



**European Foresight Platform**

supporting forward looking decision making

[www.foresight-platform.eu](http://www.foresight-platform.eu)

EFP Deliverable– WP 5 – Background Report

# Policy options for surprising and emerging ISSUES - Background Paper to the EFP Policy Workshop

26 October 2011, Brussels

Date: 26 October 2011

Author: Annelieke van der Giessen, Bas van Schoonhoven

With contributions from Rafael Popper, Susanne Giesecke, Vicente Carabias-Barcelo

---



Project funded under the Socio-economic Sciences and Humanities



**European Foresight Platform**  
*The European Commission is providing the means to continue the important networking activities of foresight initiatives. Setting out on the previous work of the European Foresight Monitoring Network and For-Learn the new European Foresight Platform resumes its work.*

All rights reserved © 2010, EFP consortium

# Contents

1. Goals & desired results of the Policy Workshop .....	3
2. Surprising and emerging issues .....	4
2.1. Introduction.....	4
2.2. Blue Sky research initiatives .....	8
2.3. Weak signals & emerging issues identified in Blue-Sky projects .....	10
2.4. Prioritising emerging issues and weak signals.....	19
3. Policy implications and requirements .....	21
4. Early Warning Systems .....	23
5. Final remarks .....	27
6. References.....	28

## 1. Goals & desired results of the Policy Workshop

The European Foresight Platform (EFP) is a network building program supported by the European Commission's (Framework Programme 7). It aims at building a global network of networks bringing together different communities and individual professionals to share their knowledge about foresight, forecasting and other future studies methods.<sup>1</sup> The ultimate purpose of EFP is to better exploit foresight as a resource to support policy-making.

To further this end, EFP is organizing the present workshop which focuses on those issues and surprises that could shape the European Research Area (ERA). Specifically, the workshop objectives are:

- To discuss and prioritise the most important emerging issues and surprises for Europe.
- To identify policy requirements and research questions to address these emerging issues and surprises.
- To discuss in more detail how the European and national approaches for early warning could operate and collaborate and how national and European governments can manage emerging issues.

The workshop consists of a number of different blocks to facilitate achieving these objectives:

- Introducing EFP and EU Blue Sky research on surprising and emerging issues
- Mapping surprising and emerging issues from EU-funded research
- Prioritizing and discussing identified surprising and emerging issues
- Assessing potential implications of surprising and emerging issues
- Contextualising surprising and emerging issues into EU research and innovation policy
- Transferring know-how from national actors mapping surprising and emerging issues
- Supporting EU and national cooperation on emerging and surprising issues management and research

The background paper is chiefly divided into the following main sections: introduction of terminology and examples of weak signals and wild cards that are provided as input, a discussion of means of assessing potential implications of these emerging issues, a discussion of possible policy requirements, and examples of early warning systems.

---

<sup>1</sup> Find more information on EFP, including a large number of foresight activity briefs, a guide on foresight, and more, on the project website: <http://www.foresight-platform.eu/>

## 2. Surprising and emerging issues

### 2.1. Introduction

Foresight is a conceptual framework for a number of forward-looking approaches of informed decision-making that include long-term considerations. They focus on the increasing need of generating anticipatory strategies and future scenarios in the present for the future (and present). Due to the complexity of decision making processes with multiple stakeholders involved, foresight puts particular emphasis on the participatory component of forward looking activities. It is often regarded as a policy-making process by which stakeholders are assumed to arrive at a deeper and shared understanding of dynamics influencing long-term development<sup>2</sup>.

Although foresight activities have specific objectives it is important to mention that there are several other, often overlapping or complementary, supportive functions of foresight that help to reach the main goal. Foresight can be applied to contribute to reaching consensus around shared visions, provoking a creative and motivating decision making, stimulating participation of stakeholders, paving the way for coordinated/coherent action, enabling mutual learning and strategic dialogue, and linking technology and innovation to wider socio-economic issues.

As the bandwidth of application of foresight can be broad and expectations on what it may be used for are often fuzzy, it helps to distinguish between exploratory and normative nature of foresight. Exploratory approaches lead to discussions of alternative futures by asking “what if?” Normative approaches can build on alternative futures by asking “what to do?” and discussing for example policy options in response to identified issues.

A highly explorative means of finding alternative futures is based on finding surprising elements and emerging issues. Surprising and emerging issues are future developments that are still outside the mind set of organisations or society, but can have a significant impact on these organisations and society. The concept of emerging issues emphasises the fact that these developments with possible substantial impact need attention from organisations and society. The emerging issues are preceded by early warning signals and (the combination of various) signals are an indication that an issue with impact might develop. An important element is that the emerging issue in itself is often unknown to organisation and society, while the early warning signals can be well known<sup>3</sup>. A specific approach to think about emerging issues and early warning signals are wild cards and weak signals.

Wild cards were introduced in 1992 by the the Copenhagen Institute for Futures Studies (Denmark), BIPE Conseil (France), and the Institute for the Future (USA) and focused on the business context. Petersen (1997; 2000) extended the concept to social systems and defined a wild card as ‘ a Low Probability, High Impact event that is so large and/or arrives so fast that social systems are not able to effectively respond to it.’ Hence, a wild card is an event that is surprising and unexpected (i.e. has a low perceived probability of occurring) but with a ‘potentially high impact and strategic consequences for an organisation or a society’ (Mendonça et al., 2004). A wild card can ‘alter the fundamentals, and create new trajectories which can then create a new basis for additional challenges and opportunities that most stakeholders may not have previously considered or prepared for’ (Saritas and Smith, 2011).

Wild cards are surprising events, but they are not necessarily a surprise for all. Or as Smith and Dubois (2010) discuss: ‘wild cards need not be a wild card experienced universally’ and the

---

<sup>2</sup> There are many definitions and explanations of foresight. The explanation given here is based on the combined insights from projects and initiatives such as FOR-LEARN, European Foresight Monitoring Network, iKnow, and contributions from foresight experts. An extensive overview of foresight practices and methodologies is provided in Georgiou et al (2008) *The Handbook of Technology Foresight*, Cheltenham: Edward Elgar Publishing Ltd.

<sup>3</sup> SESTI working paper ‘Approach to exploratory scanning’, 2011

formulation and analysis of a wild card has a subjective character, as it depends very much on one's world vision. Wild cards are especially shocking and surprising, because they do not fit into our usual frame of reference. Actually, wild card change our frame of reference, or as Steinmueller (2004) formulated: 'wild cards are earth quakes of the mental landscape'. Markley (2011) elaborated on the subjective elements of wild cards by introducing another dimension, i.e. the credibility or trustworthiness and believability of a source or message. These sorts of events can hit us anytime and this is why Popper (2011) highlights that wild cards are also associated to unexpected systems failures or sudden transformations resulting from breakthrough or incremental innovations.

The subjective and unpredictable characteristics of wild cards is also taken into account by Taleb. In 2007, he introduces the concept of black swans as a surprising event that will have a major impact and which is rationalised by hindsight, as if it could have been expected<sup>4</sup>. In other words, black swans are here because human beings have certain psychological limitations and biases that prevent use from foreseeing these events, while also thinking that the events were perfectly predictable after they occur.

The type and scope of impact can differ substantially. Some wild cards will be a one-off event with a very strong and abrupt impact world wide, while other wild cards may emerge slowly via a series of smaller, unplanned but interrelated events with also smaller and more localised impacts (Mendonça et al, 2004; Saritas and Smith, 2011) . Also, it is often very unclear what the exact impact will be as an event may have a very unclear development when it happens. Nevertheless, wild cards are not the same as trends (as they are surprising and unexpected, while trends are recognizable over periods of time), but they are related. Specifically, "many wild cards are actually following (usually with hindsight) a narrative where one or more almost invisible (sniping) trends or sequences of less important events lead to a critical tension which cause a sudden outburst."<sup>5</sup> Trends may result in growing "tension" eventually leading to a sudden "outburst" (i.e. a wild card).

Why are wild cards important? According to Steinmueller (2004) a wild card analysis has the capacity to introduce new elements into the process of scenario building, which is often performed in a closed circuit of experts. Wild cards help to open up the debate and make decision-makers think outside their 'usual frame of reference'. The purpose of wild cards is to test the reactivity of a system or organisation to unforeseen, but high impact events. In this way, a wild card analysis can be seen as an organisational learning tool in improving the organisation's or system's capacity to plan for the unexpected and to anticipate and adapt to rapidly changing contexts and to do this better than other organisations or systems (Smith and Dubois, 2010). Also from a policy perspective wild cards are important to look for, as they:

#### Examples of wild cards

- 9/11 attack on the World Trade Centre in New York
- Discovery of dynamite by Alfred Nobel
- Fukushima nuclear disaster
- Global financial crisis
- Cold fusion energy
- Iceland Volcano and dust cloud
- BP deep see oil leak in the Gulf of Mexico
- Gulf stream shift
- Cyber collapse

<sup>4</sup> The term Black Swan originates from the (Western) belief that all swans are white because these were the only ones accounted for. However, in 1697 the Dutch explorer Willem de Vlamingh discovered black swans in Australia. This was an unexpected event in (scientific) history and profoundly changed zoology. After the black swan were discovered, it seemed obvious that black swans had to exist just as other animals with varying colors were known to exist as well. In retrospect, the surrounding context (i.e., the observations about other animals) seemed to imply the Black Swan assumption – empirical evidence validated it.

<sup>5</sup> FAR Horizon Deliverable 3.1: Wild Cards for and in the FAR Horizon workshops (conceptual framework and examples)

- make policies more resilient to the occurrence of wild cards and their effects;
- enable the monitoring of early warning signals of wild cards to timely adapt or mitigate to the impact
- support safety measure investments
- counteract undesirable lobby cards and human caused wild cards under construction

The main question is how to foresee wild cards. Although wild cards pop up suddenly, wild cards can result from trends or there might be signals of an ‘approaching’ wild card (Steinmueller, 2008). These signals are also called weak signals. Weak signals are early warnings of a ‘potential change of a system toward an unknown direction’ (Mendonca et al, 2004) and weak signals may lead to the identification of wild cards. Weak signals have been discussed by many researchers and there are many different definitions and also concepts that are close to weak signals, such as emerging issues, seeds of change, early warning signals etc. Ansoff’s (1975) celebrated work started the thinking about weak signals. Hiltunen (2008a and 2008b) and Rossel (2011) give an extensive overview of the literature discussing weak signals, both for the business environment and the society. Based on Ansoff (1982), Hiltunen (2008b) defines weak signals as ‘warnings, (external or internal), events and developments that are still too incomplete to permit an accurate estimation of their impact and/or to determine their complete responses’. Moreover, Hiltunen (2008b) developed the concept of ‘future sign’ presenting a more holistic view on how weak signals relate to change. Future signs consist of three elements: 1) the issue; 2) the signal, referring to the concrete form the sign takes, such as a news article, a photo, a TV news item etc; and 3) the interpretation, referring to the sense made of the future potentiality of the sign. Hiltunen (2008b) also divided the weak signs or signals into two categories: 1) early information, referring to the fact that the number of signals or the visibility of signals is small, which makes it difficult to interpret the signs, making them weak; 2) first symptoms, referring to fact that there are numerous signals with a high visibility, but it is difficult to interpret the sign with great confidence.

In general, weak signals are early signs of possible, but not certain, changes that may later become more significant indicators of critical forces for development, threats, business and technical innovation. Weak signals are unclear and ambiguous (i.e. “weak”) but may become clearer or stronger by combining with other signals. They are ‘hints’ about potentially important futures and function as ‘seeds of change’ (Popper, 2011). They represent the first signs of bigger changes, discontinuities or paradigm shifts (Saritas and Smith, 2011). Weak signals can have different orientations and a often used format to structure is the STEEP format (Socio-Cultural, Science & Technology, Energy, Ecology and Economy and Geo-Politics).

The ‘weak’ element in weak signals is explained as that a signal can be unclear and ambiguous about what it is indicating. The SESTI project has extensively explored the characteristics of weak signals and emerging issues and comes to the conclusion that ‘the weakness is not linked to the signals, but to the emerging issues. The signal is merely an observation, which can be a precursor for an emerging issue; it can be very strong if it originates from many trustworthy sources. The identified emerging issue however, is by definition “weak”, meaning that it is unknown to the target audience. Therefor the term “weak signals” is misplaced and should be “signals”; the weakness is encompassed in the term “emerging”.<sup>6</sup>

Examples of weak signals:

- The first mention of global warning and climate change in the 1980s
- Increasing self medication
- Cars banned from city centres
- Growing frequency of floods in the World
- Growing privatization of war
- Russia turns off gas/oil for political purposes

<sup>6</sup> SESTI working paper ‘Approach to exploratory scanning’, 2011

Popper (2011) points at the importance of the beholder of a weak signal as weak signals are often 'influenced by the mental frameworks and subjective interpretations with limited information about emerging trends, developments or issues in a particular time and context. Their "weakness" is directly proportional to levels of uncertainty about their interpretations, importance and implications in the short-medium-to-long-term'.

Not everyone uses the term wild card to describe this phenomena. For example, a strongly related concept is that of "global shocks" as for example the OECD describes in its 2011 report on future global shocks. In this report, a global shock "is defined as a rapid onset event with severely disruptive consequences covering at least two continents. [...] Shocks in the future may arise from previously unknown hazards for which there are no data and no model for likelihood and impacts; the so-called unknown-unknown events."<sup>7</sup> These unknown-unknown events are quite similar to Weak Signals (or are stronger: "Nonexistent Signals"), and the global shocks are similar to wild cards, although the focus is on disaster-type wild cards with a global character.

Finding relevant weak signals typically requires systematic searching and environmental scanning and is one of the most challenging tasks in futures research. An example of this difficulty can be found in a small exercise involving the wild cards mentioned in the previous text box. For which of these wild cards can we think of weak signals that gave warnings of these major changes?

Hiltunen (2008a) has looked into the sources of weak signals. She describes a study aimed at identifying the preferred sources for finding weak signals, also as preferred by futurists or future-oriented people. The empirical results showed that the top ten sources of weak signals included many human sources such as scientists, futurists, colleagues and consultants. Textual sources like academic and scientific journals, research institute reports, popular science and economic magazines, TV and radio news items and book were also considered as important sources. Sources such as artistic works, science fiction and alternative publications and press are less used by future-oriented people and futurists. Also online sources were not widely appreciated as good sources. Respondents in that study also indicated that processing the weak signals (sense-making) is as important as the sources of weak signals. Combining different sources and cross-mapping signals were mentioned as tools for understanding changes. Markley (2011) suggests a snowball survey for futurists and future-oriented people that starts with a coherent question about a specific theme or topic and a question about who else should be approached about the specific theme or topic. Another tool would be imaginative time travel. Saritas and Smith (2011) conducted a large survey (The Big Picture Survey) to FTA Symposia and Conference attendees asking them about what they are seeing as 'emerging critical forces causing change and what they are hearing or learning about the types of major changes or discontinuities that may be expected in the short, medium and long term'.

Although the study by Hiltunen (2008a) shows mainly rather traditional sources are preferred by future-oriented people, she advocates focusing on extraordinary sources of information, such as bloggers, social activists or movements of minorities to search for the 'below-noise level' signals. Also Steinmueller (2004, 2006) proposes to focus on peripheral and atypical sources, including people who are by nature a 'little bit different': artists, science fiction writers, youth, socially excluded persons etc.

The SESTI project<sup>8</sup> team followed two approaches to scanning for weak signals: 1) exploratory scanning and 2) issues centred scanning. The SESTI team found out that using a limited number of keywords lead to an overload of signals, while a strong set of key words lead to a bias in the outcome. Exploratory scanning uses a limited search profile in order to identify precursors that are unknown/unknown to the target audience and aims to identify wide variety of new issues. The issue centred scanning uses the signals to evaluate preselected potential emerging issues and aims to

---

<sup>7</sup> Downloadable from: <http://www.oecd.org/dataoecd/7/55/48329024.pdf>

<sup>8</sup> SESTI Working Paper 'Approach to exploratory scanning', 2011

assess the relevance of the potential issues and to support selection by policy makers. The combination of both approaches enhances the focus of the search profile and limits the output to a manageable amount.

The iKnow project<sup>9</sup> used horizon scanning activities to ‘monitor, analyse and position’ both weak signals and wild cards (Popper, 2011). The iKnow project followed four strategies for this horizon scanning including both scanning activities by the project team and input from external experts and stakeholder: 1) a systematic scan of over 2,000 European Commission funded research projects; 2) a systematic scan of a wide range of sources including websites, blogs, news articles, journal articles, science fiction books etc; 3) an open scan of EU funded research activities by external members of the iKnow community; and 4) an open scan of a wide range of sources by external members of the iKnow community. The iKnow project also used interviews, workshops and surveys to identify, analyse and position emerging issues. The iKnow database contains over 400 wild cards and over 300 weak signals, which can be accessed, analysed and interconnected by the community.

Comparable to the SESTI project and the iKnow project, there are many more projects around the world aimed at identifying emerging issues. Under the Seventh Framework Programme several Blue Sky projects have been initiated to focus on identifying and analysing weak signals and wild cards. These projects will be discussed in the next section.

## 2.2. Blue Sky research initiatives

The European Commission published a call for proposals in 2006 dedicated to Foresight research under the Cooperation Programme of the Seventh Framework Programme for Research, Technological Development and Demonstration Activities (FP7). The “Blue sky research on Emerging Issues affecting European Science and Technology” as it has been termed, aims to identify issues which are just about emerging and which could have an important role in shaping the European research system in the future. The six projects funded under this theme are characteristic in their creative approach and the novel methodologies that they employ; they bring together leading European experts in foresight and prospective studies and are aiming to establish an extensive dialogue with a broad spectrum of stakeholders. We will discuss each of these six projects briefly below.

**Innovation Futures in Europe (INFU):** A Foresight Exercise on Emerging Patterns of Innovation.

The INFU Foresight exercise aims to develop scenarios of future innovation landscapes in order to support strategy building for policy and other innovation actors. The scenarios will outline how future actors may collaborate in new configurations and with new approaches to transform knowledge into products and services within different socio-economic frameworks. An explorative analysis will be complemented with a debate on the desirability of different innovation futures based on an assessment of the scenario implications for key societal challenges such as sustainability. Options for policy strategies to prepare for the identified changes in innovation patterns are derived together with key policy actors. The website includes an overview of weak signals and visions for the future based on these signals (amplifications).

Website: <http://www.innovation-futures.org/>

**Scanning for Emerging Science and Technology Issues (SESTI):** use of foresight to align research with longer term policy needs of the European Commission.

SESTI aims to develop a mechanism for the early identification of newly emerging issues of importance to the European research infrastructure. By collecting weak signals and developing

---

<sup>9</sup> [www.iknowfutures.eu](http://www.iknowfutures.eu)



anticipatory intelligence, SESTI will provide the means for proactively addressing these challenges at European and national level. The project builds on and adds value to existing national structures and competences in foresight and horizon scanning to create synergies and exploit complementarities. SESTI aims to provide a transnational “foundation” to horizon scanning to enable efficient scanning of emerging issues. The website provides access to a database with many different emerging issues and themes and allows for finding interrelationships.

Website: <http://sesti.info/>

**FarHorizon:** piloting the use of foresight to align research with longer-term policy needs in Europe.

This project seeks to advance knowledge on differences across policy domains in the European Research and Innovation Ecosystem (also further articulating this concept) in terms of the role and the integration of research agendas in long-term policies and vice-versa, and appropriate foresight designs needed to get engagement and secure follow-up across policy domains/areas. The project seeks to produce immediately useful results by selecting areas and participants with a view to stimulating action.

Website: <http://farhorizon.portals.mbs.ac.uk/>

**Security and Defence in the European Research Area (SANDERA):** the future relationship between the European Research Area and those EU policies focused on the security of the European citizen in the world.

The different aims of this project are: identifying drivers of change in the relationship between security and defence policies and the European Research Agenda (ERA), developing exploratory scenarios of alternative futures of the relationship between security policy and the ERA, analysing the policy implications of the scenarios, developing indicators of change, and stimulating dialogue and promoting stronger networking between the security policy and science and technology policy communities.

Website: <http://www.sandera.net/>

**iKNOW:** interconnecting Knowledge for the early identification of issues, events and developments shaping and shaking the future of science, technology and innovation in Europe and other world regions.

The iKNOW project intends to become a cornerstone for ongoing and future horizon scanning, foresight and forward-looking activities in Europe – advancing knowledge, tools and capacities for the analysis and use of WI-WE approaches. In particular, iKNOW has developed conceptual and methodological frameworks to identify, classify, cluster and analyse wild cards and weak signals and assess their implications for, and potential impacts on, Europe and the world. iKnow consists of several elements: iBank (to characterise and store WI-WE issues), iScan (to monitor and search WI-WE issues), iDelphi (to assess and prioritise WI-WE issues), iLibrary (to share innovation and foresight and horizon scanning documents), iCommunity (to engage and network innovation and foresight and horizon scanning people), iNews (to feature key contributions to iKnow’s foresight and horizon scanning systems) and iOracle (to map foresight and horizon scanning practices, players and outcomes).

Website: <http://www.iknowfutures.eu/>

**Citizen Visions on Science, Technology and Innovation (CIVISTI):** identify new, emerging topics for the EU R&D policy by consulting citizens in 7 European countries (Denmark, Austria, Flanders/Belgium, Finland, Malta, Bulgaria, Hungary).

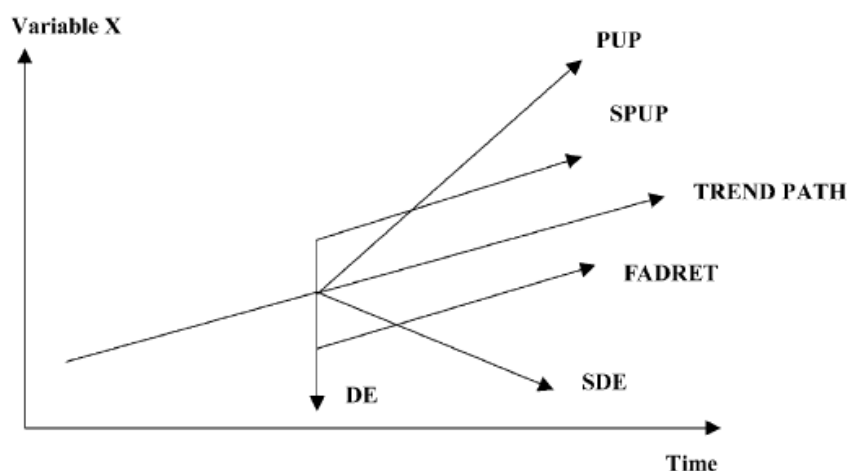
The CIVISTI project produced a list of new and emerging issues for European Research, a set of policy options of relevance to future European framework, and based these results upon a novel process of citizen participation in seven member states, supported by the analytical capacity of experts and stakeholders. Citizen consultation adds to other forms of analysis in several ways, for example: citizens carry a democratic credibility into the analysis, which is intuitively acknowledged by political decision-makers, the knowledgebase becomes more relevant when the scientific approaches are supplemented with daily life experience and ‘tacit knowledge’, and citizens are independent of the direct interests often involved in science and technology issues, which adds to the credibility of the process, and makes a more objective analysis possible.

Website: <http://www.civisti.org/>

### 2.3. Weak signals & emerging issues identified in Blue-Sky projects

There are many different emerging issues and weak signals and there are also several dimensions that can be used to systemise these emerging issues (and weak signals). Petersen (1997, 2000), Mendonça et al. (2004) and Steinmueller (2003; 2008) formulated several of these dimensions:

- Topic or theme of the emerging issue or weak signal: refers to the subject of the wild card. A classic framework for categorizing in topics is the STEEP framework, including social-cultural, science & technology, economy, ecology, and (geo-)political factors. Other frameworks can relate to the grand challenges or to the themes of the European Framework Programme, including themes such as health, agrofood, energy, environment, security, water, prosperity etc.
- Impact and reach of the emerging issue (and weak signals): refers to the nature and magnitude of the impact. A wild card can have minimal consequences, restricted to a specific industry or region for example. Wild cards can also trigger a completely new scenario, or affect the whole economy. Mendonça et al (2004) present a typology of impacts, including a) dead end type of wild card (DE); b) slow dead end type of wild card (SDE); c) fall down with a recovery to trend line (FADRET); d) push up to positive direction type of wild card (PUP), and e) step push up type of wild card (SPUP). See also figure 1 for explanation.



Source: Mendonça et al., 2004

Wild cards are often presented as events with negative impacts, such as terrorist attacks or natural disasters, but they can also have positive impacts, such as the discovery of penicillin (Popper, 2011).

- Plausibility and imaginability of the emerging issue or wild card: Wild cards are by definition rather surprising or wild ideas, but some are highly improbable, other are less improbable. Plausibility refers to the fact that some wild cards are plausible because they fit into our world view, while others are against our intuition and common sense, but are not absolutely impossible. Mendonça et al (2004) use the notion of imaginability and make the distinction between unimaginable surprises, imaginable surprises that are improbable (global nuclear war), imaginable surprises that are probable (oil price shock), and certain surprises (earthquakes).
- Time scale: some wild cards will be sudden, unique events with immediate impacts, while others will develop over time (e.g. as a creeping catastrophe) and will likely have an impact on the medium and longer-term.
- Causes: The FAR Horizon project<sup>10</sup> makes a distinction between wild cards that happened and potential wild cards. Wild cards that happened can be analysed with hindsight and categorized along their different narratives. According to the FAR Horizon project causes for wild cards are based on the growth narrative, an incident and accident narrative, or are really black swan type of surprises. The tension growth narrative refers to the fact that one or more almost invisible trends or combinations of smaller events lead to a critical tension with a sudden outburst (e.g. sub prime loans and perverse incentives in the financial sector leading to unpayable debts, leading to the financial crisis). The incident and accident narrative refers to sudden unexpected events with substantial impact that we know can happen occasionally, such as earthquakes, floodings, technical failures, but we do not know when, where and with what impact. Another distinction made is between nature and human causes. Nature caused wild cards are very difficult to prevent and will lead to adaptation or defence, while human caused wild cards may be prevented if foreseen. Human caused wild cards can be unintentional or intended.

In this section of the background report we will present an overview of various emerging issues or wild cards and weak signals that were identified and selected in some of the Blue Sky projects. It is a non-inclusive list, just providing examples of identified emerging issues and weak signals. In the workshop a selection of the most important wild cards and weak signals from four Blue Sky projects (INFU, FARHorizon, iKnow, SESTI) will be presented. We will use the framework of FP7 themes to categorise these emerging issues or wild cards and weak signals. Often emerging issues and weak signals can relate to more than one theme; here the examples of emerging issues are related to one theme only.

Note that the different projects do not all use precisely the same definitions for “wild card” and “weak signal”, or use different terms and approaches to describe the phenomena. These definitions may also differ from the one we gave above. When reading the list, this should be kept in mind. For example, the SESTI project identifies scientific and technological trends that are hardly unexpected, but that may eventually have unexpected consequences and result in wild card situations.

---

<sup>10</sup> FAR Horizon Deliverable 3.1: Wild Cards for and in the FAR Horizon workshops (conceptual framework and examples)

Emerging issues	Weak signal	Source
<b>Health</b>		
Obesity: The global epidemic marches on	Rising obesity, which is contributing to the global burden of chronic disease and disability Increasing affluence leading to abundance of food, poor consumption habits due to a hectic routine, and a sedentary lifestyle	The SESTI project D 6.3 Workshop reports (4/4) Health: Weak Signals and Emerging Issues for European Policy
Happy aging? Mental health in ageing society		
Deepening the gap between health services? Diversification in medicine Personalised medical treatment: Luxury good for few?		
Is prevention better than cure? Re-prioritising health research		
Use of neural implants as a possible means of unconsciously influencing thinking and emotions	Recent discoveries in invasive and non-invasive reading of brain activity	The SESIT project D6.3 Workshop reports Cognitive Enhancement: Weak Signals and Emerging Issues for European Policy
Cognitive enhancement deploying developmental drugs influencing the neuro-cognitive embryological and later development	Further deployment of cognitive performance-enhancing drugs	
Neuromarketing	Genetic screening of an increasing number of 'cognitive' genes	
Cognitive enhancement of individuals with lower cognitive performance levels	Knowledge gained from healing and preventing developmental cognitive impairment	
Killer virus		
Body parts on demand		iKnow project Policy Alerts, Popper and Butler (2011)
Traditional European Medicine		
Pervasive self-diagnosis and self-treatment		
Reduction in human diversity		
Robots and iCare for the aged		



Nervous breakdown of society		
iBrain vs Brain Port		
Transhumanism becomes a significant force		
<b>Agrofood and biotech</b>		
Global harvest failure resulting in social instability	Narrow food basis	FAR Horizon project D 3.1 Wild Cards for and in the FAR Horizon workshops
Rise of bio mimicry - development of artificial leaves based on the photosynthetic reaction utilised in plants	Successful genetic modification trials	The SESTI project D 6.3 Workshop reports (3/4) Energy: Weak Signals and Emerging Issues for European Policy
Crop or live stock pandemic		FAR Horizon project D 3.1 Wild Cards for and in the FAR Horizon workshops
Artificial life	Renewed attention is given to understanding the development of cells and the complex interaction of genomes with the cell interior environment	
Innovative solutions via biotechnologies to utilise the genomic resources (of plants and animals) to improve the efficiency of input to output (nutrients to food)		
Drastic reduction of population		
Wheat crisis hits humans and animals		iKnow project Policy Alerts, Popper and Butler (2011)
<b>Social Sciences and Humanities</b>		
Declining trust in medicine and science	The IPPC debate and the unfulfilled public promised of nano and biotech for health creates climate where tax payers did not take it anymore	FAR Horizon project D 3.1 Wild Cards for and in the FAR Horizon workshops
Nobody teaching anymore	Shortage of teachers because of ageing population and burnt out teachers because they cannot cope with speed of innovation	
Many elderly in poverty	Individualisation, economic crisis hitting pension funds, budget cuts in social welfare	
Extreme environmentalism leading to implosion in demand for high tech products and laws that block innovation	Large environmental accidents leading to more activism and protest movements	
Empowerment of Women		iKnow project Policy Alerts, Popper and Butler (2011)



The Poor Old		
Free Time Society in Europe		
Scientists up for murder as ethical issues are abolished		
Towards the Utopia?		
The rise of a new world		
The lottery: the way to the perfect world		
Female-centric projects a turn-off for women		
Universities close as research does not meet industry needs		
<b>Nanotech</b>		
Nano saves our energy	Nano technological approaches create materials that allow us to miniaturise structures and to create new functional but also strong/light weight materials that saves the energy we use in production, transport in a substantial way	FAR Horizon project D 3.1 Wild Cards for and in the FAR Horizon workshops
Nano giant risk: the trillion profit of nano promises denied the amounting number of risks till we found out that nano particles made us practically infertile		
Nano saves our lives: thanks to nano we can heal everything.	bio inspired nanotechnology created nano-vehicles for targeted drugs application and diagnosis	
Nano saves/steals our souls: nano-technological devices connected to the right parts of brains makes us able to control the souls of others		
Invisibility spray		
Nano-lab inside your body		iKnow project Policy Alerts, Popper and Butler (2011)
Individual nano-enabled safety capsule		



<b>Energy</b>		
Nuclear revival, rise of Hybrid Nuclear Energy Hybrid nuclear technology, box of Pandora or salvation	Scientific and technological developments	The SESTI project D 6.3 Workshop reports (3/4) Energy: Weak Signals and Emerging Issues for European Policy
Renewables from the desert (DESERTEC): Rise of renewable solar energy from the deserts, and impact on (in)stability	Concept is being applied in countries such as Australia and China	
New physics: nearly free energy		FAR Horizon project D 3.1 Wild Cards for and in the FAR Horizon workshops
Deeper and further (mining) known and unknown risks		The SESTI project D 6.3 Workshop reports (3/4) Energy: Weak Signals and Emerging Issues for European Policy
The unknown risk of Hydrogen economy, the importance of sustainable energy carriers		The SESTI project D 6.3 Workshop reports (3/4) Energy: Weak Signals and Emerging Issues for European Policy
Biofuels, biomass and bio mimicry as leading principle for real renewable energy		
Don't put it in the trash: tank your car and warm up your home		iKnow project Policy Alerts, Popper and Butler (2011)
Entering new energy era		
Severe accident of a nuclear power plant		
<b>ICT</b>		
ICT makes difficult tasks easy, no need to learn them ourselves	Development of wiki-based and self learning translation programmes, augmented reality and robots	FAR Horizon project D 3.1 Wild Cards for and in the FAR Horizon workshops
ICT learning explosion	Virtual internet related reality can be used to develop not only very direct interfaces with ICT systems on the sport but it also makes it easy to learn difficult tasks like music, flying a plane etc.	
	ICT-enhanced learning systems to be almost ripe for very promising tools for learning complex and cognitive motor tasks	The SESTI project D 6.3 Workshop reports Cognitive Enhancement: Weak Signals and Emerging Issues for European Policy
Total rejection of internet of things		iKnow project Policy Alerts, Popper and Butler (2011)



Critical information infrastructure collapsed: back to the 80s		
Universal electronic systems breakdown		
Total control by big brother technologies		
3D media trustworthily coping reality		iKnow project Policy Alerts, Popper and Butler (2011)
<b>Economy</b>		
Major epidemics stopping international trade for one year		FAR Horizon project D 3.1 Wild Cards for and in the FAR Horizon workshops
China stops to buy for US debt		
The accumulation of worthless debts blocked the economy completely		
Investments in IPR in vain as treaties on IPR for application for medical and environmental challenges were broken up		
Heavy study debts causes new economic crisis		
Developing countries moved from heavy industry to high tech services		
No Innovation		INFU Innovation Futures, project presentation
Innovation Camps		
Contests & Competition		
Top Secret Innovation		
Reverse Innovation		
Outburst of the Black Economy		
European Commission scrap research support projects		
China's investment and services 'great wall'		
Abrupt disintegration of the euro zone		





Rise of Africa		
<b>Environment</b>		
Leakage of hydrogen into the atmosphere because of rise of hydrogen economy	-	The SESTI project D 6.3 Workshop reports (3/4) Energy: Weak Signals and Emerging Issues for European Policy
Major volcanic eruption dimming sun light	Earlier occurrences	FAR Horizon project D 3.1 Wild Cards for and in the FAR Horizon workshops
Serious consequence of climate change much sooner than expected	-	FAR Horizon project D 3.1 Wild Cards for and in the FAR Horizon workshops
Biodiversity shrinkage threatens ecosystem	Shrinking biodiversity	
Climate change swops in the opposite direction as predicted by the modellers for period of more than 10 years	-	
Unpredictable climate change destroys agricultural production of whole continents		
The killer volcano: block on air transport, diminishing yields of crops, increasing lung diseases		
Istanbul Earthquake		
Burning fossil fuels saved our lives after all		
Solar flames turned off everything		
Floods in Europe cause mass migration		iKnow project Policy Alerts, Popper and Butler (2011)
The great tide: a new planet		
<b>Security</b>		
Nuclear war in the far-east		FAR Horizon project D 3.1 Wild Cards for and in the FAR Horizon workshops
Nuclear fallout of war causing crop losses and radioactive contamination		
Governments paralysed by overdose of information and communication (social media, user involvement etc)		
Nuclear conflict as practically all upcoming economies had nuclear plants and were secretly		

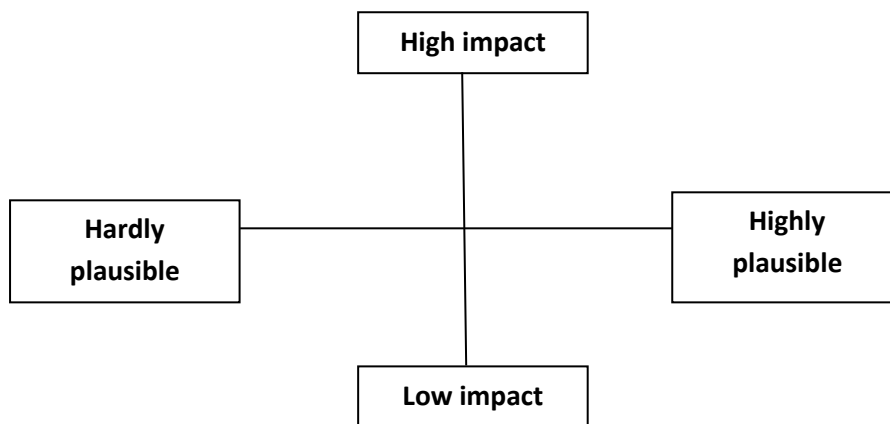


developing nuclear arms. UN lost control.		iKnow project Policy Alerts, Popper and Butler (2011)
New coalitions: EU-RU-North Africa as block against US and CHINA		
New pro-war president elected in the US		
Cyber crusade: Massive e-sabotage by 'hacktivists'		
Israel & Palestine are admitted to the EU		
Major EU state selects non-fascist leader		
<b>Transport</b>		
Minimum Flight Distance introduced		iKnow project Policy Alerts, Popper and Butler (2011)
Inner cities are closed for private cars		
<b>Space</b>		
Revolutionary space propulsion		iKnow project Policy Alerts, Popper and Butler (2011)
First contact with extra-terrestrial intelligence		

## 2.4. Prioritising emerging issues and weak signals

As mentioned before, emerging issues and weak signals can be categorized according to several dimensions and several of these dimensions can also be used for prioritising these emerging issues. For a first prioritisation and selection of emerging issues and weak signals the two most used dimensions in the literature and other studies (e.g. FarHorizon; Mendonça et al., 2004; Saritas and Smith, 2011) include the plausibility and the impact or reach. The emerging issues can be very plausible or hardly plausible. Emerging issues can have a substantial impact reaching to different areas of life, but the impact can also be limited to a specific industry, region or a specific area of life. The impact can be negative and positive.

If both dimensions of plausibility and impact are combined, emerging issues can be plotted, as shown in figure 2.



From a policy perspective it would be especially relevant to focus on those emerging issues that will likely have a high impact. To choose between those high impact emerging issues that are hardly or highly plausible is not so easy. Both categories are interesting, but the hardly plausible emerging issues are far more difficult to anticipate and to manage.

To prioritise those emerging issues that are relevant from a policy perspective, two more dimensions can be introduced. Policy makers can only anticipate and manage those emerging issues which they can influence through policy interventions. To what extent will the emerging issues impact the policy environment and to what extent can policy makers do something with these emerging issues? Policy interventions can be varied ranging from legislation to competition policy to infrastructural investments to communication efforts. Not all emerging issues will be in the range of influence for policy makers. The second additional dimension is related to the novelty of the emerging issue. By definition, emerging issues are upcoming and hence should be new, but several of these emerging issues stay on the agenda for some time, or re-emerge, or the overarching theme of the emerging issue has been on the agenda for some time. However, there will be emerging issues that are really upcoming and rather unknown to the policy world. Especially those emerging issues are interesting to further discuss and assess.

After the first prioritisation and selection of emerging issues by applying the four dimensions (plausibility, impact/reach, extent of influence possibilities for policy makers, and newness), a further assessment and identification of implications can be based on several dimensions:

- Short-term (up to 10 years) or long-term (10+ years) priority for policy-making
- Impact on several policy areas: social welfare, physical and virtual infrastructure, economy, education, security, environment and ecosystems, science, technology and innovation
- Relevance to grand challenges, European Innovation Partnerships and themes of the European Framework Programmes including health and healthy ageing, agrofood and biotechnology, information and communication technologies (ICT) and digital society, nanotechnology, climate change and energy, sustainable and efficient transport, social sciences and humanities, space, security, secured supply of non-energy raw materials and sustainable water management.
- Level of preparedness by policy-makers: to what extent are policy-makers ready to anticipate, manage and address the emerging issues? To what extent are the emerging issues recognised by the policy-makers?

### 3. Policy implications and requirements

The selected and prioritised emerging issues and weak signals are of strategic importance to policy and will need attention. The main question is how policy could respond in order to manage the emerging issues. Various emerging issues will have different implications and requirements for policy.

From a risk management perspective, the OECD (2011) discusses in its report on future global shocks how governments can ensure that society and economy can cope with risks that do occur. This is not about prevention or protection, but about resilience by fortifying systems and backup systems. Building societal resilience includes identifying vulnerable populations and development of policies to ensure they can cope with shocks; reinforcing the resilience of businesses and organisations and fortifying critical infrastructure; adapting risk communication to modern society and technologies; and building financial resilience by creating livelihoods based on flows of money or its equivalent.

In general, policy makers have different options to intervene and a general typology for policy intervention mechanisms includes a) regulations (laws, directives, co-regulation and stimulating self-regulation); b) economic means (tax incentives, subsidies, grants, guarantees, procurement, government provision); and c) information (provision of data and information, organising networks and platforms for information exchange, consensus building). Policy intervention may focus on preventing events from happening or on stimulating some early developments, or on developing emergency plans.

Without formulating the exact policy measures, it is possible to discuss what type of implications and requirements will be important for policy when dealing with a specific emerging issue. For example, if policy-makers want to anticipate and address the emerging issue that 'bio inspired nanotechnology will make it possible to heal and cure many more injuries and diseases' (identified in the FARHorizon project), one could think of, amongst others, the following implications and requirements for policy:

- If more diseases can be cured and more injuries can be healed, people may live longer in a healthier way. This will have implications for the health and social care to elderly people, the pension schemes and the demographic trends in a country. Costs of social and health care for elderly people may rise substantially and pensions schemes can get under high financial pressure.
- The bioinspired nanotechnological applications will come at a certain price and will likely push the costs of healthcare. How to finance this, how to insure this and will this high-tech health care be available for all, or only for the wealthy part of the society?
- How will the bioinspired nanotechnological revolution in health care impact the health care sector and the pharmaceutical and medical technology industry? What will be the position of Europe's industry?
- Pharmaceutical and medical products are subject to very strict regulation. To what extent can current European regulation anticipate the bioinspired nanotechnological revolution in health care? To what extent does the European regulation differ from regulatory regimes in other parts of the world and to what extent does that impact the competitiveness position of European applications. And how safe are the bioinspired nanotechnological applications developed outside Europe?
- What are the ethical implications of this wild card and how to address these?

Several of these policy implications will require new (forms of) regulation or the development of standards, others may require a different set-up for financing the health care sector, or efforts to harmonise regulation. Some policy implications will demand actions to bring stakeholders together, or to inform society about risks and opportunities, while others may require supporting further research.

Identifying relevant policy implications and options is not a simple task; it is a complex system of different policy areas and governance levels. Emerging issues will often have an impact in several policy areas at the same time, resulting in a wide range of applicable policy options. Horizontal and

cross-cutting policy interventions will be necessary to deal with the emerging issue. In addition, some of the policy options can be developed and applied at the European level, while others are subject to national responsibilities only.

The iKnow project (Popper and Butler, 2011) has developed policy alerts describing wild cards and some weak signals, assessing their likely impact and likelihood, but also discussing the potential policy actions to be taken by policy-makers and stakeholders, including research organisations, businesses, sector organisations, etc. This approach takes into account the many different policy areas the emerging issues can affect and identifies the different actions to be taken by different actors.

Foresight practitioners often see gap between the emerging issues that they consider as highly important for the future and the level of preparedness at the side of the policy-makers (Teichler, 2011). Emerging issues are then not recognised or considered as relevant by policy-makers. However, if experts are convinced of its importance, the main question then is how to bring the emerging issue to the attention of the policy-makers and to get it on the policy agenda. A related question is then who are these policy-makers and does this determine how the emerging issue can be brought to their attention? The experts consulted in the iKnow project (Teichler, 2011) argue that this depends also on the legitimacy of the emerging issues: 'What makes the claims to knowledge about the future from the foresight community more legitimate than those of others?' According to the consulted experts legitimacy is created by using a rigorous, systematic and transparent methodology, one that fulfills the criteria of science. A lack of time and resources often limits the possibility of sound scientific approaches. The consulted experts agreed that it is important to involve the policy-makers and other stakeholders in the process of identifying and analyzing emerging issues as much as possible and to apply participatory approaches.

## 4. Early Warning Systems

A general approach to early warning systems consists of three steps: 1) information gathering to find weak signals, risks, issues or trends; 2) sense-making of the identified signals through creative and multi-factorial analysis; and 3) formulation of a strategy to respond to these trends and issues in an appropriate manner (amongst others Rossel, 2011). The concept of early warning is linked with environmental scanning and also with risk management. Especially in risk and disaster management, the idea of early warning is very important and early warning systems have become a standard tool for managing major environmental risks such as tsunamis. For example, the Pacific Tsunami Warning Center (PTWC)<sup>11</sup> issues tsunami warnings for most of the Pacific Ocean, based on seismic data, sensor buoys, tide stations, and other inputs. Ideally, these systems allow governments and citizens to prepare to a certain extent for the arrival of a tsunami.

In a similar sense, governments can use “early warning systems” to prepare for the occurrence of weak signals and emerging issues or risks in all kinds of areas of society and economy, although gathering reliable “sensor data”, or weak signals, for such systems may prove to be even harder to do. Such early warning systems are intimately tied to (inter)national risk management. Risk management consists of the identification of critical systems and resources, which if disrupted could trigger a series of knock-on effects with adverse results. For example, if a possible emerging issue may disrupt a critical resource such as energy supply, risk managers may need to take preparatory action against such an eventuality. Risk management systems and tools regularly focus on risks to society and economy from a perspective of security threats and natural hazards. These systems are widely available and are often included in the military frameworks and national security doctrines. There are also risk management and early warning systems focusing on specific sub themes, such as cyber security or financial markets. The OECD (2011) describes several of these national and international early warning and monitoring systems in its report on future global shocks.

The Dutch National Risk Assessment Report 2010 (Nationale Risicobeoordeling Bevindingenrapportage 2010)<sup>12</sup> is one of an annual series of reports that is the product of a Dutch national early warning system and which is related to the Strategy National Security. For this report, a large number of scenarios was assessed, including extreme draught, flu pandemics, large-scale peaceful protests by animal activists, riots by extremists, internet disruption, and major chemical, nuclear or natural disasters. The main advice in this report for policy makers consists of further integrating national security interests in international policy, improving systematic information gathering, analysis and sharing, paying attention to risk management aspects of private-public partnerships, and improving communication in crisis situations. In the previous year, a new Wild Card appeared in this risk assessment: the event in which the Netherlands would be hit by a large-scale, coordinated cyber attack organized by an enemy state.<sup>13</sup>

Also the UK has a national risk assessment system installed. In 2008, the UK government published the National Risk Register<sup>14</sup>, providing advice on how people and businesses can better prepare for civil emergencies. In 2010, an updated was published informing the public on the Government’s most current assessment of the likelihood and potential impact of a range of different risks (both natural hazards and malicious threats) that may directly affect the UK. The National Risk Register aims to

---

<sup>11</sup> PTWC website: <http://ptwc.weather.gov/?region=1>

<sup>12</sup> Downloadable (in Dutch) from: <http://cdn.ikregeer.nl/pdf/blg-101376.pdf>

<sup>13</sup> As for example discussed in the Infosec Island blog:  
<https://www.infosecisland.com/blogview/13379-Cyber-Conflict-in-Dutch-National-Risk-Assessment-of-2010.html>

<sup>14</sup> <http://www.cabinetoffice.gov.uk/resource-library/national-risk-register>

increase awareness and to encourage individuals and organizations to think about their own preparedness.

The OECD argues in its report “Reviews of Risk Management Policies - Future Global Shocks – Improving Risk Governance”<sup>15</sup> that risk managers should adopt a broader view of risk, beyond visible direct threats, and expand their situation awareness to include trends and events that take place in far away locations.

Several authors have discussed and explored approaches to early warning systems that go beyond the detection of signals of natural hazards and security threats.

A relevant tool to inform policy and decision makers about new and future opportunities and threats and make them prepared for drastic changes and surprises/shocks is horizon scanning defined as “the systematic examination of potential (future) problems, threats, opportunities and likely future developments, including those at the margins of current thinking and planning. Horizon scanning may explore novel and unexpected issues, as well as persistent problems, trends and weak signal” (Van Rij, 2010- 1 and 2). Horizon scanning implies a search process, which is extended at the margins of the known environment and possibly beyond this (Loveridge, 2009) with the aim of identifying emerging issues and events which may present themselves as threats or opportunities for society and policy. Furthermore, Könnölä et al. (2012 forthcoming) regard horizon scanning as “a creative process of collective sense-making by way of collecting and synthesizing observations that hold potential for the formulation of pertinent future developments and the derivation of actionable implications on decision-making”. Horizon scanning may take place on specific policy domains (Botterhuis et al., 2010). While the intellectual origins of ‘horizon scanning’ can be traced to Ansoff (1975) on the recognition of weak signals, the term was popularized and institutionalized in the UK after the millennium (see Schultz, 2006). For example, the Department for Environment, Food and Rural Affairs (DEFRA) defined Horizon Scanning in 2002 as “the systematic examination of potential threats, opportunities and likely future developments which are at the margins of current thinking and planning” and, continuing, horizon scanning “may explore novel and unexpected issues, as well as persistent problems or trends”.

At present, various forms of horizon scanning are quite wide-spread (see, e.g., Amanatidou et al., 2012), even to the point where it is not easy to take stock of these activities that do not readily fit under any single label. Despite this variability, horizon scanning offers tested approaches for collecting signals which (i) articulate credible observations about current or imminent changes (either sudden, gradual, or in between these poles), (ii) are felt to be potential indications of new emerging issues that may have received insufficient attention, (iii) can be meaningfully shared, elaborated, and assessed by the participants.

Recently, horizon scanning activities have been applied at the national level to inform national foresight exercises thus providing more evidence-based approach to research and innovation policy (Georghiou, 2007). The main focus of the activity has been to address new and emerging technological areas, which may impact social, economic, environmental and political developments. The UK has a Foresight Horizon Scanning Centre, established in 2005, to support longer-term and evidence-based futures thinking and analysis throughout the government. The centre does short projects focusing on more discrete themes, but it also produced the Sigma Scan. This is a searchable set of 250+ brief papers exploring potential future issues and trends for the next 50 years that might impact UK public policy. The Sigma Scan covers a wide range of subjects and is based on a large number of different sources. The Netherlands Study Centre for Technology Trends together with the collaboration platform for sector councils (COS) produced a Horizon Scan in 2007. Also other

---

<sup>15</sup> Downloadable from : <http://www.oecd.org/dataoecd/7/55/48329024.pdf>



countries know horizon scanning projects, for example Denmark (Danish Horizon Scanning System), Japan (NISTEP exercise), and Singapore (Risk Assessment and Horizon Scanning system)<sup>16</sup>.

Kuosa (2010) introduces the futures signals sense-making framework (FSSF) based on the principles of environmental scanning and pattern management. This framework aims to address the problems of the traditional extrapolation approach, which is often used to define trends and to explore the future path for organisations. The main problem with this extrapolation approach is that weak signals can come from many different sources and societal changes are in essence interconnected, non-linear, interpretable, and multi-causal. This implies that a single weak signal cannot determine the future in itself. The FSSF approach is a framework for outlining and sense-making any type of futures oriented research material, regardless the level of futures knowledge and the fundamental nature of information. The framework makes a distinction between weak signals, drivers and trends, representing a scale from tacit/subjective to explicit/objective. These three levels of knowledge are divided into two types of information: 1) disrupting, bringing up non-linear implications and 2) promoting enhancing the understanding of linear developments. The combination results in six categories of future signals.

Mendonça et al (2004) introduce a wild card management, which consists of two components. The first component refers to a weak signal analysis, including environmental scanning for weak signals and an assessment of the weak signals and wild cards based on imaginability, substance and impact classifications (see also section 2.2). This should be a permanent process. The second component consists of real-time foresight activities to manage wild cards real time when they really happen. This refers to building improvisational capabilities that allow complementing general risk management and counter measure plans with novel tactics and locally sensitive practices. The organisational and governance structures should allow for informed improvisation.

Botterhuis et al (2010) describe how the Dutch Ministry of Justice uses an early warning system to monitor the social developments taking place in order to know which of the predefined scenarios are actually unfolding. According to the authors, an early warning system can be 1) proactive, an organisation monitors those issues that it defined as important; or 2) reactive, an organisation uses the early warning system as a radar for unexpected changes. Scenarios can be used as some kind of lenses or filters to scan and identify information in the environment and to link the weak signals to long-term changes and to place them in a long-term perspective. Using scenarios gives the weak signals structure and meaning. The scenarios do also give room for experimenting with policies on a small scale, comparable with the notion of options. With reference to Schwarz (2005), Botterhuis et al. (2010) also point at some pitfalls of including the scenarios in the early warning system: Scenarios are not broad and challenging enough, organisational isolation of the EWS manager, the scenarios limit the scanning of new developments, no agreement on what a trend of changes is, too much emphasis on quantitative data rather than qualitative data, and the (organisational) acceptance that the EWS does not provide absolute certainties about the future.

While Botterhuis et al (2010) suggest to use scenarios as some kind of lenses or filters to scan for weak signals and emerging issues and to structure them, Steinmueller (2003) advocates the use of wild cards in scenarios to estimate the susceptibility of a scenario to external disruptions, to compensate for potential weak points, to help recognizing alternatives and unexpected developments, and to counteract pitfalls in scenario thinking such as a shortage of imagination, predominance of wishful thinking or fixation on catastrophic scenarios. An analysis of 22 scenario studies by Notten et al (2005) shows that 11 out of these 22 did not use wild cards (or discontinuities as it was called in their analysis) in their scenarios, mainly because of methodological reasons, but also because of the negative connotation of discontinuities, which does not fit in considering only attractive futures, or is

---

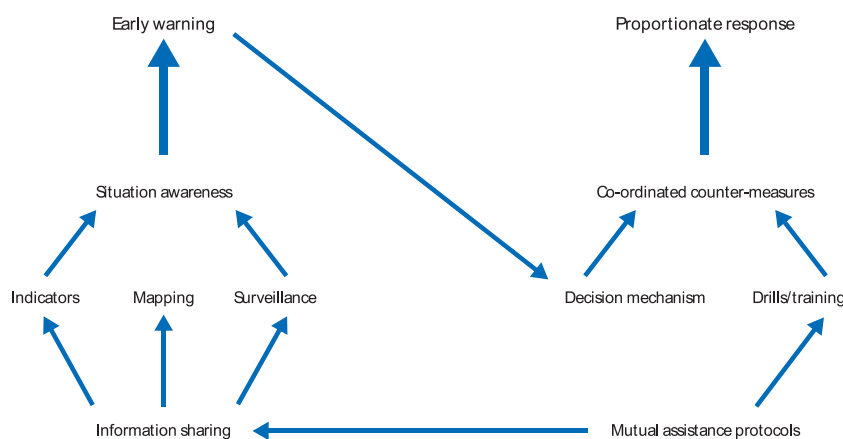
<sup>16</sup> For an overview of national horizon scanning initiatives, see Van Rij (2010) 'Joint horizon scanning: identifying common strategic choices and questions for knowledge', *Science and Public Policy*, 37, pp. 7-18

linked to resistance to radical change and uncertainty. Nevertheless, the other nine studies show that discontinuities can be included in scenario building and that it supports organisations to prepare for the future.

Nafday (2011) introduced the consequence-based structural design approach to cope with completely unexpected events and demands, such as the black swan events. The author argues that regular risk assessment build on the likelihood of an event, but that this is not very useful for black swan events as their likelihood cannot be estimated due to the lack of event knowledge and observed data. Also expert opinions and subjective beliefs are of minimal use, because too biased and because they do not really know what they do not know (the unknown unknowns). According to the author, the focus in risk management systems should move to consequences of failure to cope with unexpected events. The consequence-based structural design approach analyses the likely system consequences, irrespective of the event triggering these consequences and without knowing the likelihood of the unexpected events.

The OECD (2011) discusses in more detail characteristics of risk assessment and management systems and their requirements. These systems can help to design and reinforce complex systems to be more robust, redundant and or diverse and to build social resilience to unknown events by learning from other extreme events. Strategies that manage global shocks need to address both immediate risks and the underlying drivers. Hence, a more systemic perspective is needed to look at the causal relations, the amplifiers, and the direct and secondary impacts. Driven by advances in ICT, a new generation of mapping and modelling tools of complex systems has emerged. Nevertheless, the OECD indicated in its report that the accuracy and predictive power of modelling tools should be improved and interface improvements are needed to translate the modelling results into policy actions. The lack of data about complex systems is an important challenge, as well as the need for diverse modelling capabilities with global coverage and including variables from various disciplines. Another major challenge, according to the OECD, is recognising the signs (weak signals) that signal global shock.

An example of the capacities required for an early warning system for global shocks, which may also be usable for emerging issues in general, is also given in the OECD report. From information sharing, via developing indicators to actually implementing decision mechanisms, the implementation of a formal early warning system involves many different capacities, and is a complex task.



*Illustration from the Future Global Shocks report (OECD, 2011)*

The occurrence and impact of emerging issues will not stop at the national border, but will often be global emerging issues with global effects. Moreover, while the far-reaching European economic integration brings many benefits, it also results in new vulnerabilities, since shocks in one Member State may quickly spill over to other Member States. This draws attention to the need for strategic

preparation and international co-operation in early warning and wild card and risk management systems. The OECD (2011) has identified many different national and international institutions and networks that govern potential global shocks and it shows a patchwork of many different organisations, networks and arrangements, both formal and informal, and it is clear that capacity gaps exists. The OECD makes a plea for more international collaboration and even a global intermediary to ensure the gathering and aggregation of monitoring data according to common standards and terminology. This would help to identify emerging issues and weak signals that will hard to be find on a national or international level only and it will support the exchange of information and could even lead to co-ordinated joint counter measures. In addition, partnerships between private and public bodies would be necessary to support the exchange of information and to enhance the interpretation of the emerging issues, for example because large parts of infrastructure are in hands of private actors.

The JRC, for instance, within its newly established 'Science Advice to Policy, Innovation and Horizon Scanning' is establishing a series of activities aiming at strengthening the JRC's horizon scanning and foresight capacity to develop strategic intelligence and allow the JRC to be in a better position to deliver more integrated science-based policy options and advice to the European Commission (JRC, 2010).

## 5. Final remarks

Many projects and initiatives in the world aim at identifying and assessing weak signals and wild cards and it appears to be a rather difficult task to recognise these weak signals and wild cards and to really open our eyes. However, if we are able to identify these emerging and surprising issues and to assess their relevance and potential impact, there remains another important questions: What do we do with them? How to address and manage these weak signals and wild cards?

In the workshop we will try to take a first step by identifying and discussing potential policy implications, requirements and options for a selection of emerging and surprising issues. We will also discuss how various countries have build their early warning systems and how they deal with the weak signals and wild cards identified and analysed as most pressing for their situation. Moreover, we will brainstorm on if international or pan-European efforts would be favourable and how this could be build.

## 6. References

- Amanatidou, E. et al. (2011). On Concepts and Methods in Horizon Scanning: Lessons from Initiating Policy Dialogues on Emerging Issues. Submitted paper for the FTA 2011 conference, Seville.
- Ansoff (1975) “Managing Strategic Surprise by Response to Weak Signals”, *California Management Review*, vol. XVIII no. 2, pp. 21–33.
- BIPE Conseil et al (1992) *Wild Cards: A Multinational Perspective*, Palo Alto, CA: Institute for the Future
- Botterhuis, L., P. van der Duin, P. de Ruijter and P. van Wijck (2010) ‘Monitoring the future. Building an early warning system for the Dutch Ministry of Justice’, *Futures*, pp. 454-465
- Butter, M. and M. Leis (2011) *SESTI Working Paper: Approach to exploratory scanning*
- DEFRA (2002). *Horizon Scanning & Futures Home*. <http://horizonscanning.defra.gov.uk/> (15.7.2011)
- FAR Horizon: Deliverable 3.1: Wild Cards for and in the FAR Horizon workshops (conceptual framework and example) – Wild cards as shapers and shakers for the future
- Georghiou, Luke (2007) *Future of Foresighting for Economic Development*. UNIDO, Vienna (Available at: [https://www.unido.org/foresight/rwp/dokums\\_pres/tf\\_plenary\\_georghiou\\_201.pdf](https://www.unido.org/foresight/rwp/dokums_pres/tf_plenary_georghiou_201.pdf), last accessed 8 September 2011).
- Georghiou et al (2008) *The Handbook of Technology Foresight*, Cheltenham: Edward Elgar Publishing Ltd.
- Hiltunen, E. (2008a) ‘Good Sources of Weak Signals: A global Study of Where Futurists Look for Weak Signals’, *Journal of Futures Studies*, 12(4), pp. 21-44
- Hiltunen, E. (2008b) ‘The future sign and its three dimensions’, *Futures*, 40, pp. 247-260
- JRC (2010) *Anticipation at JRC. Development of a corporate capacity to identify and address future issues relevant to scientific support to EU policies*. European Commission, DG JRC, Brussels (18.11.2010)
- Könnölä, T., A. Salo, C. Cagnin, V. Carabias and E. Vilkkumaa (2012) *Facing the Future: Scanning, Synthesizing and Sense-Making in Horizon Scanning*. *Science and Public Policy*, forthcoming
- Kuosa, T. (2010) ‘Futures signals sense-making framework (FSSF): A start-up tool to analyse and categorise weak signals, wild cards, drivers, trends and other types of information’, *Futures*, pp. 42-48
- Loveridge, D. (2009) *Foresight: The Art and Science of Anticipating the Future*. New York and London: Routledge.
- Markley, O. (2011) ‘A new methodology for anticipating STEEP surprises’, *Technological Forecasting & Social Change*, 78, pp.1079-1097
- Mendonça, S., M. Pina e Cunha, J. Kaivo-oja and F. Ruff (2004) ‘Wild cards, weak signals and organizational improvisation’, *Futures*, 36, pp. 201-218
- Nafday, A.M. (2011) ‘Consequence-based structural design approach for black swan events’, *Structural Safety*. 33, pp. 108-114

Nationale Risicobeoordeling Bevindingenrapportage 2010, 30 November 2010

Notten, van Ph.W.F., A.M. Slegers, M.B.A. van Asselt (2005) 'The future shocks: On discontinuity and scenarios development', *Technological Forecasting and Social Change*, 72, pp. 175-194

OECD (2011) *Future Global Shocks: Improving Risk Governance*, OECD Reviews of Risk Management Policies, Paris: OECD

Petersen, J.L. (1997) *Out of the Blue: Wild cards and other big future surprises : how to anticipate and respond to profound change*, Arlington Institute

Petersen, J.L. (2000) *Out of the Blue: How to Anticipate Big Future Surprises*, Madison Books

Popper (2011), 'Introduction to iKnow and the Policy Alerts, in 'Popper, R. and Butler, J. (Eds) *iKnow Policy Alerts*, Report of the Blue Sky iKnow Project for the European Commission Directorate-General for Research and Innovation Socio-economic Sciences and Humanities, Manchester: The University of Manchester, ISBN 978-0-946007-22-6.

Popper, R. and J. Butler (2011) *iKnow Policy Alerts*, Report of the Blue Sky iKnow Project for the European Commission Directorate-General for Research and Innovation Socio-economic Sciences and Humanities, Manchester: The University of Manchester, ISBN 978-0-946007-22-6.

Rij, van, V. (2010) 'Joint horizon scanning: identifying common strategic choices and questions for knowledge', *Science and Public Policy*, 37, pp. 7-18

Rossel, P. (2011) *Beyond the obvious: Examining ways of consolidating early detection systems'*, *Technological Forecasting & Social Change*, 78, pp.375-385

Saritas, O. and J.E. Smith (2011) 'The Big Picture – trends, drivers, wild cards, discontinuities and weak signals', *Futures*, 43, pp. 292-312

Schultz, W.L. (2006). *The Cultural Contradictions of Managing Change: Using Horizon Scanning in an Evidence-based Policy Context*, *Foresight* 8(4), 3–12.

SESTI: Deliverable D 6.3 Workshop reports (3/4) *Energy: Weak Signals and Emerging Issues for European Policy*

SESTI: Deliverable D 6.3 Workshop reports (4/4) *Health: Weak Signals and Emerging Issues for European Policy*

Smith, C.J. and A. Dubois (2010) 'The 'Wild Card' of European futures: Planning for discontinuities?', *Futures*, 42, pp. 846-855

Steinmueller, K. (2003) *The Future as Wild Card: A short introduction to a new concept*, Berlin

Steinmueller, K. (2004) *Wild cards: using wild cards in influencing change*

Steinmueller, K. (2006) *Wild cards and trends*, Zpunkt, the Foresight Company

Steinmueller, K. (2008) 'Wild Cards – Preparing for the Unpredictable', Conference Paper for Thinking about the Future, Strategic Anticipation and RAHS by Risk Assessment and Horizon Scanning (RAHS), National Security Coordination Secretariat, Singapore

Schwarz, J.O. (2005) 'Pitfalls in implementing a strategic early warning system', *Foresight* 7 (4), pp. 22-30

Taleb, N.N. (2007) *The Black Swan, the Impact of the Highly Improbable*, New York: Penguin Books



Teicler, T (2011) 'Key Highlights from the iKnow interviews' in 'Popper, R., J. Butler, C. Degenhardt, I. Montenegro Pirini and T. Teichler (Eds) iKnow Interviews, Report of the Blue Sky iKnow Project for the European Commission Directorate-General for Research and Innovation Socio-economic Sciences and Humanities, Manchester: The University of Manchester

## *EFP Consortium*

### **Project Management, Briefs Production and Communication**

Susanne Giesecke, Matthias Weber, Dirk Johann (AIT)

A-1220 Vienna

Austria

☎: +43 50550 4564

✉: [Susanne.Giesecke@ait.ac.at](mailto:Susanne.Giesecke@ait.ac.at)

✉: [Matthias.Weber@ait.ac.at](mailto:Matthias.Weber@ait.ac.at)

✉: [Dirk.Johann.fl@ait.ac.at](mailto:Dirk.Johann.fl@ait.ac.at)

### **Contact for Mapping**

Rafael Popper, Thomas Teichler (UNIMAN)

Oxford Road

GB-Manchester, M13 9PL

United Kingdom

☎: + 44 161 2750926

✉: [Rafael.popper@man.ac.uk](mailto:Rafael.popper@man.ac.uk)

✉: [thomas.teichler@gmail.com](mailto:thomas.teichler@gmail.com)

### **Contact for Policy Support and Good Practice Dissemination**

Mark Boden, Cristiano Cagnin, Vicente Carabias, Karel Haegeman, Elisabetta Marinelli (JRC-IPTS)

Edificio Expo, C/Inca Garcilaso, 3

41092 Seville, Spain

☎: +34 954 488 488

✉: [Mark.Boden@ec.europa.eu](mailto:Mark.Boden@ec.europa.eu)

✉: [Cristiano.CAGNIN@ec.europa.eu](mailto:Cristiano.CAGNIN@ec.europa.eu)

✉: [Vicente.CARABIAS-BARCELO@ec.europa.eu](mailto:Vicente.CARABIAS-BARCELO@ec.europa.eu)

✉: [Karel-Herman.HAEGEMAN@ec.europa.eu](mailto:Karel-Herman.HAEGEMAN@ec.europa.eu)

✉: [Elisabetta.MARINELLI@ec.europa.eu](mailto:Elisabetta.MARINELLI@ec.europa.eu)

### **Contact for Website and Policy Support**

Annelieke van der Giessen, Bas van Schoonhoven (TNO)

P.O. Box 5050

NL-2600 GB Delft

The Netherlands

☎: +31 88 866 7428

✉: [annelieke.vanderGiessen@tno.nl](mailto:annelieke.vanderGiessen@tno.nl)

✉: [bas.vanschoonhoven@tno.nl](mailto:bas.vanschoonhoven@tno.nl)

Joachim Klerx (AIT)

✉: [Joachim.Klerx@ait.ac.at](mailto:Joachim.Klerx@ait.ac.at)