EMERGING RISKS IN THE 21ST CENTURY

AN OECD INTERNATIONAL FUTURES PROJECT

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Preface

Risk has been an inherent concern of humans since the dawn of recorded history. Not only are there more risk situations today, but modern technological development has brought a heightened awareness of risk - both of those risks that we knew about in the past, and the emerging, new risks that are associated with the march of progress. A key element in this heightened awareness is the fact that we now know a great deal more about the physical world than we did in the 19th and much of the 20th century; in addition, the mechanization of much of daily life has brought human beings into contact with new risks. At the same time, technology has provided us with the tools to measure and to manage risk, altogether avoiding it at times. Our understanding of human preferences through the study of behavioral psychology and economics has also helped us understand ways in which citizens perceive risk and manage it in their lives. Yet the increasing complexity of modern life is going to require new - and different - ways to share the burden of risk among citizens, collectivities and governments. That "way forward" is explored in the International Futures Project described in the text that follows.

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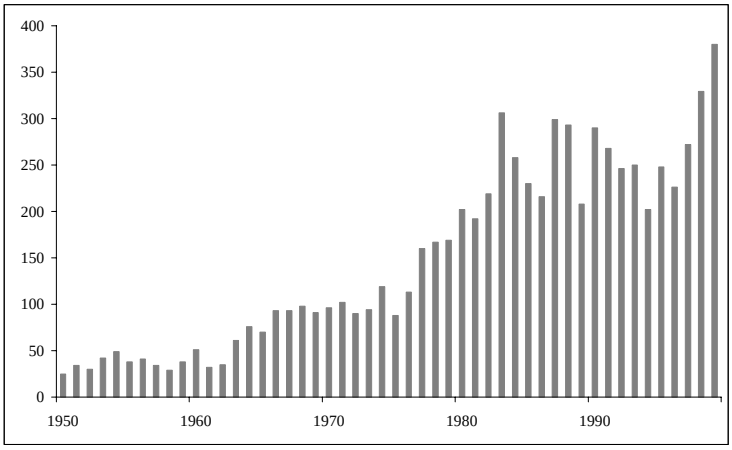
The concern about risk

New and terrifying events are happening as we take our first steps into the 21st century. The world's population has always been faced with "risk" – but the difference today is that risks can now reach magnitudes of harm that hadn't been imagined in modern times. They have the potential for inflicting devastating damage on the vital systems and infrastructures on which our society depends. The menace to all that people value – the environment, property, health, life itself – has never been greater (see graph 1).

The alarming headlines are now familiar – hugely damaging windstorms and flooding in Europe; ice storms in Canada; the appearance of AIDS, new variant CJD, SARS; terrorist action such as the September 11th attacks in the United States and the Sarin gas attack in Japan. These and other harmful events may have put policy makers and the public "on the alert", but being aware is not the same thing as being equipped to prevent those risks or mitigate the damage they cause. There is worrying evidence that countries are simply not adequately prepared.

The International Futures Programme, which was created in 1990 and which reports directly to the OECD Secretary-General, has been analysing the many pressing issues connected with risk management in OECD countries. In 1999/2000 the IFP conceived and designed a two-year risk project, the first cross-sectoral study of its kind at the Organisation. The project resulted in a groundbreaking publication, *Emerging Risks in the 21st Century – An Agenda for Action*. The value of the book's analysis lies in the fact that it's forward-looking. Risk management is often based on past experience – a course of action that might lead to critical failures in a rapidly changing environment. And it is impossible to see ahead without knowing the driving forces behind risk. Changes within those forces are bound to reshape conventional hazards and create new ones, modifying vulnerability to risks, transforming the channels through which accidents spread, and altering society's response.

Graph 1 – Number of natural and health disasters reported in the world



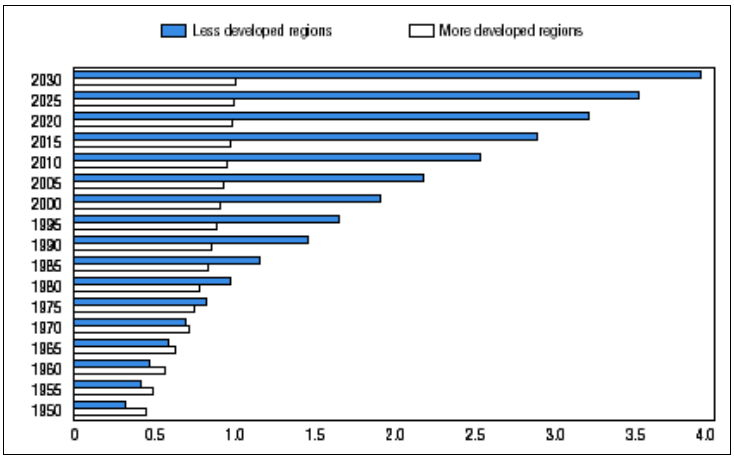
Source: the OFDA-CRED disasters database.

A changing world scene

One such force is demography. By 2050 the world population is set to increase to 9 billion from today's figure of 6 billion, and practically all of the additional 3 billion people will live in cities (see graph 2). That may not seem an especially striking statistic per se, until one realises that a huge fraction of the world population will be seriously exposed to risk. Many megacities will, for example, be located in earthquake fault zones lacking adequate urban planning and construction norms.

Changes in the environment are a second driving force; the sheer speed of those changes may put our level of scientific knowledge to a severe test in dealing with attendant risks such as climate change, water scarcity and reduction in biodiversity.

Graph 2 – Urban population (in billions)



Source: United Nations, *World Urbanisation Prospects 1999*.

Then there is technology. Will factors such as connectedness ultimately prove more useful to terrorists, or to those fighting terrorism?

Finally, many questions arise that are linked to changing socioeconomic forces. Does greater economic concentration mean increased vulnerability? If government's role is shrinking generally, who's really in charge in an emergency? If the public's perception of risk is increasingly formed by media that seek to entertain rather than by expertise, could such lack of awareness lead to panic and other misguided behaviour in the face of risk?

Broadening the notion of risk

Addressing risks in a changing environment requires a much broader perspective than those adopted in the past, and that requirement applies even to our very understanding of risk. While a variety of assessment methodologies are employed in sectors as diverse as food safety, terrorism and the environment, there are a number of observations that apply to most if not all of them.

For one thing, many risk models assume that a hazard is linked from a well-identified source to a single endpoint in more or less linear fashion. That could well prove a seriously flawed assumption if a number of complex evolving factors are at work. Such models are thus woefully inadequate when it comes to explaining or predicting complex phenomena. These days, risk assessment needs to combine knowledge from a wider variety of disciplines and areas of expertise (from "hard" sciences to psychology, sociology and economics), and pay increased attention to changing conditions within the driving forces mentioned above.

The nexus of factors points to another weakness in risk models: all too often, they overlook a hazard's potential damage to systems. What are the wider implications if an earthquake results not only in casualties and structural damage, but in infrastructural damage as well? Have those implications been incorporated into an overall plan? Can the level of readiness be deemed acceptable? Clearly, vulnerable points in the system need to be strengthened (for example by creating redundancies or building protection elements more systematically), and the "architecture" of the system needs to be made more resilient.

That leads to the question of time frames. If a system is assumed to be self-contained in space (physical or operational) and time, then it is likely the long-term consequences and impacts outside the system studied will be neglected. Only by understanding its complexities will it be possible to understand, and so be ready for, the long-term consequences of damage to a system – including the potential domino effect of harm to other systems. In terms of the nearer future, there is a need for rapid information gathering, early warning, and timely identification of vulnerabilities.

"Broader perspective" means taking in the world view. The growing interdependence of economies and societies means that emerging risks in developing countries, where monitoring and early warning systems are often inadequate or nonexistent, can rapidly spread. International cooperation and coordination must be strengthened so as to transfer knowledge, skills and technologies and thus close potentially dangerous loopholes in the overall coverage of the monitoring effort. The prospect of new threats from drug-resistant diseases, cyber-terrorism and bio-terrorism only serves to underscore this urgent need.

Citizens as partners

Risk decisions, however, are not exclusively the province of scientific understanding and experts passing judgements. They involve a variety of actors, from public officials and experts to interested and affected social groups, each of which might represent a different sensitivity to the various aspects.

Analyses leading to risk management decisions must pay explicit attention to the range of standpoints, in particular in situations with a high potential for controversy. This is often best done by involving the spectrum of participants in every step of the decision-making process, starting with the very formulation of the problem to be analysed. Introducing more public participation into both risk assessment and risk decision making would make the process more democratic, improve the relevance and quality of technical analysis, and increase the legitimacy and public acceptance of the resulting decisions. Such an approach could also act as an early warning mechanism for future repercussions in the economic, social and political domains.

A 1996 report by the US National Academy of Sciences notes that improving risk characterisation requires attention to two discrete but linked processes: analysis and deliberation.

Analysis uses rigorous methods developed by experts to arrive at answers to factual questions. Deliberation uses processes such as discussion, reflection and persuasion to communicate, raise and collectively consider issues, increase understanding, and arrive at substantive decisions. Analysis informs deliberation; deliberation frames analysis, bringing it new insights, questions and problem formulations. The two build on each other, with input from the spectrum of interested and affected parties.

Experience with deliberative procedures in diverse risk areas and countries has yielded a number of lessons and tools. When involving stakeholders, risk managers need to avoid putting a premium on well-organised private interests to the detriment of the general public. Deliberative procedures can be adapted to the specificities of the risk issue, provide lessons in risk communication to the broader public, and be based on objective and scientific assessment. At the same time, however, they have to express clearly the limits of scientific knowledge, the underlying assumptions and the uncertainties.

Recognising interested and directly concerned citizens as legitimate partners in the exercise of risk assessment is no short-term panacea for the problems of risk management. But serious attention to participation and process issues may, in the long run, lead to more satisfying and successful management methods.

A shared view on precaution?

What of the wider picture? Assessment questions rapidly become international questions since many emerging systemic risks are global (e.g. infectious diseases, terrorism, extreme weather conditions), as are their evolving contexts (e.g. growing trans-border movements of people and goods, global climate change) and the solutions available to risk management.

Cooperation among countries is therefore of major importance. Uncoordinated approaches to risk management may entail considerable costs to the global community. These costs can take the form of under-protection of global common assets due to self-interested behaviour, trade disputes, and inefficiencies and gaps in regulation that may provide unwarranted protection from legal action. International management of a variety of risks requires a policy framework in which decisions are prepared and coordinated on the basis of scientific and other considerations, with international texts providing the foundation for dispute resolution.

Cooperative structures need to rely on an internationally consistent assessment of risks. One challenge is to create a framework for clarifying the respective contributions of facts, value statements and uncertainties in risk issues. It must also be acknowledged that decision making has to aim not at a single objective (as assumed by traditional cost-benefit analysis), but at several – perhaps even competing – objectives at the same time, such as making efficient use of available resources, considering the distribution of risks and benefits among individuals, and accounting for specific societal values. One way to balance uncertainty, conflicting values and consistency is to work toward establishing common grounds for precaution.

When risk assessment entails too high a level of uncertainty to be a reliable guide for management decisions, one of two broad strategies of prevention can be adopted: either taking no preventive action and refining assessments gradually on the basis of experience (the so-called "learn then act" stance), or engaging conservative measures based on the possible magnitude of risk and improving assessments through fundamental research and controlled assays (the so-called "act then learn" stance).

The idea that in some cases the "act then learn" approach is preferable appears to have been first formalised in the 1970s, in the notion of *Vorsorgeprinzip*. This "forecaring principle" gradually became a cornerstone of German environmental policy, and was later referred to in various international fora as the precautionary principle. The version that figures in the Rio Declaration of the 1992 United Nations Conference on Environment and Development states: "Where there are threats of serious and irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation".

Precaution as a management principle has existed for a long time in a variety of areas, and is used in practice in all OECD countries. However, a number of decisions referring to the principle have led to important disputes in regional and international jurisdictions in the past years, from the European Court of Justice (e.g. the German beer case) to the WTO (e.g. the beef hormone case).

The various international agreements referring directly or, more often, indirectly to a precautionary approach substantially differ when it comes to defining the conditions that precautionary measures must satisfy. What is meant precisely by "serious and irreversible damage", the need to assess such threats scientifically, and the provisional nature of measures and their cost-effectiveness are among the major points of divergence.

As a consequence, there has been growing concern over the use of the precautionary principle by countries to increase their regulatory discretion, in opposition to trade agreements. For instance, there is no agreement within the European Union on a precise definition, and member countries tend to criticise the work of the Community's scientific committees, which provide the basis for application of the principle, and rely on their own regulatory bodies.

However, a process of harmonisation might well be under way. One indication of this is the European Commission's February 2000 communication on the precautionary principle, which endeavours to set a common understanding of precaution. Conservative measures are required to be proportional to the threats,

nondiscriminatory and coherent, based on an analysis of costs and benefits, and flexible with regard to progress in scientific knowledge. In addition, the Commission seems to exclude the use of the principle as a substitute for the scientific exercise of risk assessment.

These clarifications tend to bring the Commission's interpretation of the principle closer to precautionary approaches advocated in multilateral fora (such as the World Trade Organisation's SPS agreement), but substantial differences remain. Further progress towards an international understanding of precaution-based strategies of risk management (and in particular their legal aspects) is warranted, and seems within reach.

Protecting vital systems

Determining an acceptable level of risk leaves open the question of how to achieve that level, the domain of risk reduction and prevention. Major improvements still needed in this domain include reducing the vulnerability and strengthening the resilience of major systems against a variety of hazards.

First, improved risk prevention within major systems often entails additional costs that may seem unnecessary. In the US Federal Aviation Administration's air traffic control system, redundancy is a core element of the system design philosophy. Primary, secondary and manual mechanisms are in place to ensure that operations continue under adverse circumstances. But there is growing concern that yet more system redundancy may be required to meet new and emerging threats that could affect several systems at once. This perceived need to strengthen the safety net also holds for ICT and other critically important infrastructures such as energy provision and health delivery systems. The problem is that whereas safety contributes to competitiveness in the long term, the costs related to safety expenditures are usually immediate while benefits only materialise through time. An increase in competitive pressure can thus mean a reduction in the safety budget, leading to fewer redundancies. If governments are faced with fiscal constraints, they may be tempted to reduce spending on activities such as infrastructure maintenance or the training of personnel. That impact may not be felt in the short term, but over time it can lead to a significantly reduced ability to manage risks. Especially in public utilities, it is often necessary to clarify the regulatory framework with regard to safety obligations.

Second, whether the system in question is a critical infrastructure at risk from terrorist attack, or a public health system confronted with the resurgence of well-known infectious illnesses or indeed an unknown communicable disease, or an ecological system endangered by pollution, a crucial key to successfully reducing risk could well be diversity (e.g. of the software in particular networks), and largely decentralised but effective management of the systems themselves.

Information and communications technology is one of the sectors open to risk through inadequate diversity. Among the "architectural" features that could render ICT systems vulnerable are the growing dependence in some quarters on commercial off-the-shelf technology and in-place commercial networks; lack of diversity in system providers whose products are incorporated into a particular network; lack of redundancy in the system; and the trend among some network providers of using a single private Internet core to support network management and operations systems instead of numerous dedicated independent leased line facilities for each system. Moreover, there is some evidence of growing geographical centralisation of key computing capabilities and network hubs, and also of greater centralised management and control of ICT systems.

Third, information on risk and safety should be organised at system level. The development of new technologies such as remote sensing can make a considerable contribution to risk prevention by providing early warning of structural weaknesses in dams, transport infrastructures and other key installations. It should be noted that application of these technologies is not widespread and would benefit substantially from efforts to accelerate their diffusion.

A variety of instruments have also been developed to continually assess and monitor risk factors inside complex systems. Living probabilistic safety assessment (L-PSA), for instance, is a dynamic tool developed in the past fifteen years in the nuclear industry. The aim of L-PSA is to constantly adapt probabilistic safety assessment models to evolutions in both nuclear power plant features and the relevant risk modelling. The

result reflects the measure of risk at a specific time and under specific plant conditions. Ideally, major operational decisions (such as design or process changes) can then be tested and monitored in real time according to their impact on risk and safety margins. Tools are also being developed to assess how prevention and mitigation measures modify the vulnerability of systems to various hazards, including for example in chemical plants.

Fourth and lastly, because of the sheer size of these systems, efforts at broad-based cooperation and coordination between public and private actors is key. At a time of rapidly changing technologies, practices and market conditions, a major challenge for public authorities is to define, apply and enforce appropriate regulations. As the most centralised modes of risk management are becoming less effective, cooperation with the private sector could make the task easier and increase regulatory effectiveness. Such efforts would seem to stand a better chance of success when they benefit from high-level political backing, or indeed are initiated by political leadership. The United States is a case in point. In response to the findings of a presidential commission, a Presidential Decision Directive (PDD63) on "Protecting America's Critical Infrastructures" was issued in 1998, launching a major interagency initiative.

One possible form of cooperation is to create funds financed jointly by the private sector and the government with the aim of promoting risk prevention in specific areas or industries. Such a scheme was suggested by the French Parliament after the Grande Paroisse chemical plant accident in 2001, and is currently under consideration. The fund would improve the handling of industrial risk in inhabited areas by assisting industries in their efforts to reduce risk, and by furnishing the means to purchase threatened properties when their owners wish to sell them.

Public/private cooperation can also aim at creating win-win situations with regard to risk prevention. For instance, insurers can require, at least as a minimum condition for providing coverage, that safety rules and regulations are respected. By doing so, they benefit from the scale economies of a common system of norms and standards. In turn, regulatory authorities can rely on the insurance sector for enforcement. For example, insurance companies and other financial institutions could play a major role in the implementation and enforcement of norms such as building codes. Insurance coverage or mortgages could be made conditional on inspection, certification and, when necessary, the adoption of loss mitigation measures.

Another example is provided by the impact of ISO certification on the implementation of safety measures in corporations. Such public/private cooperation can be an effective risk management tool, complemented when needed by liability law. For instance, an injurer can be held liable for damage even while complying with safety norms if the optimal level of care cannot be imposed through norms.

At the same time it is necessary to get the incentives right, in particular by internalising to the extent possible the costs of risk-generating activities, in accordance with the Polluter Pays Principle ("Risk Imposer Pays").

The Turkish Catastrophic Insurance Pool, created after Turkey's 1999 earthquake disaster, illustrates how the combination of legislative measures (making insurance compulsory), public service (providing insurance up to a ceiling) and market forces (complementary insurance, reinsurance of the pool, possibly issuance of catastrophe bonds) can create the appropriate mix of regulation and incentive to better address risks. It is expected that the TCIP will help significantly improve enforcement of building codes and both prevention and coverage of earthquake risks in Turkey.

Preparing information and communication channels

However great the prevention efforts, risk cannot be reduced to zero – disasters happen. Disaster preparedness is therefore a crucial ingredient of risk management.

There are several important dimensions to communication prior to and in times of disaster. One key challenge is striking the appropriate balance between ensuring information flows to and through the media, and guarding against disruptive intrusion by the media into the operations of the emergency services.

Most disasters *are* a media event. Effective interaction with the media can therefore be of critical importance in reducing losses. In those types of disasters where warning is possible before the event, accurate, timely and consistent information conveyed by the media can be decisive in preventing death and injury. The media can be used to convey instructions to the public, stimulate donations, reinforce efforts to gain broad public support for mitigating actions, engender confidence in community leadership, greatly reduce the number of enquiries from the public, and provide useful coverage that may facilitate future funding campaigns.

Often, early warning is the weak link in the chain of preparations – as, for example, in flood emergencies, where frequently the problem is one of the quality of bulletins informing about the impending flood. Once the forecast has been established the information has to be communicated to the authorities, to the emergency services and to the communities concerned, in a form that is sufficiently explicit and clear for the best possible decisions to be made.

Hence, the quality of the early warning information is crucial. For example, a multidisciplinary team has worked on floods related to discharges of the Loire River in France – computer experts, sociologists, hydrological engineers, communications specialists – to ensure that the messages going out to the fire brigade, police, emergency shelters and the public at large are formulated in the most effective possible way, and clearly intelligible to these highly diverse target groups.

On the other hand, many an emergency manager has experienced considerable frustration when having to divert much-needed time and resources to address the demands of the media, while simultaneously trying to mount a multi-organisational disaster response under conditions of extreme urgency and uncertainty. There is always the possibility that the media could get in the way of operations, distort the facts of the drama, or help to perpetuate disaster myths. This argues for careful media relationship planning before the event. The absence of such planning can have hugely disruptive consequences.

The handling of the ice storm in Quebec, Canada in 1998 offers some useful indications of how new approaches are being applied to relations with a responsible media in times of crisis. Three successive waves of heavy snowfall in five days paralysed electricity distribution (there was a 75mm-thick coating of ice on cables), transport networks, drinking water supplies and many other vital sectors. Evacuation of Montreal was seriously considered. The usual command-and-control approach to crisis situations was abandoned in favour of a strategy of trust building and collaboration with the public, politicians and the media. A major media centre was established at the headquarters of HydroQuebec and regular briefings were organised with journalists. Rules of the game were established. For example, no interviews would be given on speculation about the causes of the crisis, only on the facts – but technical briefings were held for those journalists interested in detailed information. The specialists working on emergency operations were available for such interviews but at no other time, thus significantly reducing disruption to their work. The president of HydroQuebec appeared at the daily press conferences, accompanied by the prime minister of Quebec. Their statements focused on the objectives to be achieved for the day. Straightforward, non-technical language was used, and their message was aimed at generating solidarity, trust and a sense of achievement.

When disaster strikes

In addition to what can already be done prior to the disaster, the speed of response and degree to which the action taken is effective and efficient immediately after a disaster are crucial to limiting its consequences. Prompt action to save life, limb and property and curtail economic and environmental damage can greatly lessen the magnitude of losses by preventing the propagation of adverse consequences via second-round or indirect effects. Equally, however, the system delivering the emergency services needs to be sufficiently resilient under shock so as to be able to contribute to damage limitation.

In fact, a variety of emergency response systems – whose components need to work flawlessly, both sequentially and in parallel – may need to be deployed promptly and simultaneously. It is at this juncture that the resilience of these systems themselves comes into play. Even the most speedy aid and rescue

operation can founder, and damage limitation be seriously hampered, if it proves impossible to preserve the continuity of vital systems and services.

On the medical front, what seems to matter most in predicting how well communities are able to withstand the adverse health effects of a disaster is the strength of the public health system in place prior to its occurrence. There seems to be a widespread belief that the primary role of public health in disasters is to control potential outbreaks of communicable disease after the event. What is important is to ensure the maintenance and quick restoration of sanitary services and drinkable water to affected communities, in addition to close surveillance of the population's health status.

Although significant components of the health care system such as hospitals often maintain backup systems (e.g. power and water), such systems can also fall prey to a disaster and in any event are only designed to tide things over for a limited period. Clinics, doctors' rooms and pharmacies rarely incorporate such redundancies, on cost grounds.

On the other hand, the public health aspect of disaster relief management has been enhanced in the past several years by an ability to rapidly locate and position (by air, if necessary) medical supplies (e.g. sterilising and trauma equipment, antibiotics, vaccines, oral rehydration therapy) and field hospitals. But what probably counts even more when disaster strikes is a sound health care system in the first place, particularly in terms of primary health care available to communities.

It is the availability of local doctors and allied health professionals who can respond on the spot that makes the difference in terms of saving lives, preventing disability, and halting the spread of disease. Accordingly, checklists have been drawn up emphasising the public health-oriented aspects of disasters.

Depending on the seriousness and scale of a disaster, bulk shipment of needed supplies of food, drinkable water and shelter can overwhelm even the capacity of developed countries to cope with disaster – in which case mitigation efforts will need to involve international cooperation and coordination.

Rapid and reliable telecommunications in the aftermath of a disaster are at the heart of any effective operations to limit its impact. There are useful examples of regulatory and institutional infrastructures for coping with major crises. One is fixed telecom networks, which are generally configured to give priority to emergency calls. This is not, however, the case for most mobile networks. Industry Canada addresses this problem through an emergency telecommunications framework that encompasses a programme for cellular priority access as well as national priority access to dialling, and national and regional committees charged with emergency telecommunications arrangements.

There are also a number of initiatives in place at international level. The United Nations Office for the Coordination of Humanitarian Affairs and International Telecommunication Union have a working group on emergency telecommunication. Numerous international agreements exist: the Tampere Convention (drawn up in the 1990s and revised in 2001) addresses provision of telecommunication resources for disaster mitigation and relief operations; the ITU has put together a Disaster Communications Handbook and is actively engaged in persuading its members to sign up to the Tampere Convention; and the International Civil Aviation Organization is addressing standards for aeronautical emergency communications.

There are also interesting new international schemes initiated by the business sector – for example, the agreement reached in April 2002 among twelve major Asian telecom carriers (Arcstar) to strengthen disaster recovery measures through such actions as setting up a hotline linking the network operations of all carriers, and creating a manual on handling large-scale disasters and long-term network failure.

Building trust

One of the crucial ingredients of a society's effective response to a disaster is trust. Trust has been described as one of the central channels through which social identities are constructed in late modernity. Trust is fragile. Typically it is created rather slowly, but it can be destroyed in an instant by a single mishap

or mistake. Once trust is lost, it can take a long time to rebuild. In some instances, lost trust may never be regained.

An accident can engender a feeling of betrayal of trust. For some, the increasing focus of modern societies on risk regulation even reflects a cultural shift from hierarchical conceptions of society to conceptions based on trust and blame relations.

When the public feels "betrayed", there tends to be overreaction in the form of panic and stigmatisation of certain products or technologies – and so, a heightening of risk. The BSE crisis in Europe in the 1990s demonstrated that lost trust can drive a wedge between the "rational" risk policies promoted by experts and the expectations of the public. It also showed that the costs to follow for risk authorities are, in any case, bound to be formidable. Risk management services and agencies should therefore make generating and reinforcing trust one of their primary aims. That will mean building a constructive dialogue between risk authorities and society – all stakeholders should feel that their legitimate concerns receive attention in the decision-making process. Several lines of action can contribute to building this bridge and improving relations.

First of all, to be credible – thus, to generate the citizens' trust – risk assessments need to have clear and solid grounds, be effectively communicated to the public, and have no link to policy decisions. Institutional arrangements can help establish this credibility. For example, assessment can be entrusted to independent advisory agencies whose personnel are appointed solely according to criteria of competence and integrity and whose decisions are, if not necessarily followed, at least respected by policy makers. In recent years, such bodies have been created or ameliorated in several OECD countries, notably in the field of food safety. Another solution is to systematically submit scientific assessments for peer review – providing the review process is rigorous and transparent – and to make the information available to the public. That is the procedure followed by the Office of Management and Budget in the United States.

Institutional changes undertaken to reinforce credibility should properly reflect the particularities of the risk category and the country in question. And they should in no way attenuate or mask the responsibilities of policy makers. It must be clear that scientific assessment is only one input among others in decision making, and that the quest for the best scientific expertise should not serve as an excuse to delay, let alone preclude, action.

A second trust strategy relates to the participative/deliberative processes mentioned above. As stated before, analyses leading to risk management decisions must pay explicit attention to the range of standpoints, in particular in situations with a high potential for controversy.

Third, the release of information on risk should be managed in a timely and effective manner. In periods of crisis, avoiding panics cannot be used as a pretext for lack of transparency or adopting paternalistic attitudes towards the public. In OECD societies today, withholding information on major risk issues is generally not practicable over long periods of time, and can be extremely costly in terms of lost public confidence. Only in exceptional cases where the physical protection of people is involved (e.g. terrorism) can a temporary lack of information be accepted by society.

Risk management authorities need to be aware of the social dynamics of risk issues, and of how information can be framed and used by specific stakeholders. All agencies and services dealing with risk communication need to be able (notably through training) to provide a complete and objective view of risk to the public.

Next, corrective – and possibly precautionary – measures are necessary to prevent damage from spreading, and to restore the public's trust. In many cases in the past, reactive and inadequate announcements aimed at reassuring the public have only increased confusion and entailed additional costs. Therefore, such measures have to be planned for and implemented in a timely fashion after a hazard occurs, based on an accurate understanding of the actual situation and of the public's perception of it.

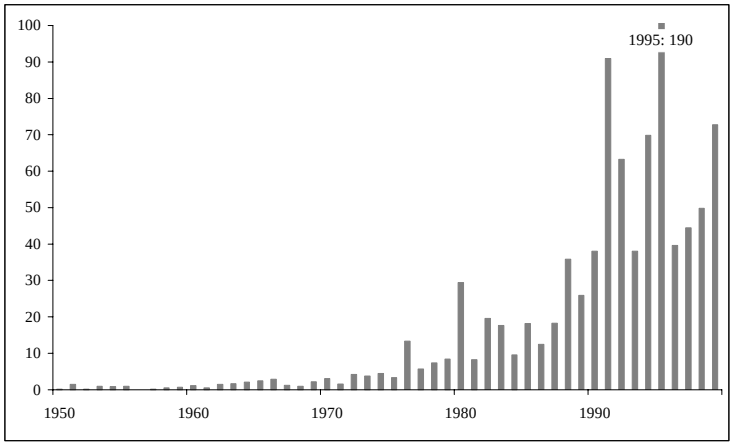
Finally, denial should have no place among risk managers' attitudes. One way to ensure this is to avoid the systematic search for scapegoats, i.e. apportioning blame on the basis of a superficial examination of responsibilities in the aftermath of disasters. Some OECD countries have begun according more room for

manoeuvre to independent bodies investigating accidents and disasters. The generalisation of such professional services is warranted as a means of detecting the real origins of risk management failures, be they individual, collective or organisational, and of restoring public trust.

Sharing the burden

The trend increase in insured losses due to natural, technological, health-related and – more recently – terrorism-related disasters has called into question the long-term ability of the insurance industry to continue providing coverage for such risks (see graph 3). As made clear by the consequences of the September 11th attacks on New York and Washington for the insurance industry, emerging systemic risks entail several insurability issues: they are often difficult to predict, at least to their full extent; they offer little scope for diversification; and, particularly when mega-catastrophes occur, they require huge financial capacity.

Graph 3 – Financial costs of natural and health disasters



Source: the OFDA-CRED disasters database.

Current estimations of insured losses due to the September 11th events are close to USD 40 billion, which makes those attacks the most costly manmade event in the history of insurance. It is possible, however, that final loss figures will greatly exceed these estimates, as is often the case in large-scale disasters. The magnitude of third party liability claims in particular remains uncertain at present.

In the wake of the disaster, the insurance industry realised that it might not have the capacity to provide meaningful coverage against terrorism at an affordable rate. Considering the magnitude of potential losses, it was argued, terrorism risk has to be insured by states. In particular, one of the major surprises for insurers was to discover the number of lines involved: life, aviation liability, other liability, aviation hull, event cancellation, workers' compensation, property, and business interruption.

Both industrial operators and insurance companies have been looking for alternative risk transfer mechanisms in recent years, most notably financial market instruments that transform existing insurance contracts into securities. Catastrophe bonds that are based on insurance against a specific natural disaster are one example.

For primary insurers, financial market instruments have the advantage of offering an alternative to reinsurance, in particular in the context of a hard market following heavy losses. In addition, prices are determined for a period of several years, whereas reinsurance contracts are renegotiated on a regular basis. However, such instruments probably cannot stand as real substitutes for traditional insurance for most risks because of the considerable costs entailed by accurate risk assessment, particularly when harmful behaviour

is not fully observable. Therefore, in the future, financial market instruments will probably play the role of a complement to traditional reinsurance, depending on insurance market conditions.

Insurers have also started to modify policy conditions in order to protect themselves from the trend increase in liability and from the costs this could incur, in particular in the case of a retroactive application of liability by law. Examples of measures that have been taken include changes in coverage over time and explicit exclusion of certain risks.

Naturally, such measures are not neutral from a burden-sharing standpoint: they protect insurers from exposure to risks, but not the operators; they therefore generate risk aversion and insolvency problems. Adapting policy conditions to individual risks and, as a prerequisite, reducing information asymmetries by improving the insurer's knowledge of a risk and of the population at risk would provide better defences against adverse selection and moral hazard. For instance, differentiating policies in accordance with mitigation measures against damage caused by natural disasters could prove effective in some cases.

Tort law and the insurance industry cannot always provide optimal incentives ex ante or sufficient compensation ex post in the face of catastrophic risks. Public intervention is then needed, and can take several forms: the introduction of compulsory insurance for specific branches, a direct involvement of the state as insurer of last resort, or provision of complementary funding for compensation.

In the latter case, government intervention can be organised through a guarantee fund providing compensation above a liability cap, or compensating for the insolvency of an injurer (if insurance coverage is incomplete) or of an insurance company. In very specific circumstances, liability and insurance can be substituted altogether by a general compensation fund.

Such schemes, however, can involve severe moral hazard problems. If insurance coverage is not adapted, it can weaken the risk-taker's incentives for prevention and mitigation of damage. In some countries, for instance, incentives to avoid building habitations in flood zones have been extinguished by the guarantee of public compensation. Public funding of compensation can amount to providing distorting subsidies to a harmful activity. In addition, if insurance companies benefit from information asymmetries, they will be encouraged to have recourse to public intervention whenever inappropriate policy conditions applied in the past later expose them to large losses.

The traditional response to moral hazard is to provide only partial coverage and to leave the individual, industrial operator or insurance company with a partial exposure to risk. In addition, the mixed public/private solution of guarantee funds (or any other form of supplementary funds) seems more adequate than simple state intervention. Finally, the financing of public compensation funds needs to be provided by taxes on the harmful activity in question, if prevention of damage is to be encouraged.

Mega-terrorism (e.g. nuclear or biological attacks), typically excluded from standard insurance policies, could entail losses exceeding the capacity of individual states. In that regard, international solutions may need to be considered.

Learning the lessons

Disasters are followed by a period in which the attention of the public and the media are at their highest point and a window of opportunity for action opens. Experience of harm forces society to reevaluate risk and the way it is managed. However, whether such reconsideration is retained or acted upon is another matter.

Investigating and analysing the origins and consequences of disaster can provide lessons on how to improve assessment and management of risk. Such lessons can be extended to other similar risk areas (or regions). The momentum created in society can help overcome inertia and resistance to reforms in the risk management process. Effective management of the window of opportunity can reinforce citizens' confidence in the way risks are handled, and all in all significantly reduce the chances that the same disaster occurs again in the future.

On the other hand, lessons from past inadequacies and failures can be ignored – especially when it comes to putting them into practice before the window of opportunity closes – and then gradually be forgotten. In the case of exceptional events, several generations can live with the unfounded belief that risks are appropriately managed, until a new disaster occurs.

Learning from disasters entails analysing all phases of risk management in the light of experience, and answering questions such as: Are there any precursors to the occurrence of a hazard, and how can they be observed? Did the occurrence of a hazard correspond to earlier assessment? How did the disaster spread, and whom did it affect? How did people react, and were warning signals received? Were there any unexpected factors of vulnerability? Which social and economic trends contributed to creating vulnerabilities, and can they be better managed? Which protections failed (if any), and why? Were there effective incentives to avoid or mitigate risk?

Beyond examination of such questions, however, there are the tasks of systematically organising feedback and ensuring that corrective measures are actually taken. These tasks have proved particularly challenging.

The aftermath of Chernobyl illustrates how risk management can be improved on the basis of information provided by past disasters.

Among Chernobyl's lessons are the need for evaluation of precursors and for in-depth analyses, the demand for transparency, and the notion of safety culture. The nuclear industry indeed took these lessons on board and developed a number of powerful methods for systematic evaluation of precursor accidents, including the follow-up of significant safety performance indicators and the establishment of general and plant-specific risk trends from operating experience. Such methods can contribute greatly to early detection of significant risks.

Similarly, transparency in relations among operators, regulatory authorities and stakeholders and the promotion of safety culture are two major objectives of past and current efforts to improve regulatory effectiveness in the industry.

For the detailed findings

A full analysis, as well as an extensive list of Recommendations for Action, can be found in *Emerging Risks in the 21st Century – An Agenda for Action*, published by the OECD (2003), ISBN 9264199470. Throughout the publication, five case studies furnish an analytical context in five areas of risk management: flooding, nuclear accidents, infectious diseases, food safety and terrorism. In addition, a wide range of concrete illustrations are drawn upon, from space technologies and the protection of critical infrastructures to xeno-transplantations, the production of chemicals, and tanker accidents.