WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

Global Risks 2010

A Global Risk Network Report

A World Economic Forum Report
in collaboration with
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Marsh & McLennan Companies (MMC)
Swiss Re
Wharton School Risk Center
Zurich Financial Services

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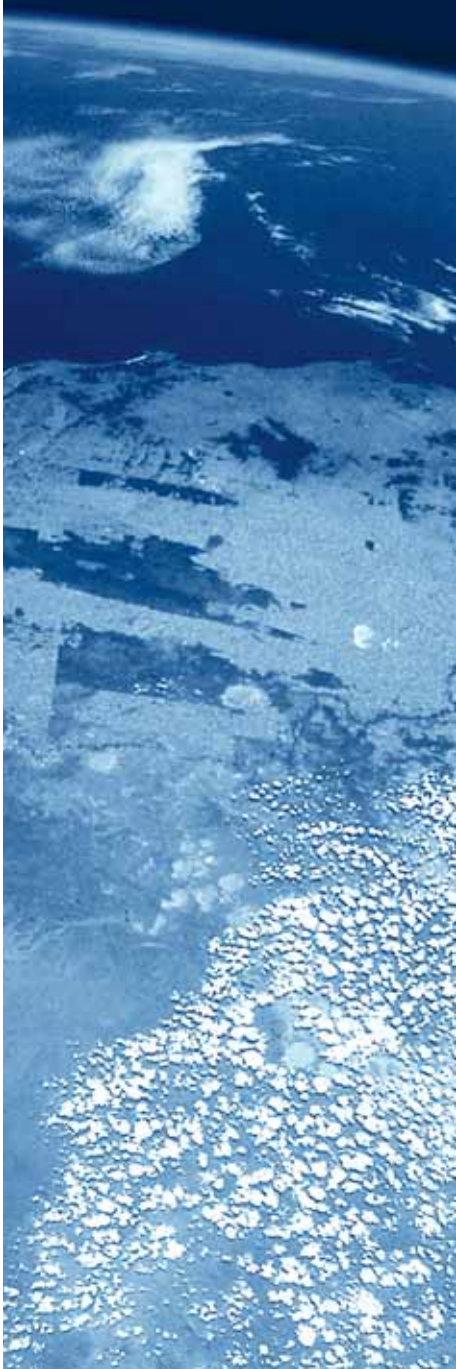

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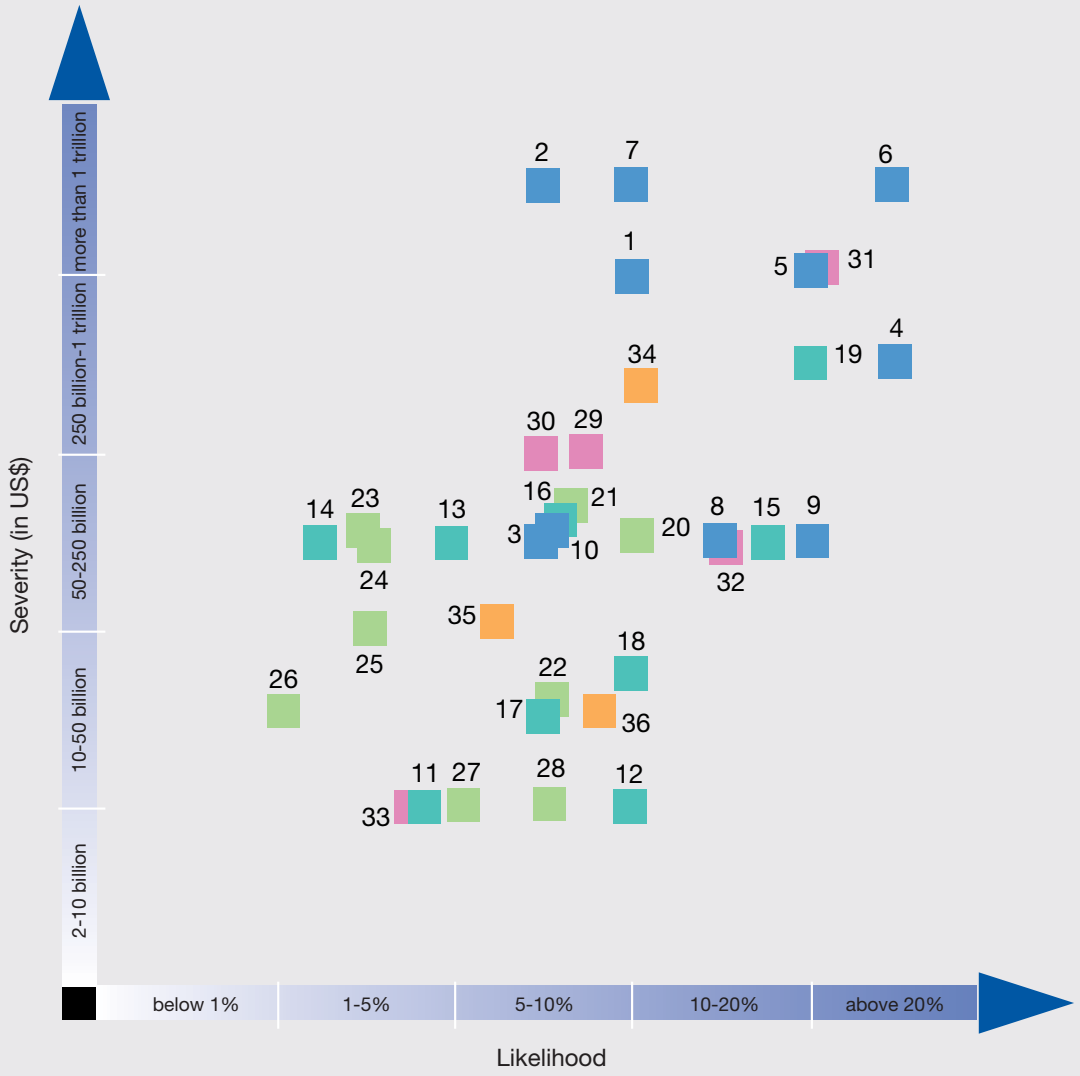
Figure 1: Global Risks Landscape 2010: Likelihood with Severity by Economic Loss



Source: World Economic Forum 2010

Economic Risks
1 Food price volatility
2 Oil price spikes
3 Major Fall in the US $
4 Slowing Chinese economy (<6%)
5 Fiscal crises
6 Asset price collapse
7 Retrenchment from globalization (developed)
8 Retrenchment from globalization (emerging)
9 Burden of regulation
10 Underinvestment in infrastructure

Geopolitical Risks
11 International terrorism
12 Nuclear proliferation
13 Iran
14 North Korea
15 Afghanistan instability
16 Transnational crime and corruption
17 Israel-Palestine
18 Iraq
19 Global governance gaps

Environmental Risks
20 Extreme weather
21 Droughts and desertification
22 Water scarcity
23 NatCat: Cyclone
24 NatCat: Earthquake
25 NatCat: Inland flooding
26 NatCat: Coastal flooding
27 Air pollution
28 Biodiversity loss

Societal Risks
29 Pandemic
30 Infectious diseases
31 Chronic diseases
32 Liability regimes
33 Migration

Technological Risks
34 Critical information infrastructure (CII) breakdown
35 Nanoparticle toxicity
36 Data fraud/loss

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Preface

Forty years ago, the inaugural Meeting of what would later become the World Economic Forum Annual Meeting was held in Davos. At this historic milestone in the life of the organization comes the fifth edition of the Forum's *Global Risks* Report, *Global Risks 2010*. Throughout its previous editions, this report has outlined some of the top issues most likely to come to the fore of the global risks landscape and stressed the need for a multistakeholder approach to address them. Global risks do not manifest themselves in isolation, neither geographically nor in time. This fundamental premise of the Forum's work on risks has become particularly pertinent since the onset of the financial crisis. As *Global Risks 2010* highlights, we are in a world with unprecedented levels of interconnectedness between all areas of risk.

At this critical juncture, the need to redress imbalances, change incentives and improve global understanding and cooperation remains the top priority if future challenges are to be met with the right solutions and sufficient levels of preparedness. Global governance gaps already featured prominently in *Global Risks 2009* and 2010 will be no different; they are part of a series of issues highlighted in this report, which due to their endemic and systemic nature can only be addressed by a fundamental overhaul of current values and behaviours. The effects of these risks will not only be felt over the coming year but will also influence decision-making well into the new decade. Inherent to these problems is the fact that they concern stakeholders from all spheres and regions across the world – the multistakeholder aspect of global risks, which renders it more difficult to manage them.

Through its analysis of the interconnectedness between risks, *Global Risks 2010* again emphasizes the need for more effective global governance structures to unlock the resolution of many of the issues highlighted in this report. However, to succeed, these structures will need to be supported by leaders willing to reconcile often diverging agenda and able to address the long-term structural issues at hand as well as the immediate problems. They will also need to consider the direct and indirect social implications of their policies. Legitimacy, accountability, clarity, concerted action: these are the keywords of efficient global risk management and effective global governance. The World Economic Forum has long promoted thinking about how these goals can be achieved, through reports such as this, and its activities and initiatives.

This fifth edition, *Global Risks 2010*, has been made possible through the valuable insights of experts from the Forum's Global Risk Network and Global Agenda Councils, together with the continued support of our partners: Citi, Marsh & McLennan Companies (MMC), Swiss Re, The Wharton School Risk Center and Zurich Financial Services. By consulting this group of experts and academics across the world throughout the year and relaying their findings in this annual report, *Global Risks 2010* seeks to provide political and business leaders with a framework for further discussion of a risk landscape that is ever more complex and urges a consideration of the longer term, global implications of risks in areas beyond their immediate focus. These risks must be addressed collectively so opportunities can be found in their complexity.

Klaus Schwab
Founder and Executive Chairman
World Economic Forum

Executive Summary

After the shock to the global financial system and world economy in 2008, 2009 was a year of appraisal and adjustment. The risk landscape that this report has explored over the past five editions has in fact changed remarkably little. What has changed dramatically is the level of recognition that global risks, like the world, are now tightly interconnected and shocks and vulnerabilities are truly global, even if impact and response can still differ at the "local" level. This recognition is illustrated by the increased number of interlinkages on the 2010 Risks Interconnection Map (RIM)[1].

Cross-cutting themes

Three themes provide the backdrop for discussion in this report. As the first chapter discusses, the increase in interconnections among risks means **a higher level of systemic risk** than ever before. Thus, there is a greater need for an integrated and more systemic approach to risk management and response by the public and private sectors alike. Second, while sudden shocks can have a huge impact, be they serious geopolitical incidents, terrorist attacks or natural catastrophes, the biggest risks facing the world today may be from **slow failures or creeping risks**. Because these failures and risks emerge over a long period of time, their potentially enormous impact and long-term implications can be vastly underestimated. These are risks linked to big shifts that are recognized and which will roll out over many years, even decades. For example, global population growth, ageing and the ensuing rise in consumption have implications for resources, climate change, health and fiscal policy. The emergence of multiple poles of economic and geopolitical influence is another shift. At the same time two nations, China and the US, will probably play a determining role through their choice of saving and investment paths. Finally, the third theme picks up the discussion of **global governance gaps** from last year's report. In light of ongoing short-term pressures on governments, business and individuals, can the necessary reform of global governance be achieved across the range of issues where it is required? Improved coordination on macro-prudential supervision, effective climate and energy policies, and new mechanisms to protect resources and security are all key to reducing vulnerability and risk. The next years will test the political will, vision and willingness of governments, business and individuals alike to make tough choices and manage the challenges ahead.

Risks in focus

This year's report explores a set of risks that share a potential for wider systemic impact and are strongly linked to a number of significant, long-term trends. First, there are those which feature highly on the Global Risks Landscape and which predated the recession but have been exacerbated by its impact through greater resources constraints or short-term thinking. These include:

- **Fiscal crises** and the **social and political implications of high unemployment**
- **Underinvestment in infrastructure**, both new and existing, and its consequences for growth, resource scarcity and climate change adaptation
- **Chronic diseases** and their impact on both advanced economies and developing countries

The report also notes how concerns over further asset bubbles remain strong, as indicated by the Global Risk Network Partner's assessment for the Global Risks Landscape.

The other risks discussed in this report are equally systemic in nature and also require better global governance but they currently feature less prominently on the Global Risks Landscape. The report raises these risks to understand if there is an "awareness gap" around these areas and suggests that they should not be forgotten in the focus on an integrated and longer term view of risks. These risks include: **transnational crime and corruption; biodiversity loss; and cyber-vulnerability**.

None of these risks feature in the upper right-hand quadrant of the Global Risks Landscape, but they are all connected to a range of other risks more likely to occur and with greater severity over the next 10 years. Thus, their impact will be truly global and cross-industry, and will affect individuals as they will businesses or governments.

The 2010 Global Risks Landscape is as crowded as ever. This report does not aim to cover all of the risks tracked by the Forum's Global Risk Network. The landscape offers a view of where each risk lies relative to others. Indeed, the core set of risks behind the report are not exhaustive: it has evolved and will continue to be refined and adjusted as new issues emerge on the 10-year horizon. Some risks are not addressed in this edition, not because they are less important but because of the constraints of length and the need for focus. In particular, though cognizant of

[1] An interactive version of the Risks Interconnection Map (RIM) is available at www.weforum.org/globalrisks

their weight, the discussion in this year's report only touches on a few of the many geopolitical risks on the landscape. Afghanistan featured highly in discussions throughout the year, with concerns that the level of instability in the country poses a threat for its own population and the troubling events that are unfolding in neighbouring Pakistan. As discussed in last year's report, though many of the geopolitical risks identified by the Global Risk Network may appear intractable and limited in their geographic reach, in reality each has an impact in terms of human suffering and the burden on development and growth. Each of these can be a source of wider regional instability or even broader conflict.

Decision-making in an interconnected world

The objective of the work of the Global Risk Network is to raise awareness of the level of interconnections among risks and the global impact of those interconnections. The report offers a framework for decision-makers to look at risks in an integrated manner and to provide an impetus to different stakeholders to focus on ways to manage systemic risks more effectively. The events of the past two years have shown how costly slow failures can be when they erupt in systems. The lessons learned were numerous but must be remembered and acted on in other areas, not only in the sphere of finance and economics. Much discussion has rightly centred on behaviour change and governance, but both are highly dependent on political and individual will and the choices acted on by decision-makers. For behaviour to evolve, a concerted effort is needed to provide the right mix of information, incentives and institutions; to stretch people's time horizons and make them understand exactly what is at risk. All of this requires a longer term approach than usually dictated by electoral cycles or indeed financial reporting and executive tenure. The Forum is driving some of the thinking on how to work towards long-term solutions, while managing the immediate challenges. Its Global Redesign Initiative has this goal at its core: it leverages the Forum's convening power to focus the minds of all stakeholders on new models of governance to manage complexity and risks to global growth and well-being. Equally, by taking the 10-year perspective and exploring interconnections, experts who contribute to the work of the Global Risk Network focus on the context in which strategies and policies are formed and the decisions taken to anticipate and manage, rather than merely reacting to risks.

1. The Global Risks Landscape 2010

The rationale behind the 2010 highlighted risks

The choice of risks to focus on in the annual report is driven by several factors. The more highly interlinked the risk, the more its impact and severity is amplified, so its level of interconnectedness on the Risks Interconnection Map (RIM) *(Figure 13, page 33)* and its position on the Global Risks Landscape *(Figure 1, page 1)* are important. Hence, using these criteria and the input from roundtables with the Global Risk Network throughout the year, the following risks were selected as the focus of discussion in this report: **Fiscal Crises, Underinvestment in Infrastructure and Chronic Diseases**.

These risks are covered through the lens of the themes that emerged from these different sources in society and the global economy over the next 10 years: systemic and creeping risks; global shifts; and the tension between the need for effective global governance and collective commitment to risk management and adaptation, with the often pressing and divergent priorities on regional, national and corporate agenda.

Fiscal crises

In response to the financial crisis, many countries are at risk of overextending unsustainable levels of debt, which, in turn, will exert strong upwards pressures on real interest rates. In the final instance, unsustainable debt levels could lead to full-fledged sovereign debt crises.

Underinvestment in infrastructure

Multiple studies across the world repeatedly highlighted that vast segments of our water, energy or transport infrastructure are structurally deficient or functionally obsolete, requiring considerable annual investments to avoid catastrophic failure.

Chronic diseases

As a consequence of profound socio-demographical transitions among large sections of the world population, changing physical and dietary habits, chronic diseases including cancer, diabetes, cardiovascular and chronic respiratory disease are continuing to spread rapidly throughout the developed and developing world, driving up health costs while reducing productivity and economic growth.

A note on three other key risks

While not explored in depth in this edition, "**asset price collapse**", "**China's growth falling to less than 6%**" and "**Afghanistan**" featured highly on the Global Risks Landscape. All are referred to in the following chapters and indeed *Global Risks 2008* discussed asset price collapse and its implications for systemic financial risk. The role of China is referred to through several sections of this report and will remain to the fore of the Global Risk Network's dialogue over the coming year and beyond.

Asset price collapse

The last edition of this report discussed the longer term implications of the financial crisis, exploring the tight interconnections among economic and resource-related risks. The fact that the risk of an asset price collapse remains the strongest risk on the landscape on the severity and likelihood axes illustrates the continuing uncertainty about the resilience of the global economy and the effectiveness of fiscal and monetary responses, governance and regulation. Concerns abound about the decline in the dollar and low interest rates fuelling another bubble, this time liquidity rather than debt-driven. Experts are also worried about a lag in the impact of the recession in a number of areas. The level of corporate bankruptcies, particularly among small and medium size enterprises remains high. Credit card default rates, which are highly correlated with unemployment, are already at historic levels. The current unemployment rate of more than 10% in the US is considerably higher than the 6.5% unemployment rate that most credit card lending models assume. Finally, though residential house prices have fallen considerably in those markets considered to have been the most overheated, concerns persist about commercial real estate. As illustrated by the events in Dubai in December 2009, debt loads remain high; as refinancing needs arise, which are only expected to peak between 2011 and 2013, further shocks could emerge.

China's growth falling to 6% or less

China appears to have successfully navigated the financial crisis and global recession. However, much of the domestic impulses derive from high credit growth, which entails an increased risk of misallocation of capital and renewed bubbles in financial asset prices and real estate. These can always carry the risk of a sharp and potentially recessionary correction. A loss in China's growth momentum could adversely affect global capital and commodity markets. The Chinese government faces a number of challenges: the need to increase domestic demand to counter the loss in exports and the need to maintain a stable renminbi given China's vast accumulation of foreign reserves.

The implications of a fall in China's growth would be particularly acute for its trading partners if it should happen before the global economy is on a more resilient path.

Afghanistan

Though geopolitical risks were not the focus of this year's report, among those tracked by the Global Risk Network, including Iran and Israel-Palestinian Territories, Afghanistan emerged highest on the Global Risks Landscape. It is also linked to nearly all the other geopolitical risks and several economic risks on the RIM. Moreover, Afghanistan's instability cannot be dissociated from rising concerns over the situation in Pakistan. The border between the two countries has become a hotspot.

The instability in the region is already a source of suffering for the local population. Their plight is compounded by the stress that rapid population growth and the impact of climate change are placing on resources, in particular water. Afghanistan's population (currently 28 million) is expected to increase by over 30% in less than 10 years. Pakistan's population is set to reach 225 million within a decade (from 41 million at independence in 1949). The World Bank has warned that population growth is already causing water stress and could soon result in outright scarcity. The social and economic consequences of this should be as much a focus for the international community as the geopolitical implications.

The Risks Interconnection Map 2010 (RIM)

The 2010 Risks Interconnection Map (RIM) *(Figure 13, page 33)* shows the results of the *2010 Global Risks Expert Perception Survey*, which the World Economic Forum runs every year to survey experts in several disciplines[2] all over the world on their perception of risk interdependencies and relations.

Governance gaps

Global governance gaps remain high on the Global Risks Landscape and are the most significant source of risk in terms of interconnectedness, meaning that independent from the expert's background the risk of governance gaps has been selected most of the time as a top connection and highly related to other risks. This shows that experts have identified weak or inadequate institutions or agreements in almost all of the risks covered. However, it also raises a red flag in terms of expectations as to which fields and concrete issues global governance bodies should take steps and get involved. Thus, the Forum is examining where the biggest gaps in governance are and how these gaps might be addressed with the tools and thinking of the 21st century.

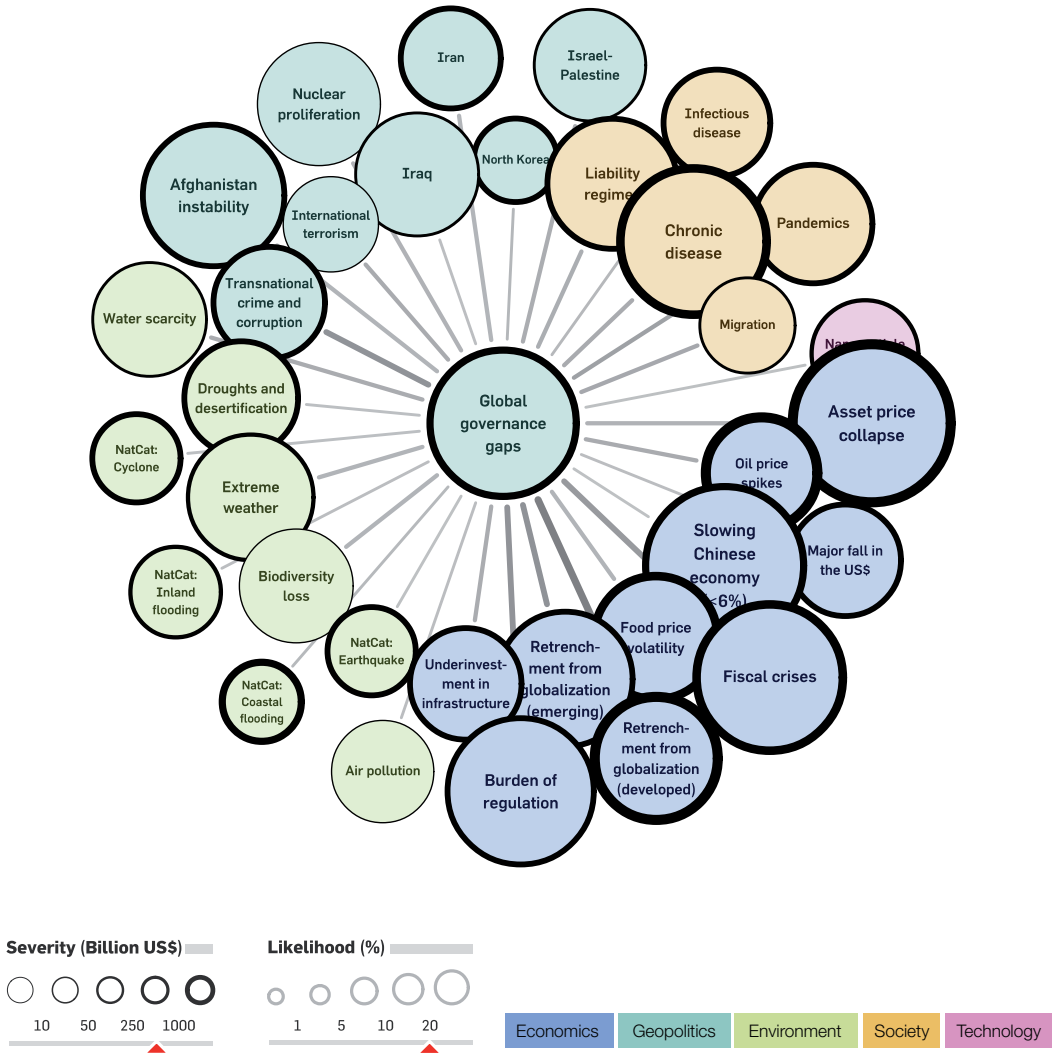
Global governance's relation with geopolitical risks has not changed from 2009. Economic and environmental risks are the areas where there has been a marked increase in the perception of interdependencies. This suggests that the recession and the Copenhagen Climate Conference 2009 call for collaboration have had an impact on heightening awareness, developing insights and understanding risk interrelations, which has been translated in our survey in the form of more and stronger connections with this particular risk. It also reinforces the message of the *Global Risks 2009* report of how crucial it is to focus on global governance not as an end in itself but as a means to address many critical global risks over the coming years.

Retrenchment from globalization

Throughout the year and across different countries, experts from the Global Risk Network have convened to reflect on and debate the outlook for the Global Risks Landscape over the coming years. On several occasions, experts have expressed concern that it is highly likely the next economic cycle will be politically more unstable once the global economy emerges from the current crisis. Despite a significant drop in global trade and investment flows, these are now recovering and the expected backlash to globalization has not materialized, trade disputes have not increased and the rise of the G20 has been welcomed as recognition that a wider group of countries has a role to play on the global stage. However, should the recovery progress without a concomitant improvement in employment, the risk of "retrenchment from globalization" (in both developed and emerging countries) could emerge more strongly. Rising protectionism, coupled with the macroeconomic instability and social unrest due to rising unemployment, adds pressure to the global outlook. Some elements of recent stimulus packages could be read as protectionist measures, discouraging cross-border investment flows. A sustainable recovery will require healthy flows of trade, investment and people and any moves to counter these should be watched with caution.

[2] Expertise of the Global Risk Network includes academics and practitioners in the areas of economics, geopolitics, environment, society and technology.

Figure 2 **Global governance gaps interconnections**



Source: World Economic Forum 2010

It is important to take into account that retrenchment from globalization goes beyond protectionist economic policies. A political or social backlash to globalization generating high levels of social turbulence or destabilizing a government is also incorporated in this risk. A major retrenchment coming from areas other than economic policy, such as societal attitudes toward multilateralism, will have equally damaging consequences on growth and development worldwide.

As global governance institutions and the remodelling of multilateralism become a channel to adjust to current challenges, national interests must correspond, support and adhere to global governance organizations and agreements. Given the unprecedented levels of interconnectedness, global leaders from all spheres need to find a common platform to debate and push forward reforms and policies to ensure a sustainable global economy.

Increasing interconnectedness: systemic risks, systemic responses

One of the major conclusions from the analysis of the results of the 2010 *Global Risks Expert Perception Survey* which drives the RIM *(Figure 13, page 33)*[3] is the marked increase in interconnectedness among the risks covered by the Global Risk Network (see inside front cover for the risk descriptions). Risk interdependency has always been at the core of our analysis but, particularly this year, it seems to have gained even more attention and generated strong

[3] The Global Risks Expert Perception Survey was conducted between July and October 2009. More than 200 experts from The Global Risk Network and the Forum's Global Agenda Councils were surveyed to assess the likelihood, severity and interconnections of the risks in our taxonomy. This report shows the results referring to the interconnections identified by the experts.

interest among experts of different disciplines. This year's survey shows that both the number and strength of interconnections among risks have increased notably. This upsurge can be interpreted as an indication of success in terms of improving the awareness, discussion and, in some cases, understanding of systemic risks.

In *Global Risks 2008*, systemic financial risk was described as a system-wide financial crisis typically accompanied by a sharp decline in asset values and economic activity and an abrupt loss of liquidity. During the last 18 months, there has been a significant amount of debate about the systemic nature of the financial crisis, its unintended consequences, and the appropriate strategies and policies which will create more resilient systems. The crisis unveiled fundamental questions about our ability to manage systemic failures. Systemic risks are inherent to every system, not only the financial industry. However, the universal scope of the financial crisis has raised awareness of interconnections and revealed the importance of thinking differently about the risk landscape, highlighting the key premise of the Forum's Global Risks work: global risks do not manifest themselves in isolation.

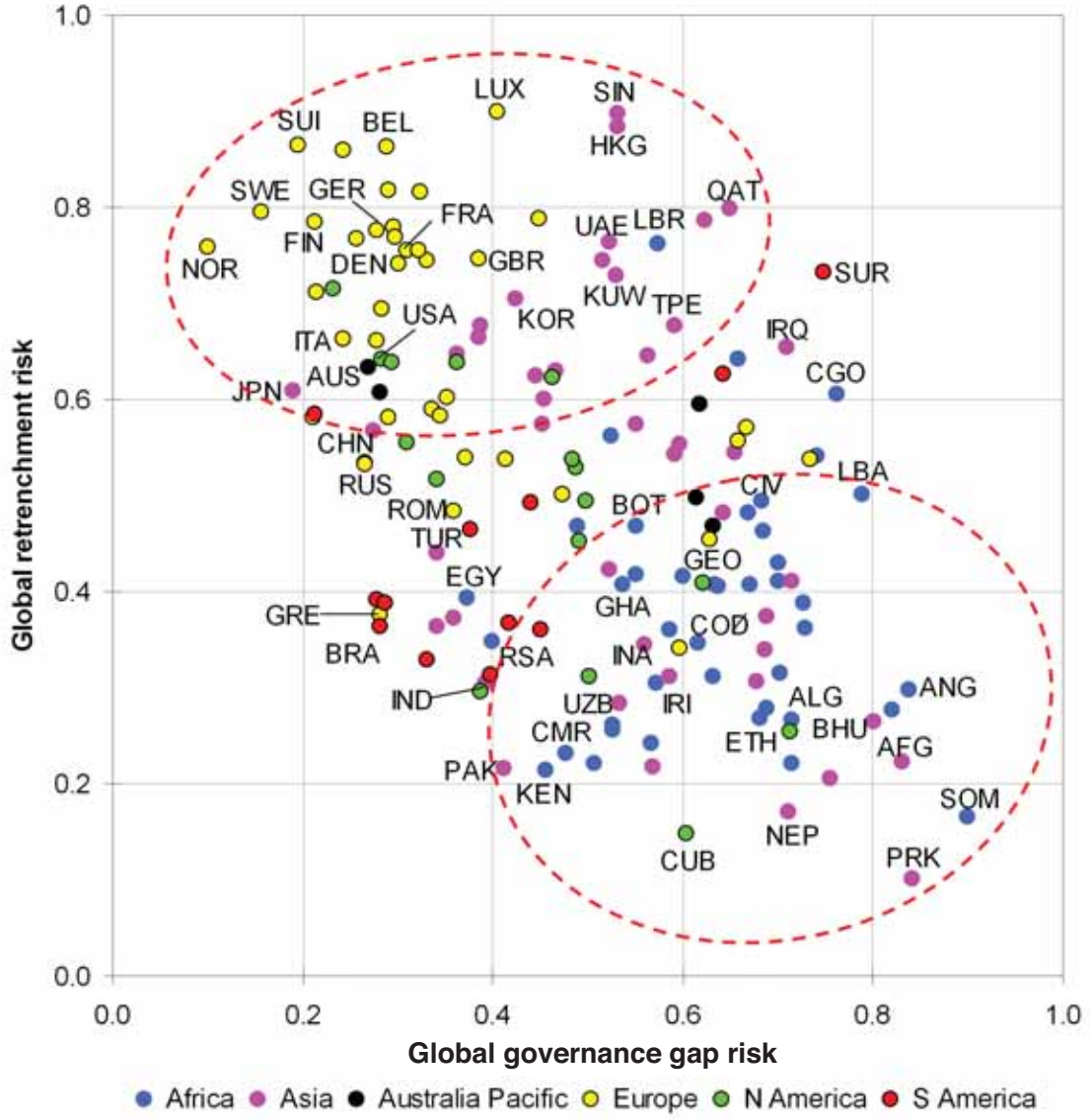
Since the Bretton Woods agreements in 1944, it is the first time where global leaders around the world agreed on the urgent need to reform the global financial system. However, real political will is necessary to muster cooperation adapted to today's reality and challenges. The response and management of the current crisis must also be systemic and global and it goes beyond financial market interventions. The increasing relevance of the G20 reflects the greater role that many emerging market countries are playing and a step towards healthier international cooperation and coordination.

The financial crisis and ensuing recession uncovered major weaknesses and revealed just how interdependent the world has become. A major improvement of our insights into these interdependencies is essential to tackle the origins of the crisis and to avoid repetition in the future. Effective regulation will be part of the solution. Systems need a certain level of flexibility to adapt to changing environments. Global decision-makers and regulators need to provide an adequate degree of freedom, while ensuring that regulation is effective in reducing risks through the necessary oversight and safeguards.

In the Global Risks Landscape 2010 (*Figure 1, page 1*), economic risks continue to feature as having the highest estimated potential severity of economic loss. This illustrates that the world economy is still in intensive care and that concerns remain about the adequacy of its global governance and measures taken at the national level. The prominence of the G20 as the group responding to the financial crisis represents a first step towards a better and more coordinated international policy-making process. Still, its efficacy has not been sufficient to fully galvanize leaders into taking action to push major reforms in global governance bodies and more effort needs to be devoted to this.

A definition of systemic risk
A systemic risk is the potential loss or damage to an entire system as contrasted with the loss to a single unit of that system. Systemic risks are exacerbated by interdependencies among the units often because of weak links in the system. These risks can be triggered by sudden events or built up over time with the impact often being large and possibly catastrophic.

Figure 3 **The risks of a global governance gap and retrenchment from globalization**



Source: Zurich Financial Services 2010G

As a consequence of the financial crisis and the fallout from the global recession, the risks of a widening global governance gap and retrenchment from globalization feature prominently in the global risks map. Introduced in last year's report, the "global governance gap" is seen as likely and severe going into 2010, as in 2009, and there is a similar high overall assessment for the risk of a retrenchment from globalization.

Given the importance of both risks, the question remains how they affect individual countries. To do so we first translated the high-level definition of global risks into individual country risk metrics. To assess the global governance gap, we measured the degree in which countries participate in existing institutions of global governance, such as bodies governing trade, finance, environment, anti-terrorism, health and humanitarian activities. Likewise, to assess the risk of a retrenchment from globalization, we measured a country's involvement mainly, but not exclusively, in global trade and capital flows. Using an approach based on game theory, we assumed that countries staying on the sideline will eventually be sanctioned by the global community. Consequently, they are more exposed to these risks.

The risk of not addressing slow moving shifts

The Global Risk Network experts agreed in events and workshops throughout the year that predicting the next crisis is a risk in itself. However, there are large-scale, slow-moving shifts already underway for which current levels of preparedness are insufficient and whose implications could have far-reaching and highly costly consequences. Independently of what shape the global recovery will take, we might have expected that the "quake" in the fundamentals would lead to a significant behavioural change and systemic overhaul of norms and practices. This shift has not yet materialized, partially because signs of recovery came relatively fast in some areas and behavioural changes take time. It is slow in part because humans gravitate to what they know and postpone dealing with what they see as future risks. The result of maintaining the status quo and not pursuing major changes at an individual, business and government level is not an option any longer.

Today's challenges emerged in part from a lack of understanding of risk interconnectedness in the past. The slow-moving shifts seen today will be harmful in the next decade if we ignore their magnitude and the scope of their consequences. Some, such as chronic diseases might continue at their current pace. Others, such as underinvestment in energy infrastructure or IT security, might reach a tipping point and provoke a sudden shock. From our taxonomy of risks, we can identify some slow-moving shifts with a noteworthy potential effect globally. These big shifts are not new, neither in our taxonomy nor in the global debate. But in the midst of the economic turbulence, it is of utmost importance that they are addressed by the many policy and corporate decisions, as their materialization could be a catalyst for another systemic crisis. The worst case scenario of overlapping economic recessions with political instability and social turbulence, triggered by untenable fiscal deficits and unsustainable government debt burdens, might not, after all, be impossible.

A retrospective of the Global Risks Report

To mark the fifth year of *Global Risks*, we would like to take a moment to review the publication's goals. The Global Risk Network (GRN) was established in 2004 with a view to responding to a growing desire among Forum Members and constituents to understand and explore how risks were interconnected and the implications of those relationships over a 10-year time frame. Through a process of research and consultation, the GRN defined the criteria for global risks and identified an initial set of risks, which has been expanded over the past years. The GRN published its first *Global Risks* in 2006. Another important aspect of the work is the recognition that in today's globalized environment, risks can have enormous systemic implications and no one country, industry or organization can deal with them in isolation. Global risks require collective thinking and responses. Thus, the objective of the report is to build awareness of these factors and to offer a common framework for dialogue and responses among leaders from business, government, international institutions and other stakeholder groups.

A framework to track and assess risk

The report has evolved over the last five years by reflecting the unique events and risk trends that evolve through each year, while maintaining a long-term perspective on a set of core risks. The report does not predict when or how specific risks could occur. The Global Risk Network draws heavily on qualitative expert opinion rather than focusing only on historic data. This match of facts and expert analysis is an approach that avoids the work falling into a silo approach. While the risk landscape has evolved relatively gradually over the past five years, the awareness of interconnections among risks appears to have steadily risen.

In its first year, the *Global Risks 2006 Report* identified current and emerging risks, and looked at the links between them and implications over a 10-year time horizon. *Global Risks 2007* focused on the fundamental disconnect between risk and mitigation, emphasizing that exercises in risk assessment are futile if they do not encourage action on the part of decision-makers. In 2008, a full section was devoted to dealing with the globalization of risk and rising interconnectedness as a series of risk issues, such as the financial crisis and concerns over the long-term security of food supply, focused attention on the fragility of the global economy. Last year's report warned against losing sight of longer term risks in the face of overwhelming short-term challenges.

As a reminder, the report is released in January of each year, based on analysis conducted in the third and fourth quarters of the previous year. The key risks and focus of each year's report are summarized in Figure 4 below.

Figure 4 **Key risks and themes from the Global Risks reports over the past five years**

2006	2007	2008	2009	2010
• Asset prices/indebtedness • Chinese growth slowing to < 6% • Fiscal crises • Oil price spikes/supply shocks • US current account deficit/fall in US$ • Critical information infrastructure	• Asset prices/indebtedness • Chinese growth slowing to < 6% • Fiscal crises • Oil price spikes/supply shocks • US current account deficit/fall in US$	• Asset prices/indebtedness • Chinese growth slowing to < 6% • Fiscal crises • Oil price spikes/supply shocks • Rising and volatile food prices • An abrupt, major fall in the value of the US$	• Asset price collapse • Chinese growth slowing to < 6% • Fiscal crises • Global governance gaps • Chronic diseases • Increase resource-related risk (water, land and energy)	• Further falls in asset prices • Chinese growth slowing to < 6% • Fiscal crises • Global governance gaps • Chronic diseases • Underinvestment in infrastructure

As Figure 4 highlights, though the number of risks it examines have evolved over the last five years, there are several issues that have remained constant. Concerns about fiscal crises have featured since the outset, as did concerns about overinflated levels of asset prices and indebtedness. The latter shifted to a concern about asset price collapse in January 2008, before the full impact of the financial crisis hit. Infrastructure was a focus in 2006, only to reappear in this year's report, perhaps a sign that long-term thinking is seen as critical given the events of the past years. Finally, the implication of a decline in China's growth has been a constant since the first edition of the report. Thus far, this risk has not materialized but it is clearly one that would have considerable implications for China and also for the global economy.

2. Fiscal Crises and Unemployment

The financial crisis triggered a broader and deeper crisis of confidence among business, investors and consumers. Central banks intervened with unprecedented measures to ensure liquidity and prevent systemic collapse. In response to the ensuing global recession, governments intervened in many countries with record stimulus packages to boost demand. Though their intervention proved vital, governments now need to avoid becoming the main cause of the next crisis.

Government debt has reached historical levels for peace time in a number of advanced economies. Though necessary at the time, the costs of their interventions, combined with the long-standing burden of pensions and health spending, have left several major economies in a historically weak fiscal position with mounting debt. Collectively, G20 budget deficits now stand at 7.9% of their combined GDP[4].

With a few exceptions, the larger advanced economies have been the most affected by fiscal crises. According to the IMF, by 2014, the average debt-to-GDP ratio of advanced economies that are members of the G20 is expected to climb from the 2007 pre-crisis level of 78% to 118%. In sharp contrast, emerging economies, with smaller governments and lower exposure to the banking crisis, kept their fiscal houses in order. According to the same IMF analysis, between 2007 and 2014 the average debt-to-GDP ratio of emerging countries that are members of the G20 will never exceed 40%. For once, and in contrast to the 1980s and 1990s, emerging economies are not causal to a global fiscal crisis.

Governments, in the US and the United Kingdom in particular, are now faced with a set of tough choices, all with consequences for future global risks. The most pressing is how to time a gradual and credible withdrawal of fiscal stimulus so that the recovery is sustained but not so late that fiscal deficits cause fears of sovereign debt deterioration and a flight to safety that could drain their economies of capital and confidence. Governments need to develop sound exit strategies and communicate them clearly to reassure investors and taxpayers.

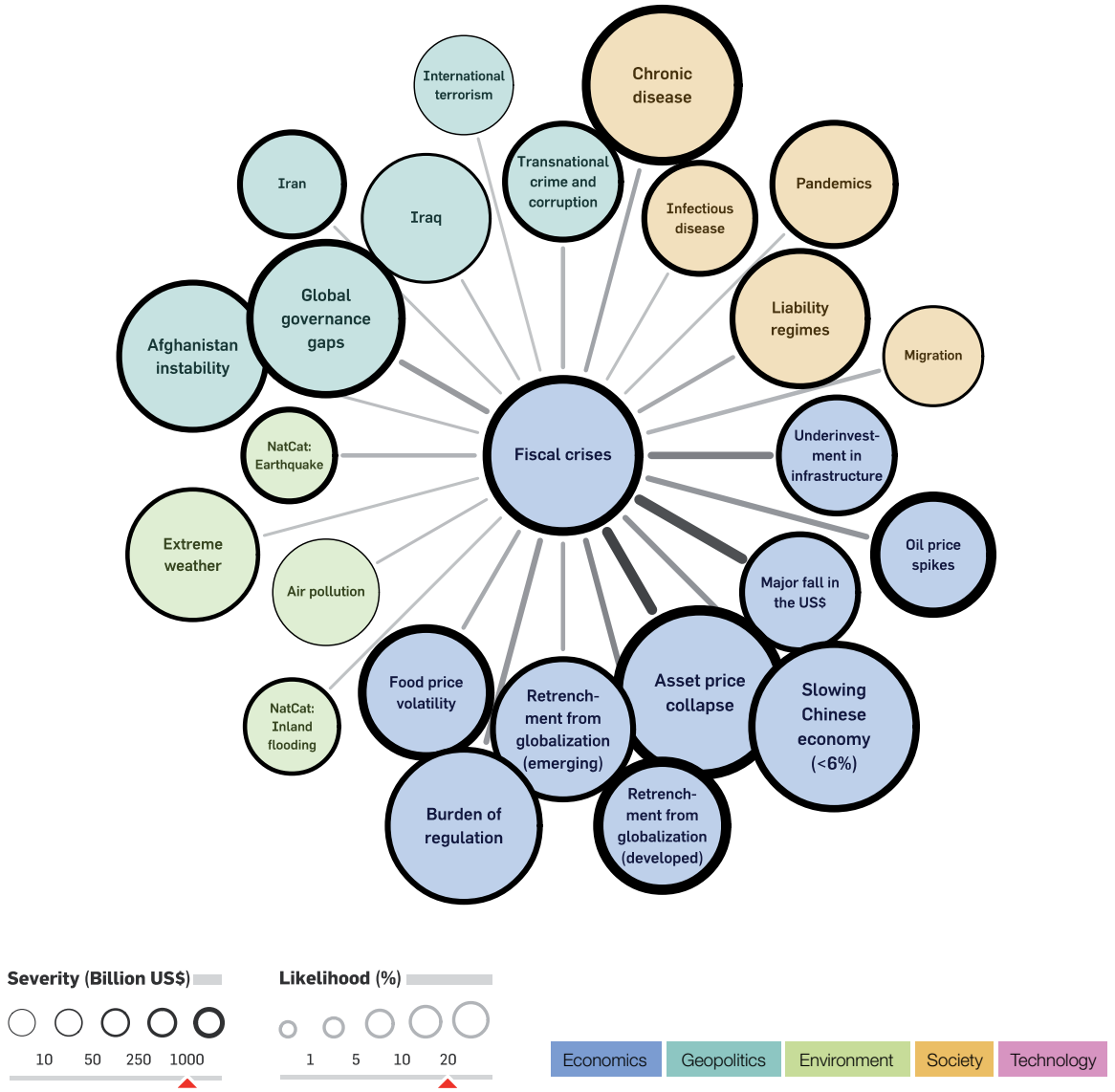
The implications for social systems: a new social contract for the 21st century?

The difficulties posed by the combination of weak fiscal positions and long-term pressures from current social spending trajectories are considerable. A generational approach that also accounts for the fiscal burden facing current and future generations (accounting mainly for social security and government-supported healthcare) reveals huge fiscal gaps. According to one estimate[5], the United States alone has to reckon with a gap of US$ 66 trillion, a figure more than five times current GDP and almost double the US national wealth. Similar outsized generational debt-to-GDP ratios are obtained for many other advanced economies.

Intergenerational accounting makes it clear that a business as usual approach to fiscal policy is unsustainable. Advanced economies in particular must face the difficult task of reforming their social security systems. Many current models for health, pensions, education and unemployment protection were designed to meet the needs of populations in growing economies with comparatively short life expectancies. This has changed dramatically. Today, people live longer, and the share of retired people that will have to be supported by the working population in pay-as-you-go social security schemes keeps increasing, placing huge strains on the costs and efficacy of social systems. Although some systems appear to be more effective, in particular those of Scandinavia, none are designed to meet future needs and the fiscal burden they represent was already becoming untenable before the crisis. The costs of social safety nets will have to be better shared among the population and the expectations of people in terms of health and pensions will have to be realigned. This may require politicians to implement unpopular decisions at a time when voters are suffering from the hardship of high unemployment caused by the global recession.

[4] International Monetary Fund, The State of Public Finances Cross-Country Fiscal Monitor: November 2009
[5] Laurence J. Kotlikoff, Is the US bankrupt? Federal Reserve Bank of St. Louis Review, July/August 2006

Figure 5 **Fiscal crises interconnections**



Source: World Economic Forum 2010

Unemployment: the long shadow of the downturn

Unemployment has risen dramatically over the past 18 months, across all sectors. Unemployment among OECD member countries alone has increased by 25.5 million since the start of the crisis and some estimates suggest that globally the increase could total over 50 million in 2010. Jobs are not created as quickly as they are lost and any protracted period of high unemployment will have adverse effect on consumption. Moreover, OECD studies show that a 1% increase in unemployment increases public debt by up to 3% of GDP over 10 years.

Though the rise may have been sharper in advanced economies, it should not be forgotten that unemployment is a global problem and that, even before the global recession, unemployment rates in North Africa, the Middle East and sub-Saharan Africa stood at 10.3%, 9.4% and 7.9% respectively in 2008 according to figures from the International Labour Organization (ILO). Even in India, with a healthy growth rate, the official unemployment rate stood at 7.2% in 2008. Population growth and the economic climate could push the numbers of poor to above the 1.4 billion estimated

by the World Bank (World Development Indicators 2009). Poverty is concentrated in sub-Saharan Africa and South Asia, which are regions most prone to the effects of climate change, natural catastrophes and global health issues. This leaves almost one-quarter of the world's population in a highly vulnerable position.

A cyclical response and structural shift

The sudden rise in jobless figures seen in developed economies in 2009 was in part cyclical, as a response to the decline in demand and these jobs should therefore return, albeit slowly, as demand increases. However, the crisis also hastened structural changes. Certain industries, such as the automobile sector, were already in decline in regions where labour costs made them uncompetitive. In other industries, airlines or pharmaceuticals for example, consolidation and new business models mean an overall decrease in the numbers employed. The question will be how to compensate for these structural changes as growth returns.

Unemployment in the Eurozone is expected to reach 11% in 2010. Some countries, such as Germany, seem to have fared relatively better thus far, through moves to shorten working hours, rather than cutting jobs and to maintain people in employment, if only part-time. Most reports suggest that unemployment will fall faster in the US than in Europe. The difference is attributable to the flexibility in US labour markets but, even with this, the US will be affected by widespread plant closures and continuing bankruptcies among small and medium size enterprises (SMEs). One risk is that this crisis leaves a legacy of underemployment, where people are constrained to accept part-time jobs or jobs that do not require their level of skills. US Department of Labour statistics show that there are 9 million workers in part-time employment who are seeking full-time jobs. Unemployment can become entrenched as workers lose skills or find themselves with the wrong skills to take advantage of new jobs when they arrive.

Widespread job losses have an immediate and direct effect on economies, but also on individuals and societies. One factor, common to both the developed and developing world, is that unemployment has a disproportionately large impact on youth. Young workers under 25 make up the greatest share of the unemployed in many regions and they have been particularly hit by the job losses and poor prospects in advanced economies. Studies suggest that the effects of unemployment or poor job opportunities early on in the working life have consequences for earning power and development over the rest of an individual's career.

As debate about necessary reforms continues in the US and Europe, it should be noted that according to the International Labour Organization (ILO) only 20% of the world has what the ILO terms "adequate" social protection, only 50% of the world has any coverage at all and in developing countries that figure falls to less than 10% of their population. While advanced countries focus on reforming their social security systems, perhaps this is an opportune moment for a global dialogue on how to design health and pension systems that are sustainable and can support growth and development in all parts of the world.

Migration and unemployment

One of the less prominent risks on the landscape concerns poor labour and migration policies, and a lack of cooperation at a global level, which meets neither the needs of donor or recipient countries. Though the arrival of immigrants can spark debate in some recipient countries, global migration flows are actually not that large. The International Organization for Migration (IOM) estimates the number of migrants in the world at 193 million, or approximately 3% of the global population. In periods of high employment, migrants are often a welcome source of labour but as unemployment rises, so do pressures on politicians to "protect" jobs. As mentioned in the previous chapter of this report, there is a risk that in response to public and sometimes populist pressures, governments introduce measures to curtail immigration. However, these policies are double-edged. In the short term, they clearly affect migrants and their home economies as remittances fall. There can also be unintended consequences of the policies, resulting in the rise of illegal migration and black and grey market activity. In the longer term, if the measures remain in place they can accentuate problems around skill shortages, which will no doubt re-emerge once jobs return. Migration policies need to be long term and cannot work in isolation. Better dialogue and coordination is needed between recipient and donor countries. Recommendations

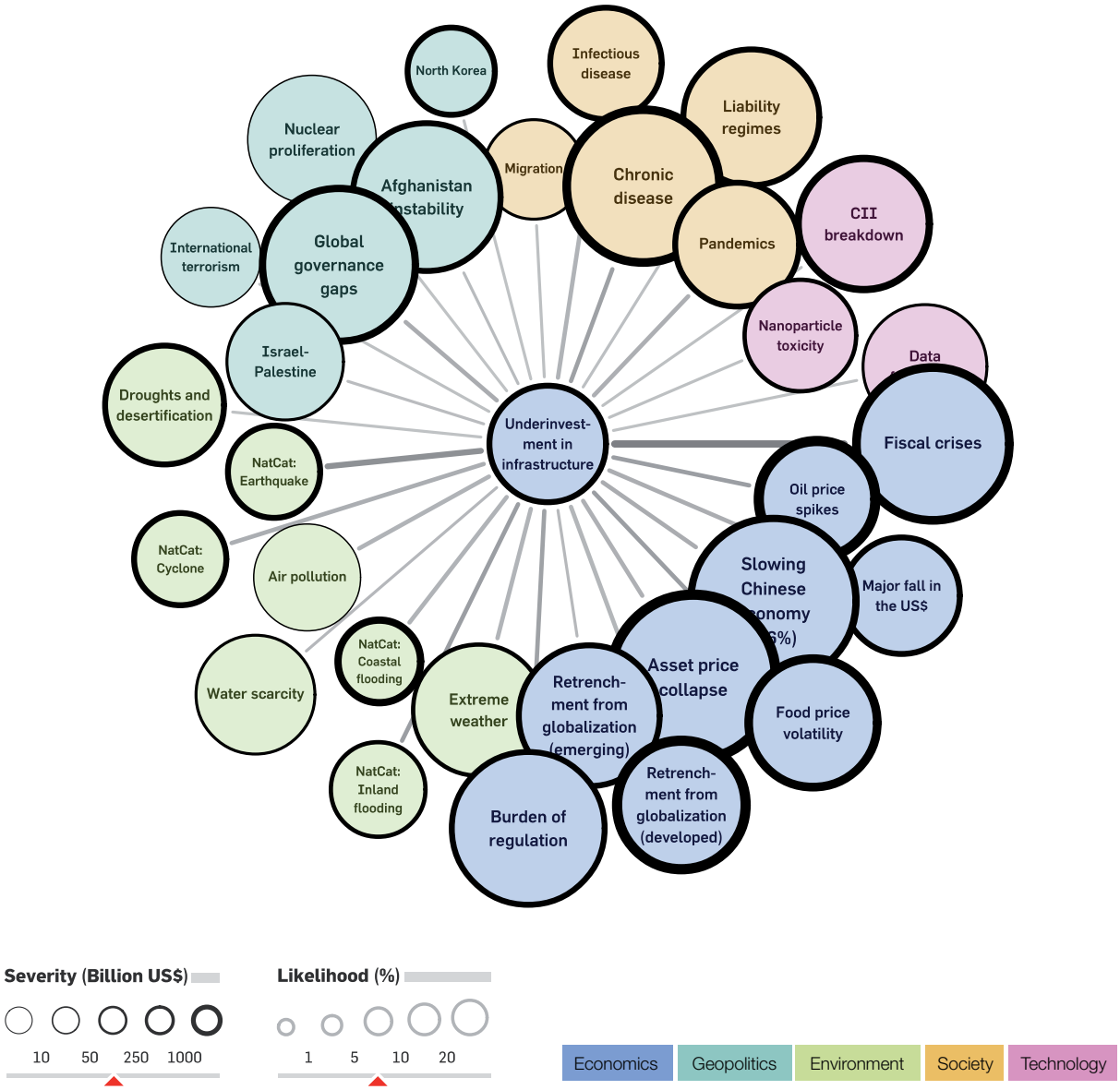
from the Forum's Global Agenda Council on Economic Growth and Development highlighted the importance of migration and suggested a focus on policies such as encouraging the return of educated diaspora as a tool for development or making the ability of countries to attract immigrants a badge of success.

The twin challenge of global imbalances

Sustainable growth in the global economy is inextricably tied to sustainable fiscal balances across the world. Large macroeconomic imbalances count among the contributing causes of the current financial crisis. A number of advanced economies were, as a whole, saving less than they were investing. For example, China's gross savings rate is nearly 60% of national income, an exceptionally high rate, particularly in contrast with the low rate of about 12% recorded in the US. The low national savings rate explains why the US has become dependent on capital inflows, with foreigners financing almost one third of US investments in recent years. These savings gaps, which materialized in current account deficits, were financed to a large extent through capital inflows from emerging economies, predominantly countries in South-East Asia with excess savings. In the long run, macroeconomic imbalances must be reduced. This requires a difficult rebalancing during which emerging economies must boost domestic spending (which will reduce excess savings), while advanced economies in turn should boost savings. At the heart of this rebalancing should be a credible path towards fiscal stability that balances the obligations of current and future generations.

3. Underinvestment in Infrastructure

Figure 6 **Underinvestment in infrastructure and interconnected risks**



Source: World Economic Forum 2010

Global Risks 2009 noted the importance of spending decisions as governments launched fiscal stimulus packages to boost growth and create jobs. Infrastructure investment choices are key at any time but they are particularly critical, if the dual challenge of population growth and climate change is to be met, in five areas: agriculture, energy, water, transportation and climate change adaptation.

The *Global Risks Expert Perception Survey 2010* data shows underinvestment in infrastructure as one of the most highly interconnected risks on the RIM *(see Figure 13, page 33).* The strongest links are to fiscal crises, oil prices and natural catastrophes, but it also links to health issues, including infectious diseases as well as chronic diseases, and to food price volatility. The World Bank has put global infrastructure investment needs at US$ 35 trillion over the next 20 years. In the US alone, the American Society of Civil Engineers rated US critical infrastructure as a "D" (where "A" is the highest grade) in 2009 and estimated that US$ 2.2 trillion was necessary over the next five years. The US spends approximately 2.4% of GDP per annum on infrastructure, compared with approximately 15% of GDP on health. Underinvestment in infrastructure is not just a risk to existing structures in the developed world, if it is not addressed it is also a barrier to growth and development in the developing world as well.

New and existing infrastructure is critical to resilience

The last decade has seen the rise of the public-private partnership model for large infrastructure projects, many of which are needed in countries where the political and governance environment are far from ideal or even stable. Traditionally, the state is seen as the driver of major infrastructure projects, such as road, rail, energy and water grids. The initial investment is made by governments, with private enterprise running the delivery and service aspects through licensing or other long-term agreements. However, as discussed earlier in this report, many governments must manage the critical maintenance and renewal of existing infrastructure, as well as new, large-scale projects in energy, transportation and urbanization, in the face of widening fiscal deficits and growing debt.

For other countries, including many emerging markets, the barriers may not be weak fiscal positions but rather concerns about political stability and governance structures to protect investments. Many countries richly endowed with natural resources, such as energy, metals, or agricultural crops, have become targeted by other countries for inward infrastructure investments in return for access to resources. The problem is that these infrastructure investments can be blinkered and "resource-centric", and might not serve the country as a whole. But this problem must rest largely with the producer nation's government, which is ultimately responsible for creating linkages to a wider plan for development. Examples of a narrower view of infrastructure development can be found from South America to Africa, where villages without running water and electricity sit next to busy highways ferrying goods to and from state-of-the-art port facilities. The risk of local unrest is high, but the greater risk is the depleted potential for long-term development and greater economic well-being for the wider population.

To address infrastructure needs with a vision for a sustainable, resource efficient approach to projects is one of the challenges of both emerging market and developed world countries. Given the financial, political, environmental and even societal risks involved in infrastructure projects, there is a need to establish best practices, to share know-how and enabling technologies, and to find innovative ways to finance development while managing risks. International finance and development institutions have long been working on multistakeholder approaches, but these efforts will have to be stepped up. One area under discussion as part of the proposals coming from the Forum's Global Agenda Councils is that new models might be found to encourage large institutional investors, who have a longer term investment horizon, such as pension funds or sovereign wealth funds, to invest in infrastructure projects. As an area linked to so many risks and one that can ultimately amplify or dampen the impact of a range of other global risks, the time has come to step up the dialogue and thinking to achieve the necessary level of infrastructure investment in an economically and environmentally sustainable manner.

Agriculture: the infrastructure necessary for food security and sustainable growth

Despite an increasingly urban global population, 75% of the world's poor continue to live in rural areas. As this report discussed in 2007, food security is driven by a number of factors but all are highly interlinked and infrastructure is at the nexus of many of these factors. A still growing global population that is moving to a more protein intensive diet engenders not only greater overall demand for food but also greater demand for the water and energy needed to produce and transport that food. Few countries have the mechanisms in place to manage their future needs in terms of infrastructure and health planning based on available water for the population. For example, a 2009 report on water by the Forum[6], estimated that by 2030 there will be a 40% shortfall between the amount of water India requires to meet its own energy and food production needs and the water available to do so.

If agricultural productivity is to have any chance of increasing to meet the demands of 9 billion people by 2050, a second Green Revolution will have to happen. Indeed, in Africa the first green revolution is still to take place. But there are also huge gains to be made from investment in better storage and transportation systems, thus minimizing waste and maximizing the amount of food reaching consumers. The impact of investment in these facilities could make a significant contribution to reducing some of the volatility in food prices. In addition to storage and transport, two other areas of infrastructure related to agriculture are key: water and energy. Agriculture accounts for 70% of the draws on water and as the effects of climate change mean that many areas become drier or more prone to extreme weather, improved water efficiency becomes vital. Improving water capture and irrigation would be an investment not only in productivity but in sustainable resource management. Investment in energy infrastructure is also a priority in rural areas in developing countries and must be part of a broader energy strategy. Farmers can be doubly hit by rising or volatile energy prices through input and transportation costs, but energy prices also link to the input side, with gas prices in particular affecting nitrate-based fertilizers.

6 "The Bubble Is Close to Bursting", World Economic Forum 2009 www.weforum.org/en/initiatives/water/

Infrastructure investment alone will not be sufficient, but it will be a necessary accompaniment to investment in other areas and to improved market structures at the national and international level. Challenges in this area are manifold. Some of the most productive land in the world is in areas of high instability and where major infrastructure projects require governments, international institutions and aid agencies to be innovative in the way risk is shared if they are to attract the substantial private investment necessary. Farms in much of the world are small, insufficiently productive and very labour intensive. As populations become more urban, there is a risk that labour and know-how are lost. As discussed in *Global Risks 2009*, and mentioned earlier in this chapter, there is a risk of "land grabbing", as nations try to secure their food supply by investing directly into agricultural land in other countries.

The infrastructure necessary to support sustainable agricultural production will not just pay off in terms of providing food to the more than 1 billion people who went hungry in 2009, but it will also help drive development in rural areas. The UN Food and Agriculture Organization (FAO) and World Food Programme predict that the food crisis of 2008, which led to riots and political turmoil in several countries, will be repeated over the coming decades. What is clear is that current levels of investment in agriculture are not enough to drive the 70% increase in food production necessary to feed an expected population of 9.1 billion by 2050. During the last period of fiscal crises in the 1980s and 1990s, agriculture suffered from reduced investment that was never restored. Poor returns, uncertainty and distorting subsidies made investment less profitable. In the face of rising unemployment and reduced consumer spending in the advanced economies and a record number of people suffering from hunger globally, governments and international institutions now need to think long term, and create the mechanisms and environment to encourage investment in infrastructure and leverage that investment for growth and stability.

Infrastructure and energy security

While the recession caused global energy use to fall in 2009 for the first time since 1981, the long-term trend for energy consumption is still upwards. The main demand will continue to be for fossil fuels. The demand for oil will be primarily driven by the transport sector. Coal and gas will be the main fuels needed to meet the growing demand for electricity, and most of that demand will be in China, developing Asian countries and the Middle East.

As energy demand fell over 2009, so did energy investment because of the tighter credit environment. The International Energy Agency (IEA) estimates that investments in oil and gas projects were cut by 19% from 2008 to 2009. Investment in renewables fell even more. Without government fiscal packages, investment in renewables would have fallen by 30% but even with them, they fell 20%. Underinvestment in energy infrastructure touches on a number of key themes of this report (see the box on energy security page 21). The demand for energy will rise as the global population grows and with it consumption. Current energy policies, based on fossil fuels, look increasingly untenable given what they would produce in terms of CO_2 and greenhouse gas concentrations. Energy security has long been used to describe the need for a stable and guaranteed supply: in the 21st century it may need to be redefined as meaning stable, guaranteed and carbon neutral.

The links to the financial crisis and to fiscal crises also have a direct impact on underinvestment in energy infrastructure. First, a lag in investment may mean that as demand returns there will be a shortfall in capacity that could lead to supply constraints in the medium term, thus oil price spikes and higher price volatility. Any major disruption to supply or rise in prices over the next years could slow the recovery and set back growth. Second, a huge amount of energy infrastructure investment, estimated at almost half of the total US$ 1.1 trillion per annum by the IEA, is needed to meet the rapidly rising demand from developing countries. Rural areas in Africa, India and other parts of Asia are in particular need of reliable energy production and supply to support their development. Third, aside from the enormous and pressing need for public and private finance for energy infrastructure, the over-arching need is for this money to be spent strategically. The stimulus packages proposed by several governments targeted investment into renewable energy to reduce long-term dependency on fossil fuels but equally to reduce CO_2 emissions. Low-carbon investments, investments in more energy efficient infrastructure and in carbon capture and storage will all be part of the arsenal needed to mitigate climate change.

Energy security and investment: Walking the tightrope between national policy imperatives and economics

Energy companies faced significant challenges as a result of the global economic slowdown in 2009, many of which will play out in 2010 and beyond. With demand growth uncertain, credit constrained and balance sheets stretched, there was a tendency for companies to prioritize short-term consolidation over longer term investment needs. In other words, the overall shortage of capital and decisions to pay off debt resulted in the postponement of major infrastructure outlays. It also meant a reluctance to exploit reserves that were economically non-viable at current oil prices, and a withdrawal from renewables portfolios with weaker or less reliable economics.

Impact on energy security 2010-2015

Long lead times in the sector mean that decisions made now could have a number of negative consequences across the different dimensions of global energy security. These include:

- **Slower expansion of upstream activities and supply side constraints**. An increasing percentage of oil concessions will be won by well-capitalized national oil companies. In addition, should there be a swift rebound in demand pressure on existing transportation infrastructure could lead to a tightening gas supply market.
- **Sudden leaps in energy prices**. Inevitably a high proportion of the likely rises will be passed on to consumers, domestic and business alike.
- **The failure of energy infrastructure to meet demand**. Investment delays will increase the likelihood of reliability issues with ageing plants, grids and networks in developed countries. Much-needed projects in developing countries, which will bring about greater access to energy resources, will not be initiated.
- **Weaker performance in emissions reduction programmes**. Delays in upgrading generation assets in developed countries will also result in an inability to achieve CO_2 efficiencies. Any slowdown on renewables investments will mean that certain countries/regions will fail to meet ambitious uptake targets and goals for increasing supply diversity.
- **Resource nationalization**. International access to new energy sources might be restricted.

What governments can do

The energy sector stimulus packages announced in 2009 *(see Figure 7 below)* are an important contribution to the situation, despite the relatively low levels of funds distributed, only 15% to date, and concern in some quarters that the sums involved are not sufficient to bring about a sustainable and reliable energy future. Given the long-term nature of the industry, companies considering major strategic commitments need an enduring policy framework with appropriate parameters and incentives that can bring some predictability to their planning. This means clear direction at the international level on climate policy and trade issues, and robust long-term strategies from national governments regarding infrastructure renewal to enhance security of supply, reliability and the reduction of carbon emissions.

Figure 7 **Key stimulus packages for the energy sector, 2009-2011**

Country/region	Amount	Key foci
US	US$ 66.6 billion	• Clean energy generation • Energy efficiency • Grid development
China	US$ 46.8 billion	
Japan	US$ 8.0 billion	
South Korea	US$ 7.7 billion	
Spain	US$ 7.6 billion	
Germany	US$ 3.7 billion	
Australia	US$ 3.4 billion	
UK	US$ 2.7 billion	
France	US$ 2.4 billion	

Source: New Energy Finance (2009)

What energy companies can do

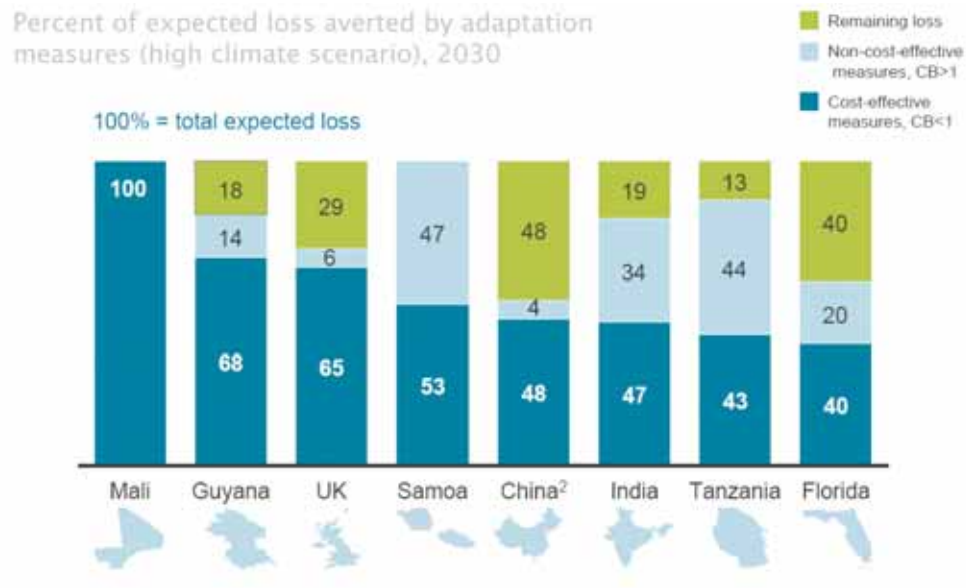
To position themselves competitively for the next few years, energy companies need to address a number of issues in their planning. They should consider how best to adjust the mix of assets, businesses or sources of supply in ways that both reduce exposure to price volatility and political instability, and enhance their capacity to respond to toughening policy requirements. In doing so, they should establish how to optimize their strategic investment capacity on a risk-return basis and ensure that their approach to debt/leverage reduction does not significantly impair their ability to achieve strategic growth.

Infrastructure and climate change adaptation

Despite declining budget resources, and in addition to the investment needed in the area of energy, governments must urgently take steps to address the unavoidable consequences of climate change. Denser urban development in coastal areas (15 of the world's 20 megacities are coastal), lax planning that allowed property development on natural flood plains or higher dependency on crops in increasingly drought-exposed areas are just some examples of the type of risks that cannot be avoided but where adaptation strategies can be adopted. But which strategies? The Economics of Climate Adaptation (ECA) Working Group[7] has created a framework for evaluating the alternatives that governments might consider. The ECA Working Group was formed to explore how countries can become economically more resilient in the face of climate change. By estimating a location's total climate risk – calculated by combining existing climate risks, climate change and the value of future economic development – and using a cost-benefit analysis to create a list of location-specific measures to adapt to the identified risk, the working group was able to evaluate current and potential costs of climate change and how to respond to them. A scenario-based approach was used to manage the level of uncertainty inherent in judging future climate patterns and assessing different conditions in which a community would need to respond.

This approach was applied to eight regions in both developed and developing countries (China, India, Samoa, Guyana, United States, Mali, United Kingdom and Tanzania) representing a wide range of climate hazards, economic implications and development stages. The overall findings, in the ECA report *Shaping Climate-Resilient Development*, showed that easily identifiable and cost-effective measures – such as improved drainage, sea barriers and improved building regulations, among many others – could reduce potential economic losses from climate change. Indeed, most could deliver economic benefits that far outweigh their costs, as adaptation measures on average cost less than 50% of the economic loss avoided. This confirmed the link between using a risk management approach to adapting to climate change and the broader goal of supporting long-term regional economic development.

Figure 8 **Cost Effective Measures for Climate Change Adaptation**



1 Based upon select regions analyzed within the countries (e.g., Mopti, Mali, Georgetown, Guyana Hull, UK, North and Northeast China; Maharashtra, India; Central regions of Tanzania; Southeast Florida, U.S.)
2 Based upon moderate scenario data and analysis

Source: The Economics of Climate Change Working Group, 2009

7 The Economics of Climate Change Adaptation Working Group is a partnership between the Global Environmental Facility, McKinsey & Company, SwissRe, the Rockefeller Foundation, ClimateWorks Foundation and the European Commission, and Standard Chartered Bank. www.swissre.com/climatechange

Addressing systemic risk in critical infrastructure

As services provided by critical infrastructure become ever more embedded in wider systems, it becomes increasingly important to maintain their integrity and resilience. For example, financial systems and emergency services are highly dependent on telecommunication operations, which are highly reliant on electricity. And, even within a given industry, a critical network is made of multiple interdependent pieces which often rely on the robustness of the weakest link in the network. Companies and governments need to be aware of these interconnections when they build and manage these systems.

Some recent examples and possible scenarios
The large-scale August 2003 power failures in the north-east of the US and in Canada, which deprived more than 50 million North Americans of electricity, was triggered by the failure of a utility in Ohio. A disease originating in one region of the globe can readily spread to other areas through transportation networks, as was the case with the rapid spread of SARS in 2003 or with swine flu in 2009. The meltdown of a nuclear reactor in one country can lead to massive radioactive contamination hundreds of miles away, as illustrated by the Chernobyl nuclear plant disaster in 1986. Looking ahead, a major terrorist attack that closed a port such as Rotterdam, Hong Kong or Los Angeles for weeks would have severe economic consequences on world trade because it would inflict major disruptions in complex just-in-time supply chains that comprise the global economy.

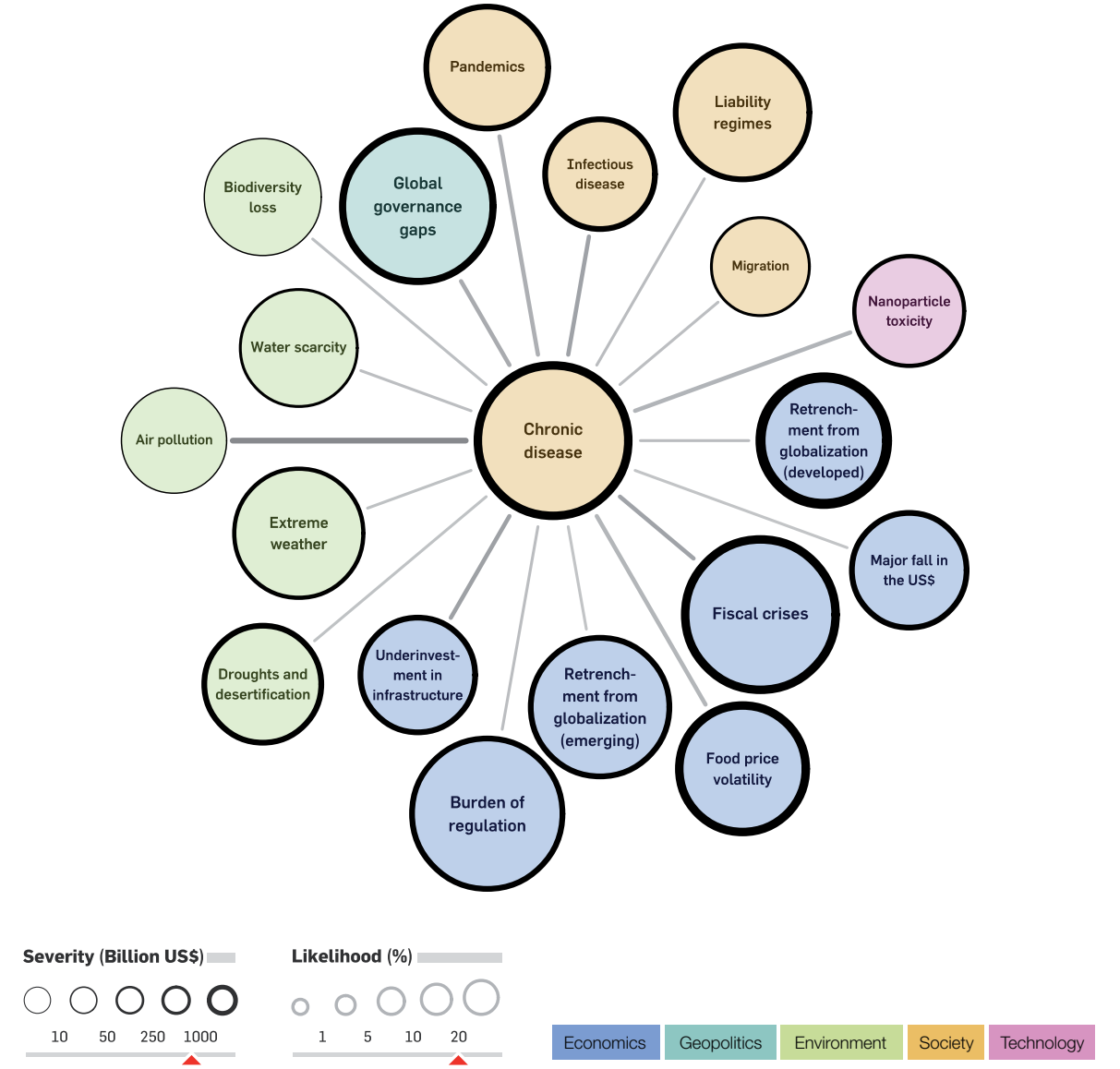
Private efficiency, public vulnerability
These examples illustrate the existence of important interdependencies between people and organizations, hundreds if not thousands of miles apart, through the malfunctioning of technical infrastructure that we use and depend upon today. If the organization is a firm, there is a need to balance the additional private costs to operate more safely that might negatively affect the firm's bottom line with the benefits of reduced global risks; that is the trade-off between private efficiency and public vulnerability. The reluctance of private firms to undertake these measures unless they know others have followed suit is a source of market failure.

Looking for solutions
A challenge for policy-makers and business leaders is to provide the right regulations or incentives to invest adequately in security.

- ***Third party inspections and well-enforced regulations*** might be necessary to ensure that infrastructure is well designed and maintained over time. In countries where the large majority of infrastructure is operated by the private sector, regulations might be inspired by industry best practices since most of the knowledge and resources will be found there.
- ***Building global coordination and reaction capacity***. Since these risks arise within interdependent networks, effective solutions usually demand looking beyond an individual firm to its operating units. These solutions might involve well-enforced regulations or coordinating efforts across divisions in a firm, across a supply chain, across operators of a given type of infrastructure, and across countries in the form of treaties or global compacts. Sometimes top decision-makers in the public and private sectors can join forces to decrease collective risk: this was done successfully under the leadership of research institutions serving as a neutral party in the aftermath of the anthrax crisis in 2001 through the development of a global reaction capacity platform between postal operators of over 20 countries. The same framework could now be applied to many other critical services.
- ***Thinking long-term return on investment***. A major challenge with security of critical services is the tendency to be myopic and to seek short-term reward. Energy companies are now considering proposals to encourage consumers and businesses to invest in more efficient energy efficient measures by incurring the upfront costs, which will be paid back over time by the user of the appliance through the savings they achieve in lower electricity bills. The market for building brand new infrastructure and replacing ageing ones is huge in Asia, Africa, Europe and the Americas. Investment decisions made today will thus have a determinant impact for years to come. There is an opportunity here to make critical infrastructure not only more secure, but also greener.

4. Chronic Diseases

Figure 9 **Chronic diseases and interconnected risks**



Source: World Economic Forum 2010

Though the worldwide spread of H1N1 brought the implications of a global pandemic to the fore again, another global health risk unfortunately illustrates the need to address ongoing slow failures. As both the Global Risks Landscape and the RIM show, chronic diseases (or non-communicable diseases (NCD)), including: heart disease, stroke, diabetes, some chronic lung conditions and preventable cancers) are strongly connected to a number of other global risks: fiscal crises; underinvestment in infrastructure; food, water and energy security. The cost of treating chronic diseases has risen globally, as have associated rates of morbidity and mortality, driven by demographic changes and dietary shifts, causing some to call it a "silent" pandemic.

Though linked to the rise in obesity associated with developed nations, low- and middle-income countries account for 80% of all deaths from chronic diseases globally. These conditions are the leading cause of death worldwide with the exception of sub-Saharan Africa and, unfortunately, chronic disease mortalities will overtake those of infectious diseases in that region as well by 2030. Out of the 35 million people who died from chronic diseases in 2005, one-half were under 70 and one-half were women. Over the next decade, if not addressed effectively, chronic diseases will increase by 27% in Africa, 25% in the Middle East and 21% in Asia and Pacific, accounting for 75% of all deaths globally.

A problem neither the developed nor the developing world can afford

Declining development assistance has already led to a significant reduction of public spending on health in many countries. When funds are limited, governments tend to focus on basic health services, in line with the United Nation's Millennium Development Goals (MDGs), at the expense of the prevention and treatment of chronic diseases. Most developing countries, with the exception of several sub-Saharan African nations, will experience a historic shift over the next decades. Deaths from infectious diseases; maternal and perinatal conditions; and nutritional deficiencies combined are projected to decline by 3% over the next 10 years. However, over the same period, deaths due to chronic diseases are projected to increase by 71%. In countries plagued by poverty and social divides, failure to protect populations from basic and preventable health risks brakes economic development and threatens social well-being and stability. The fact that chronic diseases are not part of the mainstream global health and development agenda and that these are outside of the remit of the time-bound, outcome-based targets of the MDGs shows that more long-term and integrated planning is needed to address health risks.

Chronic diseases and food security: tackling malnutrition and poor nutrition holistically

As the crisis of 2008 showed, food price spikes and volatility affect consumption patterns of poor populations rapidly and can result in increased exposure to NCD risk. Poorer populations can suffer from malnutrition and can also suffer disproportionately from poor nutrition linked to chronic diseases. Climate change in combination with water and energy scarcity further adversely affect food security, creating a vicious cycle. Although poverty has traditionally been associated with underweight because of poor diet, research has revealed a paradox in the US, which is unfortunately now also being observed in developing countries: low income and obesity can coexist in the same population. The UN Food and Agriculture Organization and World Food Programme are starting to look at this problem. Future policies for nations with poor and low-income populations who are most exposed to food price volatility and shortages must aim not only to address basic food needs but should also look at the quality of nutrition, embedding health in food security discussions.

Spending less for more

Healthcare spending in many developed economies already represents a huge fiscal burden. With sharply deteriorating fiscal positions, higher unemployment and ageing populations, developed economies will feel the costs and social impact of chronic diseases even more over the coming years. Total health spending in the US accounts for 15% of GDP. A third of this spending on health is for obesity-related chronic diseases. In other developed countries, this figure is between 2% and 3.5%. As pressures on public finances and health insurance costs mount, chronic disease risks exemplify how much more cost effective it would be for health institutions, governments and businesses to focus on prevention rather than treatment. Evidence suggests that a modest reduction in the prevalence of certain chronic disease risk factors, such as tobacco and alcohol consumption, and healthier diets, could result in substantial health gains and cost savings. For instance, a Norwegian study estimated that savings of US$ 188 million could be made by lowering the population blood pressure level by a 2 mm Hg reduction in salt intake. A Canadian study estimated that a 10% reduction in the prevalence of physical inactivity could reduce direct healthcare expenditures by Can$ 150 million (approximately US$ 124 million) in a year.

Information and innovation are key to prevention

In several countries, the application of existing knowledge has led to major improvements in the life expectancy and quality of life of middle aged and older people. For example, through campaigns to raise awareness and better education of prevention, heart disease death rates have fallen by up to 70% in the last three decades in Australia, Canada, the United Kingdom and the United States. Middle-income countries, such as Poland, have also been able to make substantial improvements in recent years by informing the population of the benefits of good diet and exercise. From 1970 to 2000, the World Health Organization has estimated that 14 million cardiovascular disease deaths were averted in the United States alone. The United Kingdom saved 3 million lives during the same period. Given the inexorable rise in health costs as populations age, governments need to rethink their health systems to make them more effective. New models of health financing, mixing public and individual contributions, will need to create incentives for greater emphasis on prevention, and this will undoubtedly go far beyond the traditional approach to health systems in both the developed and developing world.

The risk for business

One-half of those who die from chronic diseases are in their productive years and so the social costs and economic consequences in terms of lost productivity are considerable. This fact, coupled with rising healthcare costs to employers, has made the private sector aware of this problem, in particular because many of these costs are preventable. In the US, the avoidable indirect impact of chronic diseases, due for example to productivity losses, is four times as high as the direct costs of healthcare coverage.

The WHO estimates that between 2005 and 2015 income loss could rise to as much as US$ 558 billion in China, US$ 237 billion in India, US$ 303 million in Russia and US$ 33 billion in the United Kingdom. Brazil, Russia, India and China currently lose more than 20 million productive life-years annually to chronic diseases, and that number is expected to grow 65% by 2030. The losses in productivity associated with those diseases, through disability, unplanned absences and increased accidents, are as much as 400% more than the cost of treatment. It is now well established that workable solutions exist to prevent 40-50% of these diseases and their negative impact on business and the economy at large in both developed and developing countries.

The private sector can contribute significantly to the fight against NCDs by informing and supporting actions to tackle the lifestyle-related risks, tobacco and alcohol use, unhealthy diet and lack of physical activity among employees and customers.

Not only is it important for good global citizenship but there is also a strong business case. By focusing on responsible food marketing to children, reducing trans-fatty acids and salt, and providing simple, clear and consistent food labels, significant gains can be achieved at the population level. The WHO has recently announced the "Chan Commitments", a groundbreaking set of voluntary commitments by nine of the largest food and beverage manufacturers to shift to healthier options.

The democratization of health information, growth in self-care technology, increased level of social interaction through social media and liberation of the Web through mobile platforms are shifting worldwide attitudes and can support person-centred health. Mobilization of social forces and people outside of health systems is critical as it is clear that chronic diseases are affecting social and economic capital globally.

Chronic Diseases: Mitigating measures recommended by the Global Agenda Council of the World Economic Forum on Chronic Diseases

Global support for international governance

- The World Health Organization, as the lead technical agency in health, must garner necessary resources and cross-sector political will to implement the Global Action Plan for Non Communicable Diseases, 2008-2015. It must work in partnership with all relevant multilateral and bilateral agencies to provide coordinated and consolidated guidance to implement plans, policies and programmes.

- The 22 development partners, who presently spend less than 1% of the US$ 22 billion on chronic diseases, must now be more proactive in their support of individual country requests for assistance to address chronic diseases.

- Ongoing work on negotiated agreements for the reduction of salt in processed food and the work of the Conference of Parties in giving shape to the terms of the Framework Convention on Tobacco Control and the forthcoming WHO Alcohol Strategy should be supported by the development partners, countries and industry.

National and global incentives

- Countries should mount a serious public policy response to this threat. Measures should be instituted to support the control of tobacco and alcohol use, and to provide strong incentives for the production and availability of healthy foods (e.g., shift towards healthy agriculture policies).
- The food industry should work collaboratively towards reshaping the industry to introduce new products with better nutritional value and make healthy options, affordable and available. They should focus on responsible food marketing to children, reducing trans-fatty acids and salt and provide simple, clear and consistent food labels. Incentives at national and global levels to support this shifting should be developed simultaneously.
- Stimuli and incentives for employers from private and public sectors should be put in place to support further implementation of workplace health.
- Countries must prepare for changing patterns in the volume and composition of service delivery and demands for patient education and long-term pharmaceutical use in view of the changed disease trends.

A yardstick to measure progress

- A global mechanism should be developed to map and track chronic diseases, set benchmarks and track trends of solution implementation and its impact on disease burden. A **"health and well-being footprint"** could serve as yardstick to indicate progress that governments, public and private sector producers and service providers, and individuals achieve on health. Such measurement should be embedded as well as part of the Millennium Development Goals review process.

5. Risks to Keep on the Radar

This section considers a selection of risks that might not feature prominently on the Global Risks Landscape but that are highly interconnected and reflect the potential for systemic risks and failures. The themes of this year's report also links the need for better governance and, in particular, institutions and mechanisms to share information and for long-term thinking as to their impact. These are not emerging risks but all demand greater attention of leaders and greater collaboration on solutions.

To highlight the need to integrate these risks more into thinking on systemic threats and vulnerabilities, they are examined through the lens of the Global Risk Network's "5i" framework. The 5i framework refers to insight, information, incentives, investment and institutions. Looking at each of these risks, using this simple approach, can help assess risks and the governance and other gaps that need to be addressed to better manage them in a collective and effective manner.

Transnational crime and corruption: endemic risks

The economic and social costs of transnational crime and corruption

If there is one area of global risk that epitomizes how the power of globalization can be misused, it is transnational crime and corruption. Some experts estimate that global organized crime and illicit trade accounts for 10% of global GDP. Transnational crime and corruption is highly interconnected with many of the global risks across the spectrum, ranging from geopolitical risks such as terrorism, instability in Afghanistan and nuclear proliferation, to biodiversity loss, and risks to critical information infrastructure. In the health sector, counterfeited drugs represent almost 10% of the worldwide pharmaceuticals market, equivalent to US$ 35 billion in revenues, causing millions of deaths each year.

Global business exposure

World Bank estimates from 2006 show that over US$ 1 trillion is paid in bribes each year, acting like a direct tax on doing business while severely undermining legitimate competition and innovation. Meanwhile, many studies show that every form of illicit trade is linked to the legitimate economy. Both human trafficking and forced labour, for instance, have widely penetrated the legitimate economy. Through their increasingly complex supply chains and vast distribution networks, corporations are more exposed to problems such as counterfeiting, intellectual property infringement and corruption at all levels. Businesses need to engage with other stakeholders, if they are to beat what is fast becoming their biggest competitor, as well as better educate their customers. As value chains lengthen and become more complex, multinational corporations need information and must have better oversight of who they are linked to further up and down the chain.

Partnering Against Corruption

The World Economic Forum's Partnering Against Corruption Initiative (PACI) created a multinational task force of participating companies from all over the world, adopting benchmark "Business Principles" that address ethical conduct regarding bribes, facilitation payments, political and charitable contributions, as well as gifts and sponsorships. Since its formation in 2003, more than 140 companies from all industry sectors have signed on to the PACI and, in so doing, they have agreed to maintain a zero-tolerance policy towards bribery and corruption and to implement a broad-based anti-corruption programme to guide the behaviour of their employees.

The Global Risks 5i Framework applied to transnational crime and corruption

Insight: Crime and corruption thrive on the increasing complexity and opacity of supply chains and global markets. While various actors and institutions have visibility into segments of the chain, most often they lack the complete overview of the chain and interactions within it. Forward-looking risk management must therefore identify these interlinkages and account for the entire sequence of exchanges from the source to the distribution to end customers, identifying the trading routes and facilitators connecting each step.

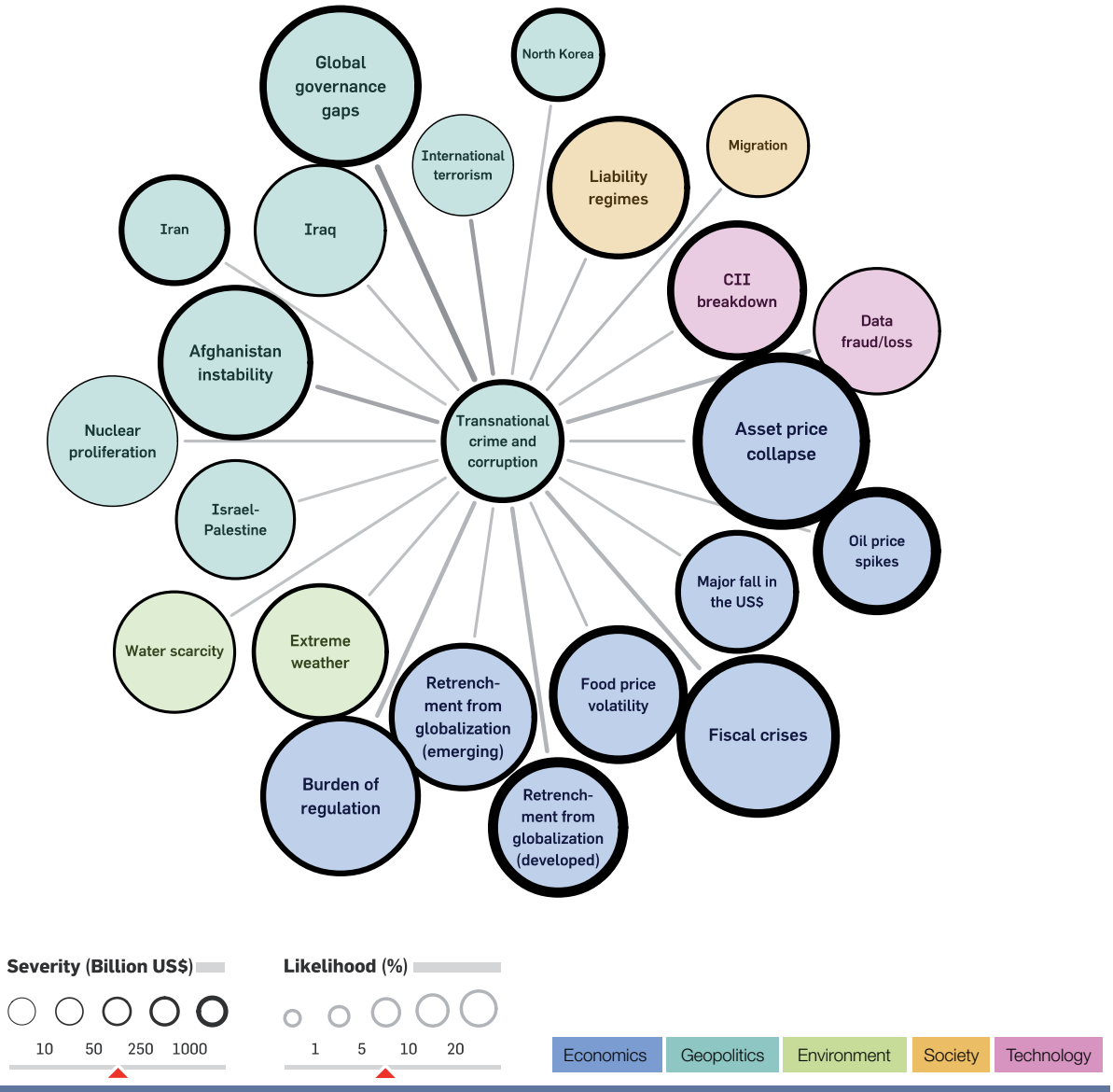
Information: More information needs to be systematically shared among international institutions and national agencies and bodies to maintain oversight and match transactions with the instigators and intermediaries involved. Improving traceability and transparency would help both business and end-consumers make informed decisions. The UN Convention against Corruption, which has been signed by 140 countries and ratified by 136, provides mechanisms for information sharing and reporting, which could be used to engage leaders in proactive measures against corruption.

Incentives: Crime and corruption prosper whenever the expected returns of proceeds far exceed any real or perceived barriers to abide by the stipulated rules and regulations. Minimum and guaranteed wages could reduce some of the incentives for crime and corruption in many countries, while lower expected returns for exchanged counterfeit or other illegal goods coupled with enforced transnational regulation would decrease incentives to enter the black market.

Investment: Efforts to restructure and improve both national and global collaboration efforts on crime and corruption will call for resources to improve the sharing of information, tracking and connecting agencies with different areas of responsibility, including customs agencies, law enforcement organs, as well as industry and trade agencies. Greater funding is required for existing measures to combat corruption, such as country visits with peer reviewers from other countries and improved reporting.

Institutions: The rise of transnational crime and corruption illustrates a major governance gap and the need to improve global oversight and regulation. Nation states have difficulty apprehending criminals that operate out of their jurisdiction, while excessive attention and resources are often applied to certain highly visible illegal activities, ignoring the larger picture and connections among many forms of illicit activity. The role of current international organizations is often limited by jurisdiction as well as the unwillingness of their members to share information and collaborate on a global basis. Combating illicit trade calls for stronger global focus on the provenance, trading routes, facilitators and means of distribution to end customers. Such oversight architecture of the future must include an element that transcends national borders and ensures broad representation in rule making with agreed and rapid

Figure 10 **Transnational crime and corruption and interconnected risks**



Source: World Economic Forum 2010

procedures for systematic enforcement. In all of these areas, a driving factor for the success of institutional measures will be political will and action at national level and the active engagement of existing and emerging business efforts to mitigate these risks.

Biodiversity loss: the systemic implications of ecosystem risk

Rules governing biodiversity and ecosystems and their services (i.e. the benefits people receive such as food, freshwater, timber, protection from natural hazards, erosion pharmaceutical ingredients and recreation) have been largely excluded from global decision-making processes. As a result, approximately 60% of the earth's recognized ecosystem services have been degraded in the last 50 years. Since 1900, over 50% of wetlands has been lost; the global forest area has shrunk by 40% over the past 300 years; and by some estimates the rate of species extinction is thought to be up to 1,000 times more rapid than the natural rate of extinction. Annual economic losses due to deforestation and land degradation alone were estimated at US$ 2 to US$ 4.5 trillion, the equivalent of between 3.3% and 7.5% of global GDP in 2008[8].

The consequences of these ongoing losses will not only affect businesses dealing directly with natural resources, but will also touch the supply chains and growth objectives of most industry sectors in the developed and developing world. Through their natural carbon sequestration and storage function, forests can mitigate against the effects of climate change. Biodiversity and ecosystems services are inextricably linked with freshwater provision, sustainable agricultural production and climate. They are also linked to food security, migration and political stability, as the habitats and livelihoods of some of the world's poorest populations are directly affected by biodiversity loss. The foreseeable path of population growth and consumption trends bode ill for biodiversity. Land and the fauna and flora that live on it are under threat from more intensive agricultural needs, from residential and commercial development, waste and pollutants, and from climate change.

Costing the earth: pricing biodiversity loss

As with many areas of systemic risk, the complexity of the interconnections renders it difficult to get a full picture of the costs and implications for biodiversity. The Economics of Ecosystems and Biodiversity, or TEEB, report, is a major project to address this problem. It is a comprehensive effort to design and present metrics that account for natural capital and to give them credibility through consensus and standardization. From this basis, TEEB focuses on the cost of inaction weighed against the cost-benefit of investments in protection and adaptation. The interim report, released in May 2008, already highlighted some of the costs of inaction.

In 2007, the collapse of bee colonies was calculated to have cost US agricultural producers US$ 15 billion[9]. The effects of climate change are putting coral reef systems in danger of reaching a tipping point: if they disappear, they take with them around US$ 152 billion of annual economic revenues[10]. On a more positive note, research also shows that investment in ecological infrastructure is not only cost-effective when compared with man-made alternatives (if available), but also essential for effective climate change adaptation and mitigation strategies.

The business impact of biodiversity loss
In conjunction with the World Economic Forum's Global Agenda Council on Ecosystems and Biodiversity and PricewaterhouseCoopers, the Global Risk Network has produced a short briefing on this topic: copies and an online version can be found at: www.weforum.org/en/initiatives/globalrisk/index.htm

The Global Risks 5i Framework applied to biodiversity loss

Insight: While the links between population growth, climate change and energy are understood, biodiversity loss has been seen as a "local" issue. There is a need to raise awareness of the systemic nature of biodiversity loss for it to be an integral part of policy-making and business strategy. The United Nation's sponsored "Year of Biodiversity" in 2010 will increase media and public understanding, but decision-makers should already include it in their thinking.

Information: The Economics of Ecosystems and Biodiversity is already influencing policy and economic agendas with the release of a Climate Issues Update and a report for policy-makers in the autumn of 2009. In the summer of 2010, TEEB will release a report aimed specifically at the business sector. These reports will help address information gaps, improve measurability and, it is hoped, lead the way for more information sharing on this risk and its linkages to other risks.

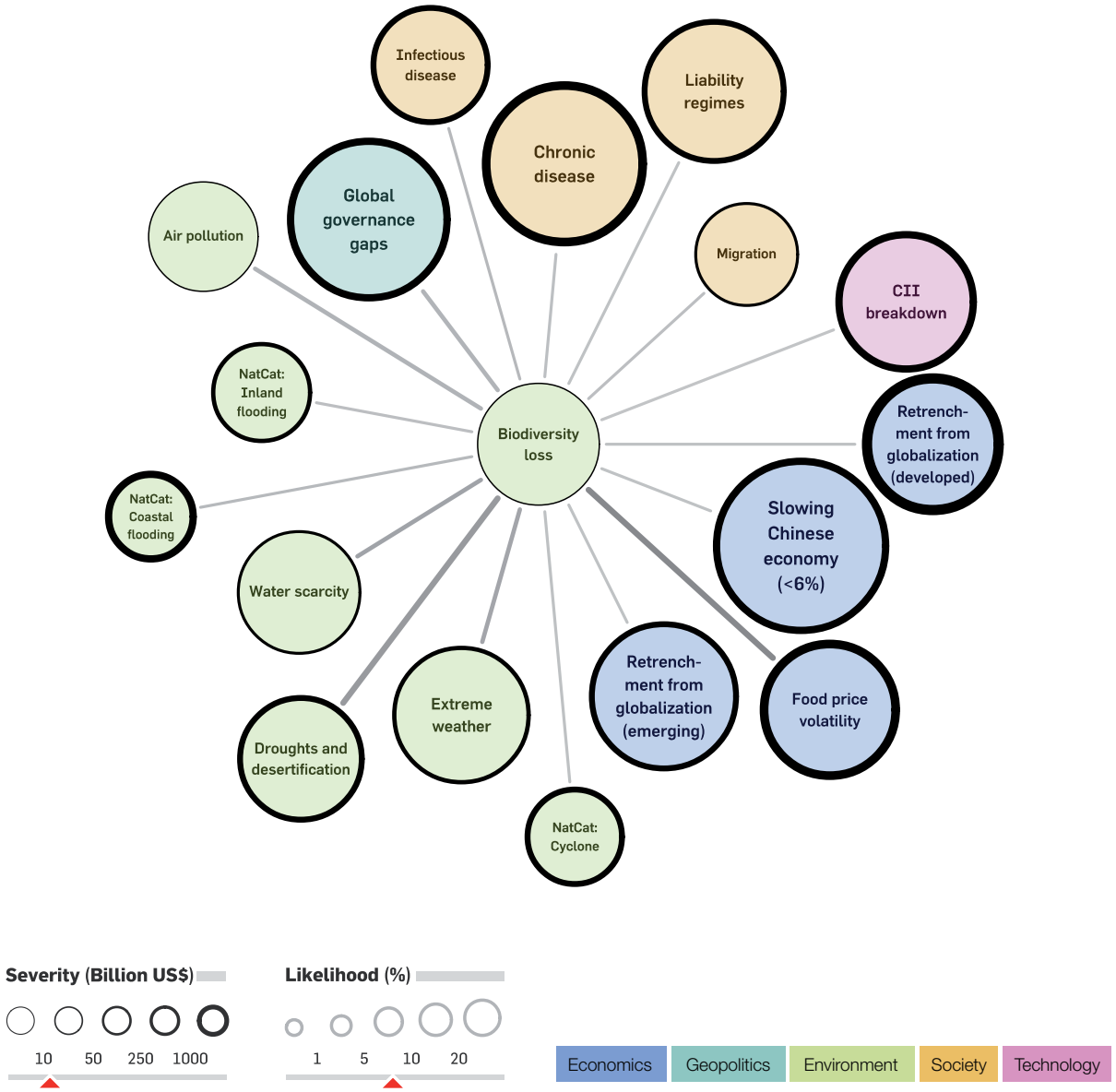
Incentives: Building an effective baseline through cost-benefit analysis will support the creation of better policies and trade and finance mechanisms that will encourage private sector investment in "greener" technologies, industry methods and product design and manufacture.

[8, 9, 10] all figures from "The Economics of Ecosystems and Biodiversity (TEEB)", Interim Report 2008: www.teebweb.org

Investment: As discussed in earlier sections, infrastructure investment choices could play a determining role in the prevention and/or management of a series of risks. Private capital must be a part of the solution, together with public policy reforms and public investment, to ensure that biodiversity conservation and restoration is profitable.

Institutions: Though only covering one aspect of ecoservices, the REDD+ (Reducing Emissions from Deforestation and Forest Degradation) initiative, which introduces the concept of payments for ecosystem services to link incentives and funding could serve as an example to design future governance mechanisms necessary for other ecosystem services and the accelerating threats to biological diversity.

Figure 11 **Biodiversity loss and interconnected risks**



Source: World Economic Forum 2010

Critical information systems and cybervulnerability

Modern industrial societies are highly dependent on a limited number of utilities that provide electricity, water, oil and gas. In the past, the information systems controlling the infrastructure underlying these utilities typically consisted of closed, completely private networks managed from a single control centre, with only limited attention given to authentication or encryption issues. These proprietary networks, however, were expensive to run while the open, Internet Protocol-based networking standards offered substantial cost-saving prospects, which led engineers to connect the control systems to the Internet across utilities and other industry sectors around the globe over the last decade. With the emergence of cloud computing, a new era of complexity and risk is opening up. By its very nature, cloud computing will make risks more diffuse and, thus, their management more difficult. Cloud computing is a new system, but it will link to numerous existing, critical systems. In many ways it could be comparable to the financial system, global but with relatively little international oversight, and critical to the functioning of economies and societies. Cloud computing can bring many opportunities but in the absence of adapted models of governance and regulation it could also bring a new degree of vulnerability and systemic risk.

The convergence of closed and open industrial control systems, however, has created systemic vulnerabilities that are still very much off the radar, judging from the outcome of the *Global Risks Perception Survey 2010*, which revealed that most experts perceive the risk of a potential breakdown of "Critical Information Infrastructure" (CII), as well as of data fraud/loss, as comparatively low – both in terms of likelihood and severity. Moreover, these two risks were assessed as being among the least interconnected risks, which is somewhat surprising given that IT systems increasingly represent the foundation of practically every service, transaction, communication and exchange required for the steady functioning of the global economy, security and individual well-being.

The increasing complexity and rapid development of dynamic systems and networks, the sophistication of changing threats and the presence of intrinsic vulnerabilities present demanding challenges to the information society. As network systems grow larger and ever more interconnected, the risk includes large system failures due to human error or lack of effective governance of digital assets. Technological, societal and economic incentives therefore need to become aligned to reduce the rapidly increasing risks of cybercrime, data fraud/loss, and CII system failure.

This is particularly important at a time when a serious incident could have a severe impact and as technological systems represent a decisive factor for growth and development.

Confidence and security in critical information and communication systems are vital for building an inclusive, secure and global information society, and a shift in the way we think about data is urgently needed. Countries need to start the dialogue on global cybersecurity and stability by addressing international cooperation. Above all, governments and businesses need to recognize the extent to which information and communications technology (ICT) is inextricably interlinked with other complex systems, from finance and power generation to communications and safety controls.

The Global Risks 5i Framework applied to cyber risk

Insight: As the Internet and CII move from 1.0 to 2.0 and beyond, more content from multiple and varied sources will be housed together on the customer or end-user side, creating a highly complex environment for security governance and protection. The degree to which ICT systems are increasingly embedded in vital systems and services, from finance to transportation and energy, heightens the level of systemic risk and the potential for a cascade of failures with severe economic and social impact. Greater analysis and understanding is needed about potential weak links and possible mitigation strategies.

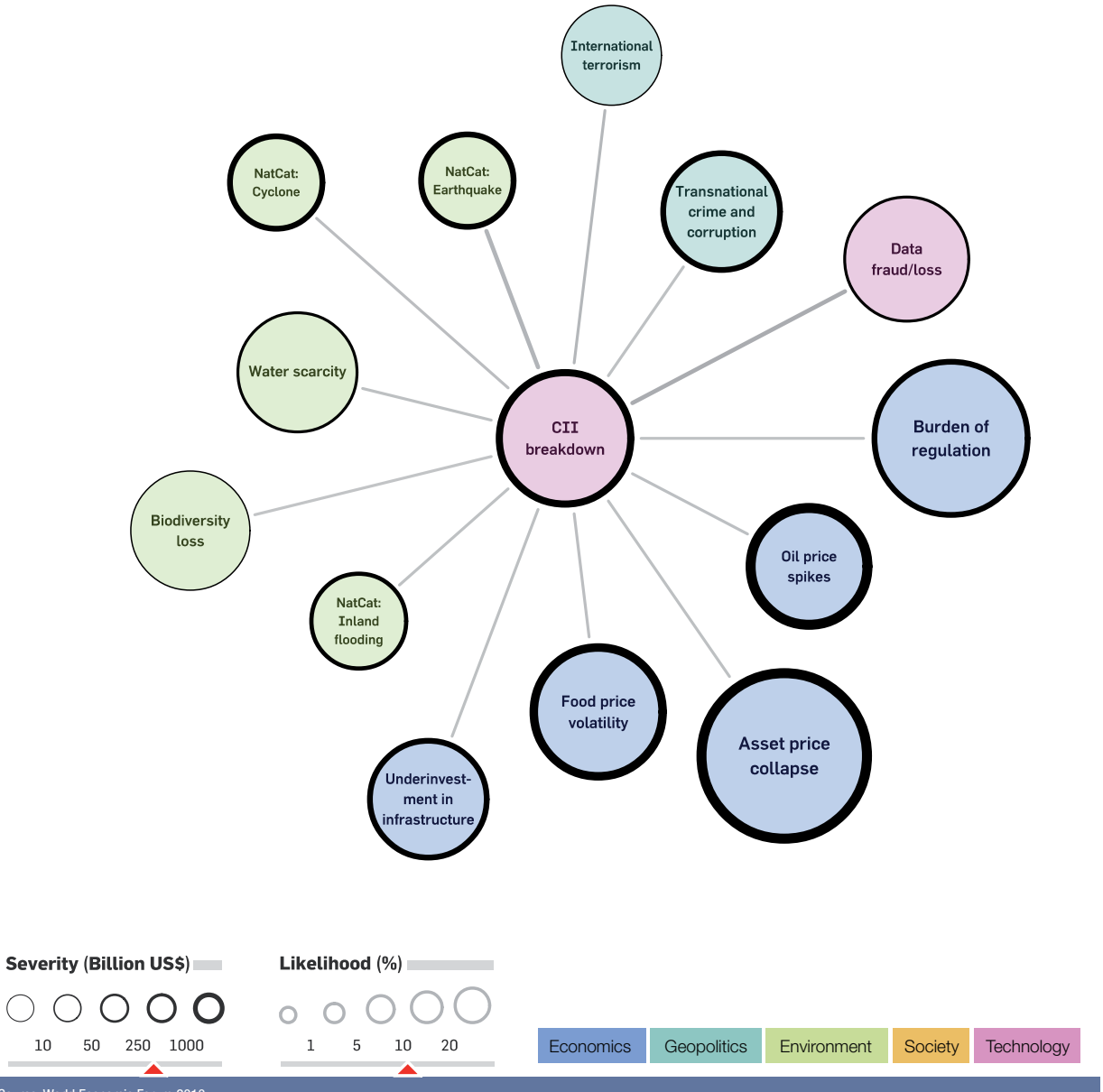
Information: Increasingly complex supply chains have led to a situation where the intellectual property developers and owners, software platform vendors, network operators and application vendors all end up trying to offload the risks and liabilities on each other, while the end-users have little power, knowledge or information over the risk to which they are exposing themselves. This has to be countered by better education and increased awareness of existing and emerging information technology-related risks among all stakeholders. Policy-makers, in particular should consider how cyber risks should be factored into other issues, such as energy security, communication and power networks, including operational continuity at corporate, community and national level.

Incentives: As new and existing technologies are applied to critical systems, ranging from smart grids to cloud computing, the appropriate regulatory frameworks and incentives have to be implemented to ensure that the required security technologies are integrated from the outset, rather than as an afterthought.

Investment: The infrastructure investments underlying emerging technologies need to be secure by default – not as an option. Furthermore, providing for a rapid, effective, transnational law enforcement mechanism will require resource commitments by both the public and private sectors, as will the sharing and compiling of threat and incident information among government and industry entities.

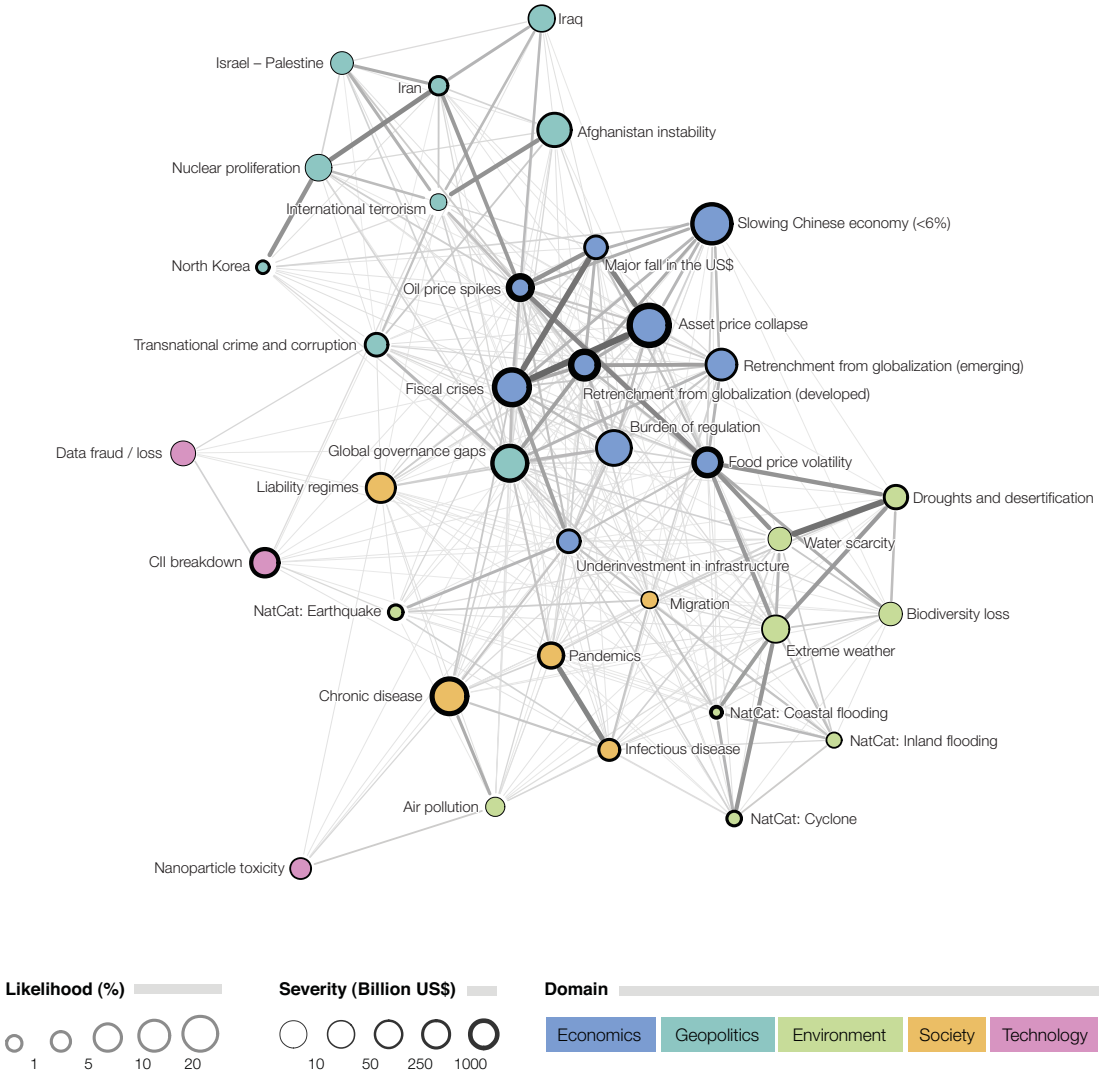
Institutions: Institutional prevention and preparedness should include a global repository of malware and security breach notification. A central clearinghouse would help ensure that all reported breaches can be located by the press, investors, researchers and sector regulators, with future laws/guidelines setting minimum standards for notification. Such a framework of universally accepted rules and standards is required to provide a globally accepted definition of a cybercrime and to criminalize offences. At the moment, a patchwork of national legislations prevents effective tracking, tracing and prosecution of criminals who operate globally, while effective security-oriented partnerships between government and industry have been difficult to establish.

Figure 12 **Critical Information Infrastructure breakdown and interconnected risks**



Source: World Economic Forum 2010

Figure 13 **Risks Interconnection Map (RIM) 2010**



Source: World Economic Forum 2010

Developing a holistic approach to risk management at country level

The financial crisis of 2008 and ensuing global recession in 2009 served as a further reminder that countries need to establish integrated approaches to risk management. Instead of focusing on company-level risks alone, governments are taking steps towards establishing bodies that would monitor systemic risks to avoid a reoccurrence of the crisis. Adopting such an integrated approach to risk management, including beyond economic and financial threats, could take it to the next level. Governments could coordinate their agencies with a prioritized national risk landscape and liaise with counterparts abroad in a more systematic and proactive manner.

The concept of the Country Risk Officer (CRO) was introduced in *Global Risks 2007* and elaborated in the subsequent editions of the publication. Given the multiplicity of risks that a country faces, from natural catastrophes or pandemic scares to terrorist attacks, there is a strong case to be made for the creation of a single point of contact and coordination for the responses to such risk events. The role, which could be performed by an individual or a committee, would also be responsible for analysing and quantifying risks, prioritizing mitigation measures and implementing programmes to adapt to the threats that these risks present.

Recent events have proven why a country should have overview of the risks it faces not only within its borders but also at the international level. Here too, a country risk officer would be in a position to liaise with colleagues in other countries and create a risk monitoring network that could serve as part of an early warning system for severe risks. The same facilities and network could be used to share and develop common frameworks to track issues and look for weak signals and emerging risks. The Country Risk Officer (CRO) would complement the kinds of macro-prudential supervision that countries are currently discussing, helping towards making those nations more resilient to financial shocks and future crises.

Given the still fragile economic environment and the pressures on national budgets, it is more important than ever that a country considers what can be done to prevent, where possible, extraneous shocks or at least to be able to manage and finance their implications. One example already operating is in the area of finance for disaster risk. Financing can be arranged after the event by redirecting funds from the budget, by borrowing or by increasing taxes. Or funds can be secured in advance through tools such as parametric or index-based insurance. A recent successful example of how governments can do this is the "Multi-Cat" (multiple catastrophes) transaction that the Mexican government signed with the World Bank. Working together with Swiss Re, the World Bank has developed a programme that enables governments to transfer the burden of economic costs from natural catastrophes to the capital markets.

By including such pre-event funding instruments in the overall disaster risk financing mix, countries could be in a position to reduce their financial exposure to natural catastrophe risk and reduce the potential burden for government budgets in the case of a major event. Here too a CRO could play an important role, taking a holistic approach to risk before events occur and ultimately reducing the risk burden to society. Not only can this help a nation financially, but it would also have an important function in reassuring the population, its neighbours and its investors that a country is appropriately prepared for a disaster.

How corporations can apply the findings of *Global Risks 2010*

Global Risks 2010 provides a framework for companies to develop insights into systemic risks in the mid- to long-term planning horizon. In general, corporations face challenges in obtaining, interpreting and applying information about systemic or "emerging" risks. The report enables corporations to:

- Test assumptions in underlying strategic plans and capital investments
- Understand and monitor the complex and changing interrelationships between systemic risks
- Identify emerging opportunities within the emerging trends or events

Corporations must continuously make decisions based on long-term perspectives to secure profitable growth. These include strategic decisions relating to new market entry, mergers, acquisitions and divestitures, joint ventures and partnerships, and capital investments. Today most corporations, large or small, are participating in the global economy and their decisions are taken against an ever-changing backdrop of influences that are external to the organization itself – macroeconomic factors, regulatory change, geopolitical upheaval, technological and product innovation, and sustainability issues. To succeed in this complex environment, corporations must develop processes to understand how these uncertain events might impact their organizations and supply chains, current competitors, potential new market entrants and the governments in the jurisdictions in which they operate.

Taking the long-term view

External and emerging risks pose challenges to most risk assessment and risk management programmes for a number of reasons. Typically, risk is considered in terms of "impact and likelihood" based on internal consensus, often involving very little external or expert input. Corporate risk assessments rarely consider a time frame beyond two to three years, or explicitly examine the long-term volatility introduced by risks to strategies with a five- to 10-year execution horizon. Decision-making is further skewed by necessary focus on the reporting of short-term results and known or recent risks affecting the current period.

A portfolio of decisions to deal with uncertainty

Further, research shows that relatively few companies effectively apply tools, such as scenario analysis, or effectively integrate risk data into long-term strategic planning. Historically, management would provide business units with prescribed scenarios and the business units would calibrate responses for each scenario. Today, the scenarios are more varied and the range of uncertainty within a scenario markedly increased. To respond, management must adjust the planning process to ensure it explicitly factors in this increased uncertainty. Indeed, strategy setting must be viewed as the optimization of a portfolio of decisions based on a set of scenarios that reflect uncertainty.

Opportunities in complexity

Global Risks 2010 emphasizes that the interconnections among risks can help management teams challenge themselves to develop more robust scenarios. The report's tools, such as the Global Risks Barometer and Risk Interconnections Map (RIM) highlight the trends and connections between emerging risks and underlying drivers in risk volatility. Taken together, these insights can help broaden the scope of trends that are considered and help management question the long-term underpinnings and assumptions about their supply chains and the competitive landscape.

As noted above, corporations must assess how risks might directly or indirectly affect the organization as a participant in a globally competitive marketplace and as a member of a global supply chain. This information must be factored into planning scenarios. The report's focus on the changing risk landscape can also be used to identify emerging opportunities in markets or sources that could provide the corporation with a competitive edge.

It has become a truism to note that all corporations now operate in a global economy. Reports, such as the *Global Risks* reports, provide corporate management with valuable long-term, external insights into the events that might impact the success of strategic plans, the performance of the overall supply chain and the emerging opportunities embedded in a complex, interconnected global economy.

Conclusion

As suggested in this report, although the interconnected view of global risks adds greater complexity to decision-making, it is vital in developing effective strategies to manage risks. These interconnections do not always reflect a direct causal relationship, as risks are often linked indirectly through common impacts or mitigation trade-offs. For many of the global risks discussed in this report, the ownership of these risks remains fragmented and unclear, and it is often difficult to identify actors willing and able to take ownership. This, coupled with the complexity of interdependencies, is perhaps why so many of these issues remain endemic and systemic in nature, although their existence and potential impact is known. *Global Risks 2008* already warned that should a systemic financial risk lead to a serious deterioration in the world economy, the impetus for collaborative mitigation might falter as leaders' attention turned to more immediate concerns; the same is true for many other so-called "creeping risks". Thus far, the response to the global impact of the financial crisis and ensuing downturn has been a willingness to cooperate on common strategies and more effective global governance to address global risks. The next months and years will put that willingness to test.

Thus, this fifth edition of *Global Risks* highlights that a number of open questions remain and many of the priorities flagged in earlier editions are still unaddressed. This report is envisioned as part of an ongoing dialogue between different stakeholders aimed at understanding a complex, interconnected risks landscape. It suggests how some of these challenges might be addressed and by extension enhance global resilience to risk. To this end, the Global Risk Network has worked closely with the Forum's Global Agenda Councils (GACs). At their annual Summit on the Global Agenda, the Global Agenda Councils offered some overarching recommendations for more effective management of systemic risks and vulnerabilities. They emphasized that these would need to be applied globally and that more effective forms of governance would be central to their efficacy. These recommendations, which echo many of those made in past *Global Risks* reports, were that institutions and governments collaborate to:

- Take a long-term approach to global risk identification, analysis, tracking and mitigation
- Use frameworks that reflect risk interconnections rather than silo approaches
- Address the need for more robust data on key risks and trends to be collected and shared in a coordinated manner
- Conduct cost-benefit analysis on risk solutions to improve fund allocation and better understand the long-term benefits of investment choices
- Track emerging risks and educate leaders and the public about real, rather than perceived threats
- Communicate clearly and consistently about the nature of threats and about strategies to manage and mitigate them
- Understand the influence of behavioural aspects of risk perception

A call came from many of the councils for action on these proposals to be taken by a new umbrella mechanism or body, a "Global System Risk and Vulnerability Facility" which could work with existing groups to take up these proposals. Leaders now recognize that the world is inadequately equipped to deal with global risks. The context in which decision-making processes happen has shifted radically from one where the immediate prevailed to one where a long-term perspective is vital. To fight systemic crises effectively we need systemic risk management. This report is a reminder of the urgency for action at individual, corporate, national and supra-national levels. "Going back to business as usual" is no longer an option. Behaviour needs to change at all levels: individual, corporate, political, if new, more forward-looking models and mechanisms for global governance are to be truly effective in managing the risks the world faces.

Appendix 1: Processes and Definitions

How global risks are defined
The criteria for global risks have been set as follows:

Global Scope: To be considered global, a risk should have the potential to affect no less than three world regions on at least two different continents. While these risks may have regional or even local origin, their impact can potentially be felt globally.
Cross-Industry Relevance: The risk has to affect three or more industries.
Uncertainty: There is uncertainty about how the risk manifests itself within 10 years combined with uncertainty about the magnitude of its impact (assessed in terms of likelihood and severity).
Economic Impact: The risk has the potential to cause economic damage of US$ 10 billion or more.
Multistakeholder Approach: The complexity of the risk both in terms of its effects and its drivers, as well as its interlinkages with other risks, requires a multistakeholder approach for its mitigation. The risks are classified in five domains: economic, geopolitical, environmental, societal and technological risks.

The Risks Interconnection Map (RIM) and Global Risks Experts Perception Survey
One of the highlights of the *Global Risks* report is the analysis of the interconnectedness between global risks *(see Figure 13).* By detailing these links, the report aims to increase awareness and understanding of the interlinkages among risk issues and what this implies for decisions on risk management and mitigation.

The data used to build the Risk Interconnections Map *(RIM, see Figure 13)* is drawn from two sources:

1. The connections and strengths are developed using data from the *Global Risks Experts Perception Survey 2010*. This Web-based survey was completed over the third quarter of 2009 by over 200 experts, business leaders and policy-makers from the Forum's and the Report partners' networks, as well as members of the Forum's Global Agenda Councils. The survey assesses how respondents perceive a selection of global risks tracked by the Global Risk Network (see above section "How global risks are defined"). For each risk respondents are asked to select 3 other risks from the taxonomy of global risks that they consider are the most connected to the risk in question. The aim is not to determine causal relationships among the risks or to identify drivers and consequences, but rather to determine the number and strength of interconnections between different risks.
2. The nodes on the RIM represent the same assessment data for severity and likelihood as in the Global Risks Landscape and the Global Risks Barometer, which are drawn from qualitative assessment that represents the aggregate views of experts from the partners involved in this Report. A greater node size indicates a higher likelihood (%), while a thicker node circumference shows a higher severity (US$). Each line represents a connection to another risk, while their thickness indicates the strength of the relationship between them.

The Global Risks Landscape
The visualisation of risk on the landscape places risks by severity of impact (measured in US$) on the vertical axis and the likelihood of occurrence on the horizontal axis over a 10-year time horizon. The numerical assessment of these categories of risks is created through qualitative assessment by the partners of the report. The risks which appear in the upper right-hand corner are those with the highest impact and highest likelihood and are the focus of the narrative of this report.

A note on the regional map of risk exposure produced by Zurich Financial Services (Figure 3)

The analysis is based on a methodology and data set developed by Zurich Financial Services. The methodology is broadly comparable to statistical cluster analysis that partitions a data set into subsets (or clusters) with the data in each subset (cluster) sharing common characteristics – in this case the characteristics are risks. Countries with similar risks are close neighbours on the risk map; they form clusters. In contrast, countries that are dissimilar with respect to their risk characteristics are displayed comparatively far apart from each other.

The data set covers 158 countries and more than 30 global risks. The risks are grouped in five risk classes: economic, environmental, health, geopolitical and technological risks. Data are drawn from established and reliable public sources and incorporated into the model using metrics developed by Zurich Financial Services for a spectrum of risk ranging from low to high.

Appendix 2: Global Risks Barometer 2010

Economic Risks

Risk description	Drivers and developments to watch
Food price volatility Rising and volatile prices affect poor consumers globally (those whose consumption basket is more than 50% food)	+ Commodity price fluctuations as a function of the global business cycle + Commodity price fluctuations as a function of deteriorating climate conditions + Government price ceilings on food prices, leading to reallocation of production and food shortages in the future +/- Input prices, typically related to fossil fuel prices +/- Regional climate variation remains the largest driver of seasonal price volatility - Progress in and access to agricultural technologies allowing for enhanced yields - Proliferation of policy frameworks to foster investments in agriculture and rural development - Implementation of social safety nets specifically targeted to benefit vulnerable societies
Oil price spikes Sharp and/or sustained oil price increases place further economic pressures on highly oil-dependent industries and consumers, as well as raising geopolitical tensions	+ Expected growth rates in key emerging markets + Extreme weather patterns + Geopolitical tensions + Factors driving potential terrorist events - Investments in exploration and production capacity - Economic and political stability in oil-producing countries - Ability of OPEC to establish price floors - Implementation of high energy-efficient, low-carbon technologies - Clear and consistent biofuels policy development
Major fall in the US dollar An abrupt, major fall in the value of the US dollar with impact throughout the global economic and financial system	+ Redirection of investments by major US dollar reserve-holding countries +/- Monetary policy differentials in the US and its major trading partners +/- Attractiveness of the US as destination for international portfolio flows +/- Relative growth differentials between the US and its major trading partners
Slowing Chinese economy Sudden reduction in China's growth to 6% or less	+ Excess ex-ante savings over-investments in China +/- Chinese government's ability to stabilize domestic demand in the wake of loss in export momentum +/- Ability of Chinese government to maintain stable renminbi in the wake of high foreign reserve accumulation +/- Ability of Chinese government to maintain political stability in the wake of sizeable loss in growth momentum
Fiscal crises Overstretch of fiscal positions generates unsustainable levels of debt, rising interest rates, inflationary pressures and sovereign debt crises	+ Short-run developments in fiscal positions due to cyclical deterioration, automatic stabilizers and stimulus programmes + Rising interest rates + Demographic developments; mainly ageing populations in advanced economies +/- Clarity around the timing and stages of exit strategies +/- Changes in entitlement programmes - Reform of social systems - Persistently high rates of inflation
Asset price collapse A collapse of real and financial assets in advanced and emerging market economies leads to the destruction of wealth, deleveraging, reduced household spending and demand	+ Sharp increase in financial asset prices + Sharp increase in prices of real assets (commercial and private real estate, commodities) + Increased volatility in financial asset prices - Changes in central banks' policy frameworks modifying price stability goals and giving more weight to overall financial stability
Retrenchment from globalization (developed) Multiple developed economies adopt policies that create barriers to flows of goods, capital and labour and fail to engage with multilateral governance structures to address global challenges	+ New trade barriers (implicit and explicit through tariffs and subsidies) erected + Increase in anti-dumping suits + Increased hurdles to cross-border labour migration + Failure of Doha trade negotiations + Consequences of regulatory reforms constraining capital flows +/- Change in outsourcing and offshoring patterns of multinational corporations + Populist parties gaining ground in elections or coming to power in developed nations
Retrenchment from globalization (emerging) Multiple emerging economies adopt policies that create barriers to flows of goods, capital and labour and fail to engage with multilateral governance structures to address global challenges	+ New trade barriers (implicit and explicit through tariffs and subsidies) erected + Increase in anti-dumping suits + Increased hurdles to cross-border labour migration + Failure of Doha trade negotiations + Measures to close domestic markets to capital inflows and foreign direct investments + Populist parties gain ground in elections or come to power in developing nations
Burden of regulation If not balanced, regulation can have unintended consequences for industry structures and market competition, distorting the allocation of capital and constraining investment and the power to innovate	+ Measures to tighten financial sector regulation + Government intervention in support of weak corporations in finance and manufacturing + Changes in rules and red tape governing various industries
Underinvestment in infrastructure Failure to invest in physical or intangible infrastructure hinders growth and development and results in major	+ Constraints on fiscal budgets and need to cut infrastructure spending + Regulatory interventions that impair efficacy of the financial system + Reports about attempted attacks on, and outright failures of, critical information infrastructure and power grids + Difficulties for the private sector to raise financing or secure guarantees for large projects

Key: = Same assessment as last year
↑ Increased
↓ Decreased

Plus signs (+) denote drivers increasing risk; minus signs (-) denote drivers that reduce risk

	Global impact	Likelihood	Severity
	Rising food prices affect mostly landless and the poorest in disadvantaged regions There is clear evidence in some crops that small producers enter and exit the sector in cycles in response to market prices, exacerbating price volatility Malnutrition and health consequences in the poorest segments of global society Social unrest and riots	↑	↑
	According to the International Energy Agency (IEA), a sustained US$ 10/barrel increase in the price of oil could lower growth of global GDP by 0.5 percentage points (pct pts) in the subsequent year Depending on the oil-sensitivity of growth, the adverse impact is substantially higher in emerging market and developing countries; the first-year loss of growth could be 0.8 pct pts in Asia and up to 1.6 pct pts in highly indebted developing countries In addition to adverse impacts for growth effects, substantially higher oil prices generate current account surpluses in producing countries, which may exacerbate global macroeconomic imbalances and fuel financial market turbulence	↑	=
	Adverse impact on the stability of the US financial markets and force the Federal Reserve to raise interest rates in defence of the dollar to levels not commensurate with growth An abrupt decline in the US dollar relative to the currencies of major US trading partners would affect an already weakened financial system and a weak global economy	=	=
	China's economy is firmly linked to the global economy and to the global capital markets; it is a large importer of commodities The country's reserves are invested abroad (predominantly in US government bonds) China has developed a strong presence on the African continent through direct investments and development aid A loss in China's growth momentum could adversely affect global capital and commodity markets	=	=
	According to an IMF baseline scenario, government debt-to-GDP ratios for the G20 countries will increase from 63% in 2007 to 85% by 2014. In advanced G20 countries, the increase will be even more pronounced, from 78% to 114% The marked deterioration is likely to exert strong upward pressure on real interest rates; according to IMF estimates, an aggregate deterioration in the global debt-to-GDP ratio of 10 percentage points may raise global interest rates by 40 basis points In highly indebted economies, spreads on government bonds may rise significantly, exacerbating the risk of sovereign debt crises	↑	↑
	Recent experience and long-term studies underscore the devastating impact the collapse of real and financial assets can have on the real economy (in terms of lost output) and the financial system (in terms of loss in allocative efficiency) The current financial crisis led to a global recession with a loss in world output of 1.5% and a contraction in advanced economies of roughly 3.5% Future asset price collapses may cause similar outcomes depending on sectors involved and their geographic location	=	=
	2009 saw sharp decline in global trade, mostly due to the global recession; however, the World Bank also observed an underlying increase in protectionist measures Similarly, proposed financial market regulation may have the unintended consequence of stifling capital market growth and innovation leading to substantial adverse welfare effects and lower growth rates of potential output	↑	=
	A retrenchment from globalization would cut off emerging market countries from the benefits of globalization, such as access to global capital markets, intellectual know-how and best practices disseminated through the presence of globally active corporations While these benefits are difficult to quantify, a retrenchment would clearly set both emerging and advanced economies on a lower growth trajectory of potential output	=	=
	Balanced regulation undoubtedly benefits a majority of stakeholders but increases the cost of doing business A recent study by Deloitte done for the FSA on the financial sector suggests the total global incremental burden of regulation would fall into a range from US$ 100 billion to US$ 500 billion	↑	=
	The American Society of Civil Engineers puts US infrastructure needs at about US$ 2.2 trillion over a time span of five years, which would require annual investments of about 3% of GDP. The impact of catastrophic failure would be a multiple of annual investments	↑	↑

Geopolitical Risks

Risk description	Drivers and developments to watch
International terrorism International terrorists continue to mount sizeable attacks, causing significant economic and human losses and exacerbating retrenchment from globalization	+ Instability on the Indian sub-continent, particularly Indo-Pakistani relations but also indigenous movements such as Naxalites + Level of political radicalization from the economic crisis + Weak governance in parts of Africa provides alternative retreat positions to Afghanistan and Pakistan +/- Whether security gains are sustainable and lasting after US withdrawal from Iraq - New and credible peace efforts in Israel/Middle East - The West's pressure on the terrorists' sanctuaries in Afghanistan and the Horn of Africa + Other marginalized groups such as ETA remain active
Nuclear proliferation Multiple states pursue nuclear armament, with associated increase in geopolitical tensions	+ Iran's nuclear ambitions, particularly whether it will test a nuclear device or seek de facto nuclear status with the capability to develop a nuclear device on short notice + Rising demand for nuclear energy capacity as an alternative to fossil fuels may lead to more countries developing nuclear capacity +/- North Korea's cooperation on nuclear disarmament + Difficulty in enforcing NPT, even among signatories +/- Whether Brazil sticks to the promises and agreements of a nuclear weapons-free South America
Iran Iran's nuclear programme and its role in the Middle East increases instability and tensions regionally and internationally	+ If Iran develops and tests a nuclear weapon, the regional power balance would be threatened + Israel-Iran tensions + Confrontation between Iran and Western powers would impact oil supply +/- Internal instability within the country could lead to more hard-line stance by the Iranian leadership or regime change +/- Shifting power and influence of Russia and China
North Korea North Korea becomes increasingly unstable and unpredictable, causing domestic suffering and heightening tensions regionally and internationally	+/- Regime stability and power transition in North Korea +/- Level of support by China and, to a lesser extent, Russia of North Korea - Inter-Korean relations and rapprochement - Control, inspection and verification activities on disarmament
Afghanistan instability Nation-building in Afghanistan fails, providing haven for international terrorist groups and triggering increasing instability in Pakistan	+ Taliban seems to be emerging stronger than before, which means more fighting, loss of life and destruction of property + Divide among the civilian population with conflicting patronage could lead to civil unrest and more internal fighting + Destabilizing elements in neighbouring Pakistan and Iran could perpetuate instability post-Allied forces withdrawal - Corruption and weak governance and national institutions
Transnational crime and corruption Penetration of organized crime in the global economy increases significantly over a 10-year period, weakening state authority, worsening the investment climate and slowing growth	+ Harsh economic conditions linked to increased illicit activity and corruption +/- tighter regulatory environment across services and products - Greater information sharing and collaboration across different jurisdictions and security, trade and financial agencies
Israel-Palestine Worsening Israel-Palestinian conflict claims thousands of lives over a 10-year period, and exacerbates geopolitical tensions and economic decline throughout the region	+/- Willingness of parties to reach a consensus on key issues such as settlements and Jerusalem + US diplomatic efforts could have significant impact on the peace process and tangible outcomes - Level of international support and pressure for new peace efforts - Increased influence of hard-line or religious groups on either side - Regime stability and governance in Palestinian Territories - Influence of Iran through its support for militants
Iraq Stabilization efforts in Iraq fail, violence and terrorism proliferate, resulting in loss of life and further destabilization of the region	+/- A timetable for a withdrawal of US and Allied forces +/- The level of sectarian violence between Shia, Sunni groups +/- The level of autonomy and secession of the Kurdish territories - Improved capacity of the Iraqi security apparatus + Involvement of Iran and other neighbours
Global governance gaps Weak or inadequate global institutions and agreements, and competing national/political interests impede necessary collaboration on global risks	+ Various governments are working at national level to reform national regulations; however, agreement at international level seems to be remote + It will take time for a new standards and governance system to come into effect + Significant gap in standards and governance among three major regions: Asia, Europe and US + Delay in new international governance set-up - G20 now established, marking a shift from the "G8+" approach

Key: = Same assessment as last year
↑ Increased
↓ Decreased

Plus signs (+) denote drivers increasing risk; minus signs (-) denote drivers that reduce risk

	Global impact	Likelihood	Severity
	Al-Qaeda and its affiliates remain active. Sporadic terrorist attacks by these and other groups remain a threat in multiple countries 2009 saw a significant rise of attacks in Pakistan Diplomatic and military escalations can both result from and drive some of these incidents Travel, local commerce and tourism are affected in regions where fears of terrorism run high	↑	=
	Potential for greater diplomatic tensions or even conflict among states in efforts to prevent access to nuclear capacity Increased need for spending on intelligence and surveillance Breakdown of regional trade and drag on development	=	=
	Economic loss and difficulties for the Iranian population as a result of embargo and sanctions Disruption in oil supply to the rest of the word if there is further confrontation between Iran and Western powers Loss of life if the countries engage in war Link to extremism and terrorism	=	=
	Less expenditure on arms and more focus on trade on the Korean Peninsula If regime comes down, exodus of North Koreans to neighbouring countries Economic strain on South Korea and the region due to handling fallout from a collapsing North	↓	=
	More regional instability, including Pakistan Exploding economic and political costs in the West to continue military campaign Other neighbouring countries/powers becoming embroiled in conflict Loss of life and suffering Link to extremism and terrorism	↑	↑
	Economic loss and significant burden on business and individuals Drag on growth in developing countries	=	=
	Loss of life and suffering Absence of any economic development in the Palestinian regions Drag on growth and development in the wider region Link to terrorism and extremism	=	=
	Loss of life and suffering Regional instability Destruction of infrastructure in Iraq Link to terrorism and extremism	↓	↓
	Economic inefficiency due to tariffs and barriers Increased likelihood of systemic risks Regulatory arbitrage opportunity	↑	=

Environmental Risks

Risk description	Drivers and developments to watch
Extreme weather Increasing severity of extreme weather events due to climate change results in greater damage to the environment, infrastructure and property, displaced populations and loss of life	+ Current global emission path + Population growth and/or economic development in risky regions (e.g. coastal cities) +/- Impact of current economic environment on commitments to long term climate change mitigation activity +/- Outcome of COP15 conference in Copenhagen and commitment of government on CO_2 emission reductions goals - Implementation of mitigation measures by government - Adaptation measures by government and participations of NGOs and private industry - Investment on renewable and green infrastructure projects - Technological developments in improving energy efficiency - Public-Private-Partnership on policies, data sharing, methodology, and risk management practices - Data gathering on changing climatic conditions and vulnerability of assets and life in exposed parts of the world
Droughts and desertification Increased frequency and severity of heatwaves and droughts and the spread of desertification significantly reduce agricultural yields around the world and displace populations	+ Population growth and resource-intensive consumption patterns + Changing weather cycles due to climate change + Soil erosion + Affected size of the population and region as percentage of GDP - International, national and regional policies and rules on deforestation - Reforestation drive supported by PPP - Adaptation measures in the form of insurance and reinsurance - Comprehensive policy measures for long-term prevention and adaptation - Use of technology to increase crop yield/water usage ratios
Water scarcity Declining quality and quantity of water leads to water shortages, increased health risks, conflict and population displacement	+ Population growth and resource-intensive consumption patterns + Changing rainfall patterns + Increase of water use in generation of energy - International policies and governance on water use for irrigation and drinking - Bilateral agreements for sharing water resources and reservoirs spanning across country borders - More efficient distribution channels and efficient use of the available water resources
NatCat: Cyclone An extreme tropical storm hits an economic centre or a densely populated area	+ Population growth and density in cyclone-prone areas + Significant changes in climatic conditions and sea temperature + Changing weather cycles + Under-investment in critical infrastructure, e.g. in resilient electricity grids +/- Global emission development path - Improvements in building codes and construction are being outweighed by asset value and population concentration in coastal areas - PPP in adaptation and rehabilitation measures of the population - Willingness and preparedness to take proactive steps in the event of impending storm activity
NatCat: Earthquake A strong earthquake hits an economic centre or densely populated area such as Tokyo, Los Angeles, San Francisco, Beijing or Mumbai	+ Population growth and density in earthquake-prone locations - New technology and methodology for more sensitive detection and early warning systems - Effectiveness and efficiency of crisis management capabilities in affected areas (mitigation plans and execution efficiency) - New design and technology for more resilient infrastructure and buildings in earthquake-prone regions
NatCat: Inland flooding Extreme inland flooding of the Mississippi, Yangtze, Thames or Rhine rivers, for example, causes direct economic and human losses and serious disruption downstream	+ Population growth and density in areas prone to inland flooding - Further investment in infrastructure for drainage and control of inland flooding - Systematic and long-term plans to move people and property from danger zones - Pre- and post-flood preparedness (early warning systems and evacuation plans) - Insurance for potential damages +/- Changing rainfall patterns
NatCat: Coastal flooding Rising sea levels, coastal flooding and erosion affect property and infrastructure and displace people and economic activity	+ Population growth and density in coastal areas - New technology and collaboration on early detection and warning systems - Evacuation plans - Insurance and rehabilitation plans - Data sharing and international cooperation on flood protection +/- Global emission path + Trend and speed of landlocked ice melting
Air pollution Poor air quality leads to increased incidence of acute respiratory diseases and allergies, reducing productivity and increasing health costs	- National regulations on pollution controls - Regional policies and directives on pollution control measures + Over-reliance on fossil fuels for energy production to meet forecast demand - Improved technology for energy use and waste treatment + Long-term health impacts and increased health costs +/- New US administration willingness to act on environmental issues - Implementation of anti-pollution technologies
Biodiversity loss Degradation of biodiversity results in severely depleted stocks of resources in fishery, forestry and other bio-services with potentially irreversible consequences for the environment	+ Population growth and resource-intensive consumption patterns + Over-fishing (oceans, lakes and rivers) - International agreement on GHG emissions - Active national plans on adaptation measures and protection of biodiversity - Legal and economic support to less-developed nations/communities for the preservation of biodiversity - International, national and local awareness on the issue - Introduction of geo-engineering - Protection of rain forests and high biodiversity regions (e.g. wetlands and swamps) - Global agreement on forestation/deforestation

Key: = Same assessment as last year
↑ Increased
↓ Decreased

Plus signs (+) denote drivers increasing risk; minus signs (-) denote drivers that reduce risk

	Global impact	Likelihood	Severity
	Damage to infrastructure and loss of property Loss of life Migration of human population Irreversible change in environment Effect on biodiversity	↑	↓
	Increase in economic losses Inefficient use of land resources Change in weather patterns Migration of human populations Concentration of populations in regions with access to water Competition for scarce resources Biodiversity loss Further damage to the environment	↑	↑
	Increase cost of water exploitation and transportation Increased cost of water consumption Conflict over water Decrease in drinking water quality and spread of diseases Extreme scarcity of drinking water in some parts of the world	↑	↑
	Economic losses and loss of life Migration and resettlement of population Increased vulnerability of ageing infrastructure Investment in rebuilding the infrastructure	=	↑
	Tremendous economic loss and loss of life Destruction of infrastructure Displacement and rehabilitation of people Infrastructure losses	=	↑
	Economic loss and loss of life Destruction of infrastructure Displacement and rehabilitation of people Infrastructure losses	↑	↑
	Economic loss and loss of life Destruction of infrastructure Displacement and rehabilitation of people Infrastructure losses	↑	↑
	Increased health costs Decrease in productivity Loss of life	↑	=
	Extinction of flora and fauna Changes in habitat Irreversible damage to environment through deforestation and ecological imbalance Reduction in agricultural and fishery yields Migration	↑	↑

Societal Risks

Risk description	Drivers and developments to watch
Pandemics A lack of preparedness to respond to a pandemic of a highly infectious disease at the international, state or corporate levels exacerbates loss of life and results in the breakdown of essential systems (ICT, power, supply chains)	+ International awareness on the pandemic and its impact + Transmission ability of the new viral strains (viral evolutionary rule) - Effective monitoring and communication of virus activity + Emergence of H1N1 and new strains of the virus - Coordination of public and private resources in mitigation planning - Coordination of response and mitigation by different countries - Availability of vaccine for specific disease (H1N1) - Supply-chain preparedness and cooperation - Emergency communication, transportation and treatment infrastructure
Infectious diseases The incidence and patterns of known (e.g. TB, malaria, cholera, HIV/AIDS) and new infectious diseases shift to new regions and population segments	- International coordination in dealing with these diseases - Availability of vaccine and treatment drugs at affordable prices - Development of generic treatment drugs made available to poor populations - Policy and legal support at international and national levels - Incentives for pharma industry regarding patent rights - Public health policies and education
Chronic diseases Chronic diseases (cardiovascular, cancer, diabetes and chronic respiratory disease) spread rapidly throughout the developed and developing world, driving up health costs and reducing productivity and economic growth	- Awareness about the importance of a healthy diet and physical activity - New scientific data on causal links - Advances in diagnostics, drug development and therapeutics - Improved understanding of genetic factors and precise treatment mechanisms + Health and insurance costs +/- Linkage to productivity and economic development
Liability regimes The spread of US-style liability regimes to other jurisdictions reduces personal accountability and loss sharing, and global insurance capacity, undermining investment and growth.	+/- EU regulation on how to deal with collective redress and burden of proof + Activism of consumer protection groups and emergence of new consumer protection laws + Formation of legal cells working on commission basis
Migration In the absence of adapted socio-economic policies (e.g. labour policies) in both donor and recipient countries, migration (including illegal) triggers social tensions and nationalistic movements	+ Increasing parochialism, especially given current economic conditions and development in coming years + Internal, regional and international conflicts - Pre-emptive social measures to deal with economic issues - Equitable sharing of resources and infrastructure by all - Fair trade measures through WTO, IMF, etc., and effective governance framework - An international migration framework taking into account the economic hardships of poor countries on one hand and ageing populations on the other

Technological Risks

CII breakdown Susceptibility of CII to attacks or system failures creates domino effect, shutting down IT-dependent applications in power, water, transport, banking and finance, and emergency management.	+/- New technology hardware and software development - Data and information sharing among governments and between government and private institutions - Acceptance of the concept of infrastructure sharing in emergency situations - Legal framework to penalize offenders - Resilience of institutions - Detection of events and BCM effectiveness + Space weather disturbances
Nanoparticle toxicity Studies reveal health impairment due to exposure to widely-used nanoparticles (paint, cosmetics, healthcare). Primary impacts on public health, secondary impacts on investment in a range of nanotechnologies	- More scientific evidence establishing the cause and effect chain - Legal obligation of the producers to label the negative effects of product usage + Increase in nano-material and technology use - Public demand for labelling +/- Protection for nano-material and technology use
Data fraud/loss Major accidental loss of data or fraud triggers backlash against the organization/body holding that data and broader loss of confidence in data sharing and accumulation	- Development of best practices for data security - Legal framework to penalize culprits - Information sharing among governments and private firms regarding loss events + Penetration of Internet, especially user-generated content - Stronger perception of data fraud as a compliance issue (in public discussion)

Key: = Same assessment as last year
↑ Increased
↓ Decreased

Plus signs (+) denote drivers increasing risk; minus signs (-) denote drivers that reduce risk

	Global impact	Likelihood	Severity
	Loss of life Tremendous burden on critical resources and services Perhaps long-term impact of vaccination if not thoroughly tested Loss of productivity and economic loss	↑	↓
	Loss of life Loss of productivity Extra burden on the healthcare system Re-emergence of drug-resistant bacteria and other pathogens Migration of the diseases to other regions through travel and contacts	↑	↑
	Increase in death rates due to these diseases Loss of productivity Increased healthcare costs Decreased productivity and quality of life	=	↑
	Increased legal costs, which will eventually be borne by consumers and/or taxpayers Shifting of business to other countries where liability regimes are less stringent	↓	=
	Suffering of people and destruction of resources in forced migrations In case of conflict, more retaliatory measures against and barriers to movement of resources and people Societal impacts as/if migrant workers return to home countries Loss of remittances from diaspora	↑	↑
	Potentially severe disruption to critical services and systems (communications, energy and financial) Disruption of business services Disruption of critical government services Loss of trust in systems and technology Direct and indirect economic losses	↑	↑
	Long-term impact on health and healthcare systems Product recalls Plethora of court cases on product liability Change in technical and chemical design of nanotechnology and nanochemicals Insurance claims	↑	=
	Loss of trust in the data systems Standardization of protocols and technology for data storage and transmission Acceptance of breach of privacy as people share more and more private information through social networking platforms Negative image impact on organizations processing mass data (telecoms, utilities, transportation, governmental organizations)	↑	↑

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Expert input
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