MAJAX, the automated intelligent alert notification system, procedures in one or more hospitals.
		Social	Damage that is confined to a specific location, or to a number of locations, but requires additional resources. Localised displacement of >100 people for 1–3 days. Localised disruption to infrastructure and community services.
		Economic	Limited impact on local economy with some short-term loss of production, with possible additional clean-up costs.
		Environment	Limited impact on environment with short-term or long-term effects.
4	Significant	Health	Significant number of people in affected area impacted with multiple fatalities, multiple serious or extensive injuries, significant hospitalisation and activation of MAJAX procedures across a number of hospitals.
		Social	Significant damage that requires support for local responders with external resources. 100 to 500 people in danger and displaced for longer than 1 week. Local responders require external resources to deliver personal support Significant impact on and possible breakdown of delivery of some local community services.
		Economic	Significant impact on local economy with medium-term loss of production. Significant extra clean-up and recovery costs.
		Environment	Significant impact on environment with medium- to long-term effects.
5	Catastrophic	Health	Very large numbers of people in affected area(s) impacted with significant numbers of fatalities, large number of people requiring hospitalisation with serious injuries with longer-term effects.
		Social	Extensive damage to properties and built environment in affected area requiring major demolition. General and widespread displacement of more than 500 people for prolonged duration and extensive personal support required. Serious damage to infrastructure causing significant disruption to, or loss of, key services for prolonged period. Community unable to function without significant support.
		Economic	Serious impact on local and regional economy with some long-term, potentially permanent, loss of production with some structural change. Extensive clean-up and recovery costs.
		Environment	Serious long-term impact on environment and/or permanent damage.

Table 8. Explanations of Category of Impact of Hazards for Local Risk Assessment in the UK[25]

	Explanation
Health	Encompassing direct health impacts (numbers of people affected, fatalities, injuries, human illness or injury, health damage) and indirect health impacts that arise because of strain on the health service.
Social	Encompassing the social consequences of an event, including availability of social welfare provision; disruption of facilities for transport; damage to property; disruption of a supply of money, food, water, energy or fuel; disruption of an electronic or other system of communication; homelessness, evacuation and avoidance behaviour; and public disorder due to anger, fear, and/or lack of trust in the authorities.
Economic	Encompassing the net economic cost, including both direct (e.g. loss of goods, buildings, infrastructure) and indirect (e.g. loss of business, increased demand for public services) costs.
Environment	Encompassing contamination or pollution of land, water or air with harmful biological/ chemical/radioactive matter or oil, flooding, or disruption or destruction of plant or animal life.

Table 9. Likelihood Scoring

Level	**Descriptor**	**Likelihood over 5 years**	**Likelihood expressed as ratio**
1	Negligible	>0.005%	>1 in 20,000 chance
2	Rare	>0.05%	>1 in 2,000 chance
3	Unlikely	>0.5%	>1 in 200 chance
4	Possible	>5%	>1 in 20 chance
5	Probable	>50%	>1 in 2 chance

The National Risk Assessment in the United Kingdom does not cover:

1) Longer term or broader global risks – like climate change or competition for energy – that might affect the safety and security of citizens of the United Kingdom in the period beyond the five years of the National Risk Assessment.

2) Risks of major emergencies occurring overseas unless they have impacts that directly and seriously damage human welfare or the environment in the United Kingdom,.

3) Everyday occurrences – like street crime – that can cause extended misery and damage over a long period of time, but are not emergencies that require central government to be directly involved in the response.

Risk assessments over multiple time frames

Three of the countries under study have adopted the practice of assessing risks over different periods of time. Short-term, medium-term and long-term views on risk provide policymakers useful information concerning the imminence and durability of a particular risk. Such risk assessments factor in variables that could intervene to alleviate or aggravate a risk depending on its proximity or remoteness. The probability of occurrence for some hazards,

such as earthquakes, increases over the period in between events. Such information helps policymakers decide when mitigation investment should be undertaken or delayed in favour of addressing a more pressing need. Whereas lack of attention to fluctuation of risk over different time horizons may result in mitigation investments that are appropriate in the short-term, but not five years ahead. The result can be poor mitigation investment decisions and support for capabilities that may be obsolete or require extensive updating in a short time period.

Singapore's Strategic Planning Office (SPO) conducts horizon scanning to identify risks for the whole of government. Every three years, 'National Scenarios' are produced, according to a 15-20 year time frame. SPO has trained more than 1,000 government officers in scenario planning methodology to conduct their own strategic planning process and in this exercise each ministry and many agencies carry-out horizon scanning. It is estimated that 80 percent of the ministries use SPO's 'National Scenarios' as the basis for their own horizon scanning analysis, although along much shorter time frames; normally 3-5 years.

Multidisciplinary approaches in risk assessments

New risk assessment tools are ever more sophisticated and inclusive, taking more accurate account of the environmental, human, behavioural and social factors affecting the transmission of and exposure to hazards. The increased attention to changing socio-economic conditions is also intended to make risk assessments more reliable over time. Census data provide a periodically updated source of information on population growth, distribution and concentrations that, when used in combination with GIS technologies and hazard maps, can produce more dynamic probabilistic risk-models to assess a country's exposure to potential disasters. In Japan, hazard maps for floods and earthquakes can be cross-referenced with maps that track the location of vulnerable populations in these areas, such as the elderly. Japan is preparing programmes based on these maps to communicate risks to these populations and to deliver targeted emergency services in case of disaster.

Several countries are beginning to combine knowledge from a wide variety of disciplines (from "hard" sciences to economics, sociology and psychology) to drill down beyond common measures of an event's probability and impact. In the United Kingdom, CCS is beginning to make greater use of behavioural science to inform capabilities planning. The National Risk Assessment considers a risk's impact both against quantifiable effects of an emergency (deaths, power shortages, etc.) and the psychological effects on society as a whole, covering issues such as fear, outrage and anger generated.

There are a number of difficult questions to be addressed when preparing for a potential emergency, including whether interventions can be effective, calculating their opportunity costs and potential for unintended consequences. Some countries under study are beginning to construe impact criteria not only in terms of potential lives lost from a particular disaster scenario, but also to calculate how many lives would be saved as a result of a particular intervention plan. Such analysis requires the inclusion of public health and urban planning experts in disaster preparation to estimate the cost and potential for success of alternative

plans. In Singapore for example the SPO analyses hedging effects that its risk management practices are likely to produce, including whether they increase vulnerabilities in other areas.

Validation of prioritisation systems

Several of the country risk management approaches under investigation seem to lack a standard feature of enterprise risk management, namely, a systematic evaluation of mitigation decisions and lessons learned from crises. Once governments set priorities for investments to mitigate perceived vulnerabilities, there should ideally be a procedure to measure their effectiveness and to re-evaluate the national risk landscape in light of reinforced capabilities.

The United Kingdom provides a best practice example in this regard. It uses a highly organised system of consultation to test whether its capabilities system is targeting the right risks. The National Capabilities Survey (NCS) provides an assessment of current levels of national resilience to better enable prioritisation of mitigation investments by informing policymakers where improvements need to be made. The NCS gathers information from a wide range of resilience stakeholders from different sectors and at all levels of resilience planning. The results of the survey are held in confidence and help to improve understanding of national preparedness and inform priorities not only for future mitigation programmes, but also for training exercises and policy development. A range of questionnaires are issued, each tailored to their intended audience and designed with the aim of collecting specific information relating to capabilities.

In the last exercise conducted in 2008, questionnaires were issued to over 900 groups of Category 1 responders. The survey had a 95% response rate and included some 50 questions on a range of 'capabilities' relevant to local responders' responsibilities for emergency planning and response. Organisations providing essential services (including gas, electricity, water supplies and the National Health Service) were asked questions concerning major incident planning and their ability to maintain business continuity in the event of disruptive events. In addition, over 20 government departments with a leading role in the event of a crisis, or who need a crisis management capability, were asked about their planning and business continuity arrangements.

The overall finding of the 2008 survey is that the general level of preparedness is higher than in the last survey in 2006. This is as expected given the attention that has been paid to resilience since then, and that the 2004 Civil Contingencies Act only came into force in November 2005, just before the 2006 NCS. The picture shown is of qualified improvement in all four pillars of resilience (general planning and levels of capability; specific plans for major contingencies; business continuity; organisation for crisis management):

a) General capabilities have improved in line with the expectations of lead government departments at this stage of the resilience capability programme launched in 2004. The extent of planning activity is more widespread and up-to-date than was the case

two years ago; in some areas planning is well advanced. But gaps remain with the delivery of staff training and exercising regimes.

b) Specific planning for flu pandemic – the main contingency for which specific contingency plans have been required – is widespread (but there is separate evidence from a review of draft Local Resilience Forum plans that many are in need of further improvement).

c) There is heightened awareness of the need for business continuity planning, as one of the four pillars of resilience, but many organisations have taken only the first steps, following last year's launch of the new British Standard (BS 25999).

The 2006 results had shown some early benefits from a growth in investment and interest in resilience; the 2008 results show a continuation of that positive trend. There was an increase in planning activity across all sectors, but validation processes through exercising, and the training of key personnel, have yet to receive the attention they need. Capabilities of local responders have improved, in some cases following the issue of central guidance or lessons identified from real-life crises or exercises. The key multi-agency structures are well established through the successful operation of Local Resilience Forums. There is a high degree of familiarity and compliance with the provisions of the Civil Contingencies Act 2004. Co-ordination between Category 1 responders is generally good, but the involvement of Category 2 organisations, the voluntary sector and communities is less developed in many Local Resilience Forums.

An innovative metric for supply of energy security has been developed by the Energy Research Centre of the Netherlands that could serve as a general model for countries to measure the effectiveness of their capabilities programmes to manage a wide range of risks. The 'Crisis Capability Index' combines the risk of a country to be confronted with sudden supply interruptions and its potential impact (the Risk Assessment) and the capability of that country to manage and mitigate these impacts (the Mitigation Assessment).[26] For security of energy supply, Dutch and Irish experts have partially tested the methodology by making their own risk assessment and mitigation assessment on the basis of checklists with some simple scoring values. In cases where the risk assessment score is higher than the mitigation assessment's, the Crisis Capability Index receives a value of less than 100. Although expert opinion underlies the methodology, assigning a quantitative score for every capability within an all-hazards framework allows policymakers to track progress over time.

Risk-based allocation of mitigation grants

Every country under study recognizes that it is impossible to protect all potential targets from future terrorist attack and to render every community impervious to natural disasters. Their general practice is to identify specific valuable assets and highly populated areas at risk and then work to reduce that risk taking into account vulnerabilities. Central government departments in several countries administer grant programmes to reinforce public and private

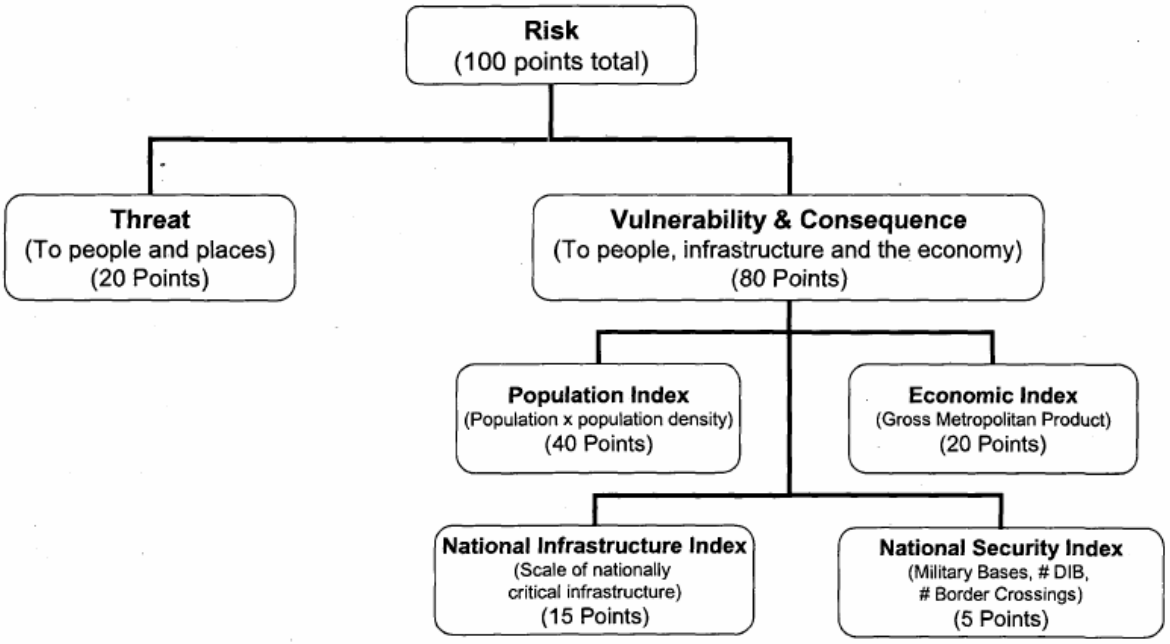
capabilities for the prevention of future terrorist attacks and reduction of natural disaster damages.

In the United States, priority for mitigation grants is ordered to preventing future terrorist attacks and diminishing the impacts of those that do occur. The Department of Homeland Security (DHS) administers hazard mitigation programmes to reinforce the capabilities of states to prevent, protect against and respond to future terrorist attacks and natural disasters. Since 2002, DHS has distributed approximately $ US 22.7 billion in grants to strengthen the capacity of first responders, port security, local police forces, critical infrastructure and communication interoperability to lower overall risk. DHS has continuously refined and improved upon its method to prioritize mitigation grants, and although it recognizes improvements can still be made, several branches of the programme stand as examples of best practice for transparency and incorporating risk based analysis into decisions.

While it is impossible to protect every target and render every community impervious to future attacks, DHS tries to identify the areas and entities most at risk and works to reduce that risk taking into account vulnerabilities. A risk assessment model is used to allocate resources for purposes which include, but also go beyond terrorism prevention, such as preparation and response to natural disasters. For example, the FY2007 Homeland Security Grant Guidance describes the DHS risk formula as the product of three principal variables: R=T*V*C, where: Threat (T) is the likelihood of an attack occurring, and Vulnerability and Consequence (V&C) — are the relative exposure and expected impact of an attack. Although DHS continues to discuss its risk methodology in terms of the formula, it appears as if the department is treating vulnerability (V) and consequence (C) as an amalgamated, single variable, as depicted in Table 10 below.[27]

The DHS risk-based methodology is also used for ‘Infrastructure Protection Activities’ (IPA) grants, which in 2008 distributed more than $ US 844 million in grant awards to strengthen security at ports and enhance transit, trucking and intercity bus systems. Funds provided are used to prevent, protect against, respond to and recover from terrorist attacks, major disasters and other emergencies. IPA grants reinforce the department’s approach to risk-based funding and commitment to regional planning and security coordination. In addition to the threat, vulnerability and consequences of an attack on critical infrastructure, DHS considers the potential effectiveness of an applicant’s proposed solutions in making grant determinations.

Table 10. FY2007 Risk Formula



Source: Congressional Reporting Service Report for Congress (February 2, 2007).

Conclusions

The governments of the six countries under study have set course to implement all-hazards approaches to manage the risks facing their respective territories and populations. Although clearly in the beginning stages of an iterative process, governments are taking necessary steps to integrate the technical strengths of separate departments and agencies for the improvement of risk identification, assessment, prevention, protection, response and recovery from disasters and crises. Among these efforts are:

1) Newly established legal and policy frameworks that clarify the roles risk managers at various levels of government;

2) Improved coordination between these various government actors;

3) Establishment of information sharing networks to better identify and assess country risks; and

4) Implementation of mitigation policies that contain incentives to prevent risks.

There has been remarkable progress in a field in which it is difficult to keep pace with climatic, societal and technological changes, however country risk managers continue to face challenges in the implementation of their strategies. This section identifies some of the challenges and suggests options to address them.

Governance of country risk management

Central governments in the six countries under study have each undertaken a more systematic approach to country risk management featuring concepts familiar to the private sector's risk management culture. They do not, however, possess the standardisation and completeness of the COSO framework for analysing enterprise risk, which includes three components: [28]

1) Risk assessment, which is both qualitative and quantitative in nature, includes specific time and objective horizons, and differentiates between inherent and residual risk;

2) The risk response mechanism includes interdependencies, such as an organisation's tolerance for risk, and allocates response resources based on defined cost and benefit metrics; and

3) Governance and control infrastructures ensure the methodology is adopted across an enterprise, consistently governed with consistent data points, and included in both processes and technologies.

There are of course key differences between States and firms with regard to managing risks. A State is responsible to protect and preserve a permanent population and territory, whereas firms control the number of workers whose safety they must ensure and whether to assume the risks associated with conducting their activities in a particular location. Further, the government policies of States are designed not only on the basis of cost effectiveness, but also to take account of equitable considerations that serve the public interest, and in a manner that supports transparency and accountability. These factors lend more flexibility to firms in the management of risks and weigh heavily in the calculation of optimal government policy, but they do not provide governments an excuse for excessive risk avoidance.

The establishment of high level policy committees dedicated to analysing a country's all-hazard risk portfolio is a positive step toward improving the efficiency and effectiveness of efforts to reduce losses in terms of deaths, damaged assets and reduced industrial productivity. Governments, however, could draw lessons from the risk management systems of some large corporations that sometimes incur monetary damages from disasters close to the level suffered by States. For example, performance measures could be instituted to evaluate high level policy committees. As corporations benefit from risk management oversight provided by boards of directors, governments could commission independent reviews that benchmark the effectiveness of the above described all-hazards policies, institutions and high level committees. Such measures have proven useful in the business context to improve the horizontal and vertical policy coherence, increase transparency and promote accountability.

Another measure that governments could adopt from large firms to achieve a broad, portfolio view of risks facing their country would be to institute an equivalent function to the chief risk officer (CRO). Such a view is necessary to objectively prioritise risk mitigation investments. The all-hazards portfolio view would also contribute to understanding the interconnections between the full range of national risks, as well as spill-over benefits deriving from individual mitigation measures. Responsibilities of a 'Country Risk Officer' could include: formulating a risk-based, portfolio view of all-hazards facing the country; serving as a government focal point to educate the public about the range of risks it faces; and communicating an official posture on specific risks. The Country Risk Officer should manage an information flow that integrates the various technical risk assessments performed by government bodies into a tool to support mitigation investment decisions.

The plurality of government departments and agencies responsible for technical risk assessment makes it difficult for insurers to identify and interact with the correct government agency and to base their catastrophe models on the most accurate information. A Country Risk Officer could support such coordination to improve the exchange and use of meteorological, seismic, actuarial (non-personal), demographic, structural and other data that are needed to prepare and distribute robust models and hazard maps. The central government's Country Risk Officer would be in a strong position to ensure the execution of goals set-out in disaster risk management framework policies and to distribute and oversee the execution of risk management standards across government bodies. It could also be made responsible to carry out the proposed benchmarking of high level policy committees mentioned above. Finally, a Country Risk Officer could coordinate public private partnerships to reduce the vulnerabilities of critical infrastructure and other key assets or services whose disruption might create cascade effects.

The benefits of this function are several:

1) Whereas ministers are beholden to defend the best interests of their institutions and limited to the competencies within their remit, an independent 'Country Risk Officer' could overcome silo-thinking and objectively consider trade-offs between priorities that might compete when managed between ministries.

2) A Country Risk Officer could be empowered to act with flexibility to meet needs that arise quickly rather than be tied to an inflexible programme of work and budget.

3) Taking the concept to its logical conclusion, Country Risk Officers could meet their homologues in international forums to investigate opportunities to manage cross border risks.

A second option would be for governments to create independent national risk institutes, staffed by a multi-disciplinary group of experts, to identify, assess and compare risks that span their country's risk portfolio. The institutes could be charged with making recommendations for priority mitigation actions directly to the Head of government. Ministries, in turn, could be directed to reflect these recommendations in their budget proposals and funding decisions.

A third option would be to open interministerial deliberations on country risk management policies to public comment from industry, scientific experts and representatives of civil society. High-level colloquia that include participation from a wide group of stakeholders could be organised on an annual basis to complement deliberations on risk prioritisation in an open, transparent manner.

Risk assessment

Risk assessments provide policymakers with information that is instrumental to steering mitigation investments toward producing their greatest economic and societal benefit. The countries under study have instituted collaborative mechanisms to leverage multiple sources of expertise and data that improve the reliability and credibility of information used to quantify the likelihood and impacts of uncertain events. Carrying out technical risk assessments remains the task of specialized public bodies, which in most countries under study do not have administrative affiliation to one another through a consolidated ministry or other form of coordinated mechanism. Without a tool such as the 'National Risk Assessment', it may be difficult for top level policymakers to make informed decisions on the relative benefits of buying down risks to public health, safety or security through mitigation investments.

The efforts of the United Kingdom and the Netherlands stand out as best practices in this regard, for producing tools to help high level policymakers compare multiple risks. These

initiatives to build and maintain centralised risk assessments, however, face several challenges:

1) Despite abundant literature available on risk assessment methods in the fields of industrial safety, enterprise risk management, decision analysis, etc., the Netherlands confronted several challenges in the effort to better understand potential impacts and likelihood of catastrophic events. For example, crisis scenarios need to weigh and integrate very different types of criteria (loss of territory versus deaths); the difficulty in assessing likelihood for new risks (no statistical data); assessing impacts for extreme hazards (malicious threats) and assessing both likelihood and impact for phenomena developing over time (climate change).

2) The 'National Risk Assessment' (NRA) process mobilises a large number of experts to provide breadth of experience, but numerous inputs can make reaching consensus on a design and process for determining priority risk scenarios difficult. Grounding risk assessment upon expert opinion also requires careful screening for conflicts of interest to ensure the process is not used to promote or justify research or mitigation projects in which the experts are personally involved. The collective, cross-government approach at all levels (including Ministers) helps ensure that this does not occur.

3) The work is labour intensive and without great personal incentive. Co-ordinators in the Netherlands keep participants motivated in the consultation process by soliciting new participants for the network. Strengthening ties with knowledge institutes both inside and outside governments would increase the supply of qualified analysts and advisors.

4) To be credible these tools should be revised over time to take account of new conditions, and receive broad input from several ministries and experts in various fields. Their purpose, however, is to serve high level policymakers as an informative tool, thus they must provide content that is easy to comprehend under tight deadlines. Risk identification and capabilities assessments are unavoidably time consuming processes; it can take as long as five months for the Netherlands' process to complete interdepartmental work for one scenario with representatives from backgrounds as diverse as the Ministry of Economic Affairs, Foreign Affairs, Defence, Intelligence and industry associations. Every government department is involved in the Netherlands capabilities assessment, meaning that reports have to be delivered to the Cabinet on the state of resiliency for various hazards and threats. Each department operates according to its own time table, and some have taken up to a year to report on capabilities within their remit.

A common challenge facing the countries under study concerns risk assessments for terrorist events, whose precursors are dynamic and not susceptible to the monitoring technology that is so helpful to model and forecast natural disasters. The ability of terrorists to modify their course of action, adapt to successful countermeasures and the lack of a rich historical database of events necessitate reliance on constant intelligence reports and the

insight of terrorist experts to produce probabilistic assessments. New forms of government intelligence cooperation with the private sector are expected to improve probabilistic modelling for different types of attacks against critical assets and/or regions. As capacity to gather and share intelligence grows, the execution of prompt response actions and targeting mitigation investments should improve, but the ability of insurers to revise their models, and hence to provide coverage related to terrorist events, will not proportionally increase because much of this information will likely remain classified.

Disaster mitigation

There is general recognition across the countries under study that risk management needs to be reinforced at the pre-disaster mitigation stage, yet too much emphasis is often placed on expensive protection projects and not enough on implementing prevention strategies. Structural measures require constant maintenance in addition to high costs upfront, thus the deliberations of policymakers should take account of the potential net value of savings from non-structural measures that prevent the interaction of natural hazards with the built environment to the capital costs of structural measures that reduce the probability of disaster.

Many countries face budget constraints that prohibit the investment necessary to finance effective prevention, protection and recovery measures. As unforeseeable expenses associated with large scale disasters increase for central governments and insurers, pressure will mount on policymakers to reinforce the resilience of communities and individuals and to reapportion their share of the burden. The benefits of investing in protective measures are often not seized upon by property owners due to their misperception of risks, their short-term outlook and the upfront costs of implementation. Governments should continue to strengthen public resilience by:

1) Encouraging property owners to adopt mitigation methods through education of risks. The United Kingdom's National Risk Register should be considered an innovative best practice in risk communication with the public.

2) Encouraging property owners to adopt mitigation methods through provision of financial incentives for effective protection measures.

3) Ensuring that robust early warning systems are firmly in place to inform the public before a disaster strikes. Early warning systems are clearly more advanced for meteorological hazards such as hurricanes, than for earthquakes or terrorist events.

4) Ensuring that robust emergency communication systems are in place during and after a disaster strikes. Radio, television and internet media in conjunction with transport services and public health officials should be mobilized to inform the public how to avoid or evacuate themselves from affected areas, and how to care for themselves in the first 24 hours following a disaster.

All-hazards disaster risk management provides a portfolio view of risk to help prioritise mitigation investments. Such decisions, however, are driven not only by where they have the greatest economic benefit, but also by political will, which is influenced by intangible, societal values. Repeatedly rebuilding devastated areas, for example, may be economically inefficient in many cases, but the attachment of residents to home and community remains a common obstacle to relocation efforts. Governments should consider adopting systematic approaches, such as 'Capabilities programmes', that direct funds toward rationally established priorities through transparent processes and that can flexibly redirect resources over time to new priorities.

Evaluation of the impacts and success of mitigation grants is not systematically practiced in some of the countries under study, though there is recognition that effectiveness measures should be developed and used to inform future decisions. Such studies are expensive and take a long time to conduct, but are a useful tool for capabilities based planning that help ensure government expenditures are directed to where they can generate the greatest value. Several countries under study require government regulators to carry out cost benefit analysis in their efforts to control potentially harmful industrial activity, yet the practice is not clearly part of the mitigation investment decision making process due to reluctance to place a theoretical, monetary value on a statistical life. Without some similar type of control, over-investment in mitigation may occur and comparisons of cost savings associated with alternative investment options are made more difficult.

Financial management of large scale disasters

To strengthen the flow of resources for effective financial management of large scale disasters governments should consider both "ex-post" and "ex-ante" risk financing solutions. Public sector partnerships with the private sector can improve disaster preparation and help societies adapt to features of the changing risk landscape. To begin, governments and the private sector can work together to raise awareness of risks. They could also enhance the effectiveness of private markets with stricter guidelines on land use planning and building construction and favourable tax treatment for more robust insurance reserves that are set aside for catastrophe pools. Consideration of new risk transfer mechanisms should be a key feature of an integrated approach to country risk management.

Large government insurance or reinsurance programmes should only intervene when the availability and affordability of private catastrophe insurance are in short supply. In such case, the underlying causes of supply shortfalls should first be analysed, such as the impacts of disaster assistance on demand, taxation on returns of capital held in reserve, and restrictions on private sector underwriting or pricing of coverage. Policymakers should also consider whether government insurance programmes reduce costs to taxpayers, mitigate moral hazard and improve incentives for loss control. Finally, policymakers need to compare whether government insurance against catastrophe losses, with its tendency toward subsidies and programme expansion, is more efficient than relying on well-targeted, ex post disaster relief.

1. OECD (2003a).

2. Swiss Re, sigma No 2/2006.

3. Munich Re Press (29 December 2008).

4. Swiss Re, sigma No 1/2008.

5. Japan Ministry of Land, Infrastructure and Transport (2005), White Paper on Land, Infrastructure and Transport in Japan.

6. The Council is chaired by the Prime Minister and comprised of the Minister of State for Disaster Management and Food Safety, and the Cabinet Ministers, Presidents of major Japanese institutions (Japanese Red Cross Society, Bank of Japan, public utility providers) and experts from Academia, local government and the Fire and Disaster Management Agency.

7. HSC members include: the Vice President, the Secretaries of Homeland Security, Treasury, Defense, Health and Human Services, Transportation, the Attorney General, the Director of National Intelligence, the Director of the Federal Bureau of Investigation, and the Assistant to the President for Homeland Security and Counter-terrorism. The following senior officials are invited to attend any HSC meeting: the Chiefs of Staff to the President and Vice President, the Assistant to the President for National Security Affairs, the Counsel to the President, the Director of the Office of Management and Budget, and the Chairman of the Joint Chiefs of Staff. Other senior officials are invited to attend HSC meetings pertaining to their responsibilities or otherwise as appropriate.

8. Multi-hazard Mitigation Council (2005), Natural Hazard Mitigation Saves: An independent Study to Assess the Future Savings from Mitigation Activities.

9. FEMA (2007), East Bay Municipal Utility District: Seismic Improvement Program.

10. Brinkhuis-Jak, Holterman, Kokand and Jonkman, (2005) The Boertian Commission, Cost benefit analysis and flood damage mitigation in the Netherlands, ISSH – Stochastic.

11. Public Safety Canada (2008), Working Towards a National Strategy and Action Plan for Critical Infrastructure.

12. The Netherlands Ministry of the Interior and Kingdom Relations (2004), Critical Infrastructure Protection in the Netherlands: The Dutch approach on CIP.

13. United States Department of Homeland Security (2006), The National Infrastructure Protection Programme.

14. The links below provide exact lists of critical infrastructure sectors for each country:

Canada: http://www.publicsafety.gc.ca/prg/em/nciap/about-eng.aspx#a01

Japan: http://www.us-cert.gov/control_systems/pdf/Japan's_CIIP_Guideline_Development.pdf

The Netherlands: http://www.minbzk.nl/bzk2006uk/subjects/public-safety/national-security/protection

Singapore: OECD Secretariat consultation with Singapore Government.

United Kingdom: http://security.homeoffice.gov.uk/counter-terrorism-strategy/working-with-partners/protect-national-infrastructure/

15. United Kingdom Cabinet Office (2008), National Risk Register.

16. National Fire Protection Association (2007), NFPA 1600: Standard on Disaster/Emergency Management and Business Continuity Programs.

17. Becker, G. (Jan 4, 2005), And the Economics of Disaster Management, Wall Street Journal.

18. Her Majesty's Government, Association of British Insurers (July 2008), FINAL-AGREEMENT.

19. OECD (2003) Large Scale Disasters, Chapter 5.

20. Mississippi Windstorm Underwriting Association, (Mar. 1, 2006), "Accounting Report for Year Ended December 31, 2005".

21. OECD (2006) Policy Issues in Insurance, Environmental Risks and Insurance: A comparative analysis of the role of insurance in the management of environment related risks, No.6,.

22. Risk level for hazards considers likelihood based on historical evidence, predictable events (for example weather forecasts) and expert advice. Risk level for threats is based on plausibility, intelligence about an aggressor's capability and intent, intelligence about vulnerability and the limited record of successful attacks.

23. United Kingdom Emergency Preparedness Annex 4F.

24. United Kingdom Emergency Preparedness Annex 4D.

25. United Kingdom Emergency Preparedness Annex 4D.

26. Scheepers, Seebregts, de Jong, Maters, Clingendael: EU Standards for Energy Security of Supply: International Energy Programme (2007).

27. The Department of Homeland Security's Risk Assessment Methodology: Evolution, Issues and Options for Congress, (February 2, 2007).

28. Committee of Sponsoring Organisations of the Treadway Commission : http://www.coso.org/

OECD Studies in Risk Management

INNOVATION IN COUNTRY RISK MANAGEMENT

Looking back on the disasters of recent years alone (the Indian Ocean tsunami disaster, Hurricane Katrina, terrorist attacks in New York, Madrid and London, avian flu, the 2003 heat wave in Europe), one could be forgiven for thinking that we live in an increasingly dangerous world. A variety of changes are giving shape to a new global risk landscape, from urban concentration of populations and critical assets, to climate change, through the rise of synthetic biology and nanotechnology. These evolutions clearly present a major challenge for risk management systems in OECD countries, which have occasionally proved unable to protect the life and welfare of citizens or the continuity of economic activity.

The OECD Future Project on Risk Management Policies was launched in 2003 in order to assist OECD countries in identifying the challenges of managing risks in the 21st century, and help them reflect on how best to address those challenges. The focus is on the consistency of risk management policies and on their ability to deal with the challenges, present and future, created by systemic risks. This report highlights recent developments in risk management at central government level in six countries, e.g. organisational reforms to facilitate multi-risk identification and assessment, and policy maker's tools to prioritise investments in mitigation activities.

This work is now published as the OECD Studies in Risk Management.

www.oecd.org