



international risk
governance council

APPENDIX

IRGC GUIDELINES FOR EMERGING RISK GOVERNANCE

Guidance for the Governance
of Unfamiliar Risks

Abbreviations

BHAG	Big Hairy Audacious Goal
BMI	Body Mass Index
CEN	European Committee for Standardization
DG Sanco	Directorate General for Health and Food Safety
EC	European Commission
EFSA	European Food Safety Authority
ENISA	European Union Agency for Network and Information Security
ERG	Emerging risk governance
IRGC	International Risk Governance Council
OECD	Organisation for Economic Co-operation and Development
PESTLE	Political, economic, social, technological, legal and environmental
RIVM	Dutch National Institute for Public Health and the Environment
STEEP	Social, technological, economic, environmental and political
UK	United Kingdom
US	United States

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INTRODUCTION

The IRGC Guidelines for Emerging Risk Governance describe key steps and associated methodologies for early identification and management of emerging risks. The process, described in a separate report and illustrated in Figure 1 on the following page, covers an overarching, flexible and adaptable set of guidelines designed to deal with complex, evolving and uncertain environments.

The development of the IRGC Guidelines for Emerging Risk Governance was made at the intersection of various disciplines and theoretical frameworks. IRGC has integrated expertise from various fields in this project, including risk management, futures studies, innovation management, dynamic capabilities and strategic decision-making. These disciplines contribute to enrich the expertise of risk managers facing the challenges of dealing with new, emerging or ambiguous issues.

The guidelines also benefit from learning from experiences in various organisations that have developed and implemented their own guidelines for dealing with emerging risks.

This volume accompanies the IRGC Guidelines for Emerging Risk Governance. It comprises two sections, which form the evidence for the Guidelines. Section 1 reviews existing emerging risk governance frameworks, from the European Union Agency for Network and Information Security (ENISA), the European Food Safety Authority (EFSA), the Swiss Reinsurance Company (SONAR system), the CEN workshop agreement on managing emerging technology-related risks, and the Dutch framework for identifying and managing emerging risks involved in the use of chemicals. Section 2 provides theoretical foundations.

This appendix to the main report is intended for risk managers, researchers and a wide range of professionals whose interests relate to emerging risks and their governance, at the intersection of various disciplines.



Figure 2: Emerging risk governance and other disciplines

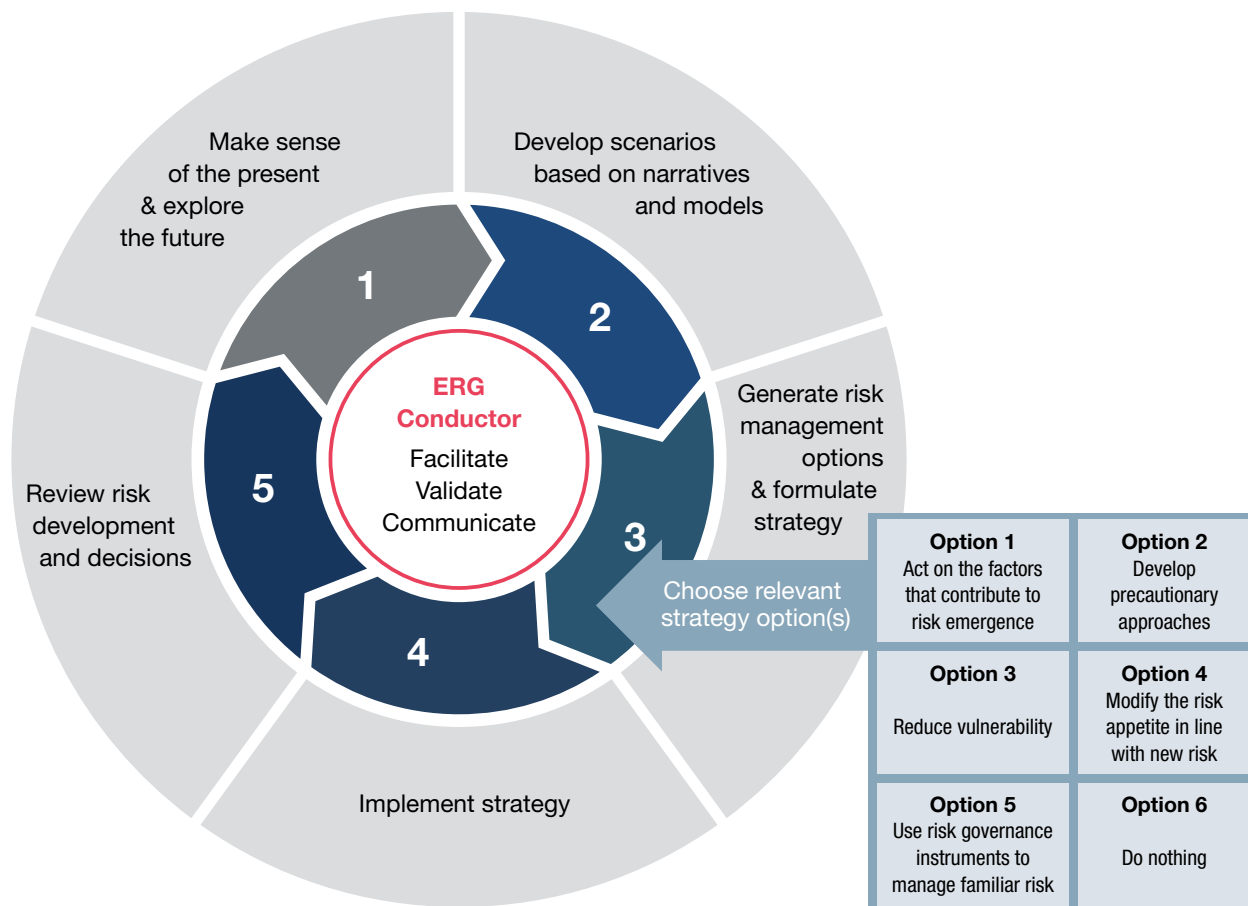


Figure 1: IRGC Guidelines for Emerging Risk Governance

1.

REVIEW OF EXISTING EMERGING RISK GOVERNANCE FRAMEWORKS

Practitioners and academics have developed various systems or frameworks to identify and deal with emerging risks. Although these initiatives are highly contingent on the decision-making context and the legal mandates of specific organisations, they provide an interesting perspective of the operational challenges and existing or suggested practices for emerging risk management.

Five frameworks and the decisional context in which they can be applied are described below. These descriptions are based on a series of interviews that IRGC conducted with practitioners in 2014.

1.1 Framework of the European Union Agency for Network and Information Security (ENISA)

Increased pervasiveness and interconnectivity are probably the two key trends in information and communication technology today, providing fertile ground for risk emergence. At the European level, the European Union Agency for Network and Information Security (ENISA) acts as a

central node for developing and disseminating good practice on emerging risks related to information technology.

In addition to a regular overview of emerging risks related to information technology, ENISA has elaborated and published a dedicated framework (Figure 3). The first phase (*information management*) addresses the collection of information on technology and process trends that could lead to risk emergence. *Topics selected* once a year undergo a call for scenario proposals, published by ENISA at the end of the year. Top-ranking proposals are then explored and a business case for each is proposed.

The aim of the *scenario-building and analysis* phase is to develop proposals that include a narrative describing the time frame, location, actors, technology and applications, data and drivers to be considered for each scenario. The narrative thus sets the stage for the *risk assessment* to be performed in the next phase. The findings of the assessment are then *reported* to key stakeholders for *promotion, dissemination and feedback*, and finally for *continuous improvement*.

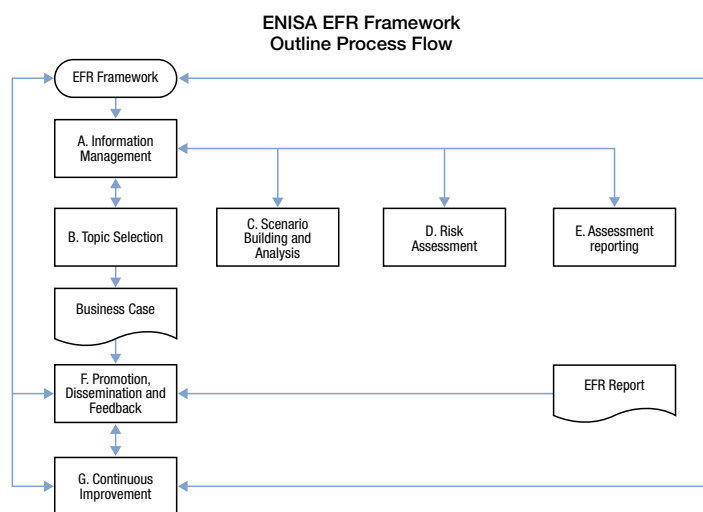


Figure 3: ENISA emerging and future risk framework
(Source: ENISA, 2010)

1.2 Framework of the European Food Safety Authority (EFSA)

The identification and characterisation of emerging risks related to food safety is one of the missions assigned by the European Commission (EC) to the European Food Safety Authority (EFSA) (Regulation EC 178/2002). Accordingly, an emerging risks unit was created with the mandate of identifying and characterising emerging risks. Once an emerging risk is evaluated as potentially affecting food safety in Europe, its complete assessment and management is the responsibility of the Health and Consumer Protection Directorate General (DG Sanco).

The EFSA emerging risk identification framework comprises three steps (see Figure 4 below).

A reflexive process based on external peer reviews was conducted in 2012 to evaluate the strengths and weaknesses of EFSA's practices and to suggest improve-

ments¹. As a result, the framework (described below) was improved as follows:

- Better selection of data sources: Instead of global and non-focused screening of all information sources performed in the previous framework, Step 1 now focuses on expert recommendations.
- Simplification and optimisation of the filtering process to select the most critical emerging issues from a large set of data.
- Increased coherence and scientific soundness of the filtering process.

The lessons learned by EFSA from implementing the emerging risk identification framework include:

- A focus on well-defined issues instead of vague threats, which decision-makers might tend to consider as not related to their objectives, is important.
- Decision-makers benefit from being involved throughout the process, to allow gradual familiarisation

Step 1 defines the “watch list” of issues that need to be further explored in the subsequent steps. The watch list is determined by experts and through exchanges with similar organisations.

Step 2 explores relevant data sources pertaining to the issues listed in Step 1. Here again, further prioritisation is determined according to the additional knowledge collected.

Step 3 provides decision-makers at the European level with a list and a description of emerging risks as well as recommendations for action. EFSA's experience in emerging risk identification and characterisation is particularly thorough.

1. Identification and prioritisation of emerging issues

Emerging issues are identified through information exchanges with relevant organisations, expert consultations, existing EU food safety regulations and EFSA-related activities on emerging risks.

Prioritisation is established based on EFSA's definition of emerging risk and other ad hoc criteria.

Output: List of “emerging issues” including drivers, megatrends, specific issues.

2. Identification of data sources and data collection

Focused monitoring and further filtering as well as information collecting on the emerging issues identified take place. Consultation with the EC, member states and stakeholders is advised.

Prioritisation is established based on the EFSA's definition of emerging risk and other ad hoc criteria.

Output: Preliminary report on emerging issues submitted to the scientific committee working group.

3. Final evaluation: Emerging risks identified and possible actions recommended

Output: Reports on specific emerging risks identified and an annual report on emerging risks.

Figure 4: EFSA emerging risk identification framework
(Source: EFSA, 2012)

¹ A detailed account of this process appears in an EFSA report available at www.efsa.europa.eu/fr/search/doc/243e.pdf

with issues that may initially appear unrealistic or disconnected from their own concerns.

- Detecting emerging issues is a complex task that requires important resources and expertise. Much time and effort can be wasted if the exercise does not focus on well-defined priorities.
- The public context in which EFSA operates makes it particularly pertinent (or difficult) to frame an issue as a risk. The framing of a given issue as a risk may trigger important media attention, and stakeholder reactions will likely be shaped by political and economic agendas.

1.3 The Swiss Re SONAR system

Emerging risk governance begins with the process of regularly revising an organisation’s portfolio of risks and opportunities. This involves scanning the environment and analysing the many signals and trends produced by early-warning systems. Risks can be business opportunities for insurance companies, for whom the ability to detect or anticipate developments in customers’ risk profiles can be a competitive advantage. Swiss Re, a major reinsurance company, has long invested in the field of emerging risk management, considering both the downside of risk (when an emerging issue may involve losses) and the upside (when an emerging issue may generate new business opportunities), as indicated in Figure 5 below.

SONAR (Systematic Observation of Notions Associated with Risks) is the overarching process used by Swiss Re’s Emerging Risk Unit to identify and characterise emer-

ging risks, as well as to evaluate their relevance for the insurance market. The process addresses the following questions: What emerging risks should Swiss Re consider? Can new insurance products be developed? Should existing products be reviewed? (Swiss Re, 2014). SONAR is a funnel-type process based on the sequential filtering of emerging issues (“perceived hazards”) according to a set of predefined criteria (see Figure 6 below).

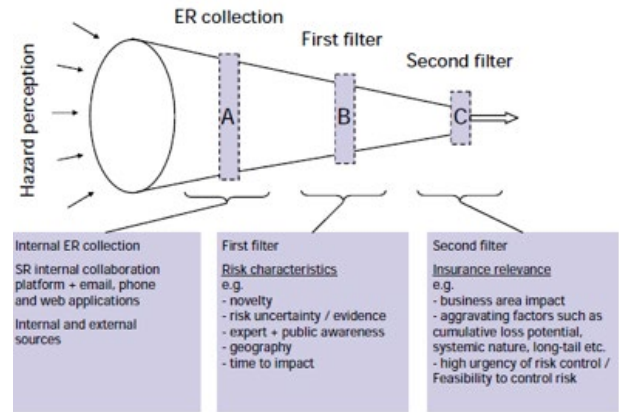


Figure 6: Description of the SONAR system (Source: Swiss Re, 2014)

SONAR initially collects perceived hazards, i.e. *notions* and signals that suggest emerging risks, through various complementary channels including:

- An extended internal and external collaboration platform involving Swiss Re employees and external experts.
- Various types of media outputs, especially those produced by the internet, social media, think tanks and scientific organisations.

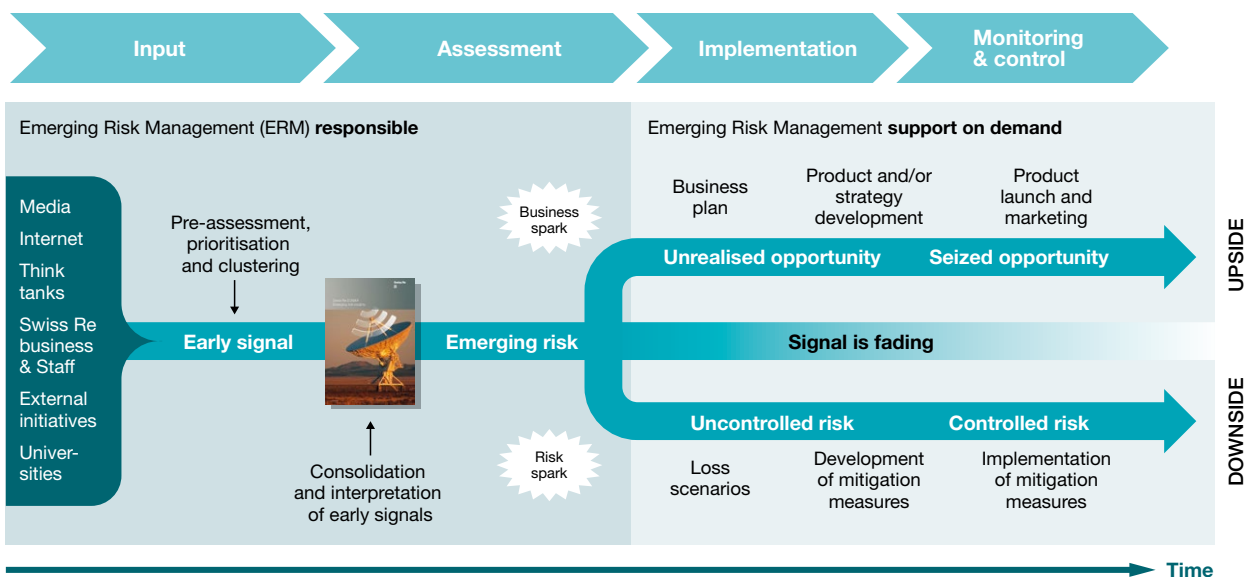


Figure 5: Swiss Re process for emerging risk management (Source: Schneider, 2014)

These notions are classified in five categories that cover sociopolitical, regulatory/legal, economic and financial, technological and environmental dimensions.

A first filter is applied, analysing the notions according to predefined characteristics:

- Novelty
- Uncertainty/evidence
- Expert judgment and public awareness
- Geography
- Time to impact

The outcome of this analysis is used to evaluate the importance of a notion and to determine whether it needs further exploration.

A second filter evaluates the notions' relevance for the insurance industry, according to criteria that include:

- Impacted business areas
- Cumulative loss potential
- Possibility to control the risk

After the filtering process, the Emerging Risk Unit writes narratives and stories to describe how the notions could unfold and become risks and/or opportunities. At this stage, it becomes the responsibility of a business area manager to analyse the emerging risk further and, if appropriate, to develop associated insurance products or modify insurance policies' terms of business and consider exclusion clauses.

Swiss Re's experience in dealing with emerging risk has also shed light on some key aspects to be considered in the IRGC guidelines:

- The need to manage expectations: Emerging risk governance should not be expected to predict future risks. More modestly, it should aim to closely monitor key developments.
- Swiss Re's experience is that operational risk managers should be involved in the early phases of the process to allow for a progres-

sive construction of a common understanding of the emerging risk. This supports their understanding of the relationship between the notions explored and future business activity.

- It is extremely difficult to show the effectiveness of a process for emerging risk management through the demonstration or estimation of avoided losses.

Each risk needs an "owner" to ensure that the required assessment and management actions are taken. Organisations should make sure that the inclusion of responsibilities related to emerging risk identification, assessment and management will not conflict with internal incentive and reward mechanisms.

1.4 CEN workshop agreement² on managing emerging technology-related risks (DIN CWA 16649)

iNTEg-Risk³ was a European Commission funded research project that developed a European framework to deal with emerging risks linked to new materials and technologies. One of the key project outcomes was the proposal of a framework for emerging risk governance, which provides the methodological basis for the CEN workshop agreement on emerging risk management. The whole process is based on the concept that emerging risks go through a maturation process. Accordingly, the

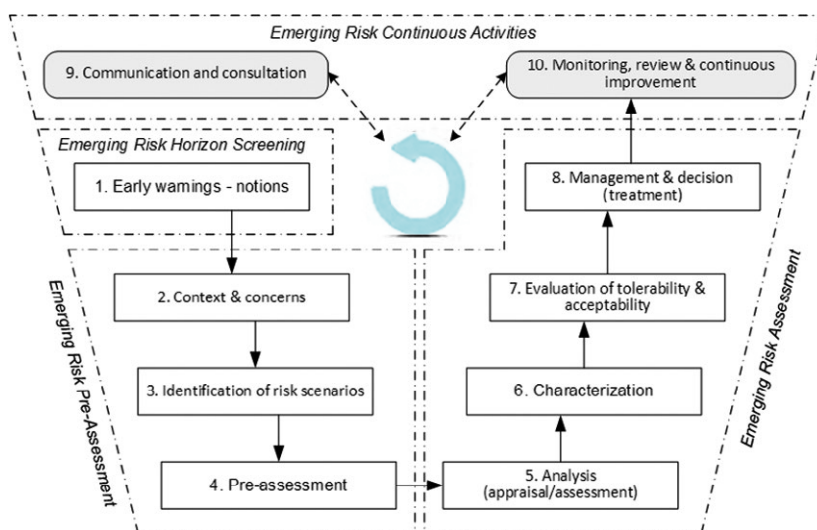


Figure 7: CEN emerging risk management framework (Source: DIN CWA 16649, 2013)

² CEN workshop agreements are reference documents elaborated under the supervision of the European Committee for Standardization (CEN). They are not, however, recognised as standards or norms.

³ www.integrisk.eu-vri.eu

various phases described above reflect how risk managers should confront the different stages of maturation.

At the beginning, only weak signals and vague notions may be available. Accordingly, organisations should develop horizon-scanning capabilities to collect and interpret weak signals and basic notions in a timely manner. The identified notions are investigated further in the emerging risk pre-assessment phase. Pre-assessment provides a global picture of the various perspectives on an emerging risk. It describes the key stakeholders who are potentially concerned and the variety of issues, if any, that are associated with this risk, and it gives an account of available knowledge on the cause-effect link. The output of this phase will set the stage for the next phase by determining the needs and purposes of risk assessment and treatment. Emerging risk assessment encompasses the more conventional phases⁴ of risk estimation, evaluation of tolerability and acceptability, and risk treatment.

to assess the existence and strength of the relationship between the chemical exposure and the consequences. Compared to EFSA's approach, which is based on targeted signal detection, RIVM adopts a larger, open horizon-scanning process.

Here again, not all the signals can be treated; prioritising is necessary. The various criteria used at this level include strength of the signals, related human and environmental

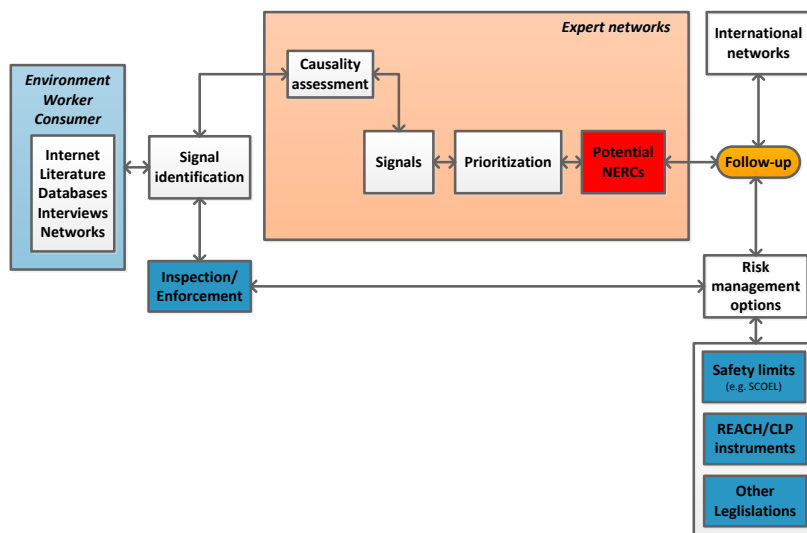


Figure 8: RIVM process for emerging risk identification and management (Source: Salverda, 2014)

1.5 Identifying and managing emerging risks involved in the use of chemicals – the Dutch framework

The Dutch National Institute for Public Health and the Environment (RIVM) is a public institution that, among other missions, supports authorities in the Netherlands in their task to identify and manage new and emerging risks related to chemical substances.

A dedicated framework has been set up, illustrated in Figure 8.

The inputs of the process are provided through signals collected from various sources (internet, literature, databases, interviews, epidemiological studies, etc.). These signals are then analysed according to expert judgments

risks and options for risk management measures, and social and ethical aspects.

The list of emerging risks will be examined at a later stage according to the most adapted management frameworks: derivation of standards or safety limits, enforcement and inspection, reliance on REACH/CLP Regulation (on classification, labelling and packaging) or any other existing regulatory framework.

⁴ With respect to ISO 31000 and IRGC risk management frameworks.

⁵ More information is available at www.rivm.nl/Onderwerpen/R/REACH/New_Emerging_Risks_of_Chemicals_NERCs

2.

THEORETICAL FOUNDATIONS AND ADDITIONAL COMMENTS

One goal of the IRGC emerging risk project is to highlight the many theoretical traditions and disciplines that can contribute to better understanding and managing emerging risks. This section proposes an overview of certain disciplines and theoretical frameworks which, in addition to risk analysis and governance, establish the scientific background of IRGC's guidelines. It provides:

- A review of some key concepts in the literature
- Examples of methodological approaches that apply some of the concepts and recommendations referred to in the main report

Readers are invited to use this section like an annotated bibliography, to provide further references for a comprehensive thinking about emerging risk governance.

2.1 Cultural theory of risk

In the context of emerging risk governance, risk taking can be analysed within the framework of the cultural theory of risk, that describes four major cultural categories to understand and judge risks and hazards. A group of distinguished anthropologists and cultural sociologists identified four value clusters that differentiate groups in society (Douglas & Wildavsky, 1982; Rayner, 1990; Thompson, Ellis, & Wildavsky, 1990; Schwarz & Thompson, 1990). These different groups have formed specific positions on risk topics and have developed corresponding attitudes and strategies. They differ in the degree of *group* cohesiveness (the extent to which someone identifies with a social group) and *grid* (the extent to which someone accepts and respects a formal system of hierarchy and procedural rules).

These four groups are the entrepreneurs, the egalitarians, the bureaucrats and atomised or stratified individuals.

They can be identified within a group-grid (Renn, 1995), and illustrated in Figure 9.

Organisations or social groups belonging to the *entrepreneur* group perceive risk taking as an opportunity to succeed in a competitive market and to pursue personal goals. They are characterised by low degrees of hierarchy and cohesion. They are risk prone and underestimate emerging threats before they become apparent. This group contrasts most with organisations or groups belonging to the *egalitarian* group, which emphasises co-operation and equality rather than competition and freedom. Egalitarians are also characterised by low hierarchy but have developed a strong sense of group cohesiveness and solidarity. When facing risks, they tend to focus on the long-term effects of human activity and are more likely to abandon an activity (even if they perceive it as beneficial to them) than to take chances. They are very fearful of emerging risks and may overestimate their impact. *Bureaucrats*, the third group, rely on rules and procedures to cope with uncertainty. They are both hierarchical and cohesive in their group

relations. As long as risks are managed by a capable institution, and coping strategies have been provided for all eventualities, there is no need to worry about risks. Bureaucrats believe in the effectiveness of organisational skills and practices and regard a problem as solved when a procedure to deal with its institutional management is put in place. As long as there is a protocol for dealing with an emerging risk, they believe they can handle it. *Atomised or stratified individuals*, the fourth group, principally believe in hierarchy but do not identify with the hierarchy to which they belong. These people trust only themselves, are often confused about risk issues, and are likely to take high risks for themselves, but oppose any risk they feel is imposed on them. At the same time, however, they see life as a lottery and are often unable to link harm to a concrete cause.

In addition to the four groups, there may be a hybrid group called *autonomous individuals* or hermits who can be categorised at the centre of the group-grid. Risk expert Michael Thompson (1980) describes autonomous individuals as self-centred hermits and short-term risk evaluators.

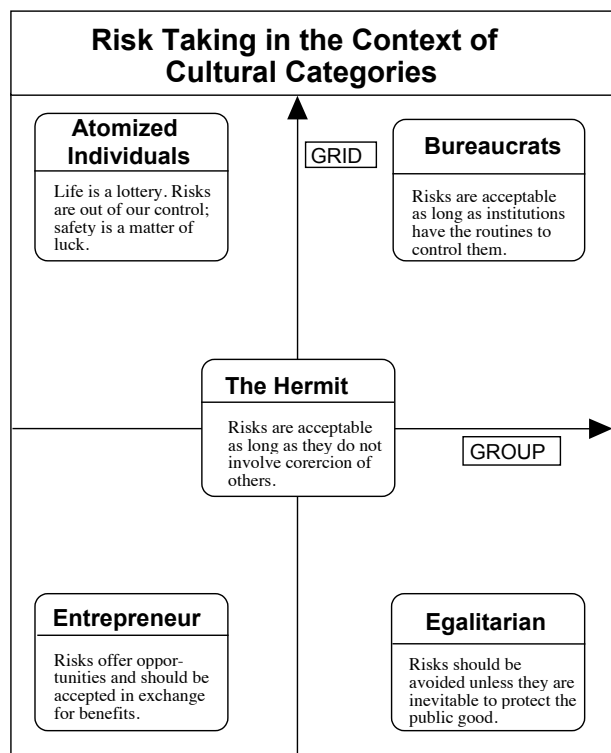


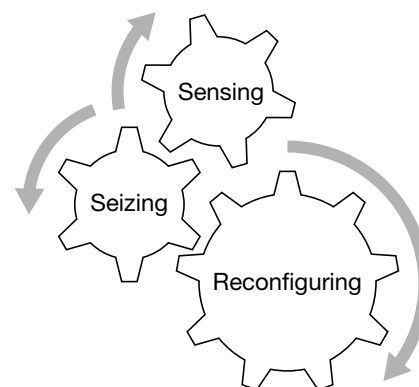
Figure 9: Patterns of value clusters
(Source: Renn, 1995)

2.2 Proactive thinking in management: Dynamic capabilities in strategic and innovation management

Emerging risk governance is not solely the concern of proactive management in organisations operating in complex and uncertain environments. Scientists and practitioners alike have developed concepts and practices to identify threats or seize business opportunities. For the sake of scientific and empirical validity, IRGC analysed how the notion of dynamic capabilities, an increasingly central concept in the fields of strategic management and innovation management, can provide useful input.

Dynamic capabilities of firms

Academic literature reporting on investigations into psychological and organisational levers through which organisations gain competitive advantages in fast-moving, uncertain and complex business environments (Teece, 2007; Ambrosini & Bowman, 2009) refers to dynamic capabilities as a firm's capacity to integrate, build and reconfigure internal and external resources and competences to address rapidly changing business environments (Teece, Pisano, & Shuen, 1997). Practically, this implies aligning and realigning the resources and competences of an organisation to its business environment (Katkalo, Pitelis, & Teece, 2010).



Among the large set of capabilities this literature identifies (Ambrosini & Bowman, 2009), three generic dynamic capabilities are particularly emphasised (Teece, 2007; Hodgkinson & Healey, 2011, 2014):

- *Sensing and shaping opportunities and threats* is about continuously scanning, interpreting and filtering existing and latent trends and developments

across technologies and markets of concern to the organisation.

- *Seizing opportunities* can be performed through reconfiguring an organisation's resources and incentives to best meet customers' needs and create value from new opportunities.
- *Reconfiguring assets and structures* to maintain competitiveness means the continuous process of aligning and realigning a firm's tangible and intangible assets to the evolving environment.

Innovation management

The purpose of innovation management is to detect innovative ideas early and explore and shape them to develop and deploy innovation. Innovation management is performed through frameworks (including the dynamic capabilities notion, outlined above) that acknowledge the need to:

- Constantly assess market trends, monitor technological innovations and make sense of these developments with respect to the organisation's specificities.
- Generate a large set of ideas among which the most promising are selected.
- Shape and transform these ideas into products and services that meet customers' needs.

Goffin and Mitchell (2010) present an example of an innovation management framework that meets these requirements. The process is structured according to the funnel-type model that allows organisations to progressively concentrate their resources on the most relevant ideas and innovation opportunities.

The distinct work and literature described above concur on certain managerial patterns suitable for proactive

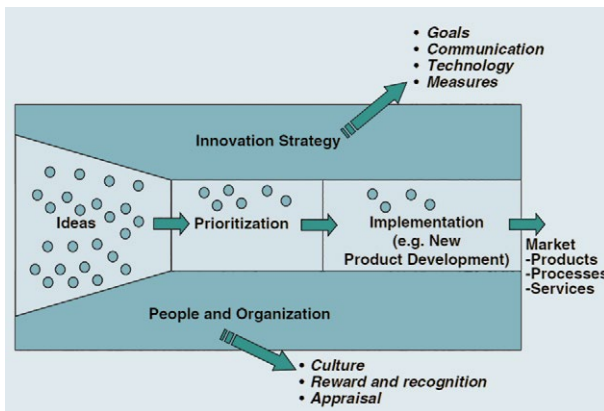


Figure 10: The innovation pentathlon framework (Source: Goffin & Mitchell, 2010)

management in highly complex and uncertain environments. Sensing, seizing, reconfiguring and providing support at the level of strategic management are recurrent requirements that IRGC took into account during the development of its guidelines for emerging risk governance.

2.3 The use of signals and early warnings in technology management

Identifying threats and opportunities (i.e. sensing) is a challenge for organisations facing competitive environments. However, analysis of existing processes indicates that:

- All organisations need to detect, analyse and prioritise threats and opportunities and put in place the corresponding capabilities and processes.
- Most sectors use the same general techniques and tools, and build upon similar individual and organisational capabilities. Emerging risk governance does not require inventing new concepts and tools. Efforts can build on existing mechanisms, adapting terminology and concepts.

Teece (2007) provides an example of existing frameworks that can be adapted for emerging risk governance (see Figure 11 below).

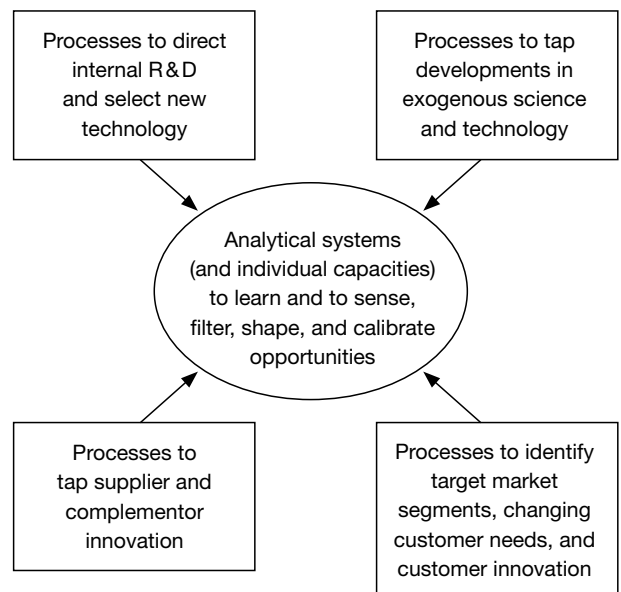


Figure 11: Elements of an ecosystem framework for "sensing" market and technological opportunities (Source: Teece, 2007)

In the same way that risks can arise from various types of developments and trends (technological, natural, societal, economic, etc.), technological opportunities may emerge from different dynamics: Advances in science and technology, changing customer needs, innovations in the supply chain or internal R&D. Accordingly, this ecosystem aims at detecting signals and early warnings by tapping processes that target different types of developments in the organisation's environment and making sense of them through filtering, shaping and calibrating its own capabilities.

2.4 Foresight and scenario development

Foresight approaches have broadened the scope of forecasting to include methods that build upon the collection, assessment and interpretation of information as well as methods to support decision-making (Cuhls, 2003). Foresight does not intend to identify *the* future (Dreyer & Stang, 2013). It is a reflection on possible leading trends in an attempt to provide guidance to decision-making. The future is not considered as a pre-existing situation, but as a construction that can be influenced by decisions and strategies. It is shaped by observed patterns of temporal or causal regularities, the sum of human decisions by individuals and social aggregates, as well as non-causal variability and unique events (Renn et al., 2013). Another key aspect of foresight activities is the dialogue process it triggers to combine various types of knowledge and visions and to build up informed representations of possible futures (van der Meulen, de Wilt, & Rutten, 2003).

Strategic foresight involves forward-looking approaches intended to identify future opportunities and risks (Rohrbeck, Arnold, & Heuer, 2007). Investing in and deploying foresight capabilities for emerging risk governance enable organisations to be more effective than those investing in reactive capabilities only. Various types of foresight approaches and techniques can be deployed, allowing organisations to tailor their investment level to available resources and goals. These approaches include scenario development, horizon scanning, expert workshops, benchmarking with peers, and the analysis of scientific and professional literature and reports on future threats

and opportunities regularly issued by agencies or consultancy companies.

For an introduction to futures studies, policy officials and analysts in government can consult "The Futures Toolkit, Tools for Strategic Futures for Policy-makers and Analysts", a publication prepared by the UK government. The toolkit was designed by the Horizon Scanning Programme team (a joint Cabinet Office and Government Office for Science initiative), with contributions from experts in government, academia, industry and non-governmental organisations. It provides a set of tools to help embed long-term strategic thinking within the policy process (UK Government, 2013)⁶.

Practitioners can also consider light and "repeatable" methods, such as morphological analysis, a general method for non-quantified modelling (Ritchey, 2013)⁷.

Scenario and narrative development: Methodology

Scenarios are widely used by organisations wishing to enhance their ability to deal with the inherently uncertain and complex character of their environment (Malaska, 1985; Healey & Hodgkinson, 2008). The benefits of these approaches range from considering uncertainty in strategic decision-making (Porter, 1985) to organisational learning (van der Heijden et al., 2002) and building a common understanding among participants (Mannermaa, 1986).

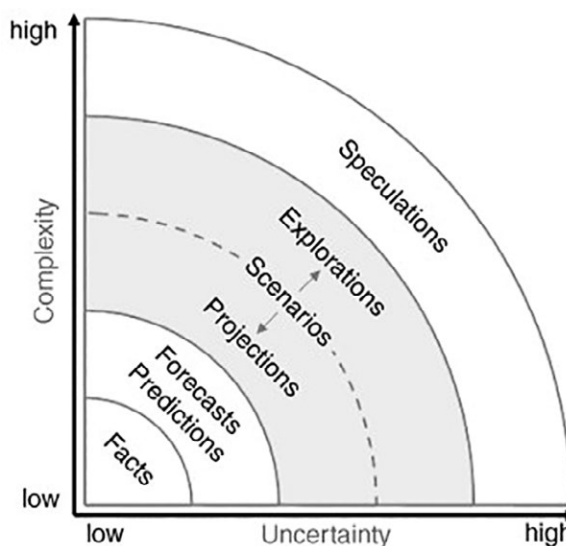


Figure 12: Scenario-based approaches in dealing with uncertainty and complexity (Source: Zurek & Henrichs, 2007)

⁶ A beta version of the toolkit (as of 5 March 2015) is available at www.gov.uk/government/uploads/system/uploads/attachment_data/file/328069/Futures_Toolkit_beta.pdf.

⁷ See www.swemorph.com/ma.html for more details.

It should be noted that scenarios are sometimes described as controlled speculation (Swierstra & Keulartz, 2011) or disciplined imagination (Wilkinson, 2011) as they represent a balanced and rigorous approach that avoids an exclusive reliance on facts, on the one hand, and pure speculation, on the other hand (see Figure 12). As a reminder, scenarios are not meant to predict the future but to provide an understanding of ongoing dynamics and to improve coping skills.

There is no unique scenario development method (Kosow & Gassner, 2008). A variety of approaches, techniques and workshop designs can be used to elaborate scenarios. For example, readers can refer to work about scenario planning in industry (Schoemaker, 1995), scenario development for environmental decision-making (Alcamo & Henrichs, 2008) and sustainability (Mangalagiu, Wilkinson, & Selsky, 2011).

Quick guidelines to develop scenarios and narratives for emerging risk governance

Phase 1: Representation of the initial situation and key parameters

The analysis of known or identified threats and opportunities is the main input for the first phase. Past dynamics, existing signals and identified factors of change or levels of awareness in society are gathered as descriptive elements of the current situation.

Based on these inputs, initial hypotheses and narrative choices can be made, especially with regard to:

- Time horizon to be considered: Short, medium or long term
- Geographical scope: Local, regional, national, international
- Scenario scale, ranging from the contextual (environment or macro) to the transactional (meso) or to the exclusive focus on the organisation (micro) (van Notten, 2006)
- Level of detail, which must match the expectations and support requested by decision-makers.

Given the importance of these initial hypotheses for the following phases of the scenario-building exercise, a validation phase involving decision-makers is highly recommended.

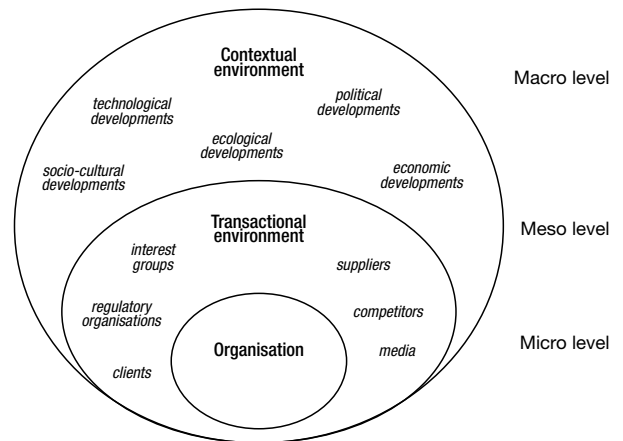


Figure 13: Scenario scales
(Source: van Notten, 2006)

Phase 2: Identification of the key factors

Driving factors (also called drivers of change or trends) designate the variables and determinants of the pattern(s) of evolution that will determine the characteristics of each scenario. Most organisations use STEEP factors (social, technological, economic, environmental and political)⁸.

In practice, when first analysing the current state of threats and opportunities, the primary factors to consider are identified trends and variables. If necessary, other possible drivers can be included. Practitioners may also distinguish between main factors that directly influence the system and indirect factors that alter the direction or the intensity of its evolution (Alcamo & Henrichs, 2008).

Defining, selecting and prioritising the set of key factors are challenging on several levels:

- Given the complexity of issues related to emerging risks, it is likely that the set of identified key factors may exhaust available resources, not least cognitive capacities for analysis and strategic decisions. Therefore, prioritising and narrowing down the set of key factors are important at this step and need to be addressed in a transparent and consistent manner.
- Identifying and selecting key factors may require tapping into various types of expertise and values. Facilitated workshops or larger participation structures involving various stakeholders can be useful for this purpose. Here again, the available resources, the openness of the exercise to internal and external stakeholders, as well as the cultural practices within the organisation are key.

⁸ or PESTLE analysis, with political, economic, social, technological, legal and environmental factors.

In the context of emerging risk governance with regard to reviewing and selecting key factors, it may be useful to consider Wilson’s (1998) typology of environmental forces, as listed in Box 1 below.

Box 1: Categories of possible driving factors

Category of driving factors	Examples
Demographic patterns	Age, family, household, regional and national migrations, labour force structures and trends
Social and lifestyle factors	Consumer values, needs and demands, psychological profiles, educational levels, social issues and priorities, special interest groups
Economic conditions	Macroeconomic and microeconomic trends, regional and national variations, economic structure
Natural resources	Energy resources and availability, raw materials, land uses
Physical environment	Air/water/land pollution trends, environmental quality issues (global warming, ocean pollution)
Political and regulatory forces	Geopolitical trends and blocs, political policy shifts, governmental expenditures and deficits, specific regulations and governmental policies
Technological forces	Basic research trends, emerging technologies, technological infrastructures
International relations	Levels of tension and conflict, trade and protectionism, exchange rate developments
Market forces	Specific customer needs, spending patterns
Competition	Changes in industry structures, sources of new/substitute competition

(Source: Wilson, 1998)

Phase 3: Analysis of the key factors

The key factors identified in the previous phase must be further analysed according to the uncertainties associated with their development. How each of these factors may evolve in line with different possible patterns will contribute to building the image of possible futures piece by piece.

The new ways an infectious disease spreads due to climate change provides a good example. The threat considered here is exposure to a disease such as malaria by populations that are poorly informed and/or prepared. An analysis of the spreading mechanisms reveals that several key factors influence the intensity and geographical extent of the disease with, among them, an increase in temperature and rainfall (IPCC, 2001), and sea level rise or changes in ultraviolet intensity (Lipp, Huq, & Colwell, 2002).

Considered separately, each of these factors is often the result of complex mechanisms endowed with uncertainties. Assessing these uncertainties and describing their impact on the final outcome contributes to distinguishing various scenarios according to the funnel-shaped model depicted in Figure 6 in the main report.

In addition to the best available knowledge, imagination and creativity must also play a central role in this phase to ensure that surprises and extreme events are part of the analysis. Which of the millions of low-probability events will occur is highly uncertain. It is thus prudent to model some of these unlikely events and test the organisation’s resilience to absorb them. Imagination and science should be combined to ensure imaginative (including rare events) and scientifically sound scenarios.

Box 2: Typology of “surprises” in risk governance

There is always a chance of being considered irrational or naïve when asking decision-makers to invest in preventing low-probability surprises. Not all surprises are alike, however, such that different levels of unexpected or extreme events should be taken into account.

Van Asselt, et al. (1998) suggest four categories of surprises in decision-making:

- Unimaginable surprises, like a journey to Earth’s centre in the time of Jules Verne
- Imaginable surprises that are improbable but plausible, like a nuclear war
- Imaginable surprises that are probable, like oil price shocks and ecological refugees
- Surprises that are certain, like earthquakes and economic recessions

The suggested categorisation gives decision-makers the possibility to avoid the binary and often too simplistic choice of whether to integrate surprises in scenarios. Instead, offering various levels may make it easier to fit their preference structures. Another valuable insight to keep in mind is that decision-makers or experts may disagree: In using this categorisation, some, for instance, may put oil price shocks or earthquakes in the improbable category while considering ecological refugees as a “certain” surprise.

Phase 4: Scenario generation

Describing how each key factor may unfold and interact with others through a coherent and plausible sequence of events is the main focus of this phase. In theory, an exhaustive combination of all the possible future developments associated with each factor may lead to too many scenarios. Selecting a subset of combinations that is manageable and still representative of the diversity of futures is a modelling effort that depends on each situation. Here again, the availability of resources and the need for support and transparency are the main criteria.

This phase must be dedicated to identifying the conditions under which present threats and opportunities may or may not become risks or competitive advantages. More precisely, scenario generation should highlight the conditions and the turning points favouring or stopping a threat or an opportunity from becoming a reality. It is also expected to provide a rough estimate of each scenario’s impact on the organisation if nothing at all is done.

Greeuw, et al. (2000) examined 20 different European and global scenario studies and models by both private and public organisations and described four types:

- The “*Wait and see*” scenario type describes a future situation where no or only a limited set of policy actions are put in place.
- “*Just do it*” scenarios acknowledge important interventions and their impact on the future.
- “*Doom monger*” type scenarios focus on the impact of external factors (on which decision-makers have no influence), the main hypothesis being their unfavourable development for the organisation’s interests.
- “*Carpe diem*” scenarios also concentrate on the role of external factors but assume a development favourable to the organisation’s interests.

Application of scenario development in the case of obesity

Although obesity itself is not new, its prevalence in society certainly is, and is increasing at such a pace that many refer to it as the “obesity epidemic”. Out of a global population of approximately 7 billion people, the World Health Organization estimates that 1.2 billion are overweight (defined as having a Body Mass Index (BMI) of 25-30) and at least 300 million of these are obese (defined as having a BMI of over 30) (UK Government, 2007). Obesity is not just a problem in developed countries. Much of the developing world has also witnessed a strong increase in obesity rates over the last 20 years (Hossain, Kavar, & El Nahas, 2007). Obesity can be seen as a naturally occurring risk resulting from human physiology: if energy intake exceeds energy output, excess energy will be stored as fat. The prevalence of obesity, however, is as much the result of lifestyles and patterns of food consumption as the consequence of natural biological phenomena.

The human and economic costs of this epidemic are growing. An overwhelming amount of evidence supports the fact that obesity is linked to increased morbidity (Kim & Popkin, 2006). In addition to increased susceptibility to many diseases, obese individuals also tend to have higher absenteeism rates from work and to retire at a younger age. This imposes further costs on society, owing to lost productivity and higher worker compensation costs.

Exploring how the prevalence of obesity may develop in the future is a key input prior to the selection of response strategies. The three studies presented below describe various aspects and consequences of the development of obesity as an issue of growing concern. With this illustration IRGC’s aim is not to argue that obesity should still be considered an emerging risk that increasingly affects many organisations, but to highlight the variety of approaches that can be adopted by institutions in their effort to make the case that obesity will increasingly negatively affect overall societal performance and welfare.

The first study was conducted by the Minnesota Department of Health in 2008 for the purpose of considering the increase in future health-care costs (MDH, 2008). The second study is an academic project that looked at the genetic, social and ethical aspects of obesity (Swierstra & Keulartz, 2011). The third study was published by the UK Department of Business, Innovation and Skills and describes various scenarios of systemic interactions between factors related to obesity (UK Government, 2007).

Review of the studies indicates that:

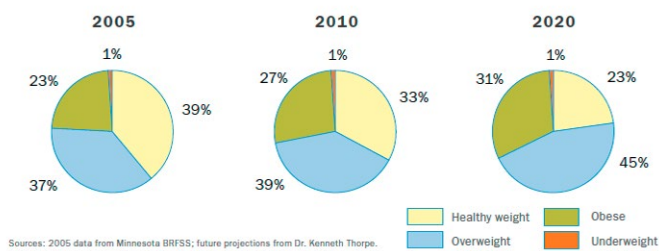
- **A large variety of scenarios can be developed as possible stories of the future.**
- **Scenarios must be developed with a certain objective or purpose, and for a certain organisation.**
- **Developing scenarios is necessary before making decisions about management strategies and options.**

Study 1: The public cost of obesity (Minnesota Department of Health, 2008)

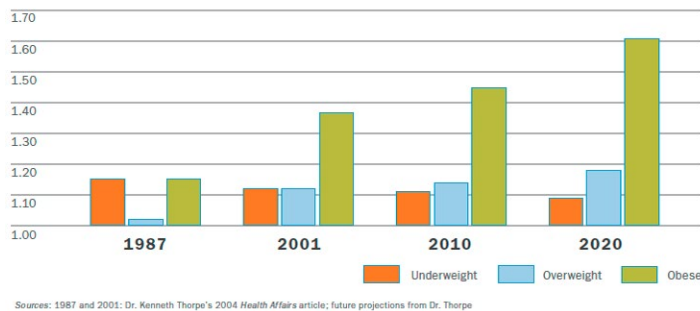
The goal of the first study was to assess future health-care costs. It focused on three factors: (i) the prevalence of an overweight and obese population in the United States, (ii) the treatment costs of obesity, and (iii) population ageing (see Figure 14).

The assumptions based on these factors lead to the formulation of two scenarios. Scenario A (Business As Usual) considers that all underlying trends will continue. Scenario B introduces the possibility that there could be no increase in obesity, but the projections on the second and third factors are maintained. The impact on health costs is described in Figure 15. The Minnesota Department of Health continues to refer to future obesity-related costs to support its prevention programmes in communities.

CURRENT AND PROJECTED FUTURE PREVALENCE OF WEIGHT CATEGORIES IN MINNESOTA



PROJECTED ANNUAL TREATMENT COSTS OF OBESE, OVERWEIGHT AND UNDERWEIGHT ADULTS, RELATIVE TO HEALTHY-WEIGHT ADULTS (1987–2020)



PROJECTED AGING OF MINNESOTA ADULT POPULATION, 2005–2020

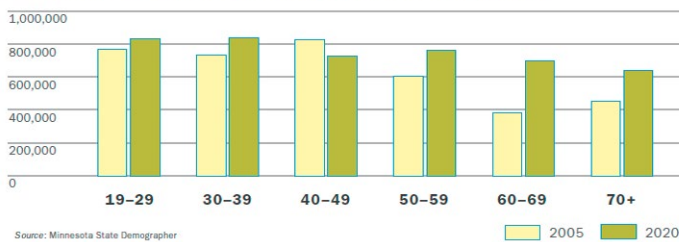


Figure 14: Trends associated with the three key factors used in the Minnesota Department of Health's scenario analysis (Source: MDH, 2008)

MINNESOTA'S PROJECTED TOTAL ANNUAL DIRECT HEALTH CARE COSTS: TWO FUTURE SCENARIOS, 2005–2020

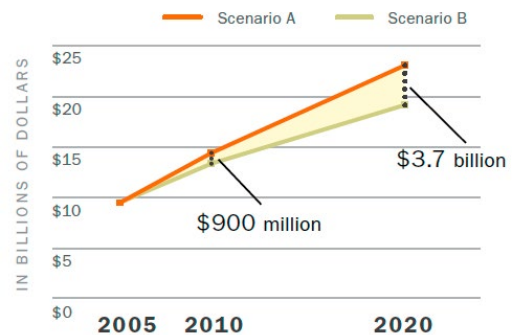


Figure 15: Projected health costs according to scenarios A and B (Source: MDH, 2008)

Study 2: The genetic, social and ethical aspects (academic project “Obesity in 2020”)

The second study results from an academic research project that looked at the relations between genetic information and social and ethical perspectives. The starting point is an analysis of current social discourse patterns that describes the attribution of responsibility for the development of obesity. The first pattern is centred on behavioural aspects and associated with individual responsibility; the second pattern links the epidemic to environmental factors (lack of regulation, the food industry’s aggressive strategies) and points out the regulators’ responsibility; the third pattern is focused on biological mechanisms and the need for more effective treatments. The analysis is based on the assumption that technological developments contribute to shaping social discourse and vice versa.

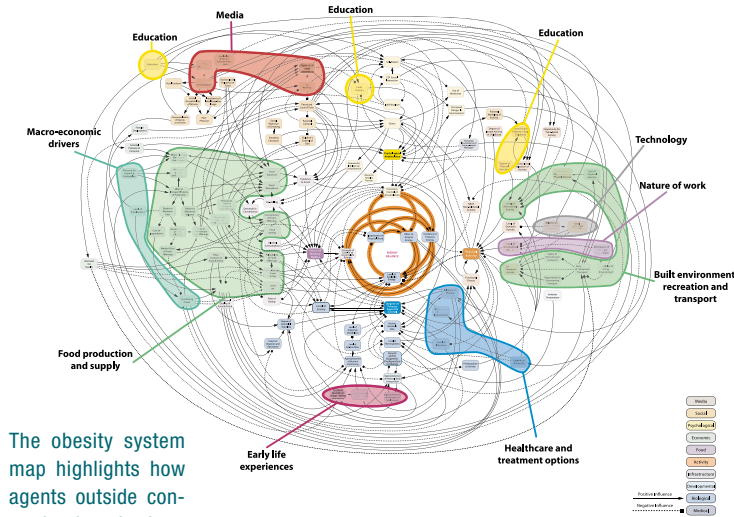
Among the key factors identified, some have been considered as stable and are thus common to all scenarios. For instance, it is assumed that discourse evolution will take place in modern, democratic and increasingly multi-ethnic societies. On the contrary, the rise of individualism vs. collectivism is used to differentiate possible distinct futures according to the funnel-shaped model. Three scenarios or framings of the problem and future of obesity result from this study:

- In the first scenario, “*Health as merit*”, obesity appears as a matter of individual failure. This scenario assumes that genes influence but do not determine obesity and there is no prospect of any “magic pill”. Furthermore, the individualisation of diagnosis and treatments combined with their increasing costs erodes social solidarity in the health-care system. Consequently, politics stimulate individual responsibility by focusing on prevention, reducing collective financing to the minimum and supporting prevention efforts by individuals.
- “*Corporate responsibility*” describes a future where still no cure for obesity has been found, society is disappointed by having allowed privatisation, and markets rule large aspects of everyday life. More demands for state intervention and an increasing sense of community have led to the perception of obesity as a major problem for society for which all stakeholders share responsibility: employers for imposing sedentary work environments, schools for failing to supply healthy food, and the food industry for marketing junk food. Additionally, genomics have demonstrated the strong link between genes and the environment and the long-term impact of malnutrition on genetic change and the creation of addictions. This has convinced politicians to launch large DNA screening programmes to reinforce prevention for children and to detect genetic mutations. Furthermore, the responsibility of food sellers and advertisers in the epidemic has been established.
- “*The liberation of fun*” is the last scenario. Genomics research has finally developed a drug with the ability to correct malfunctioning biological mechanisms related to obesity. More than just a treatment, this major advance is largely used as an enhancement for healthy people who need no longer worry about the consequences of satisfying all their cravings.

This second case study uses a narrative approach for stimulating thinking about the future and provoking a change in perception and attitude. It demonstrates that purely qualitative descriptions of scenarios, especially through narratives, can describe complex systems in a comprehensive and understandable manner.

Study 3: The systemic interactions between factors (UK Government)

The third study presents a larger and more in-depth scenario analysis applied to obesity. An exhaustive review of various influencing mechanisms (biological, behavioural, environmental and economic) was conducted. This led to an extensive modelling exercise describing the systemic interactions between the various factors, including a representation of the strength of links and the existence of positive loops as described in the report *Tackling Obesity: Future Choices - Modelling Future Trends in Obesity & Their Impact on Health* (UK Government, 2007).



The obesity system map highlights how agents outside conventional mechanisms are key enablers of and barriers to change. The central engine is highlighted in orange at the centre of the map

Figure 16: Systematic modelling of key factors related to obesity modelling (Source: UK Government, 2007)

The map presented in Figure 16 does not need to be read in detail, but illustrates the large and complex network of intricate factors that influence obesity development and modelling. For this reason, scenario analysis is also about defining the right balance between acknowledging complexity and focusing on a subset of factors.

and strategic approaches taken to mitigate the development of risk (management performance). The first factor corresponds to the perception of obesity as either an individual or a collective responsibility. The second factor is related to the type of strategy adopted by the government to deal with the epidemic. Anticipation and preparation versus reaction and mitigation are the two strategies explored. Combined, those two key factors lead to the definition of four scenarios presented in the report (see Figure 17).

In the UK study, this balancing exercise was conducted with respect to two key drivers: people’s values and behaviours (social acceptability)

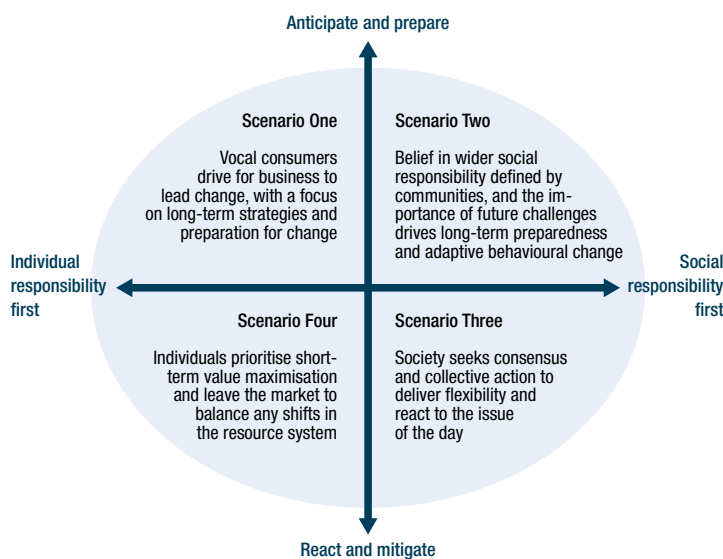


Figure 17: The four scenarios related to obesity development (Source: UK Government, 2007)

In 2012, a review of the extent to which the report has continued to influence government policy-makers and other strategists concerned with managing obesity was published. The UK government drew very significantly on the scenarios in developing its major strategy on tackling obesity: ‘Healthy Weight, Healthy Lives: Across Government strategy for England’ (HWHL). The scenarios were also useful to develop research agendas (UK Government, 2012).

2.5 Robust decision-making

Robustness is a concept whose definition and implementation differ depending on context and purpose of use.

In the context of systems evaluation, IRGC defines robustness as the property of a system to cope with the known variations of a potential hazard. Robustness, in this context, is one among other possible system properties. Resilience, i.e. the capability to cope with unknown and unfamiliar hazards, is another possible property.

In the context of decision-making, robustness describes the ability of a decision or policy to perform well in the context of various identified possible futures. It is one of the qualities decision-makers look for when choosing among different options. Instead of a robust option, they can select an optimum option, providing the best possible performance in a given future configuration. They can also adopt a solution that is easy and fast to identify, but still satisfies a minimal set of performance requirements, instead of looking for optimum or robust options that might require more effort and time to identify, explain or implement.

For the purpose of emerging risk governance, IRGC defines robust decisions as those that either maintain enough flexibility for adaptation in the future or offer good performances for more than one of the future scenarios. For instance, in the case of precautionary-based options discussed in Step 3, continuous monitoring to identify opportunities for early adaptation can provide enough flexibility to act purposefully.

The large variety of operational approaches and mathematical models used for the development of robust decisions share the common understanding that decision-making should be less about planning and acting than about continuously planning and adapting to situations (Rosenhead, Elton, & Gupta, 1972). The following two examples of applying robustness to strategic decision-making illustrate this idea.

Example 1: The real options theory

Originally introduced in finance by Black and Scholes (1973), real options theory describes the possibility for a decision-maker to make an investment commitment at time t_0 , but keep open the possibility to take advantage of the situation at t_1 , i.e. when more information and knowledge will be available. In other words, decision-makers

may purchase the right, but not the obligation, to commit resources to a project at a future point in time, when a better assessment of uncertainties or better knowledge about the future will exist.

This approach has gained popularity in finance as well as in several other sectors characterised by long-term investments and high levels of resource commitment. The traditional net present value criterion used in several domains to analyse the profitability of an investment or project has demonstrated its limits mainly because of a lack of flexibility and poor acknowledgment of the various sources of uncertainties (Dixit & Pindyck, 1994; de Neufville & Scholtes, 2011).

However, it is worth noting that this type of approach relies on sophisticated mathematical modelling and requires a large set of hypotheses to characterise scenario sequences and their consequences in quantitative terms. Its use must thus be planned early in the process to ensure that scenario designs and descriptions will provide the necessary inputs.

Illustrative examples in the domains of energy planning, industrial design and human resources management can be found in Fuss et al. (2012), de Neufville (2003) and Bhat-tacharya & Wright (2004).

Example 2: The XLRM matrix and its application for securing future water supply in the South-western United States

In its report on addressing climate change in highly uncertain environments, the RAND Corporation calls for using robustness as a main driver in decision-making and suggests the use of a framework matrix called XLRM (Groves, et al., 2013).

XLRM is an abbreviation reflecting:

- **X**: The set of uncertain or driving factors identified and considered for the development of descriptive scenarios of the future.
- **L**: Management strategies or policy levers used in response to the various scenarios (which correspond to the alternative decisions or options discussed earlier in this report).
- **R**: The relationship between the elements that are reflected in the planning model(s) used to simulate future conditions.
- **M**: The set of performance metrics used to evaluate and compare the system's robustness.

Table 1: The four components of the XLRM matrix

<p>Factors of uncertainty (X) What are the main uncertainty factors that should orient scenario management?</p>	<p>Response package (L) What decision options are available to deal with the uncertainties?</p>
<p>Models (R) Which models of future evolution will be used to support the XLRM analysis?</p>	<p>Performance metrics (M) How will the performance of the adopted decision options be assessed?</p>

This approach has been used to manage emerging risks related to water supply disruption in the Southwestern United States (California, Arizona and Nevada, comprising almost 40 million people) due to overexploitation and changes in the hydrological regime of the Colorado River.

The authors first developed a set of scenarios (X) representing the variety of possible futures in the river basin. Variations in water demand, the evolution of water supply due to climate drivers and reservoir operations were identified as the driving factors to describe the possible futures. The way the basin could evolve in these different futures was evaluated according to various criteria (water supply, electric power resources, water quality and flood control). Performance metrics (M) were associated with each of these criteria, including thresholds (signposts) pointing to necessary actions and associated decision options. By running simulations (R), the study team analysed how strategies would perform in each scenario with respect to the metrics. Decision options that resulted in good performance were defined as robust options and recommended for implementation. In addition, the simulations suggested at which time each of the options should be implemented. This provided decision-makers with a significant lead time.

2.6 Strategy implementation

A great variety of models and recommended practices to implement strategy exist. This section proposes an annotated bibliography of selected models and practices. Before introducing them it is important to recall that there is no single recipe since several contextual factors may influence the way strategies are implemented. An organisation’s structure and alignment with its strategic orientation is an initial contextual factor that may strongly influence the implementation process

(Heide, Gronhaug, & Johannessen, 2002). The anticipated commitment to the adopted strategy by middle and operational management (Noble, 1999b) is another critical factor for a strategy’s implementation. Depending on the organisation’s culture and leadership style, various implementation models may also be envisaged. Bourgeois and Brodwin (1984), for example, distinguish five models of strategy implementation: commander model, change model, collaborative model, cultural model and crecscive model. In the commander model, inspired by the army, the chief executive holds absolute power and distributes resources to ensure effective strategy implementation. The change model focuses on putting in place adequate incentives and compensations to support the required actions, whereas the implementation phase in the collaborative model seeks to involve top management in the early stages of strategy conception, thereby fostering and securing their support for the strategy implementation phase. The cultural model is interested in adapting the entire organisation’s culture to promote acceptance of the strategy. The crecscive model is a bottom-up vision creating support for strategy implementation by involving the whole organisation in the process of strategy formulation.

Whichever orientation is adopted, the models and recommended practices described below provide suggestions for organising the tasks required to put the adopted decisions into action.

Models and recommended practices in strategy implementation

The various references mentioned below suggest various resources and models that may be relevant, depending on the organisation’s own decisional context. A set of descriptive models is presented, illustrating how the process of implementing strategies is embedded within an organisation’s overall management system and influenced by a large set of factors. These models do not show “how” to

implement strategy, but highlight the complexity inherent to every strategy implementation process.

- Pedersen (2008) defines six processes that form part of every strategy execution:
 - *Translation*: Converting the ideas, visions and aspirations of the strategy into workable plans and metrics
 - *Communication*: Ensuring that all key employees are aware of and understand the “What”, “Why”, “How”, “When”, “Where” and “Who” of the strategy
 - *Coordination*: Passing on both responsibility and accountability to key personnel for a specific action or goal in the process
 - *Adaptation*: Monitoring the process of strategy implementation and making adjustments to the strategy, to better reflect the real world
 - *Resource allocation*: Linking the strategy to the resources required to execute it
 - *Implementation*: Carrying out the specific actions defined by the strategy execution process.
- Peters and Waterman’s 7S model (Figure 18) demonstrates a holistic approach where every strategy revision requires the alignment of six other aspects, i.e. the values of the organisation, its structure, systems, skills, staff and style.

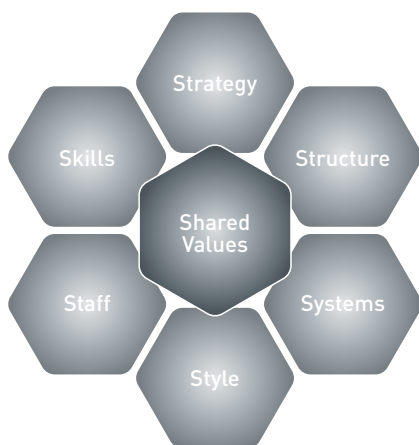


Figure 18: The 7S model of strategy implementation
(Source: Peters & Waterman, 2004)

Shared values are at the centre of this process as they describe the central beliefs and attitudes shared by the whole organisation and motivating its actions. *Structure* reflects the way the organisation’s units relate to each other (centralised, decentralised, matrix or network). *Systems* describes the procedures and routines framing the various activities carried out within the organisation. *Staff* and *Skills* are related to the personnel and available core competences. Finally, *Style* refers to the culture and managerial approach for achieving objectives.

The descriptive essence of this model does not provide insights on how these elements and their interactions should be considered in the implementation process. Instead, it clearly highlights the various aspects to be addressed and its holistic perspective is useful to demonstrate how strategy implementation is highly correlated to its environment.

- A revision of this model has been suggested by Higgins (2005), replacing skills by resources and adding the aspect of strategic performance as the key driving force of the interactions initiated each time the strategy is modified (see Figure 19).

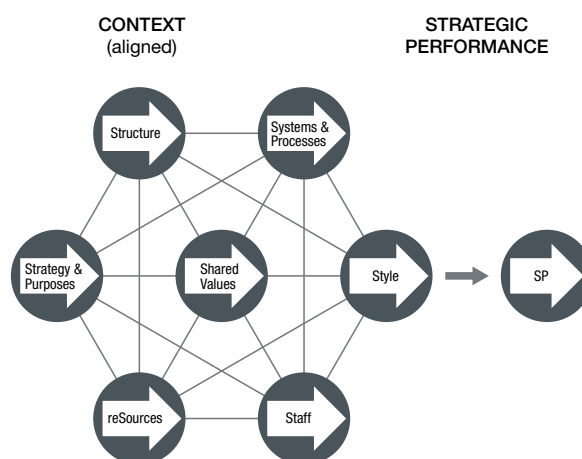


Figure 19: Higgins' eight “S”s of successful strategy implementation
(Source: Higgins, 2005)

- Crittenden & Crittenden (2008) have adopted a complementary perspective by identifying two macro-families of levers for successful strategy implementation.

Structural levers are related to the way the organisation operates:

- *Actions*: Allowing all the players within the company to effectively participate in implementing the strategy through cross-functional integration.
- *Programmes*: Putting in place organisational learning and continuous improvement practices, achieved by hiring the right people and offering them the possibility to learn and innovate when necessary.
- *Systems*: Installing relevant and efficient information systems that provide timely and reliable information.
- *Policies*: Ensuring that day-to-day decisions are made according to the strategic orientations adopted.

Table 2: Main steps in a strategy implementation process (Source: Noble, 1999a)

Stages				
Levers	Preparing the pre-implementation	Organising the implementation effort	Managing the implementation process	Maximising cross-functional performance
Goals	Ensure that all managers are aware of the strategic goals of the firm	Introduce the goals of the strategy being implemented, ensuring they fit within the firm's broader strategic vision	Maintain the flexibility to adapt goals based on environmental changes	Develop and focus on common goals to encourage cross-functional cohesiveness
Organisational structure	Ensure that functional areas have the slack resources needed to contribute to the implementation effort	Establish a formal implementation unit and ensure its visibility throughout the firm	Ensure equal representation by all affected functional areas	Temporarily suspend the key implementation of team members' normal responsibilities to allow them to focus on the implementation effort
Leadership	Develop employees' knowledge and appreciation of multiple functional areas	Establish a "champion" who has both official cross-functional authority and is respected throughout the firm	Ensure that leaders show equal attention to all functional-level concerns	Balance visible and charismatic leadership with maintaining autonomy for functional-level implementation efforts
Communications	Maintain regular cross-functional communications to foster understanding and appreciation	Discuss and resolve implementation details early in the process	Update the implementation team frequently on progress and changes in objectives	Communicate implementation progress across the entire organisation to foster buy-in
Incentives	Reward the development of cross-functional skills	Develop time and performance-based incentives for the implementation team while lessening traditional incentives	Adjust incentives as strategy and environmental conditions change during implementation	Establish visible and consistent cross-functional rewards for successful implementation efforts

Managerial skills levers are the behaviours deployed by managers at various levels to put the strategy in practice. They can be divided into the following sub-categories:

- Exercising leadership
 - Ensuring relevant and timely resource allocation
 - Putting in place adequate reward and compensation systems
 - Shaping the organisation's culture according to its strategic orientations.
- Noble (1999a) suggests organising the process of strategy implementation according to four stages: preparing the pre-implementation, organising the implementation effort, managing the implementation process and maximising cross-functional performance. Each stage has a set of levers (Table 2 above).

Supportive conditions for effective strategy implementation

IRGC recommends paying appropriate attention to five types of supporting conditions for strategy implementation (see Step 4), which collectively may require organisational change.

1. Internal communication

Internal communication needs to be both top-down and bottom-up. Top-down communication should focus on explaining the complexity and uncertainties associated with emerging risks. Organising communication is a task specifically assigned to the emerging risk conductor. It is also important to ensure that strategic developments are made clear to everyone in the organisation. According to Pedersen (2008), quoting a study by Kaplan & Norton (2005), a large majority of employees are not aware of or do not understand their companies' strategies. Acting on

contributing factors to risk emergence, for instance by reducing information asymmetries, may require various departments and staff members to commit to information sharing and knowledge communication within and outside the organisation. This is time-consuming and may appear pointless to those who are not aware of what is at stake.

Internal communication should also make the case that proactive governance of emerging risks is well worth the effort and in the interest of all employees. This can be achieved by demonstrating how emerging risk governance, by neutralising threats and helping the organisation to seize opportunities, contributes to the organisation's overall performance.

Bottom-up communication, on the other hand, will ensure that employees' contributions, difficulties and needs for support are consistently addressed at the appropriate management level. Work overload, change in operational practices or the need for additional competences are examples of classic difficulties to be resolved when managing organisational changes (see Box 3). In addition, all employees may be confronted with environmental developments and weak emerging risk signals, which makes them a precious source for the evaluation of strategy effectiveness and for feedback and suggestions for improvement.

2. External communication

The role external communication plays in strategy implementation depends on the legal status of emerging risk management in the organisation. If there is a legal mandate to identify or manage emerging risks, external communication will be an important means to present and explain the strategies adopted and to trigger appro-

prate reactions from other stakeholders. The European Food Safety Authority, for example, has a legal mandate to identify emerging risks, while DG Sanco has a legal mandate to manage them.

In the case of other organisations, external communication may serve different purposes. Reputation management, the demonstration of proactiveness and a high level of awareness of emerging risks that may affect the whole society can be important to an organisation's strategy. It can also become a competitive advantage, allowing the organisation to modify its innovative capacity vis-à-vis its competitors (if its strategic focus emphasises risk/opportunity taking) or to adopt a prudent approach if a precautionary strategy is selected.

3. (Re)allocation of resources

Emerging risk governance is not only about risks and strategies. It is also about resource allocation and interaction with the external environment. Continuously assessing the available resources and aligning them with the overall objectives can be useful to avoid dissonance between strategic management and emerging risk reduction.

Accordingly, resource allocation may be an opportunity to decommission some risks or to change the risk management policy adopted for some others. As these decisions can be particularly hard to make, strong leadership is required.

4. Roles, responsibilities and rewards

Whatever strategy is adopted, it may enter into conflict with the organisation's existing description of roles and

Box 3: Communication and strategy implementation: The Big Hairy Audacious Goal

The Big Hairy Audacious Goal (BHAG) concept emphasises the importance of companies to define visionary goals that are ambitious, strategic and emotionally compelling (Collins & Porras, 1994). One of the most famous BHAG examples was John F. Kennedy's commitment to send an American to the moon by the end of the 1960s.

The main quality of a BHAG is for it to have the "ubiquitous power of a virus" of getting the desired message delivered and understood inside and outside the organisation. It is also a successful means to energise people and make them committed to a goal.

In the field of ERG, building a BHAG based on anticipation or adaptation can be relevant to shape the organisation's values and to justify the efforts demanded at all levels. Although the purpose here is not to reduce communication to this concept, it clearly demonstrates the powerful lever that a good communication strategy can constitute in the field of strategy implementation.

responsibilities and the associated rewards and incentive systems.

In strategy implementation, roles and responsibilities need to be defined and redefined as the situation evolves. Noble (1999a) suggests establishing a formal implementation unit led by a “champion” (comparable to the risk conductor) with official cross-functional authority and generally respected in the firm. This person or organisational unit should focus on three major questions:

- Whose area of responsibility should be narrowed or widened?
- Is any action not associated with a recognised responsibility?
- What overlaps, conflicts and grey zones exist pertaining to roles and responsibilities?

It is not necessary for these questions to be answered at a specific time – rather, this should be a continuous process fuelled by the top-down and bottom-up communication mechanisms discussed earlier.

Finally, it is important to align the roles and responsibilities with the organisation’s incentive and reward system (IRGC, 2011). For example, a prudent strategy based on precaution and vulnerability reduction may highly conflict with incentives and rewards based on financial performance, i.e. on taking risks. Doing nothing, on the other hand, may conflict with incentives and rewards linked to safety performance and corporate social responsibility. Not paying sufficient attention to the alignment of rewards and strategy may elicit resistance from those in charge of implementing the strategy on a day-to-day basis and thus considerably hamper its effectiveness.

5. Leadership and culture

Leadership provides the required momentum for an effective strategy implementation process, within an appropriate risk culture. This entails providing a clear vision, giving due priority, making the necessary trade-offs and ensuring that an organisation’s culture fits the adopted strategies.

Authority is required at different levels. At the day-to-day implementation level, it means ensuring constant communication with all operating units to avoid conflicts and promptly resolve trade-offs. At a strategic level, leadership provides the necessary support to those in charge of leading the implementation process, who may

be confronted with resistance and conservatism at lower levels. Fairness towards various operating units is a key aspect of successful leadership.

Implementing organisational change

Implementing organisational change requires overcoming such obstacles (Fernandez & Rainey, 2006) as:

- Resistance to change. Managers must be able to recognise overt as well as covert forms of resistance to change in order to understand the nature and magnitude of such resistance. The sources of resistance to change are varied and operate at four levels: the individual (involving personality, fear, lack of trust, defence mechanisms); the group (involving group norms, group cohesion); the organisation (formalisation, control systems); and the external environment (normative pressures, environmental uncertainty). Once resistance to change has been assessed, a variety of methods can be used to overcome it, including communication about the need for change, exchanges to compensation for loss, rewards for compliance, employee consultation and involvement in decision-making about the change, efforts to build mutual trust, and psychological support.
- Routine and institutionalised change. To achieve lasting change, employees must integrate new patterns of thought and behaviour into their daily routines, to the point where they become deeply embedded and displace old ones. Methods for institutionalising change include modifying formal structures, procedures and human resource management practices that reinforce change; admitting employee rites and ceremonies; supporting trial runs and pilot projects; encouraging vicarious learning and learning by doing; and monitoring employee attitudes and behaviour during and after implementation.

Organisational change often requires coordinated modifications in the different subsystems of an organisation to bring them into alignment. Advocates of subsystem congruence argue that organisations consist of various subsystems (including training, recruitment, incentive, work design, information and control subsystems) that shape and reinforce behaviour. For fundamental reform to occur, leaders must make systemic changes to these various subsystems to ensure they are all consistent with the desired end-state. Changing only one or two subsystems will not generate sufficient force to bring about organisational transformation.

Interventions required to transform strategy into action

The following tables list the various interventions required to transform strategy into action for each of the six strategic options presented in Step 3 of the IRGC Guidelines for Emerging Risk Governance, according to the five main supportive conditions described in the previous section.

Option 1: Acting on the factors that contribute to risk emergence or amplification

Internal communication	<ul style="list-style-type: none"> • Explain the link between the contributing factors and the emerging threats and opportunities • Make the case that early work on controllable factors will benefit the organisation in the short, medium or long term • Put information feedback loops in place (bottom-up communication)
External communication	<ul style="list-style-type: none"> • Explain the link between the contributing factors and the emerging threats and opportunities • Identify and convince other stakeholders to share efforts in dealing with the contributing factors
(Re)allocation of resources	<ul style="list-style-type: none"> • Evaluate the resources required to control the factors
Roles, responsibilities and rewards	<ul style="list-style-type: none"> • Compare the role of the organisation to other organisations that can also act to control the factors • Define individual roles within the organisation • Set the metrics to continuously monitor the situation
Leadership and culture	<ul style="list-style-type: none"> • Provide the support needed for the actions • Assign risk ownership, rewards and incentives
EXAMPLE	<p><i>On 22 January 2014, the European Commission decided to include a certain number of chemicals used as additives in hydraulic fracturing fluid (i.e. for a process exploiting gas from shale and other geological formations) in the list of substances covered by the REACH directive (see Box 6 in the main report). The implementation of this decision could conflict with the fact that chemical additives are often confidential business information. However, in principle, this may force the industry to share data and information collected during the exploration process, thus reducing information asymmetries, promoting co-operation and collaborative assessments, and reducing environmental risks related to hydraulic fracturing.</i></p>

Option 2: Developing precautionary approaches

Internal communication	<ul style="list-style-type: none">• Elaborate upon and explain the conditions necessary for the precautionary approach to remain relevant and justified (e.g. research and monitoring)• Put information feedback loops in place (bottom-up communication)
External communication	<ul style="list-style-type: none">• Seek dialogue with other organisations that are affected by the same emerging risk• Identify opportunities for partnerships to reduce uncertainties (research and monitoring)
(Re)allocation of resources	<ul style="list-style-type: none">• Allocate the resources required for research and monitoring
Roles, responsibilities and rewards	<ul style="list-style-type: none">• Assign (or review) risk ownership, rewards and incentives• Translate the precautionary approach into objectives and practices at the various decision-making levels• Make the required trade-offs, especially if risk transfers are identified• Define research orientations and set the metrics to continuously monitor the situation
Leadership and culture	<ul style="list-style-type: none">• Resolve conflicts• Support the implementation of the precautionary approach by ensuring coherence and fairness in practices across the various operational units

EXAMPLE *The risk of fisheries' depletion and collapse is a major concern in view of the important nutritional and economic value provided by fish and other seafood. The risk is well known and thus familiar in many regions. Valuable lessons can therefore be learned from past practice, allowing familiarity with the risk to avoid irreversible shifts in fish stocks. Food and Agriculture Organization guidelines (FAO, 1999) recommend using a precautionary approach for dealing with the risk and emphasise the following implementation actions:*

- *Legal or social management frameworks should be established for fisheries to define the risk owners.*
- *Consultation with the fishing industry, conservation groups and other interested parties is essential. The communication of decisions and their rationale to the public and the fishing industry is highly recommended.*
- *Precautionary approaches must be transformed into operational decisions and rules, and the actions to be taken must be determined in advance.*
- *Continuous monitoring should start as early as the precautionary measures are implemented. In addition, research programmes on the stocks and fisheries, including on the response of individual vessels to regulation, should start during the early phases of implementation. Research objectives should be to: (i) formulate biological objectives, targets and constraints regarding the protection of habitats, (ii) evaluate populations' reproductive capacities, and (iii) describe the structure of fishing communities and associated socioeconomic aspects.*

Option 3: Reducing vulnerability

Internal communication	<ul style="list-style-type: none">• Describe the vulnerabilities related to the emerging risk at the right decision-making levels• Collect employees' relevant input: Are there any vulnerabilities that have not yet been considered?
External communication	<ul style="list-style-type: none">• Evaluate partners' resilience. When organisations are tightly connected through supply chains, their own resilience performances may be strongly correlated to those of their suppliers or customers• Communicate strategies with others who are affected by the same emerging risk• Demonstrate the reliability of the organisation's safety performance by describing the efforts carried out• Transform this reliability into a competitive advantage
(Re)allocation of resources	<ul style="list-style-type: none">• Ensure the cost-effectiveness of the actions taken to reduce vulnerability• Allocate or reallocate budgets• Assess the skills and competences required
Roles, responsibilities and rewards	<ul style="list-style-type: none">• Define the risk owner in the organisation• Translate vulnerability reduction and resilience building into operational objectives and practices at the various levels of the organisation• Associate explicit rewards and incentives to the effective implementation of actions to reduce vulnerability• Make the required trade-offs, especially if risk transfers are identified• Set the metrics to continuously monitor the situation
Leadership and culture	<ul style="list-style-type: none">• Resolve conflicts• Support the implementation of the approach by ensuring coherence and fairness in practices across the various operational units

EXAMPLE *Effective actions to reduce the consequences of emerging climate change risk include strategies to reduce exposure and vulnerability. For example, agricultural practices are modified in countries that are increasingly affected by droughts, introducing crops that are drought-resistant. Also, populations in regions exposed to natural hazards (and flooding in particular) are encouraged to relocate to less affected areas. The implementation of these strategies requires large communication efforts, such as those of the United Nations International Strategy for Disaster Reduction, to raise awareness and share good practices.*

Option 4: Modifying the organisation's risk appetite in line with a new risk

Internal communication	<ul style="list-style-type: none"> Describe the exact limits of the increase in risk appetite and their consequences for everyday practices at the right decision-making levels
External communication	<ul style="list-style-type: none"> Monitor other stakeholders' strategies Explain the rationale behind the organisation's decision Pay attention to preserving the organisation's reputation
(Re)allocation of resources	<ul style="list-style-type: none"> Allocate the resources required for monitoring Make provisions for additional losses
Roles, responsibilities and rewards	<ul style="list-style-type: none"> Define the risk owner in the organisation Adapt the incentives and rewards to the risk-taking strategy
Leadership and culture	<ul style="list-style-type: none"> Resolve conflicts Support the implementation of the approach by ensuring coherence and fairness in practices across the various operational units

EXAMPLE *Many companies need to operate in weak governance zones (OECD, 2006) characterised by high levels of insecurity, corruption and low economic and social development. Their staff face higher risk levels than their colleagues at headquarters, resulting from a deliberate increase in risk appetite, which is accompanied by specialised operating units focusing on real-time monitoring and incident tracking. The OECD has published guidelines for multinational companies operating in weak governance zones, including:*

Internal communication

- Employees at all levels must understand the implications of company policies for their work
- Employees must be confident that if they lose business because of compliance with company policies, with relevant international instruments or with home or host country law, they will be supported by their supervisors and will not suffer adverse consequences

External communication

- Human rights and the management of security forces, fighting corruption and money laundering are examples of issues to be considered in reputation management
- There must be regular and effective disclosure of information regarding the company's activities
- The company must co-operate with other companies, home and host governments, and international institutions, and provide full disclosure of benefit streams from its investments
- The company must explicitly address issues of conflicts of interest when collaborating with public officials

(Re)allocation of resources

- The company's board must make additional resources available for implementing these policies and for complying with the law and with relevant international instruments

Roles, responsibilities and rewards

- Employee management practices (promotion, compensation, evaluation, disciplinary actions and internal audits) must create genuine incentives for compliance with company policies and the law as well as for the observance of relevant international instruments
- Adequate internal company controls must be put in place to manage the heightened risks of operating in weak governance zones

Leadership and culture

- Visibility and the commitment of senior managers and boards of directors must ensure that activities respect international and internal standards

Option 5: Using “conventional” risk governance instruments to manage familiar risks

Case 1: The organisation has no existing risk governance framework

Internal communication	<ul style="list-style-type: none">• Explain why a risk governance framework is necessary• Make sure staff knows the risk governance framework and its implications for everyday activities
External communication	<ul style="list-style-type: none">• Foster the development of dedicated regulation if it is lacking• Regularly inform regulatory bodies, business partners and local communities of the risk governance efforts deployed• Share experiences with organisations dealing with the same risk
(Re)allocation of resources	<ul style="list-style-type: none">• Allocate the resources required for the risk governance steps and supporting activities
Roles, responsibilities and rewards	<ul style="list-style-type: none">• Either internally or externally, develop the capacities required for implementing the various risk governance activities• Allocate clear responsibility for each task of the risk governance framework• Translate these activities into employees’ operational and routine tasks• Define risk-management-based incentives and rewards for staff
Leadership and culture	<ul style="list-style-type: none">• Undertake no major changes in the way leadership and culture have been deployed thus far in the organisation

EXAMPLE *Biogas production refers to the portfolio of technologies producing bio methane from waste fermentation. The process outputs are used for electricity cogeneration, injected in gas grids or directly reused by producers (Salvi, Chauet, & Evanno, 2012). With 31% growth in 2010, biogas production is rapidly spreading, especially among farmers interested in waste recovery. However, accidents have increased with this evolution, mostly due to the lack of knowledge and familiarity among farmers with little experience with the technology.*

Little uncertainty exists regarding the mechanisms involved in biogas production, making existing risk management frameworks fully applicable as long as they are correctly implemented.

Initiatives to ensure the correct implementation of conventional risk management frameworks in this context are numerous. For instance, the European Technology Platform on Industrial Safety (www.industrialsafety-tp.org) promotes the following actions:

- *Improve risk analysis models, especially those related to the evaluation of consequences*
- *Develop a European database gathering relevant key production parameters, safety methods and best practices*
- *Adapt existing regulation to biogas production specificities*
- *Develop operators’ education and awareness of risk issues*
- *Address the human and organisational factors describing the way individual and collective behaviours may be framed for better risk management*

Case 2: The organisation extends an existing risk governance framework to a new risk

Internal communication & External communication	Both from inside and outside the organisation, extending an existing governance framework may be perceived as though nothing has been done or as a lack of awareness on the part of management. Communication here intends to: <ul style="list-style-type: none">• Explain that the organisation is aware of the threat/opportunity (following the analyses performed in Steps 1 and 2)• If necessary, describe the rationale behind adopting this strategy
(Re)allocation of resources	<ul style="list-style-type: none">• Allocate additional resources if needed to conduct a complete risk assessment, evaluation, management and communication strategy
Roles, responsibilities and rewards	<ul style="list-style-type: none">• Assign risk ownership if the risk is established and there is sufficient knowledge to implement a management framework for familiar risks
Leadership and culture	<ul style="list-style-type: none">• Undertake no major changes in the way leadership and culture have been deployed thus far in the organisation

EXAMPLE *Treating a new risk as closely related to a familiar risk often produces significantly different outcomes from treating it as an emerging risk.*

The US States of Texas and Pennsylvania have developed robust unconventional gas development activities by treating the risks of shale gas as an extension of the familiar risks of conventional gas development. Other jurisdictions (New York, California, France, Province of Quebec) chose to treat the risks of producing gas from unconventional reservoirs as a new risk, which led to moratoria or bans that blocked the development of the technology and the process of learning by doing.

Option 6: Doing nothing

Internal communication & External communication	Both from inside and outside the organisation, doing nothing may be perceived as a lack of awareness on the part of management or a misperception of the potential severity of the emerging risk. Communication here intends to: <ul style="list-style-type: none">• Explain that the organisation is aware of the threat/opportunity (following the analyses performed in Steps 1 and 2)• Explain the rationale behind adopting this strategy
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(Re)allocation of resources	<ul style="list-style-type: none">• Allocate the resources required for continuous monitoring
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Roles, responsibilities and rewards	<ul style="list-style-type: none">• Undertake no adjustments to the roles, responsibilities or reward system
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Leadership and culture	<ul style="list-style-type: none">• Undertake no major changes in the way leadership and culture have been deployed thus far in the organisation
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EXAMPLE *Organisations such as Swiss Re or EFSA develop and sometimes publish lists of emerging issues or risks (see Section 1). Among those on the list, many are still too vague and are not fully assessed for their possible impact or relevance. However, they remain on “watch lists”, where they are monitored and their initial assessment is reviewed if certain indicators signal potential important changes. In the meantime, the organisation “does nothing” to manage these issues.*

GLOSSARY

Complexity: The difficulty of identifying and quantifying causal links between a multitude of potential causal agents and specific observed effects (IRGC, 2005).

Complex system: A system composed of many parts that interact with and adapt to each other (OECD, 2009).

Emerging risk: A new risk, or a familiar risk in a new or unfamiliar context (re-emerging). These risks may also be rapidly changing (in nature). Although they may be perceived as potentially significant, at least by some stakeholders or decision-makers, their probabilities and consequences are not widely understood or appreciated (IRGC, 2010a).

Familiarity: Knowledge and experience with an organism, the intended application or activity and the potential receiving environment. A relatively low degree of familiarity may be compensated for by appropriate management practices. Familiarity can be increased as a result of trial or experiment. This increased familiarity can then form a basis for future risk assessment (UNEP, 1995).

Precautionary approaches: The 1992 Rio Conference on the Environment and Development adopted the Rio Declaration, whose Principle 15 states that: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capability. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation".

Risk: An uncertain negative consequence of an event or an activity with regard to something that humans value (definition originally in Kates, et al., 1985, p.21).

Risk appetite: The amount and type of risk that an organisation is prepared to pursue, retain or take (ISO 73, 2009).

Risk assessment: The task of identifying and exploring, preferably in quantified terms, the types, intensities and likelihood of the (normally undesired) consequences related to a risk. Risk assessment comprises hazard identification and estimation, exposure and vulnerability assessment, and risk estimation (IRGC, 2005).

Risk governance: The identification, assessment, management and communication of risks in a broad context. It includes the totality of actors, rules, conventions, processes and mechanisms concerned with how relevant risk information is collected, analysed and communicated, and how and by whom management decisions are taken (IRGC, 2005).

Risk management: The creation and evaluation of options for initiating or changing human activities or (natural or artificial) structures with the objective of increasing the net benefit to human society and preventing harm to humans and what they value; and the implementation of chosen options and the monitoring of their effectiveness (IRGC, 2005).

Risk profile: In the case of a single risk, a profile capturing several dimensions, qualitative and quantitative, that describe the risk in ways useful to a risk manager who is making initial decisions about what should be done. A profile may also describe a set of risks of concern to an organisation.

Risk tolerance: An organisation's or stakeholder's readiness to bear the risk after risk treatment (process to modify the risk) in order to achieve its objectives. (Note: Risk tolerance can be influenced by legal or regulatory requirements) (ISO 73, 2009).

Systemic risks: Risks affecting the systems on which society depends. The term "systemic" was assigned to risk by the OECD in 2003 and denotes the embeddedness of any risk to human health and the environment in a larger context of social, financial and economic consequences and increased inter-dependencies both across risks and between their various backgrounds (IRGC, 2005). Systemic risks are characterised by complexity, uncertainty and ambiguity. Most often, they are also trans-boundary.

Uncertainty: A state of knowledge in which the likelihood of any effect, or the effects themselves, cannot be precisely described. (Note: This is different from ignorance about the effects or their likelihood.) (IRGC, 2005).

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