RSA Risk Commission

An Overview of Risk

Prepared

by

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RSA Risk Commission

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The RSA

The RSA (Royal Society for the encouragement of Arts, Manufactures and Commerce) is a global organisation that is at the forefront of much social, economic, political and artistic thinking. Since its inception in 1754 the RSA has encouraged the development of a principled and prosperous society, in which human potential can be fully realised. Today, supported by 25,000 Fellows, we do this through five manifesto challenges:

- encouraging enterprise
- moving towards a zero-waste society
- developing a capable population
- fostering resilient communities
- advancing global citizenship

Effective policy making in all of these areas demands a balanced and informed attitude to risk. The RSA Risk Commission, as part of our 'encouraging enterprise' challenge, offers the opportunity to look at an area which has been of long-running interest to the RSA.

RSA Contribution to the Risk Debate

Seminars

Public Perception of Risk
DTI Foresight/RSA Forum for Technology, Citizens & the Market
December 13, 2004

Conferences

Do New Risks Need New Thinking?
Science, Citizenship and the Market'
2 April 2003

Lecture Programme

Risk and Enterprise
Chairman's Inaugural Lecture
26 September 2005
Sir Paul Judge
Chairman, RSA

Show and Tell: Is market competitiveness hindered by data protection activism and whistle-blowing compensation seekers?
Eversheds Lecture
08 June 2004
Richard Thomas, Roger Steel, Guy Dehn

The Politics of Risk
Institute of Management Annual Lecture
Sir Mark Moody-Stuart
Former Chairman, Royal Dutch/Shell Group, Chairman, Business Action for Sustainable Development
13 May 2002

Reports

What's There To Talk About?
Public Engagement by Science-Based Companies in the United Kingdom
RSA Forum for Technology, Citizens & the Market
June 2004

RSA Risk Commission Terms of Reference

Establishing the Risk Commission

The RSA as an independent body is uniquely placed to mobilise the divergent expertise required for the project. The RSA has a long history of tackling awkward and difficult questions and is known for its impartial approach. These characteristics enable the RSA to bring the required expertise together under the ambit of a long-term commission to lead and provide guidance in the articulation and implementation of a work programme.

Many sectors of society, business and public sector organisations have developed protocols to manage their perceptions of risk. In so doing they have in many instances focused on their specific areas of interest. The multi-disciplinary approach that the RSA is championing through the development of the Risk Commission will provide an arena where complimentary and sometimes antagonistic viewpoints about risk can be ventilated. By breaking through sectoral barriers the Commission aims to bring together the central underpinning themes that are at the heart of risk and thereby provide a synthesis of factors/issues that will contribute to increasing public understanding.

The Commission

The RSA Risk Commission will run initially for a three year period, beginning in March 2006. It will be chaired by Sir Paul Judge, RSA Chairman and will consist of an expert group drawn from a wide cross-section of disciplines including public policy, law, business, health and transport among others.

Aim

To enable society to respond to risk in a more constructive manner thereby liberating public policy from the burden of unrealistic public opinion.

Remit

The Commission has been tasked to examine and contextualise risk using a number of key areas as exemplars. Its programme of work should culminate in the development of a communications strategy that will target key decision makers and the general public in order to foster a more informed, rational attitude towards risk both in the UK and internationally.

Scope

Risk in today's society is pervasive, cutting across all sectors. The Commission, while cognisant of this, will focus on a number of key broad areas such as business, childhood, engineering, healthcare, security and transport. Findings derived from these subject areas along with cross-cutting thematic investigations will contribute to informing an integrated framework aimed at guiding people in the principles that they should employ in their efforts to measure and contextualise risk.

Work Programme

The work programme will be comprised of several strands of activities including:

- Sector studies
- Conferences
- Lectures/panel discussions

- Internet based discussion groups
- Interviews/Articles in various media
- Commentary on emerging risk issues
- Compilation of interim and final reports

Sector studies will be used to inform the conclusions and recommendations of the final reports of the Commission. Interim reports will be used to stimulate debate about risk in different arenas while generating and maintaining the interest of the various stakeholders in the findings of the Commission. Subgroups and internet based discussion groups will enable a number of activities to progress in tandem and broaden the scope for stakeholder participation.

Outputs

To ensure that the programme of work generates the greatest impact the outputs will be delivered at defined intervals throughout the life of the project.

- The results of the sector studies will be published as soon as possible after completion and appropriate mechanisms will be established to enable and encourage debate about the findings.
- At least two conferences will be held to provide multi-disciplinary presentations and discussions; the proceedings of which will contribute, a) to the pool of information being assembled and, b) to the integration of risk approaches.
- A number of lectures to be delivered, during and after the project, using the RSA as the main vehicle for dissemination.
- A dedicated website will be set up which along with providing information to the public will be used to host themed discussions. This medium will enable the Commission to tap international expertise and also promote its work internationally.
- A final report documenting the major findings of the Commission.
- A Communication strategy aimed at increasing public understanding of risk and improving capabilities to deal with risk.

Spin-offs

It is envisaged that the profile that the Risk Commission will be able to give to the risk debate, both nationally and internationally, will generate ongoing interest and give rise to activities that will build on the outcomes of its programme of work.

One such possibility is the development of Risk Commissions in other parts of the world where RSA Fellow groups are to be found such as South Africa, India, the USA and Australasia.

PREFACE

We believe that as society has become more complex, the ability of the public to assess and deal with comparative risks has diminished. For example, following a train crash, a major investigation lasting many weeks is undertaken during which the railway line is closed: traffic is thus diverted onto the roads where proportionately many more lives may be lost. Similarly, health scares over prescription drugs may cause thousands of people to stop taking them, which leads to far greater damage to health.

Societal risk perception is influenced by several factors of which the role of the media is a prominent example. Poor public understanding of risk is compounded by sensationalist news reporting, which can reinforce inaccurate perceptions. This, in turn, influences the climate of public debate and, hence, government responses. These responses are almost invariably disproportionate, thus in time bringing politics into further disrepute and damaging public confidence in the political process. Government, professional groups and academic institutions have sought to contribute to the risk debate, mainly within their specialised domains, through various means. Integrated frameworks that actively include the public and the media in defining the national risk landscape along with appropriate management protocols should be requirements of modern society.

The RSA Risk Commission is embarking on an ambitious programme of work aimed at contributing specifically to the UK risk perspective and more generally to the global risk debate. This programme of work, set out in the Terms of Reference, will through various methodologies, engage with stakeholders to establish the characteristics of the current UK risk scene and subsequently derive a set of recommendations aimed at fostering a balanced attitude to risk. A part of this work will aim to highlight the positive side of risk as a necessary catalyst for economic, scientific and social development. The Risk Overview is the beginning of this process and is intended to establish a platform on which the work of the commission will build.

The Risk Overview is intended to summarise some of the current thinking about risk as a concept and to highlight some of the practical issues surrounding the perception and management of risk both nationally and internationally. The document will firstly review notions about risk, risk governance, analysing risk and risk communication. Secondly, given this framework, practical aspects of how risk translates into everyday life will be investigated to illustrate its complexity and how perceptions about specific risks contribute to a culture that appears to be increasingly averse to all forms of risk.

EXECUTIVE SUMMARY

Risk is a contested notion that continues to generate much debate about its precise nature. While academics and risk professionals argue about the finer details of what risk is about the public has come up with its own interpretation. The perception of risk held by the public has been identified by academics, policymakers and a variety of concerned stakeholders as creating a society that is becoming increasingly intolerant of all forms of risk. In preparing the groundwork for the RSA Commission programme of work on risk an overview has been compiled to illuminate its complex nature, the difficulties that arise from its misinterpretation and the resulting impacts on societal behaviour.

The influential role played by the media in shaping the UK risk landscape has been acknowledged in many quarters. Examples of irresponsible reporting have contributed to the social amplification of certain types of risks. Distortions in information about public health issues in particular engender fear and distrust among the public. The BSE crisis and the MMR triple vaccine controversy clearly illustrate the power of the media in influencing public responses to perceived threats.

Risk as a social construct has been described by many commentators, with some going as far as identifying it, as a modern phenomenon. Other commentators dispute the modern perspective and argue that risk has always existed. It is the ability of humankind to identify, evaluate and manage risk that has changed. The ability of individuals and organisations to reduce risks has created an inextricable link with safety in the minds of the public. In the UK the establishment of agencies such as the Health and Safety Executive and the Food Standards Agency are examples of regulatory attempts to ensure public safety.

Preoccupation with reducing and/or preventing risks has led to the positive aspects of risk receding into the background. Innumerable 'accidents' over the ages have given rise to scientific discoveries and technological developments that have made significant contributions to the advancement of society. Restricting the latitude for accidents in all walks of life restricts natural behaviour impacting negatively on curiosity, willingness to fail and venturing into the unknown which are hallmarks of the way we expand the horizons of knowledge and development.

The benefits derived from risk taking are varied and are defined by preconceived expectations. People gamble on the off-chance that a small bet will reap much larger rewards. Some people measure and weigh the odds i.e. take a calculated risk while others may resort to 'gut feelings' or use a combination of these factors. Both methodologies carry expectations of gain nonetheless. People may avoid risk because they hate losing. Integral to the process of deciding whether to take or avoid a specific risk is the issue of control over possible adverse outcomes such as by reversing or minimising their impacts.

The corporate world is a prime example of balancing risk and benefit. If successful the rewards can be significant to those willing to invest in new ideas. Venture capitalists and other financial institutions have developed methodologies that enable them to make rational assessments of the risks and benefits of

projects. Entrepreneurs appear to deliberately court risk and relish the next new adventure into the unknown; prime examples are Ted Turner, creator of CNN, Sir Richard Branson of the Virgin Group and Stelios Haji-Ioannou of easyGroup.

In the US the typical lifespan of the best run companies appears to average less than 50 years. The UK experience mirrors that of the US. Notwithstanding the finiteness of company lifespans the enterprising spirit of entrepreneurs keeps them creating new commercial entities. Can a prevailing societal perception that all risk taking is bad dampen this sprit of enterprise and impact negatively on economic development?

Attempts have been made by several sectors of society to define and measure risk. The resulting variations in definitions and constructs have added to the difficulties that the public encounter when attempting to understand risk issues. Some schools of thought subscribe to the narrow quantitative concept of risk while others advocate a broader interpretation that includes societal values and norms. Integrating both perspectives has proven to be complex.

The concept of risk as a societal construct requires an understanding of the contributory factors that influence how it is perceived both individually and collectively. There is an extensive literature on risk perception emanating from several disciplines such as the behavioural sciences, management sciences and public policy. The perceived consequences of the adverse effects of a particular hazard vary from one individual to another. Variation in risk perception is directly related to the sets of inputs used to arrive at a decision about the possible impact of risks. In modern society the media is accepted as being an influential player in the shaping of risk perceptions. In the UK there is concern that the media is now driving government response to risk issues.

Different societies, using cultural norms and collective knowledge, have developed national systems to manage events and activities identified as having a risk potential. More recently, organisations such as the United Nations, World Economic Forum, World Bank and the International Institute for Economics have broadened this perspective by making concerted efforts to identify global risks and in some instances make recommendations on treatment. Governments are increasingly adopting the view that national risk management systems need to be framed by the global context within which they operate. The UK risk landscape identified in the Prime Minister's Strategy Unit Report, 2005 is a prime example of this thrust.

Risk analysis is the process of identifying, evaluating, managing and communicating about risk. This overview identifies the components but focuses on risk communication as this part of the process is the link with the various risk publics. Information about risks reach the public through a number of channels such as the public sector, business, the media, peer reviewed papers, grey literature and word of mouth. Among communicators journalists, politicians and government ministers are among the least trusted professions. Various analysts have identified the shortcomings of journalists when reporting on health risk issues as an example of inaccurate and sometimes sensational media coverage.

This overview of risk serves to highlight the major components of risk and the tensions surrounding its definition and management. These tensions are grounded in the subjective interpretations accorded to the concept of risk. This report does not seek to resolve the differences in opinion but rather to acknowledge the dichotomy and its influence over how risk regulatory and management systems have evolved. The difficulties experienced in bridging the divide between the narrow and broad interpretations of risk also contribute to an understanding of the complex nature of risk.

1. What is Risk?

1.1 The Concept of Risk

> *The word 'risk' derives from the early Italian risicare, which means 'to dare'. In this sense, risk is a choice rather than a fate.*
>
> *(Bernstein, 1996, p.8)*

It is an inherent trait in humans to take chances. We believe that even though the future is uncertain we can make calculated choices based on our knowledge of past occurrences and the outcomes will be skewed in our favour. The opportunity for reward is also reflected in the Chinese word for risk *wai chi,* which means "danger opportunity" (IRM, n.d.). Opportunity and threat are therefore the two faces of risk and on balance each side has the potential to prevail given the right circumstances. We take chances because we believe that there is the possibility of successful outcomes. Taking chances drives economic and social progress as people strive to discover new facts, develop new ways of doing things and create wealth through the provision of goods and services.

Ulrich Beck in his seminal book: *Risk Society* proposed that developments in science and technology have enabled society to make economic progress but have contributed the side effects of new risks. Risk according to Beck defines modern society. He draws a distinction between hazards found in pre-industrial society and those created by modern science and technology. Personal risk has always been an issue throughout history but global dangers such as nuclear waste and deforestation are modern phenomena created by industrialisation (Beck, 1992, p.19-21). The mainstay of his thesis is the production of risk as a consequence of the social production of wealth i.e. a manmade phenomenon.

> *Risk* may be defined as *a systematic way of dealing with hazards and insecurities and introduced by modernization itself.*
>
> *(Beck, 1992, p.21)*

This view is contested by Adams who posits that even though new risks have been created by modern science and technology manmade risks are not a recent phenomenon. He argues that the types of risks may differ as a result of scientific and technological advances but the 'fears and anxieties' of both types of societies may not be as distinct as Beck suggests (Adams, 1995, p. 179-180). Ancient peoples managed to develop societies with management systems that ensured their survival. It could be argued that they too were masters of the risks that confronted them. Giddens, draws a distinction between risk and hazard to explain why risk is a modern phenomenon. He argues that hazards always existed but it is the active assessment of hazards in relation to future possibilities that differentiates between traditional and modern societies (Giddens, 1999).

Bernstein argues that the mastery of risk, as a result of the evolution of systematic methodologies to handle events that may have adverse effects, defines the boundary between modern times and the past (Bernstein, 1996, p.1). This argument broadly agrees with Beck's position in differentiating between these two periods. Bernstein and Beck both define risk within the context of the pre and post industrial age. The age of scientific discovery heralded the development of the modern world and along with the greater insight provided by new

knowledge developed ways of controlling a wider array of risks. Diseases associated with poor sanitation for example were no longer death sentences but became manageable illnesses. While these developments reduced the gravity of many traditional risks they created a new group of risks; hence risks evolve along with societal progress.

> *...if there were no tomorrow there would be no risk.*
>
> *(Bernstein, 1996, p.15)*

Risk is about contemplating possible future outcomes. Bernstein argues that risk and time are opposite sides of the same coin and that time influences risk. Different risks have varying time horizons associated with them forcing decision-making processes to use information which in many instances is incomplete. People make decisions everyday in this arena of uncertainty. Efforts to assess risk involve estimating the likelihood of an adverse effect being realised at some point in the future. People rarely reduce information about risks to probabilities as part of the decision-making process. To anticipate what is likely to happen in the future past experiences are used, along with other factors, as a guide to decide what course of action to take – proceed, do nothing, mitigate or avoid.

Adams is of the view that a world with no risk would have no uncertainty, freedom or individuality and would result in no progress (Adams, 1995, p. 19). Bernstein (1996, p.12) agrees with this viewpoint and cites the example of the Soviet government's efforts to remove uncertainty which resulted in the suppression of risk-taking causing social and economic progress to stagnate. "In the 15th century, China had the opportunity to be the world's foremost maritime power and, indeed, possessed that capability. The Chinese ruling class, nonetheless, decided that the sponsorship of the fleet was an indulgence. As a result it became inward looking and failed to maintain its cultural and scientific superiority for the next five centuries "(Judge, 2005, p.14).

> *Risk is all in the mind.*
>
> *(Adams, 2005)*

Risks are constructed in the human mind – representing what people observe, what they experience and what they are told by others. Humans use their accumulated knowledge to make determinations about risk and to decide on issues of acceptability or tolerability. The link between mental concept and reality comes through the experience of actual harm (IRGC, 2006, p.23). In theory then the range of risk possibilities is framed by the variety of experiences that have been encountered by an individual. The perception of risk therefore varies from one individual to the next given the same set of facts. The implication at the societal level is that there may be as many 'states' of risk as there are people. Risk is therefore a societal construct.

The act of creating and selecting risks is a human phenomenon, giving rise to choice. It is this differentiating ability that enables the other side of risk i.e. opportunity to thrive. Risk selection is guided by many factors including cultural beliefs, institutional and financial resources and systematic reasoning (IRGC, 2006, p.24). Adams discussed the cultural construction of risk highlighting the subjective behaviour of people when confronted with various types of risks. He believes that

> *…risks are culturally constructed not because people prefer make-believe to facts, but because, at the point of decision, sufficient 'facts' are unavailable.*
>
> *(Adams, 1995, p.194)*

People utilise different framing assumptions to make decisions about risk where some:

- Knowingly use incomplete knowledge
- Use a foundation of strong belief and conviction
- Use a scientific approach to attempt to reduce or remove uncertainty - delaying tactic.

> *…risk has meaning only to the extent that it treats how people think about the world and its relationships.*

Societal values are important contributors to the concept of risk. Factors such as controllability, voluntariness, catastrophic potential, equity and threat to future generations are some of the considerations that are integrated into the determination of risk (Kasperson et al., 2000, p.233).

> *Risks don't just happen. They are brought about by human activity, sometimes unwittingly but frequently by someone somewhere along the line estimating, rightly or wrongly, that the benefits associated with a course of action outweigh the likely costs. Asbestos, we now know, can be fatal if its fibres are inhaled. But this is not the 'fault' of asbestos. Asbestos constitutes a risk to human health because of how it has been used in building construction, with the commendable aim at the time of safeguarding people and property against fire. Even natural disasters such as earthquakes, floods and volcanic eruptions only constitute risks because of decisions taken by people about where to live, how strongly to build their houses, or whether to invest in flood protection. And human activity can make such 'natural' events worse than they otherwise might have been, for instance through climate change.*
>
> *(Source: Eiser, 2004, p.15.)*

1.1.1 Risk and Safety

Risk and safety have become intertwined and the discussion of risk invariably leads to issues about safety. The creation of regulatory bodies, at the national level, such as the Health and Safety Executive in the UK is an example of society coping with risks encountered in the workplace. The Food Standards Agency is another. Adams sees this obsession with safety as the progenitor of the risk reduction industry (Adams, 1995, p.31). Some experts are of the view that people are not necessarily reassured by this development and view themselves as being more vulnerable to technological hazards (Kasperson et al., 2000, p.233).

- What does this say about our attitudes to risk and our expectations of safety?
- How do we as a society decide which risks we expect government to protect us from and those we assume individual control over?
- Do we expect absolute safety for those activities that we have entrusted to designated authorities, e.g. crime prevention, public transport and water supply?
- Do we have the same expectations of zero risk for activities over which we exercise personal control e.g. extreme sports, driving and diet?
- Why do we feel that we are better able to judge the risks associated with these activities and also to handle them?

These questions are at the heart of the UK risk debate.

The Prime Minister, Tony Blair in an address to the Institute for Public Policy Research spoke about the danger of UK society developing a disproportionate attitude to normal everyday risks and the pressure this puts on policymaking. The resulting plethora of rules and guidelines end up creating the opposite effect for which they were intended by placing too much emphasis on risk reduction. In spite of Britain been safer in many areas than say thirty years ago society is less comfortable with handling risks (Blair, 2006).

The UK Constitutional Affairs Committee issued a press notice in February 2006 entitled 'Government needs to address excessive risk aversion' wherein it said that contrary to public perception that the UK is increasingly adopting a compensation culture the number of personal injury claims have not been increasing. The Committee blames inappropriate regulation, public perception and misleading media coverage as contributors to exaggerated fears of being sued. There are negative consequences associated with this phenomenon in particular on business competitiveness.

Studies into voluntary and involuntary risks indicate that people are willing to accept the risks associated with activities that they choose to participate in compared with those that they have no control over. The level of control that a person feels that he/she can exert over a risk has a direct bearing on the degree of seriousness attached to the risk. Table 1 shows the fatality rates associated with three modes of transport, two of which people have to take on trust that they are safe. Rail and bus are clearly the safest forms of travel by a significant margin but nonetheless car purchases continue unabated year on year in the UK; new car registrations average 2.45 to 2.5 million per year.

Table 1 Comparisons with other UK transport modes

Passenger fatality rates by mode: 1992-2001
Per billion passenger kilometres

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001[P]	2002*	92-01 Avg[P]
Rail killed	0.42	0.41	0.43	0.25	0.36	0.53	0.39	0.93	0.36	0.15	0.33	0.43
Bus coach Killed	0.37	0.74	0.46	0.78	0.23	0.27	0.37	0.24	0.31	0.22	0.37	0.40
Car Killed	3.55	3.17	3.15	3.11	3.15	3.10	2.89	2.86	2.81	2.91	2.84	3.06

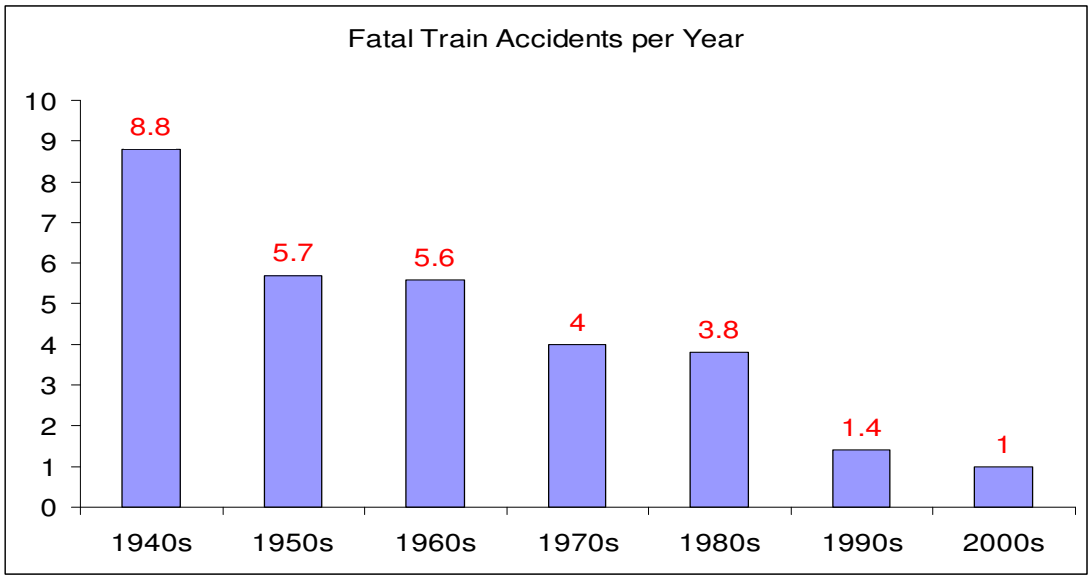
Source: Figures derived from Transport Statistics Great Britain 2003 Edition Table 1.6.
* Figures for 2002 provisional and currently unpublished.
[P] Provisional

Source: The Future of Rail, 2004

The UK national rail transport system has reduced the number of fatalities per year to its lowest level since the 1940s (Figure 1) but there is a perception that even one fatal accident per year is one too many. Several questions emerge from this observation:

- Is it realistic to expect zero risk from a mass transport system such as the railway?
- Is the perception that society is unwilling to accept this level of risk genuine or is it contrived by the media coverage given to rail fatalities versus snowboarding fatalities for example?
- Should budgetary considerations influence the determination of an acceptable number of permissible fatal accidents per year?

Figure 1 Fatal Train Accidents per year in the UK



Source: Sharpe, 2003

The improvement in rail safety is also echoed in the statistics for road and air fatalities. The number of passenger vehicles on UK roads has shown a general increasing trend. In 1950 there were 3.9 million vehicles compared to 32.3

million in 2004. It is logical to assume that with such an increase in vehicle numbers that there would be a corresponding increase in accident numbers. However, fatalities declined from 5,012 in 1950 to 3,221 in 2004 and serious injuries declined from 49,000 in 1950 to 31,000 in 2004 (DfT, 2005a). When compared with some members of the OECD (Organisation for Economic Cooperation and Development) UK road fatalities in 2003 stood at 6.1 per 100,000 people compared to a low of 5.9 for Sweden and a high of 14.8 for Portugal and Poland. The US has an equivalent rate of 14.7(DfT, 2005a).

Motor cyclists represent a disproportionately high percentage of all road fatalities at approximately 21 percent. According to the statistics in 1950 there were 1,129 fatalities peaking at 1,743 in 1960. Since then the annual figures have declined to 585 in 2004 (DTI, 2005, p.140). Less than one in five road users belong to this group, proof that motor cyclists belong to the least safe group on UK roads (patient.co.uk). In spite of the higher associated risk of death from this mode of transport motorcycle registrations have increased from 630,000 in 1994 to 1,060,000 in 2004 (DfT, 2005a, p. 158). The converse argument could be given here as even though the number of fatalities is high in comparisons with other modes of transport the number of fatalities has declined in relation to the increase in the number of motorcycles on the roads.

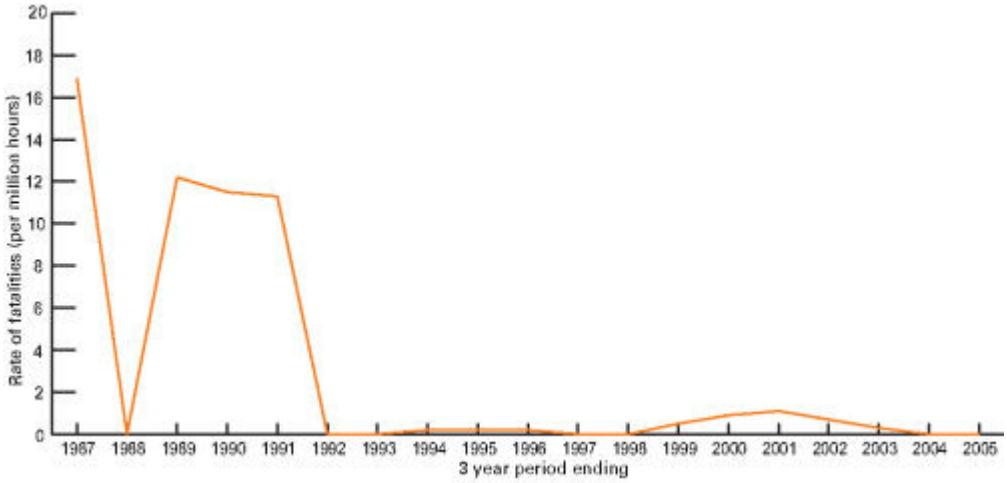
Air transport has mushroomed over the last 20 years with the emergence of low cost airlines such as Ryanair and Easyjet increasing significantly the volume of short haul flights in Europe. In 2005 approximately 2.3 million flights were recorded in UK airspace. The worldwide rate of fatal accidents is 0.2 per million flying hours. The UK compares favourably with this as shown in Figure 2. Against this backdrop the low number of accidents over a ten year period set out in Table 2 supports the claim that air travel is a very safe mode of transport.

Table 2 Number of Fatal Accidents, Non-Fatal Accidents and Serious Incidents - UK Registered/Operated Large Public Transport Aeroplanes

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Fatal Accidents	0	0	0	2	2	1	0	0	0	0
Non-Fatal Accidents	19	14	20	13	13	7	17	16	17	11
Serious Incidents	22	14	17	7	12	8	11	18	18	23

Source: CAA, 2006

Figure 2 Rate of Fatalities to UK Registered Aircraft



Source: CAA, 2006

The record of fatalities for UK registered aircraft shows that there have been no fatalities since 2001:

- On 22/08/1985 a Boeing 737 suffered an uncontained engine failure and fire on take-off from Manchester - 55 fatalities
- On 08/01/1989 a Boeing 737 crashed on approach to East Midlands after suffering engine problems - 47 fatalities
- On 25/02/1994 a Viscount crashed following problems with engine and airframe icing near Uttoxeter - 1 fatality
- On 12/01/1999 a Fokker F27 crashed into a house in Guernsey - 2 fatalities
- On 14/09/1999 a Boeing 757 departed runway at Geirona, Spain following heavy landing in severe rainstorm and fuselage broke into three pieces - 1 fatality
- On 02/05/2000 a Learjet caught fire on landing at Lyon, France after suffering engine problems - 2 fatalities
- On 25/05/2000 a Shorts SD330 was struck by the wing of a MD80 that was taking off from Paris, France - 1 fatality
- On 27/02/2001 a Shorts SD360 ditched in the Firth of Forth, UK following a double engine flameout - 2 fatalities.

Source: CAA, 2006

The HSE has been accused by many sectors of society as creating unnecessary bureaucracy in the name of safety. Numerous examples abound in the media of activities been stopped because they did not conform to health and safety regulations. A few well known examples are:

- Banning games of conkers in schools
- Requiring trapeze artists to wear hard hats
- Flattening hundreds of cemetery headstones deemed to be 'unstable'
- Removal of hanging flower baskets in high streets

Recently the HSE has become proactive in trying to redress the imbalance created by the misuse of health and safety guidelines to curtail various activities. The chairman of the Health and Safety Commission (HSC) Bill Callaghan launched a set of principles of sensible risk management on 22 August to discourage excessive caution in everyday activities.

If you're using health and safety to stop everyday activities, get a life and let others get on with theirs.

(*Bill Callaghan, 2006)*

1.1.2 Seeking Risk

Many of us embark on leisure activities regularly where risks are inherent. These risks are generally acknowledged and people, acting in the belief that they can overcome them, employ various methods to mitigate or reduce either the risks or their consequences. Statistics of injuries and fatalities resulting from accidents in some extreme sports indicate that in spite of the possibility of injury or death people are participating in increasing numbers. In the United States of America, in 2002, approximately 86 million people tried one of the activities in Table 3.

Table 3 Number of people participating in extreme sports in the US

Sport	Participants
1. Inline skating	21,572,000
2. Skateboarding	12,997,000
3. Paintball	8,679,000
4. Snowboarding	7,691,000
5. Artificial Wall Climbing	7,185,000
6. Mountain Biking	6,719,000
7. Trail Running	5,625,000
8. BMX Bicycling	3,885,000
9. Wakeboarding	3,142,000
10. Roller Hockey	2,875,000
11. Mountain/Rock Climbing	2,089,000
12. Boardsailing/Windsurfing	496,000

Source: www.ski.insurance.co.uk

Fatality profiles for snowboarding for example indicate that between 1991 and 1999 there were 285 reported deaths from a total of 426.2 million ski and snowboard days (i.e.: 1 death per 1.49 million visits to the ski area. The death rate for snowboarding is 0.46 per visits - 34% lower than for skiing which is 0.70 (www.ski-insurance.co.uk).

In spite of the attraction to extreme sports of a wide cross-section of society there is cause for concern that the safety culture has dampened the scope for adventure for many young people. Many cite a downturn in the numbers of youth that are participating in adventurous activities. Concerns over the decline in managed adventures for young people have been expressed in several quarters. His Royal Highness the Duke of Edinburgh has championed the cause for managed adventurous activities highlighting the social costs associated with inactivity. He set up the Campaign for Adventure, a national organisation in 2001, as a response to the increased tendency of people to avoid risk. Its aim is to improve understanding of the benefits which stem from an adventurous approach to life. An offshoot of this initiative was the formation of the All Party

Parliamentary Group on Adventure and Recreation in Society in 2004 to lobby for balanced views on risk-taking in society.

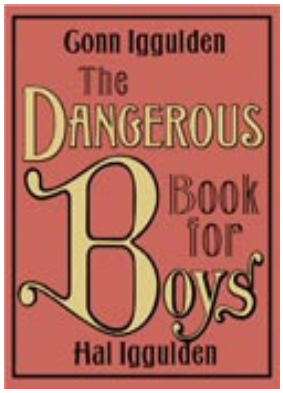
HRH The Duke of Edinburgh

"However, genuine accidents do happen and it is important to differentiate between incidents which are due to lack of knowledge and experience and those which are genuinely unforeseeable accidents. There is naturally an emphasis on the risks inherent in all adventurous activities, but this needs to be balanced against the risks of not being allowed to take part. We should take into account the consequences to young people of not being exposed to any form of physical challenge. It can result in a lack of fitness and resistance to disease, to obesity. It can lead to the choice of alternative 'thrills', such as drugs, drink and crime; and it can lead to alienation from the family and to becoming unsuitable for employment. The question that the safety-obsessed need to answer is, are the risks in adventurous activities more acceptable than the risks of the alternatives?"

School trips are on the decline as many teachers are no longer willing to take on the responsibility of ensuring the safety of their charges. Youth organisations are in need of volunteers as less people are willing to come forward due to the perception that society has become less forgiving and more litigious. The sensational reporting of accidents on school trips and in holiday activity centres have contributed to fostering negative notions about managed adventure activities for young people. The case of the Lyme Bay tragedy in 1993 is illustrative of public campaigns influencing government decision-making. The campaign for regulating holiday activity centres was supported by The Association of County Councils, the National Union of Teachers, *Holiday Which?,* The townswoman's guild, the media, parents and teachers. In spite of opposition by the HSE and the Government, an Act of Parliament was passed in January 1995 requiring that all holiday centres be licensed (Judge, 2005, p.11).

Carol Midgley wrote a piece for the Times entitled 'Our cotton-wool kids' investigating parent paranoia. She argued that road deaths for 0 to fifteen year olds had declined by 75 percent since 1976 and child murders had remained fairly constant over the same period. Yet many parents are convinced that roads are more hazardous and that there are strangers everywhere looking to harm children. This culture of fear is being transmitted to children as many traditional childhood activities are been curtailed.

There are people who are using creative means to counteract the excessive curtailing of everyday activities by regulators. Books such as *The Dangerous Books for Boys* published in 2006 are responses to what many recognise as a need to re-introduce positive attitudes to risk through healthy activity.



'Just William would be proud. A new book teaching boys old-fashioned risky pursuits...has become a surprise bestseller.'
Daily Mail

1.1.3 The Positive Side of Risk

> *Risk is rarely given a balanced review. It is not just negative. It is a balance of potential outcomes in terms of both the positive and the negative.*
>
> *(Judge, 2005, p.12)*

Risk seen in the context of a balance of possible outcomes sets the stage for human progress. Scientific advances, improvements in the human condition and wealth creation are the rewards that individuals, organisations and societies reap from taking balanced approaches to risk. The opportunity to reap some benefit is the incentive for taking risks. Balancing the possibility of an adverse outcome with a potential benefit (cost/benefit) has become a preoccupation of modern society as evidenced by the plethora of entities that are now actively engaged in making predictions about future opportunities and the provision of risk management services.

Benefits derived from risk taking are subjective in that they appeal to individual or group desires which are framed by unique combinations of attributes. It creates the possibility of a large gain in experience, capacity or knowledge. Those who do not take a risk cannot expect such benefits. The Chairman of the RSA in his lecture entitled 'Risk and Enterprise' reasoned that we take risks to expand our experience and which may result from:

- taking a journey to see other places or people,
- exploration to discover new mountains, oceans or planets,
- giving ourselves a thrill
- spending time or money on pursuing an idea to see whether it is valid.

> *Risk taking increases the probability that one will find something of value despite the search cost.*
>
> *(Judge, 2005, p.13)*

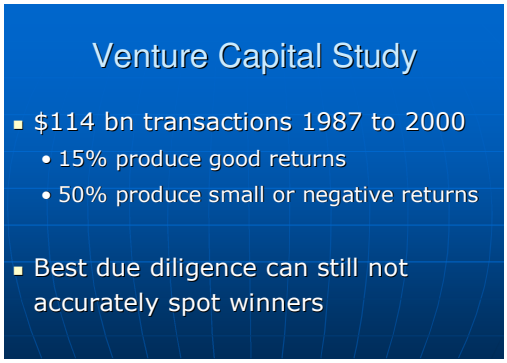
Adams describes risk taking within the context of a risk thermostat wherein we all exhibit some degree of risk taking behaviour. The degree of risk taking in this context is directly related to the level of expected reward (Adams, 1995, p.14-15). In the world of the entrepreneur and the venture capitalist taking risks are occupational norms.

1.1.4 Corporate Risk

Entrepreneurs take risks because of the potential for huge emotional and financial rewards. In spite of the uncertainty of the outcome, entrepreneurs continually seek new opportunities to develop new enterprises. Successful entrepreneurship is about bringing together a series of elements: the idea itself, the marketing strategy, the management team, the finances, sales and distribution, and the ability to stay ahead of the competition (Judge, 2005, p.11). Inherent in this process is the ability to assess and make rational assessments about the risks involved in bringing ideas to fruition.

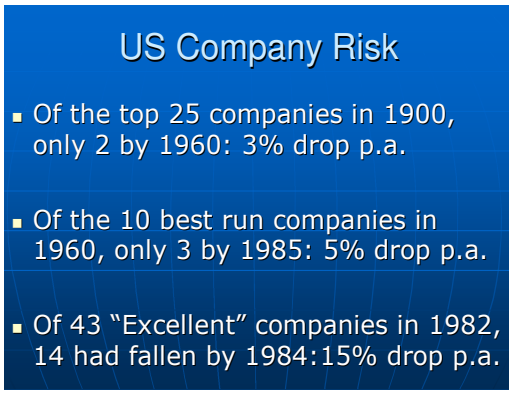
> *Venture capitalists are the most sophisticated reviewers of new business ideas.*
>
> *(Judge, 2005, p.18)*

Venture capitalists seek ideas that, on balance, appear capable of providing attractive rates of return on their investments. A major US study on 8,000 companies showed that 50 percent of the companies produced small or negative returns and only 15 percent produced very good returns. Even with such odds the venture capital market continues to grow worldwide. In the case of the UK the private equity and venture capital market accounts for 52 percent of the European market (BVCA, 2006). Investment in the UK increased from £3 billion in 1997 to £6 billion in 1997 with a slight increase to £6.8 billion in 2005 (BVCA, 1999, 2006).



Over the last 5 years, an average of 302,000 companies has been incorporated each year in the UK. In contrast the average yearly company dissolutions stand at 174,000. People are clearly not deterred in taking the risks to develop new enterprises. However, according to a poll conducted by Domino's Pizza, 40 percent of aspiring entrepreneurs in the UK are afraid of starting up their own companies. Feelings of inadequacy with respect to skills, training and resources fuel this negative perception and feed their concerns about failure. As a result entrepreneurial levels among young people in the UK are below that of the US (www.startups.co.uk).

Large companies are not immune to risk. Data on US companies illustrate the changing fortunes of the top American companies over the last century. Companies House data for the UK indicate that the average company age is 8.6 years and that 70 percent of all UK companies were incorporated within the last eight years. Only ten percent of companies incorporated before 1983 still exist.



Curiosity and risk go hand in hand.

(Lord Stone of Blackheath, 2006, p.905)

Innovation is at the heart of entrepreneurship. Innovation depends on the creative urges of people to do something different. Some innovations may evolve into commercial success e.g. the Dyson bagless vacuum cleaner, or contribute to the common good like the Baygen clockwork radio developed for use in Africa.

In the UK, discoveries and innovations when measured by the number of applications for patents, trade marks and designs appear to be fairly consistent.

Table 4 UK Patents, Trade Marks and Designs, 2001-2004

		2001	2002	2003	2004
Patents	applications	n.d.	20,196	20,064	18,816
	granted	n.d.	3,310	3,646	3,780
Trade Marks	applications	20,820	21,696	21,260	22,450
	registered	18,811	17,656	16923	17,626
Designs	applications	3,517	4,902	4,100	3,692
	registered	3,881	4,248	3,268	2,782

Source: The Patent Office

These figures do not necessarily reflect the concerns of some sectors about the negative impacts of risk aversion on creativity. The National Advisory Committee on Creative and Cultural Education in its 1999 report said:

> *In our view, creativity is possible in all areas of human activity and all … people … have creative capacities. Developing these capacities involves a balance between teaching skills and understanding and promoting the freedom to innovate, and take risks.*

Concerns have been expressed over the curtailment of experimentation in the school curriculum and the shying away from the 'hard' subjects (physics, mathematics, etc) by students. Lord Stone of Blackheath, a member of the Risk Commission, raised the issue of creativity and risk in his contribution to the House of Lords debate on Education: Science and Technology in April 2006. He noted that risk is an element in creative success and an essential ingredient in enterprise. An aversion to uncertainty reduces people's capabilities to strike the right balance between achievement and opportunity.

1.2 Defining Risk

1.2.1 Risk as a quantitative construct

The modern concept of risk is said to be rooted in the Hindu-Arabic numbering system but it was during the Renaissance that risk became an area of serious study leading to Pascal and Fermet's discovery of the theory of probability. Today's quantitative risk management techniques are grounded in the mathematical advances of the seventeenth and eighteenth centuries (Bernstein, 1996, p.3). From its early beginnings where problems of chance associated with gambling consumed the efforts of early mathematicians risk has evolved into a tool for organising, interpreting and analysing information to make decisions about the future.

Daniel Bernoulli, a Swiss mathematician working with probabilities in the eighteenth century, recognised that the calculation of probabilities for games of chance did not reflect adequately the choices people make in everyday life (Bernstein, 1996, p.104,105). Intuition and measurement were brought together by this observation. People apply their own value systems to calculated probabilities and arrive at their individual reactions which to onlookers may seem irrational given the nature of the risk. It is this individual reaction to risk that drives the creative processes of humankind.

The ability to apply mathematical principles to defining risks has enabled the development of methodologies geared towards their identification and management. These methodologies are based on the notion that risk is a function of the magnitude and the probability of harm. Such quantification methods have enabled the evolution of a risk industry with specialised professionals trained to address issues revolving around uncertainty. Examples that readily come to mind include health, engineering, insurance, financial markets and transport. The public sector has also embraced the use of these methodologies into their regulatory frameworks. The UK Health and Safety Executive, the National Health Service, The Food Standards Agency among other bodies work at developing protocols that quantify and manage risks relevant to their respective sectors.

A typical interpretation of risk within the two dimensional quantitative risk model is to determine the impact of an adverse event on humans or the environment. The engineering and health sectors are replete with examples of how mathematical models are used to define a wide range of risks. Engineers make calculations about the load bearing capacities of various materials and structures and drug companies use dose response trials to determine the safety of experimental drugs.

This construction of risk is deemed to be too narrow by social scientists as people have a multi-dimensional concept of risk. A purely technical assessment of risk does not address adequately the social characteristics inherent in risk and is therefore not an adequate basis for policy-making (Kasperson, et al., 2000). Merging quantitative risk measurements with the social dimensions of risk is exercising the minds of policymakers and others engaged in the risk debate.

1.2.2 Risk as a qualitative construct

Several arguments have been put forward by social scientists that given the societal underpinnings of risk its definition should be broadened and that quantitative determinations of risk are inadequate in portraying the influence of social factors. The Royal Society (1992) argued that

" given the essentially conditional nature of all risk assessment, one should accept that assessments of risk are derived from social and institutional assumptions and processes; that is, risk is socially constructed."

Klinke and Renn (2001) incorporate human influence and values into their definition:

"Risk refers to the possibility that human actions or events lead to consequences that affect aspects of what humans value."

Defined in this manner risk is tied to human activity and societal values (Wint, 2004). Social scientists such as Irwin, Wynne, Stirling and O'Riordan argue for the inclusion of societal values into the management of risk. Stirling (1997) argues that the perspectives of a number of countries and institutions are shifting in response to pressure to acknowledge subjective value judgements which frame and inform risk analysis. The UK is a case in point where for example it conducted a 'consensus conference' on GM technology in 1994. The difficulty

lies in how to integrate technical and scientific information with varying value judgements to make decisions about risk.

A shortcoming of the quantitative risk model is said to be its inability to include indirect impacts such as liability or loss of confidence in institutions. These indirect impacts tend to be aligned with judgements made about:

a) the adequacy of institutional arrangements to address the risk

b) the possibility of assigning blame

c) the perceived fairness of the risk management process (Kasperson et al., 2000).

The exclusion of attendant factors such as these results in underestimation of the overall risk associated with an event. A corrective measure to this difficulty is to integrate the concerns of society into the risk determination process. One such measure is the social amplification of risk which is a phenomenon that takes cognisance of the "social structures and processes of risk experience, the resulting repercussions on individual and group perceptions, and the effects of these responses on community, society and economy" (Kasperson et al., 2000, p. 234). In identifying the qualitative components – information processes, institutional structures, social-group behaviour and individual responses they highlight the complexity involved in integrating quantitative risk methodologies with qualitative risk perspectives.

Measuring risk using this broad qualitative definition may provide a more complete picture about the essential nature of a particular risk. However making assessments under such a framework is likely to provoke fears about subjectivity and bias.

1.2.3 Some Definitions of Risk

Many definitions of risk and risk related terminologies have emerged in tandem with the evolution of risk as a phenomenon that affects societal behaviour (Table 5). A large number of these definitions are context specific having been coined in response to serve the needs of specialised interests, e.g. health and safety, finance and engineering. The UK Government provides the only example of an explicit reference to the positive opportunity that may also be an outcome of the uncertainty associated with a perceived threat. All others make reference to adverse effects, danger, harm, injury, loss and things going wrong. It is hardly surprising that the overwhelming notion about risk is that it is a negative concept. Policymakers need to rethink how they define risk as part of their contribution to reshaping public perceptions about risk.

The RSA Risk Commission has at the core of its work programme the fostering of a balanced attitude to risk by highlighting the positive side of risk as a necessary catalyst for economic, scientific and social development. A necessary part of this work is influencing policymakers to redefine risk so that the balance between opportunity and threat are clear. In so doing the risk stakeholders will be encouraged to recognise that opportunity and threat should be given equal prominence.

Table 5 Examples of Definitions of Risks

- The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood. (Aus/NZ Standard)

- A function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard(s) in food. (Codex Alimentarius)

- Risk is the chance that a given hazardous effect will occur. (CEFIC)

- Expected losses (of lives, persons injured, property damaged and economic activity disrupted) due to a particular hazard for a given area and reference period. Based on mathematical calculations, risk is the product of hazard and vulnerability. (European Environment Agency)

- The likelihood of the occurrence and the likely magnitude of the consequences of an adverse event to animal or human health in the importing country during a specified time period. (FAO - EMPRES)

- In a technical perspective, risk refers to two variables – the probability of occurrence of a specific instance of damage and the extent of that damage. The social science perspective focuses on aspects of societal and psychological risk experience and risk perception, while socio-economic approaches focus on risks to livelihood, security and the satisfaction of basic needs. (German Advisory Council on Global Change)

- A multi-attribute quantity expressing hazard, danger or chance of harmful or injurious consequences associated with actual or potential exposures. It relates to quantities such as the probability that specific deleterious consequences may arise and the magnitude and character of such consequences.

  The probability of a specific health effect occurring in a person or group as a result of exposure to radiation. (both from IAEA Risk Glossary)

- The probability of an adverse effect in an organism, system or (sub) population caused under specified circumstances by exposure to an agent. (IPCS)

- The potential for realization of unwanted, adverse consequences to human life, health, property, or the environment; estimation of risk is usually based on the expected value of the conditional probability of the event occurring times the consequence of the event given that it has occurred. (SRA)

- The uncertainty of outcome, whether positive opportunity or negative threat, of actions and events. It is the combination of likelihood and impact, including perceived importance. (UK Government Handling Risk Report)

- The probability of harmful consequences, or expected losses (death, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from the interactions between natural or human-induced hazards and vulnerable conditions. (UN Living with Risk Report)

- The combined answers to (1) What can go wrong? (2) How likely is it? and (3) What are the consequences? (US Nuclear Regulatory Commission)

- The probability of a specific outcome, generally adverse, given a particular set of circumstances. (US Presidential/Congressional Commission)

- A probability of an adverse outcome, or a factor that raises this probability. (WHO World Health Report 2002)

(Source: IRGC, 2006, p. 141, 142)

2. Risk Perception and Society

2.1 Risk Perception

> *Risk perception is a response to uncertainty.*
>
> *(Eiser, 2004, p.32)*

Human behaviour is inextricably rooted in bias and error and the reliability of our decision-making processes can be affected by how much influence they exert. Public reaction to hazards such as smoking, poor diet and substance abuse when compared to nuclear energy and genetic modification demonstrates clear differences in risk perception. In general it appears that there may be a divide between risks directly attributable to individual action or inaction and those occurring in the societal domain where specific agents have been given the responsibility to manage them.

The Royal Society (1992) report defined perception as "people's beliefs, attitudes, judgements and feelings, as well as the wider cultural and social dispositions they adopt towards hazards and their benefits" (in Pidgeon and Beattie, 1998). Prior to this definition Jasanoff (1990) sought to highlight the human dimension of decision-making in regulatory science by arguing that perceptions of scientific reality are coloured by a scientist's professional, institutional, political and cultural affiliations. This subjectivity in interpretation of data results in varying outcomes where scientists arrive at different conclusions using the same set of facts. This rationale also holds true for the general public where they will use their 'expertise' to arrive at conclusions about risk.

In *Citizen Science,* Irwin (1995) points to the work of Wynne in identifying the relationship between scientific understanding and social influences by demonstrating that different constituencies define risk systems differently for example, scientists made their framing assumptions based on idealized systems, whereas lay people used actual experience to guide their perceptions of risk. Wynne's work with Cumbrian sheep farmers after the Chernobyl disaster drew attention to differences in reaction between the lay public and officialdom to risk.

A recent interpretation from the International Risk Governance Council agrees with the general thinking that perceptions are formed by commonsense reasoning, personal experience, social communication and cultural traditions (IRGC, 2006, p.31). Wolt and Peterson (2000) identified the role of available and understandable knowledge in defining a perception of risk as the lower the level of understanding the higher the influence of emotive factors. The perception of a particular risk is therefore dependent on how it is framed i.e. what factors are brought to bear in defining the problem.

Today's world presents a confusing array of new and emerging technologies at any given moment. Only a small minority of individuals in any society are sufficiently equipped to understand them and make any form of scientific assessments about their potential benefits and or costs. For the majority of society then the tools at their disposal i.e. experience of other similar technologies, information from various sources oftentimes with media reports being dominant, and intuition are brought to bear on navigating through the

plethora of risks associated with living in an increasingly technology dependent world.

A number of commentators have expressed some puzzlement about the reaction of industrialised societies towards risks. Americans apparently think that they face more risks today and that future risks will be even greater (Harris, 1980 in Slovic, 2000, p. 221). The notion of a 'zero-risk society' and its negative implications for societal progress cannot be ignored. A similar sense of fear and opposition to many new technologies is also evident in the UK.

2.1.1 How do we make decisions about risk?

Risk taking and risk avoiding behaviours may be partially explained by the variation in the sets of attributes that we use to make decisions. There are some schools of thought that argue that people are not risk averse but rather that they hate losing. Losses have more impact than gains thus provoking intense irrational risk-aversion. People are more sensitive to negative stimuli than to positive stimuli (Tversky in Bernstein, 1996, p. 274).

Research into the way people make decisions led two Israeli psychologists to develop a concept called Prospect Theory. The core of this concept is – performance does not improve or get worse indefinitely. People's behaviour shift about the average – sometimes its good and other times not, but when taken as a whole gives an average level of performance. In addition emotion and incomplete understanding of the problem negate people's ability for rational decision-making by creating 'cognitive difficulties'. To compensate for our shortcomings we use shortcuts based on a sampling of our experiences and 'gut feelings to arrive at our decisions (Bernstein, 1996, 270). Our decisions will therefore vary depending on the emotional and composite set of experiences brought to bear on the problem.

A number of interesting issues are raised by the above. Firstly, circumstances determine whether people will exhibit risk avoiding or risk taking behaviour. Secondly, there is a combination of influential factors at play – emotion, comprehension and experience. This leads to the following questions:

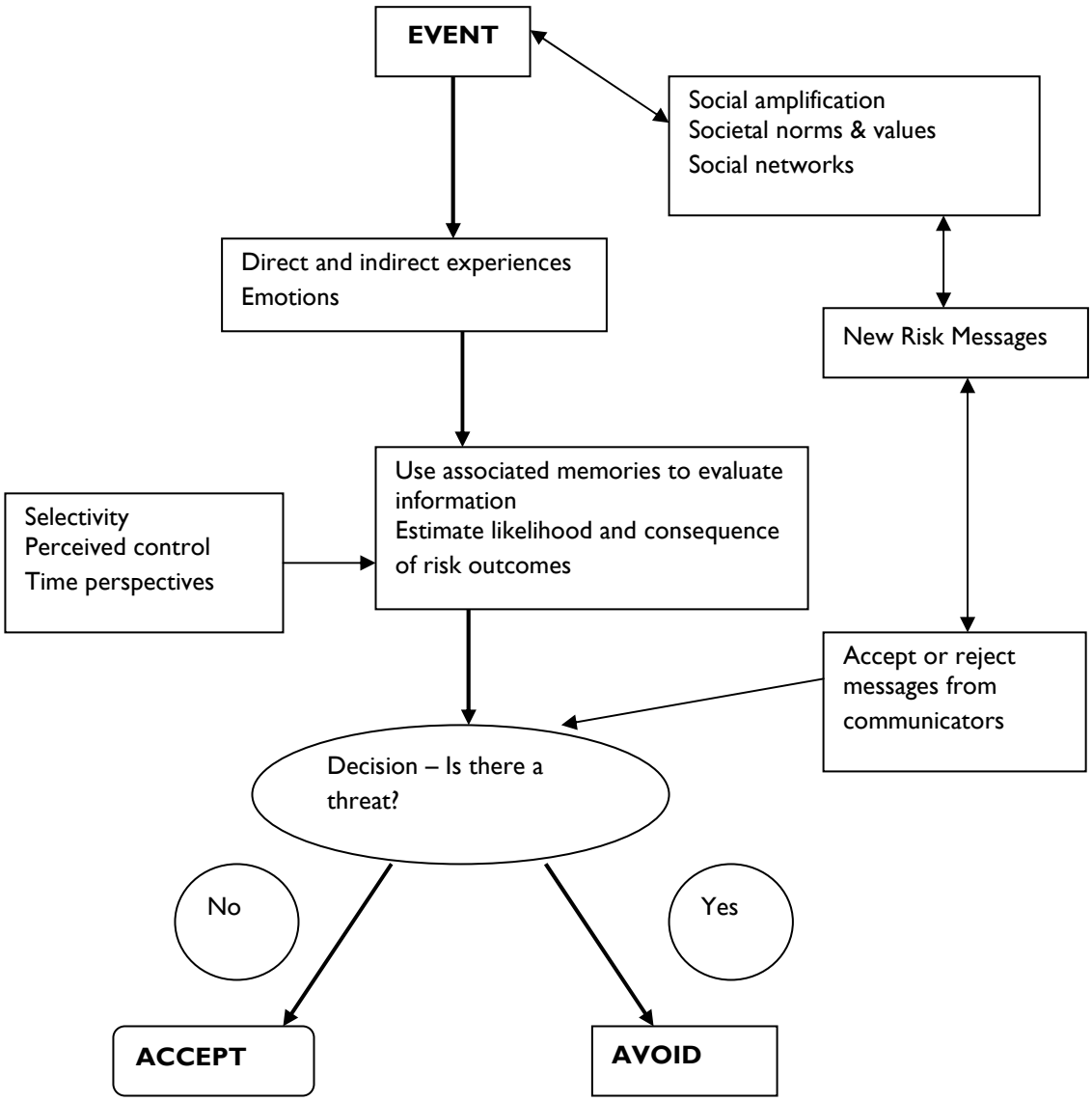
- Does having more information lead to more rational decisions about risk and does it increase the possibility of success?
- Is there ever enough information or can there be too much?

Psychological research indicates that there are circumstances when adding to the available information hinders rather than advances decision-making capabilities. Notwithstanding this finding the importance of information was identified on the basis of a phenomenon defined as 'ambiguity aversion' by Daniel Ellsberg. People prefer to take risks on the basis of what they know about the possibility of adverse outcomes rather than to take risks if they have no knowledge about the possible probabilities. A lack of knowledge about possible probabilities takes one into the realm of uncertainty. Ambiguity aversion is said to be driven by feelings of incompetence and operates during comparisons when choosing between prospects with clear probabilities and those with vague prospects (Tversky and

Fox in Bernstein, 1996). People exhibit this behaviour when decisions about comparative risks are to be made.

Eiser derived a flowchart that highlights the inputs that result in a decision to accept or avoid a particular risk. A simplified version is presented below to illustrate the general process.

Figure 3 Flowchart of processes involved in judging risk



Source: Adapted from Eiser, 2004, p.40

Even in this simplified format making decisions about risk is predicated on a collection of factors contained within the experience portfolio of the individual. Factors brought to bear on the risk being evaluated are selected from this portfolio and assimilated to arrive at a conclusion about its potential to affect and the degree of the effect on the individual. In the above scenario the role of communication is clearly identified as an influential factor in this process. Communicators to the public, in particular the media are clearly part of the risk matrix. The role of the media in influencing risk perception will be discussed in detail in section 2.3.1.

2.1.2 Types of risk

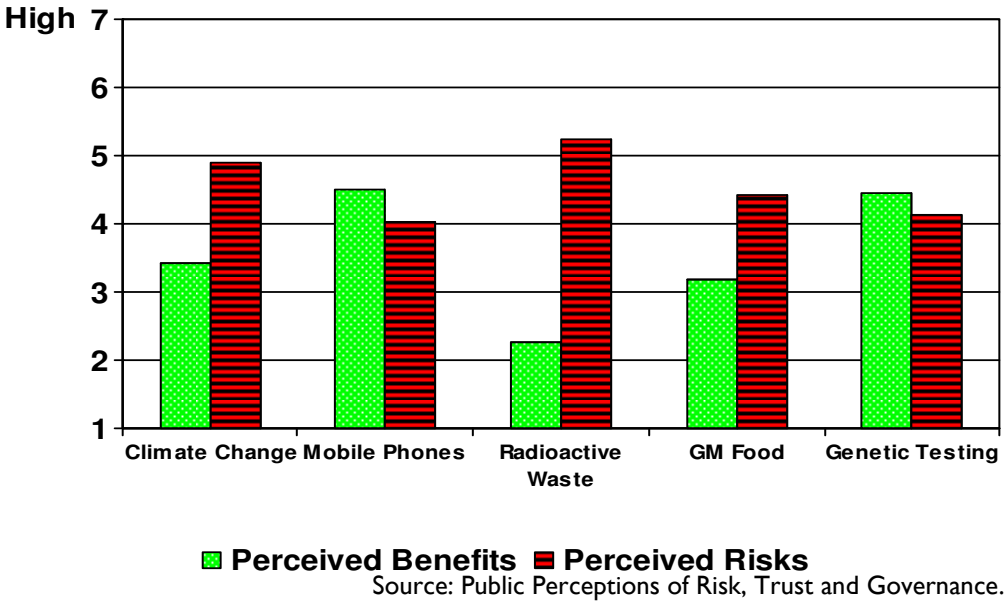
Risk is manifested as two broad types:

A) Individual - how individuals see the risk from a particular hazard affecting them and things they value personally.

B) Societal - the risks or threats from hazards which impact on society. Typical examples relate to nuclear power generation, railway travel, or the genetic modification of organisms (HSE, 2001, p.12).

A British survey of public perceptions of risk conducted by the Centre for Environmental Risk, University of East Anglia in conjunction with MORI in 2003 developed a rating system for a selection of personal and social issues. The findings indicated that personal issues were considered to be more important than issues such as climate change, radioactive waste and GM food. Over 85 percent of respondents said that health and family were very important personal issues compared with 76 percent who thought that law and order was a very important social issue. Only 53 percent saw radioactive waste as a very important issue.

The study looked at perceptions of the risks and benefits associated with five risk issues – climate change, mobile phones, radioactive waste, GM food and genetic testing. The risks associated with radioactive wastes far outweighed its perceived benefits while the reverse was true for genetic testing where the possible benefits were viewed as being greater than the negative aspects associated with the technology. Confidence in the rules and regulations developed by the British government to manage each risk issue played a key role in the overall response. Public confidence in risk regulation was identified as low for these cases.



Source: Public Perceptions of Risk, Trust and Governance. 2003

Individual risks centre around health, personal safety, financial security and relationships. In 2003, disease accounted for 96.9 percent of all deaths in England and Wales with cancer and problems with the circulatory system being the two main causes, accounting for 64.3 percent.

Cause of Death

Cause	Number	%Total
Circulatory System	205,508	38.3%
Cancer	139,360	26.0%
Respiratory System	75,138	14.0%
Digestive System	24,948	4.7%
Nervous System	15,756	2.9%
Mental Disorders	14,846	2.8%
Other Diseases	43,741	8.2%
External Causes	16,693	3.1%
Total	535,990	100.0%

External causes were responsible for 3.1 percent or 16,693 deaths out of 535,000. Self-harm or suicide is the largest single contributor followed by transport accidents and falls. Surprisingly death due to human events such as murder and manslaughter account for only about 2,000 fatalities. Transport accidents accounted for only 0.55 percent of all deaths (Judge, 2005, p.6).

External Causes

Cause	Number	%Total
Transport	2,983	0.55%
Falls	2,732	0.51%
Fire/Water/Electricity/Exposure	1,244	0.23%
Other Accidents	3,937	0.73%
Self-Harm	3,270	0.61%
Human Event	2,092	0.39%
Medical Misadventure	435	0.08%
Total	16,693	3.10%

If external causes contribute less than 5 percent to annual death statistics why do some groups of incidents generate high levels of media interest? Transport accidents, suicides and murders make the national news regularly while events such as falls do not. Many journalists contend that the public are interested in these stories and they are filling this need. There are concerns in many quarters that the high profile of some of these stories have contributed to the perception that some types of risks are more pervasive than others. If you are more likely to take your life than to be murdered why is it that the media refuse to tackle the underlying issues that lead to suicide as a legitimate area of news?

2.2 Risk and Society

"…Zero risk is an unattainable ideal"

(Adams, 1995)

Societies guided by cultural values use their experiences and collective knowledge to define what sets of events and activities will be managed. Some risks are amplified while others are attenuated as exemplified by intense public reaction to gm technology or nuclear energy and to low level responses to smoking or the presence of substances with potential carcinogenic effects in food. This conundrum presents a difficulty for risk managers when developing balanced measures to deal with a wide variation in responses to risks.

When risk is amplified by society behavioural responses emerge that become manifest as 'secondary impacts' such as:

- Enduring mental perceptions, images and attitudes
- Impacts on business sales, property values and economic activity
- Political and social pressure
- Social disorder
- Changes in risk monitoring and regulation
- Increased liability and insurance costs
- Repercussions on other technologies (Kasperson et al., 2000, p.239).

Many commentators have remarked on the apparent intolerance of modern society for certain types of risks. Media campaigns such as the News of the World "name and shame" anti-paedophile campaign illustrate the intense public response that can be generated when certain risks are presented as being imminent and extreme. Campaigns run by other newspapers include the Daily Mail's anti–GM protest with misleading headlines such as Trials of GM crops bring new fears of 'Frankenstein' food, The Secret GM Trials, GM super-weed discovered in UK field and GM blunder contaminates Britain with mutant crops. These campaigns are said to be on behalf of the public and are aimed at eliciting government response, which in some cases are as extreme as demanding the banning of certain types of technologies.

2.2.1 How society manages risk and uncertainty

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. *(OECD, 2003)*

Society's efforts to handle risk have come mainly through the development of risk analysis protocols (Wint, 2004, p.36). Risk reduction has now developed into a high priority activity for governments and industry and has spawned an industry in its own right - the safety industry. Britain has a significant risk reduction industry covering diverse areas such as:

- Safety in the home
- Fire
- Casualty services
- Safety at play
- Safety at work
- Safety on the road.

These are in addition to the police force, security industry, insurance industry, environmental health officers, pollution inspectors, the National Health Service and safety and environmental pressure groups (Adams, 1995, p.31-32). Globalisation of many activities e.g. trade, financial markets and terrorism triggered the debate about developing international management systems capable of handling transboundary risks. Risk governance protocols will be discussed in Section 3.

2.2.2 Emerging Risks

New risks have evolved in tandem with global progress. The risks that occupy centre stage now will be augmented by new risks as well as changing manifestations of existing risks. Increased interconnectivity has made the world a smaller place in several respects. Risk events are broadcast almost instantaneously triggering reactions sometimes in advance of risk mitigation systems' ability to respond. Rapid declines in share prices on the major stock markets are well known examples of the immediacy of response to global risk events.

An interconnected world sees the highlighting of events happening in even the most remote parts of the planet. For some people this gives an impression of a world that is becoming increasingly dangerous even though in many instances the statistics prove that in some countries life has become safer. Foresighting experts assemble scenarios of the future to provide insights for policymakers and other professionals engaged in strategic planning for future development.

> ***A changing world***
> *1. World population – by 2050 estimated to increase from 6 billion to 9 billion. Practically all of the additional 3 billion people will live in cities*
> *2. Environment - climate change, water scarcity and reduction in biodiversity*
> *3. Technology. Will factors such as connectedness ultimately prove more useful to terrorists, or to those fighting terrorism?*
> *4. Changing socioeconomic forces.*
>
> *(OECD, 2003)*

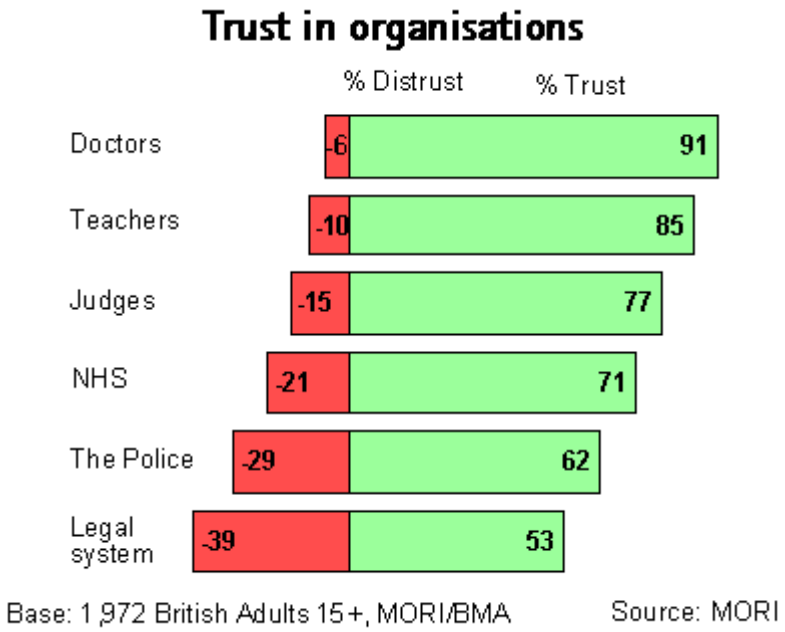
2.2.3 New and emerging complex technologies

Risks posed by this group of technologies appear to elicit shifts in public behaviour as it attempts to decide how to respond to them. The public

recognising its lack of knowledge to understand a new technology transfers authority to persons/bodies to make determinations of risk on its behalf e.g. nuclear energy, biotechnology, nanotechnology. Trust comes into play and may become a functional substitute for knowledge (Gaskell et al., 1998 in Wint, 2004, p. 32).The development of regulatory bodies engaged in identification, assessment, monitoring and management of risks is now a significant component of some national public sector management systems. Wynne (1992) thinks that the major issue is the level of trust and credibility that people are prepared to invest in those designated to act on their behalf. A network of counterbalancing individuals, groups and organisations oftentimes develop as a means of eliminating bias from the determination process e.g. think tanks, non-governmental organisations, special interest groups, concerned individuals, research bodies, business interest groups and parastatal bodies.

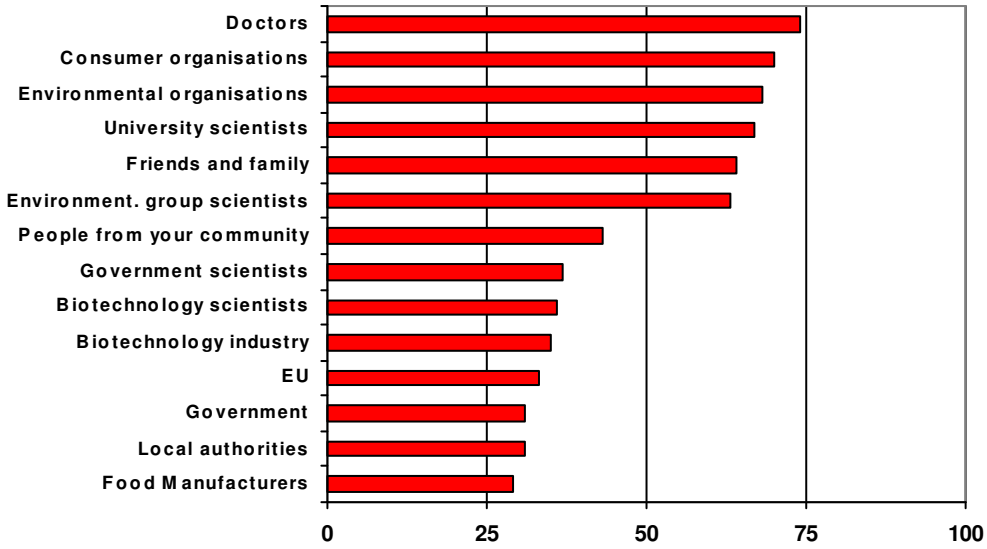
New and emerging technologies tend to be complex requiring specialist knowledge to understand how they are developed, how they work and the array of associated risks given varying levels of uncertainty. A relationship based on trust, in theory, between the public and its appointed officials should remove the worry from everyday life of the potential of harm when new innovations are brought into the public domain. The reality however is much different. Other players come into play and distort the relationship. Coming between the public and the risk regulators is a group of individuals/entities that sets itself up as an information filter. The ability of the media, advertisers and special interest groups to influence shifts in personal and societal risk behavioural patterns have been documented by many commentators.

Public scepticism has become apparent with people being less willing to accept government information especially in light of its track record with risk issues such as BSE. Marris et al. (1996) questioned who people would trust to tell them the truth about environmental risks and found that government was the least trusted at 6 percent. Family and friends received the highest trust ratings. MORI surveyed the British public to determine trust in organisations and found that doctors were the most trusted group and the legal system the least.



The Centre for Environmental Risk/MORI survey, 2003 tried to gauge trust levels for the five risk issues under study. The graph below illustrates the variation in trust across a cross-section of society with respect to GM food.

'To what extent would you trust each of the following …to tell the truth about GM Food?'



Source: Public Perceptions of Risk, Trust and Governance. 2003

Government and its associates are not seen as being trustworthy when compared with other groups. In general people seem to trust government and industry less than other groups. Scepticism about the information provided by government and its representatives is a contributory factor to the current divide between the public and risk regulators. The media has to some extent appeared to fill the information void for some sections of the public.

MORI also tracked over a 22 year period (1983 to 2005) the trust profiles of several professions to identify who the public look to for reliable information.

	Doctors %	TV presenters %	Civil Servants %	Journalists %	Politicians %	Gov. Ministers %
1983	82	63	25	19	18	16
1993	84	72	37	10	14	11
1997	86	74	36	15	15	12
1999	91	74	47	15	23	23
2000	87	73	47	15	20	21
2001	89	75	43	18	17	20
2002	91	71	45	13	19	20
2003	91	66	46	18	18	20
2004	92	70	51	20	22	23
2005	91	63	44	16	20	20

Source: MORI, 2006

A sample of the listed professions show that journalists, politicians and government ministers are least trusted and doctors once again enjoy the highest level of trust. In another poll conducted between 1999 and 2003, people were asked to rate how well doctors did their jobs. The results returned an average 88.3 percent confidence in doctors doing their job very well and well

corroborating the high levels of trust identified in the other studies (MORI, 2003). People draw a big distinction between journalists and TV presenters as they enjoy almost as high trust levels as doctors. If journalists enjoy such low levels of trust from the public are they capable of influencing opinions about risk issues?

2.3 Communicating Risk Information to the Public

Risk communication refers to the exchange of information, using various mechanisms, among interested parties about aspects of risk. Risk communication aims to:

a. Create trust and confidence in risk decision-making processes,
b. Ensure that experts and regulators discuss all relevant issues,
c. Engage stakeholders in two-way communication (DETR, 2000 in Wint, 2004, p. 49).

These assertions imply that even though societies appoint 'informed persons' to make determinations about risk on their behalf, the public need to be informed not just of the result but about the processes and the inputs used to arrive at the result, including their own contributions. The difficulties associated with communicating risk information effectively revolve around characteristics and limitations of science and perception and fall into four categories:

- scientific data about risks
- spokespersons in communicating information about risks
- the media in reporting information about risks
- the public in evaluating and interpreting risk information (Covello, 1998 in Wint, 2004, p.49)

Problems that compound the difficulties of communicating risk to the public include: lack of coordination among responsible bodies, different mandates and lack of clarity with respect to responsibility and authority, leading ultimately to a decline in public trust. Public trust in official bodies is undermined if the communication process does not make the issues more understandable, is inconsistent in both quality and frequency, and is not responsive to the needs of the public. (Wint, 2004, p.49-50)

Risk information is conveyed through a wide variety of channels. Peer reviewed journals provide detailed technical data and findings about scientific trials and new technologies to specialised audiences. Grey literature i.e. documents not published by commercial publishers such as reports, bulletins, factsheets, working papers etc. are sources of detailed information for a variety of specialist groups of the public. The most pervasive forms of information dissemination however are the media and word of mouth.

2.3.1 The Media

In the UK communicating risk issues to the public has come under increasing scrutiny over the last few years. A noted study *Risk, reporting and media influence* carried out by the King's Fund in 2003 concluded that 'sustained public debate' was needed to improve reporting of health risk issues. Several studies have

identified the media, in all its forms, as an influential player in the shaping of people's perceptions of risks. There is no direct measurement of this effect but the evidence suggests that:

- Some kinds of coverage make an impact on public behaviour
- Policy makers sometimes respond to media stories as a reflection of public opinion
- Government priorities and spending patterns influence media agendas (Coote, 2003, p.4 in Harrabin et al. 2003)

Given the ability to contribute to shaping risk perception the media should take cognisance of the effect on the public when news stories are inflated in the interest of competition. The triple MMR vaccine and its attendant risk of autism in children and human variant CJD are examples of distorted media reporting. Issues about accuracy arise as a result of the thirst for new and/or bigger scare stories to grab public attention. Also the power of evocative imagery and sensational headlines contribute to the perception of risk.

Certain health issues appear not to excite the media. According to the King's Fund report issues with small or unproven risks receive significantly more media coverage than major risks such as obesity and mental health problems. Even though mental health issues affected many people very little coverage was given by the media and when it was covered the reporting was likely to be negative (Harrabin et al, 2003, p.8,15).

Ben Goldacre, author of the Bad Science column in the Saturday Guardian thinks that the media are not the only guilty ones when it comes to publication bias. Academics are just as guilty in the filtering out certain types of studies from scientific journals. Negative studies for example of drug trials that fail do not get prominence in major journals. Instead they are quietly shelved. Manipulating information is certainly not the exclusive domain of the media as scientific studies can be carefully crafted to give prominence to any positive findings (Goldacre, 2006). Both communities are guilty of inflating news to gain attention.

Several reports have come out in the last year about the increased risk of a heart attack in those taking Ibuprofen, a pain killer, for arthritis. Medical News Today reported that:

> *Ibuprofen and other commonly used painkillers for treating inflammation may increase the risk of heart attack, says a study in this week's BMJ.*
>
> *Patients should not stop taking the drugs involved - non-steroidal anti-inflammatory drugs (NSAIDS) - but further investigation into these treatments is needed, say the authors.*

The most significant findings were for the drugs ibuprofen, diclofenac and rofecoxib, say the authors. In terms of "numbers needed to harm" in the 65 and over age group, for those taking diclofenac, one extra patient for every 521 patients was likely to suffer a first-time heart attack. For rofecoxib the figure was one patient for every 695 patients; and for ibuprofen one patient for every 1005 patients was at risk.

In contrast other reports emphasised the risk by making claims like:

A study by British researchers suggests regular use of the drug increases the chances of an attack by almost a quarter.

Other painkillers in the same family of anti- inflammatory drugs - used by millions of arthritis patients - are even more hazardous, raising the risk by up to 55 per cent, according to the study.

Daily Mail, 2005

The article continued by saying that

Millions of men and women take ibuprofen regularly, many having turned to it as an apparently safer alternative after the Cox-2s scare.

It is prescribed to many of Britain's eight million arthritis victims, who may take up to eight tablets a day totalling 2,400mg.

Daily Mail, 2005

No effort is made to translate the percentage change in risk attributed to the drug into absolute figures, as in the first article, leaving an impression that this risk directly relates to a pool of up to eight million people.

The Daily Mirror used the following headline to tell its version of the story:

IBUPROFEN CAN RAISE YOUR RISK OF HEART ATTACK BY 100%

Goldacre, in analysing the reporting of the Ibuprofen story wrote:

Risky business: Health-scare stories often arise because their authors simply don't understand numbers

Saturday Guardian

He noted that most of the newspapers with the exception of the Daily Telegraph and the Evening Standard reported the increased risk in terms of percentages rather than in frequencies so an increase of 24 percent in this study translates to an increased risk of one in 1,005 people. People instinctively understand what this means in terms of the potential consequence of the specific risk to the population. If people understand risks when defined in this manner, why do journalists report in percentage terms?

Several studies have documented the inadequacy of journalists in handling statistical information when simplifying technical information into everyday

language. Specialist health and scientific journalists were generally viewed in a more positive light than editors who have a tendency to sensationalise elements of stories for grabbing headlines. Inflating health risks is a commonly used example of both confusing scientific findings and unproven risks. Distortions in information about health issues is generally agreed to have the potential to make people more fearful and develop less trust in public authorities. (Harrabin and Allen, 2003, p.8)

The media are in the business of creating news mainly for commercial gain. Increased competition from new and emerging forms of information dissemination such as the internet, email and blogs have altered the time frames for winning the scoop race. Leading media professionals recognise that newspapers in particular have to be innovative to compete in a rapidly evolving technological environment that enables global news to be available almost instantaneously. A part of the survival strategy for some appears to be to appeal to an apparent public appetite for sensational and salacious reporting. Providing balanced factual information about mundane but important issues such as the dangers of smoking and alcohol abuse become secondary unless they can be incorporated into stories like George Best's fight with alcoholism. Mass coverage of the issue died with him.

Notwithstanding the need for strategies to maintain market share many commentators are calling for the media to acknowledge the influential role that they have in shaping public opinion. A more responsible treatment of risk issues would contribute to tempering the aversion to risks expressed by some sections of the UK society. A key part of the RSA Risk Commission's work programme is to develop a communications strategy aimed at contributing to balancing the national perceptions about risk.

3. Managing Risk

3.1 Risk Governance

Risk governance is about developing comprehensive strategies to manage risks. An underlying premise to international risk governance is the notion that in an interconnected world risks can have far reaching effects and therefore should be addressed in an integrated framework. Risk governance seeks to develop coordinated mechanisms that are capable of responding to major societal challenges by compensating for the variation in capabilities of the various stakeholders. A number of international bodies have considered aspects of risk governance.

3.1.1 Identifying Global Risks

The World Economic Forum under its Global Risk Programme has published two reports:

- Global Risks to the Business Environment (2005)
- Global Risks 2006

The first report looks at global risks that are not specific to business that are likely to have an effect on the corporate world. It identifies 36 global risks under four categories – economic, geopolitical, societal and environmental. The ten risks most likely to affect business were identified as:

- Instability in Iraq
- Terrorism
- Emerging fiscal crises
- Disruption in oil supplies
- Radical Islam
- Sudden decline in China's growth
- Pandemics – infectious diseases
- Climate change
- Weapons of mass destruction
- Unrestrained migration and related tensions

The second report highlights the need for collaborative approaches given the complexities associated with global risks. Effective mitigation of global risks requires sophisticated strategies to be developed through both public and private sector initiatives. The work of the World Health Organisation in coordinating global health risk programmes is a noted example of global risk management. International risk mitigation strategies are however hampered by divergent perceptions of risks and differing agendas. Amplification of risks through a lack of information or misinformation can contribute to the amplification of risk fears leading to 'infodemics' which may have equally serious impacts as the risks themselves (World Economic Forum, 2006, p.7).

Global risk management require collaborative partnerships among governments, businesses and international institutions. At the core of the global risk system are the following;

- Insurance
- Financial instruments
- Business continuity planning
- Private sector enterprise risk management
- Government action

All these groups have to act within collaborative mechanisms that enable holistic treatment of the problem. Key to the success of such networks is the effectiveness of the flow of information among the members. The key elements are:

- Surveillance of threats
- Dissemination of information to enable quick response
- Early warning systems
- Risk information systems
- Exchange of information about best practice (World Economic Forum, 2006, p.11)

3.1.2. Risk governance frameworks

The IRGC has developed a white paper on risk governance which proposes a Risk Governance Framework aimed at improving the management of risks that have international implications. This proposed framework attempts to integrate the scientific, economic, social and cultural aspects as well as stakeholder inputs. Within this framework the contextual underpinnings of risk are taken into account.

The IRGC proposes the inclusion of two components into this framework; the societal context and a new categorisation of risk-related knowledge. Inclusion of society into this model it is argued will take cognisance of the differences in perception of risk and concerns regarding the potential consequences by the different sectors of society. The proposed framework is an attempt at bringing together the quantitative and qualitative dimensions of risk.

3.1.3 Risk Reduction Initiatives

The United Nations produced two reports in 2004:

- Reducing Disaster Risk: A Challenge for Development (UNDP, 2004)
- Living with Risk – A global review of disaster reduction initiatives (UN, 2004)

Emphasis is on risks due to the effects of natural phenomena on humans. The impact of natural disasters on human populations is of increasing concern to governments as global population growth is increasing the sizes of the urban centres. Future megacities such as Tokyo, Sao Paolo, Mumbai and Jakarta are already places with high risk potential due to earthquakes, volcanoes and tsunamis. The consequences of any of these events occurring on a major scale, in terms of fatalities, are of a magnitude that is difficult for ordinary members of the public to comprehend.

3.1.4 National Governance Initiatives

The United Kingdom through the Prime Minister's Strategy Unit embarked on a project in 2001to develop a national framework for understanding risk; clarification of how risks can be managed and by whom; proposals for organisational coherence; and proposals for managing culture change. The failure of several initiatives and lack of public trust in government's handling of some safety issues prompted the self examination. The framework was developed on the premise that:

> *Governments have always had a critical role in protecting their citizens from risks. But handling risk has become more central to the work of government in recent years. The key factors include: addressing difficulties in handling risks to the public; recognition of the importance of early risk identification in policy development; risk management in programmes and projects; and complex issues of risk transfer to and from the private sector.*
>
> *(Prime Minister's Strategy Unit, 2002, p .4)*

The report defines three clear roles for government in managing risk:

- Regulator - setting the rules of the game
- Steward - to provide protection or mitigate the consequences
- Service provider - the identification and management of risks.

The risk issues that government has oversight over fall into two main categories, risks to the public and to the delivery of government business.

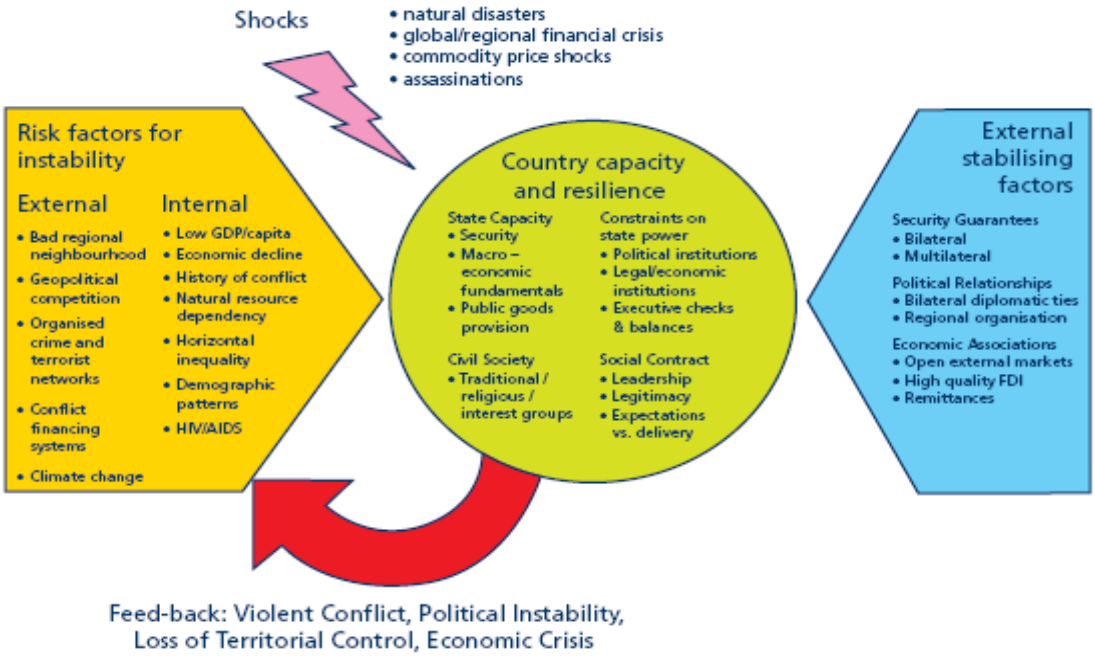
Following on this work, a strategic audit conducted by the Prime Minister's Strategy Unit in 2003 identified "…the need to improve the effectiveness of prevention in countries at risk of instability as an area requiring increased strategic focus." The audit highlighted the interconnections that exist between global threats such as poverty, human rights, terrorism and energy security and UK national priorities. Managing these priorities effectively could only be achieved by reducing global instability. Interdependence is one of the key characteristics of this global strategy in that events occurring elsewhere, which are seemingly far removed, have the ability to affect national stability.

Some key points of the report:

- Prevention is fundamentally about effective management of risks of instability to reduce the occurrence of crisis.
- More effective international responses to reduce risks of instability – and thereby prevent crises – are possible.
- Political transition and rapid economic development can both increase risks of instability.
- International responses should revolve around four complementary areas:
    - Invest in stability
    - Align Incentives
    - Increase International Responsibility
    - Improve Response to Crises

The UK government has defined the dynamics of national stability including the elements that undermine it. Crises are often the result of instability. At the heart of this framework is the reduction of the risk of crises developing to undermine statehood. Prevention is the key element in this framework.

A subsequent report published in 2005 set out graphically the UK risk landscape and is reproduced below:

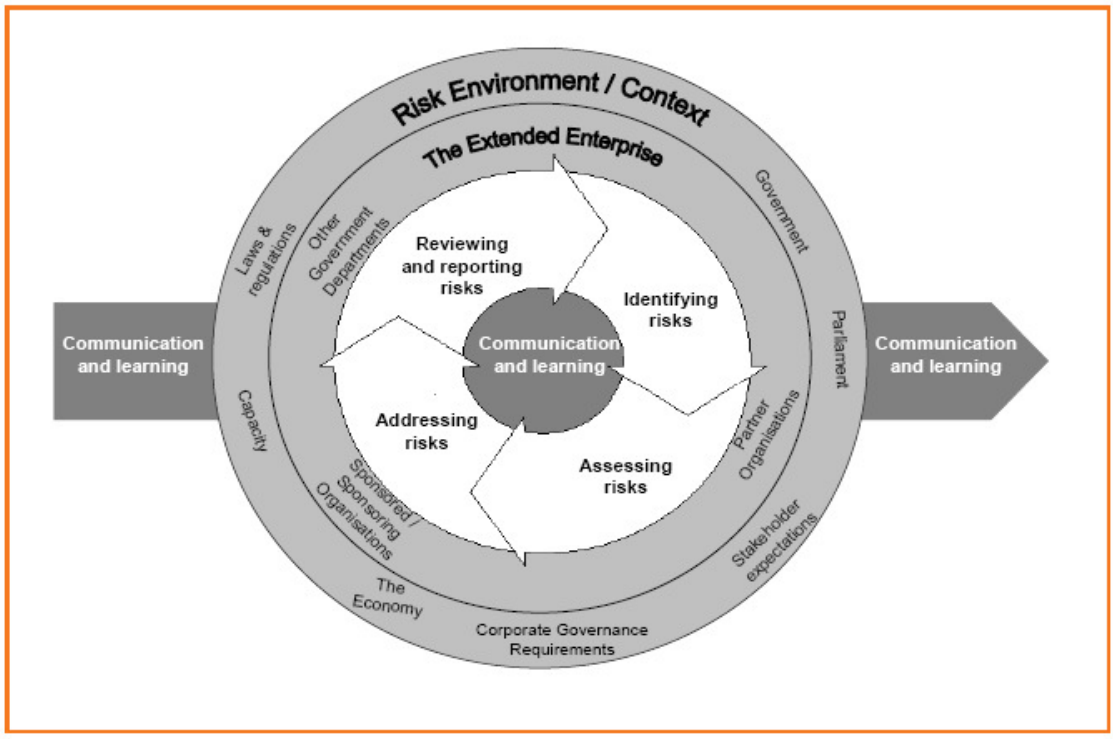


Source: A Prime Minister's Strategy Unit Report to The Government, February 2005

As far as government is concerned national stability has to be maintained within a context framed by a combination of external and internal competing factors. The UK risk landscape brings into sharp relief the wide array of risk issues that national risk management strategies have to take cognisance. The figure illustrates clearly the influence of external factors on national wellbeing. National strategies must incorporate explicit methodologies to work with international partners to manage transnational risks. The national risk management model described in the section below is framed within this risk landscape.

3.2 Some Risk Management Models

UK Government - Risk Management Model



Source: The Orange Book, 2004

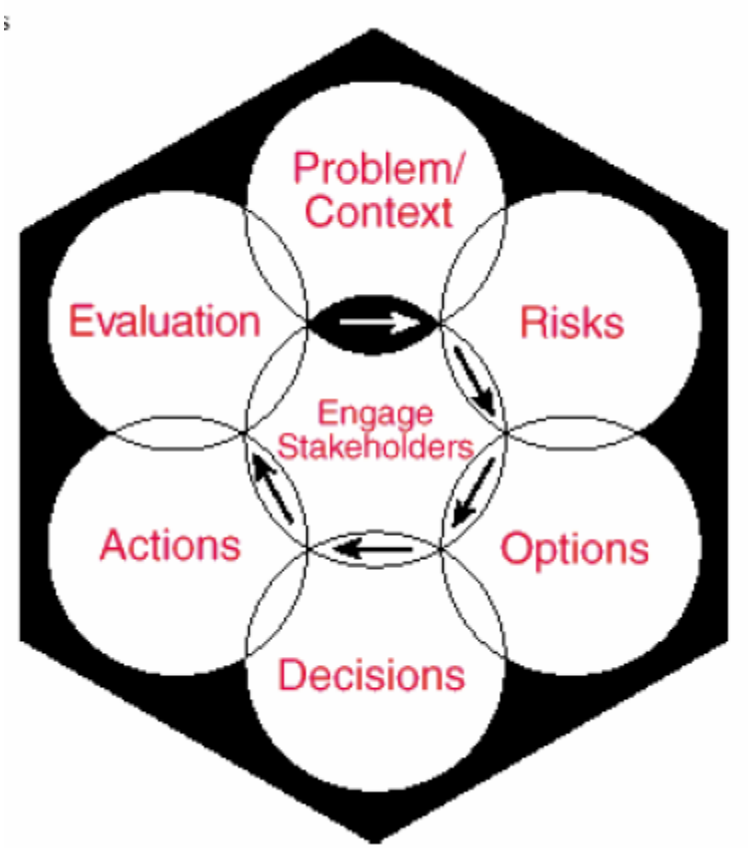
The Risk Management Model builds on the findings of an earlier report completed in 2002 " Risk – improving government's capability to handle risk and uncertainty". The model is based on the notion that risk is not linear but a balancing of interacting elements. A key element of this concept is that the elements need to be in balance for effective risk management and specific risks should be addressed in terms of its connectivity with other risks and possible solutions. As a result the management of specific risks cannot be undertaken effectively in isolation. Risk management occurs within a context within which several processes are occurring in tandem. Underpinning the model is communication and learning, key factors in connecting the phases of the risk management process, the network of entities that are relevant to the process and the national risk context.

The US risk model derived from the framework developed for environmental risk management also conforms to the notion of a set of interconnected components contributing to the identification, assessment and management of risks. While the UK model is explicit about the role and importance of

communication and learning to the risk management process the US model does not. The UK model incorporates the framing parameters that define the context within which the risks are been analysed and managed. In so doing the UK government is acknowledging that a risk management framework requires giving prominence to the broader contextual factors as well as the technical measurement processes.

The US version of a risk management model concentrates on the direct inputs and does not make explicit reference to the contextual factors that frame it. The importance of contextual issues such as societal and economic factors are discussed but not used to frame the graphical depiction below. The reasoning behind the framework however does state that one of its aims is to "Emphasize the importance of collaboration, communication, and negotiation among stakeholders so that public values can influence risk management strategies" (US Presidential/Congressional Report, 1997, p.5).

US Framework for Risk Management



Source: US Presidential/Congressional Report, 1997

The US Office of Management and Budget (OMB) and the Office of Science and Technology Policy released a 'Proposed Risk Assessment Bulletin' in early 2006 which outlines technical guidelines for federal risk assessment programmes. Its aim is to improve technical quality and objectivity.

As highlighted above there are differing perspectives on how the risk management process should be depicted but the broad societal underpinnings that influence and define risks are gaining currency among policymakers.

3.3 Analysing Risk

The examples below illustrate the variation in the definition of risk analysis with, for example, The Codex Alimentarius Commission for international food standards speaking of three components and the FAO of four components. Risk communication is explicitly identified as a component of risk analysis in two instances highlighting the importance of information transfer among stakeholders. It is generally agreed among risk professionals that assessment of a specific risk, methodologies for its mitigation or prevention and communication mechanisms are key components of any risk framework.

Table 6 Examples of Definitions of Risk Analysis

A systematic use of available information to determine how often specified events may occur and the magnitude of their consequences. (Aus/NZ Standard)
A process consisting of three components: risk assessment, risk management and risk communication. (Codex Alimentarius)
A process comprising four components: hazard identification, risk assessment, risk management and risk communication. (FAO-EMPRES)
A detailed examination including risk assessment, risk evaluation, and risk management alternatives, performed to understand the nature of unwanted, negative consequences to human life, health, property, or the environment; an analytical process to provide information regarding undesirable events; the process of quantification of the probabilities and expected consequences for identified risks. (Society for Risk Analysis)

(Source: IRGC, 2006, p.23)

Hazard identification has been explicitly set as the first part of the risk process by one body above. To some this may appear to be an obvious requirement and therefore not requiring to be defined as a separate step. For many organisations defining the hazard is an integral part of the risk assessment step.

3.3.1 Risk Assessment

Risk assessment has several uses. It can be used at the policy level to enhance priority setting agendas, as part of the system for managing risks or part of government strategies aimed at informing the public. Risk assessment uses a variety of systematic processes based largely on the use of probability methodologies. Various techniques have been developed in several disciplines of which the most notable are medicine, engineering, toxicology, statistics and economics. Examples of types of risk assessment include:

- Actuarial analysis
- Dose-response analysis
- Infectious disease and epidemic modelling
- Failure analysis of physical structures (USOMB, 2006, p.3-7)

Risk assessment is defined by Renn (2000) as the scientific process of identifying unwanted consequences (and their causes) and calculating their probabilities and magnitude.

The assessment of risk occurs when a specific hazard has been identified and deemed to have the potential to have an adverse impact. Some common features of risk assessment are:

- Identification and estimation of hazard
- Assessment of exposure
- Estimation of risk – combines the likelihood and the severity of the consequences (IRGC, 2006)

Risk assessment is said to be faced with three major challenges - complexity, uncertainty and ambiguity (IRGC, 2006, p.29). Renn identified the common features of risk assessments as:

- *Relative frequencies are used as a means to express probabilities*
- *The undesired effects are confined to physical harm to humans and the ecosystems, thus excluding social and cultural impacts*
- *Probabilities and the magnitude of adverse effects are multiplied.*

(Renn, 2000)

Once assessed risks are evaluated to determine whether they are:

- low level
- intermediate
- intolerable

Low level risks are characterised by a low level of uncertainty about the potential for damage and the probability of occurrence. Intermediate and intolerable risks are those that are characterised by high levels of uncertainty, major disagreement over benefits and there is room for improving safety. Intolerable risks are those that are deemed to be disastrous so abandonment is a logical course of action. Intermediate and some intolerable risks are usually subjected to treatments that are geared at reducing their impacts with the ultimate aim of making them eventually acceptable. (Renn, 2000)

3.3.2 Risk Management

Strategies used to manage risks can be grouped according to the level of knowledge and uncertainty associated with a specific risk. Renn uses three categories to define the types of strategic approaches:

- Risk-based management
- Precaution-based management
- Discourse-based management

The first case is dependent on the scientific assessment of probabilities and is the classic example of risk management. The second case covers incidents where there is a high degree of uncertainty requiring methodologies such as more research, contained experimentation and ongoing monitoring to be employed (Renn, 2000). Many risk regulatory frameworks work on this premise under the ALARP (As Low As Reasonably Practicable) principle where risks are reduced to as low levels as possible within the contexts of balancing costs and benefits. The ongoing debate about GM crops is an excellent example of this strategy being

played out. In the third case, political consensus, public participation, risk communication, trust and transparency are the hallmarks.

Conclusion

This overview of risk serves to highlight the major components of risk and the tensions surrounding its definition and management. These tensions are grounded in the subjective interpretations accorded to the concept of risk. This report does not seek to resolve the differences in opinion but rather to acknowledge the dichotomy and its influence over how risk regulatory and management systems have evolved. The difficulties experienced in bridging the divide between the narrow and broad interpretations of risk also contribute to an understanding of the complex nature of risk.

The perception of risk by society is oftentimes seemingly at odds with regulators. The RSA Risk Commission has undertaken the task of providing some insight into why the UK society in particular, is widely considered to be becoming more risk averse. By exploring the issues surrounding risk and the responses to risk this review sought to lay the groundwork for the programme of work outlined at the beginning of the document.

The proposed sector case studies, it is hoped, will provide practical insights into the workings of decision-making by lay people about issues of risk. These insights will provide the basis on which the findings and recommendations of the Risk Commission will be built and which will form the basis for its interventions into the risk debate.

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