



**European Foresight Platform**

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EFP Deliverable– WP 5.11 – Workshop Report

## Policy options for surprising and emerging ISSUES - Workshop report of the EFP Policy Workshop

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EUROPEAN  
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SEVENTH FRAMEWORK  
PROGRAMME

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### **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.*

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# Contents

- 1. Goals & aims 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 ..... 12
  - 2.4. Prioritising emerging issues and weak signals..... 16
- 3. Policy implications and requirements ..... 22
- 4. Early Warning Systems ..... 25
- 5. Conclusions and lessons from the workshop ..... 30
- 6. References ..... 31
- Annex 1 – Workshop agenda ..... 34
- Annex 2 – Participants..... 39
- Annex 3 – Summary working groups..... 40

## 1. Goals & aims of the Policy Workshop

The European Foresight Platform (EFP) organised a European policy workshop on 'Policy options for surprising and emerging issues' on the 26<sup>th</sup> of October 2011 in Brussels. The workshop focused on those issues and surprises that could shape the European Research Area (ERA). Specifically, the workshop objectives were:

- 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 consisted 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

To provide more background information on the topic of surprising and emerging issues a background paper was prepared. This background paper gave information on 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. This workshop report updates the original background paper with results from the workshop and adds the surprising and emerging issues presented during the workshops, the results of the working groups on prioritisation of these issues and possible policy requirements and actions, as well as the results from the presentations and discussions on early warning systems.

The programme for the workshop is included in Annex 1. The workshop was attended by 35 people. An overview of the workshop participants is provided in Annex 2. Presentations given at the workshop can be downloaded from

<http://www.foresight-platform.eu/7746/eventreport/efp-european-policy-workshop-policy-options-for-surprising-and-emerging-futures-in-europe/>

## 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>1</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>2</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 Copenhagen Institute for Futures Studies (Denmark), BIFE 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 formulation and analysis of a wild card has a subjective character, as it depends very much on one’s

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<sup>1</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>2</sup> SESTI working paper ‘Approach to exploratory scanning’, 2011

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 the black swan as a surprising event that will have a major impact and which is rationalised by hindsight, as if it could have been expected<sup>3</sup>. In other words, a black swan is here because human beings have certain psychological limitations and biases that prevent use from foreseeing such an event, while also thinking that the event was perfectly predictable after it occurs.

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 worldwide, 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>4</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:

- make policies more resilient to the occurrence of wild cards and their effects;

<sup>3</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 swans were discovered, it seemed obvious that black swans had to exist just as other animals with varying colours 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>4</sup> FAR Horizon Deliverable 3.1: Wild Cards for and in the FAR Horizon workshops (conceptual framework and examples)

#### 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 sea oil leak in the Gulf of Mexico
- Gulf stream shift
- Cyber collapse

- 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 an 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. Therefore the term “weak signals” is misplaced and should be “signals”; the weakness is encompassed in the term “emerging”’.<sup>5</sup>

Examples of weak signals:

- The first mention of global warming 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>5</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>6</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>7</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 leads to an overload of signals, while a strong set of key words leads 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 a wide variety of new issues. The issue centred scanning uses the signals to evaluate preselected potential emerging issues and aims to assess the relevance of the potential issues and to support selection by policy makers. The

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<sup>6</sup> Downloadable from: <http://www.oecd.org/dataoecd/7/55/48329024.pdf>

<sup>7</sup> SESTI Working Paper 'Approach to exploratory scanning', 2011

combination of both approaches enhances the focus of the search profile and limits the output to a manageable amount.

The iKnow project<sup>8</sup> uses 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 article, 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. Also under the Seventh Framework Programme several Blue Sky projects have been initiated to focus on identifying and analysing weak signals and wild cards. These Blue Sky 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.

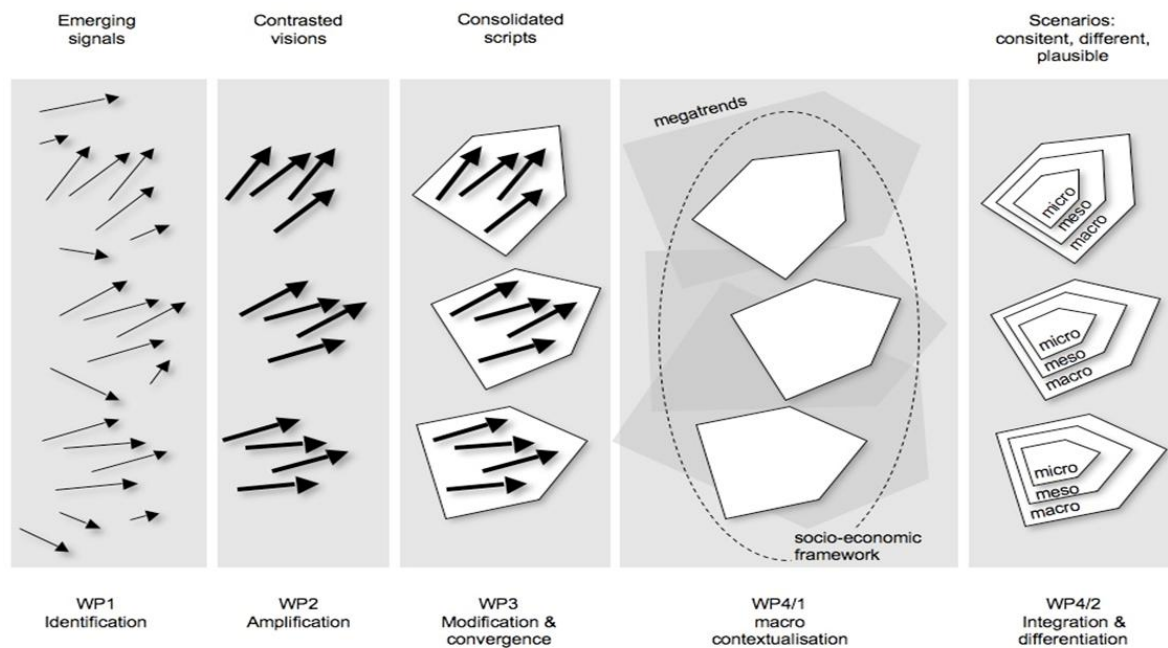
The INFU Foresight exercise aims to develop scenarios of future innovation landscapes in order to support strategy building for policy and other innovation actors. The main question of the INFU Project is how innovation will be organised in the future. INFU follows a foresight process, combining the elements of weak signal scanning, the development of visions, scenario construction and scenario assessment. The scenarios 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 is 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).

Figure 2-1 shows the methodology in INFU to go from weak signals to scenarios.

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<sup>8</sup> [www.iknowfutures.eu](http://www.iknowfutures.eu)

Figure 2 -1 INFU Methodology From Weak Signals to Scenarios



Source: INFU presentation by Susanne Giesecke, EFP Workshop, 26 October 2011, Brussels

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 aimed 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 anticipatory intelligence, SESTI provided 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 aimed 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/>

In SESTI emerging issues are storylines:

- With high impact (on society, economy, ecology and the domain);
- That are plausible, because including factual basis and reliable sources;
- That are novel (really new for the policy makers);
- Include emotional and critical aspects;
- Where interests are at stake (commonalities and or conflicts);
- That can be changed (the story or its impact can be changed by human action);
- Have policy relevance.

Wild cards, on the other hand are a special kind of issue, including events or series of events with seemingly low probability, that can change the settings of our world completely (highly unpredictable and high impact shocks), which we hardly see or do not want to see coming, and when they occur it is hard to see how they will evolve (high uncertainty). Wild cards can be categorised as wild cards that have happened or that may happen (imagined), and wild cards can be nature caused or human caused (intentionally or not intentionally).

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

This project uses foresight to align research and innovation with longer term policy needs in Europe. It seeks to advance knowledge on differences across policy domains in the European research and innovation ecosystem and on appropriate foresight designs to get engagement and secure follow-up across policy domains/areas. FarHorizon focuses on connecting the European research system and agenda with broadly desirable socio-economic goals and challenges through foresight tools. FarHorizon selected four pilot domains: agriculture and adaption to climate change; dynamising innovation policy; education in an ICT-revolutionised society; and breakthrough technologies for the security of supply of critical minerals and metals in the EU economy. In the project, scenarios were developed and imagined wild cards were used to assess the robustness of the scenarios. Participants in workshops were invited to imagine wild cards coming from all STEEP<sup>9</sup> areas with high or low impact on the scenarios. The wild cards were grouped around different types of impact, and a rough assessment of robustness was made.

The wild cards played different roles in the preparation of the scenarios in the four pilot domains. For example, in the innovation policy domain scenarios, it was concluded that some of the wild cards could create additional challenges (hence, extra demand) for innovative solutions, while others could lead to less financial means for innovations. In the agriculture domain, many wild cards point in the direction of enhancing the capacity and resilience of the agricultural system, to create buffers against local and global shortages. Overall, the imaginative wild cards produced by the participants in the FarHorizon workshops focused on the scenarios to develop, they mainly reflect present day problems and had some, but not substantial, influence on the scenarios that were developed.

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/>

The SANDERA project was not presented during the EFP workshop.

**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 on-going 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

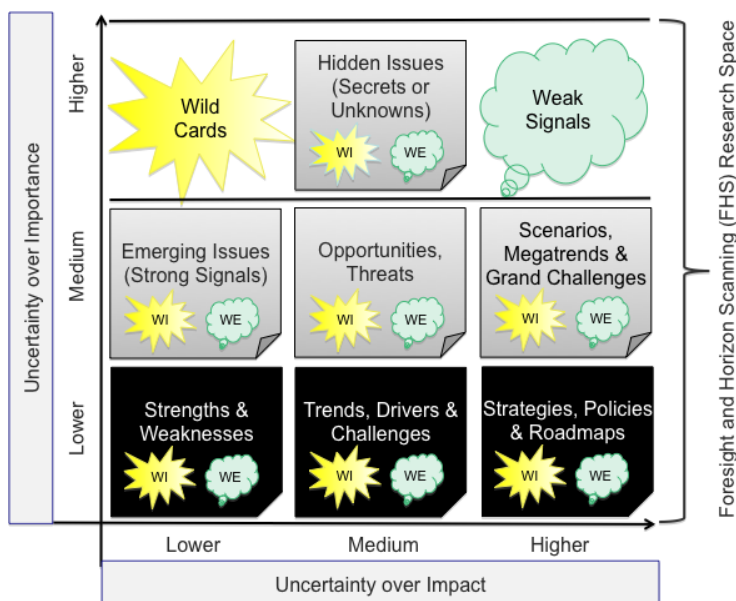
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<sup>9</sup> STEEP: Social, Technological, Economic, Environment, Political

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).

In the iKnow project three broader types of wild cards are defined: nature related, unintentional results of human actions and intended results of human actions. The iKnow project also assumes that anything could be a weak signal, but that it all depends on the observer’s interpretation. Eight broader types of weak signals are defined: current strengths & weaknesses; current drivers, trends and challenges; current strategies and policies; emerging issues, future drivers, scenarios, threats & opportunities; shared visions, megatrends and grand challenges; hidden issues; and past wild cards. Wild cards and weak signals can emerge or re-emerge, but also discontinue or continue over time. Past wild cards can be weak signals of future events and weak signals can hint about potential wild cards. Figure 2-2 shows these different types of wild cards and weak signals in relation to the uncertainty over importance and over impact.

Figure 2-2 Wild cards and weak signals



Source: iKnow presentation by Rafael Popper at EFP workshop, 26 October 2011

The iKnow project developed a new concept for weak signals: “Weak Signals are ambiguous events, often referred to as ‘seeds of change’, providing advance intelligence or ‘hints’ about potentially important futures, e.g. Wild Cards, challenges and opportunities. Weak Signals lie in the eye of the beholder and are often influenced by the mental frameworks and subjective interpretations of individuals 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. Weak Signals are unclear observables warning us about the possibility of future ‘game changing’ events.” (iKnow presentation by Rafael Popper at EFP workshop, 26 October 2011). The iKnow project selected and assessed 120 wild cards and weak signals.

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/>

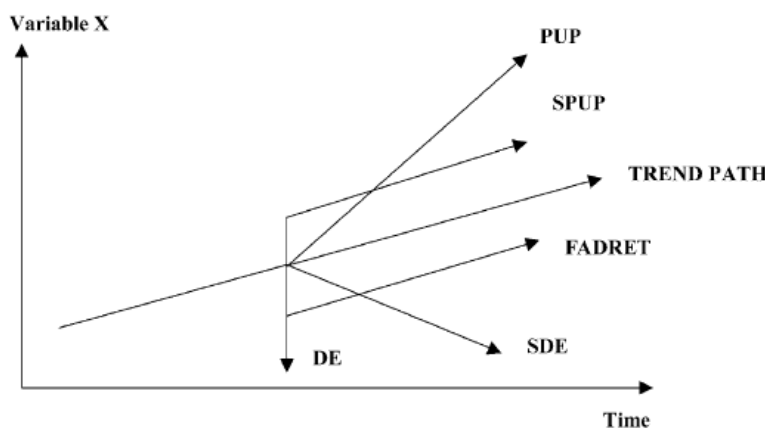
The CIVISTI project was not presented at the EFP workshop.

### 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, 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 2-3 for explanation.

Figure 2-3 Different types of impact and reach of wild cards



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. subprime 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.
- Uncertainty over importance and over impact: The iKnow project structures different types of wild cards and weak signals according to the level of uncertainty over importance and the level of uncertainty over impact (see also figure 2-2).

In this section of the workshop paper we will present an overview of various emerging issues or wild cards and weak signals that were identified in some of the Blue Sky projects and selected for the EFP workshop. The wild cards and weak signals are clustered according to the broad themes also used in FP7. 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 ones given 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)

<b>Wild card or weak signal</b>	<b>Blue Sky Project</b>
<b><i>Health</i></b>	
Nano-lab inside your body	iKnow
Neuro-enhancement Cognitive enhancement of individuals with lower cognitive performance levels	iKnow
Increasing self-medication	iKnow
Re-prioritising health research: prevention vs. cure	SESTI
Mental health in an ageing society	SESTI
Influencing and reading brains Use of neural implants as a possible means of unconsciously influencing thinking and emotions	SESTI
Obesity, a global epidemic marches 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	SESTI
Influencing embryonic and evolutionary cognitive development of humans Cognitive enhancement deploying developmental drugs influencing the neuro-cognitive embryological and later development	SESTI
<b><i>Agrofood and biotech</i></b>	
Artificial food	FarHorizon
Drastic changes in consumption	FarHorizon
Innovative solutions via biotechnologies to utilise the genomic resources (of plants and animals) to improve the efficiency of input to output – extending the surface	FarHorizon
(Nuclear) War causing immense crop losses and radioactive contamination or destroying soil structures	FarHorizon
<b><i>Social Sciences and Humanities</i></b>	
Lack of interest in science by young scholars	iKnow
Social unrest: immigrants are regarded as the scapegoats and/or elderly are regarded as the scapegoats	FarHorizon
Society becomes hostile towards innovation	FarHorizon
Large technology / science failure	FarHorizon
Risks from new technologies found out too late	FarHorizon
<b><i>Energy</i></b>	
Gas from Trash	iKnow
Very cheap and abundant 'clean' energy (e.g. by low temperature nuclear fusion)	SESTI
Hybrid nuclear energy	SESTI



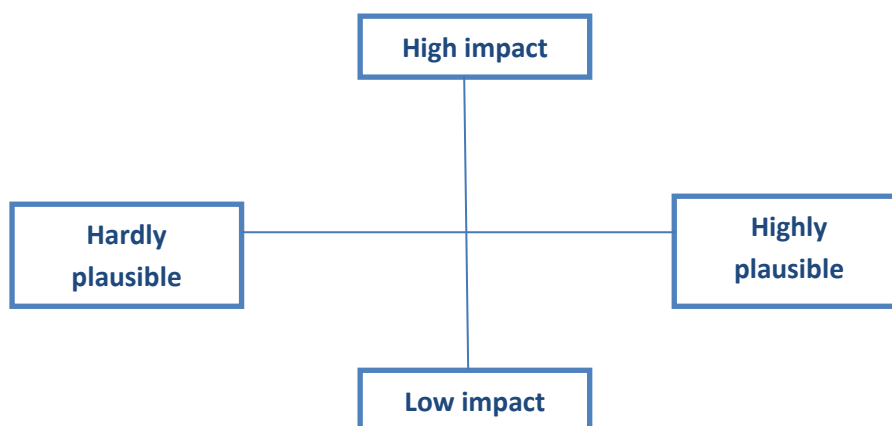
<b>ICT</b>	
Information crisis caused by personalized information delivery	iKnow
Migration of internet services in pervasive ICT environment	iKnow
ICT-enhanced learning systems Virtual internet related reality can be used to develop not only very direct interfaces with ICT systems on the sport but it 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	SESTI
Automatic learning through neuro-data transfer	iKnow
<b>Economy and Policy</b>	
A long, deepening recession	FarHorizon
Not handling the financial crisis	FarHorizon
Financial crisis blocking world trade (e.g., China stops to buy for US debts)	FarHorizon
No innovation: cherishing traditional values like honesty, trustworthiness, security, ecological awareness; evergreens; response to growing mistrust of consumers in innovation	INFU
Contests & Competition: several new solutions compete in a contest to be voted on by customers (democratization, client needs)	INFU
Innovation Camps / Bar Camps: interaction between large numbers of participants real and virtual, participatory, supported by social computing tools	INFU
Reverse innovation: Western companies make use of cheap R&D and low-cost manufacturing in emerging and developing regions; start innovation locally for domestic market (China, India), followed by introduction on western home markets	INFU
Top secret innovation: artificial hype about a brand; users become followers and identify with the brand; storytelling part of product innovation (e.g. Apple).	INFU
European Commission scrap research support projects	iKnow
Administration rather than results a priority	iKnow
New alliances in the world	FarHorizon
<b>Environment</b>	
Climate change faster of leading to completely unpredictable local weather, alternating heavy rainfall, hail, drought, heat and freezing cold are alternating frequently in a year	FarHorizon
Major natural eco-disaster like volcanic eruption – dimming of sun light for long period	FarHorizon
Rebalancing the greenhouse by re-greening earth & enhancing the carbon cycle	SESTI
Man-made ecological disasters	FarHorizon

## 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 2-4.

Figure 2- 4 Impact vs. plausibility



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 vary, 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.

During the EFP workshop, the selected wild cards and weak signals were divided over four working groups for a discussion and assessment in more detail. The dimensions plausibility, impact and reach, novelty to policy and influence of policy were used to screen the selected emerging issues and to select two issues for further discussion. Annex 3 provides a summary of the working group

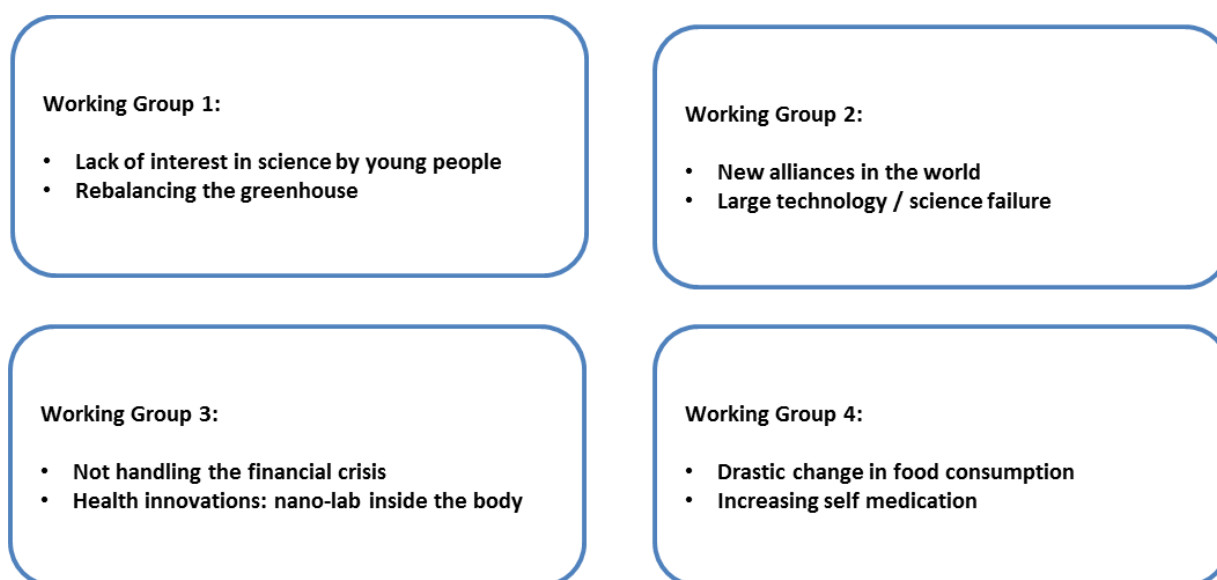
discussions. The selection of the two issues per working group was based on a voting by the participants. The rationales used for this voting were as follows:

- An issue must be plausible
- The impact and reach should be high
- The novelty for policy makers should be high or the issue has not been handled adequately by policy so far
- The influence of the policy should be high

In some working groups, following these rationales did not make it easy to choose, because opinions differed too much or because participants wanted to discuss both a weak signal and a wild card.

Figure 2-5 shows the issues selected in the four working groups.

**Figure2-5 Selection of issues during the EFP workshop**



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?

The four working groups discussed these dimensions for the issues selected. The following figures present the results of this assessment for each issue selected. Not all dimensions were discussed in each working group to the same extent, also due to limited time available..

## Lack of interest in science by young people

### Relevance to policy-making:

- In the short term immediate and sustained efforts are needed
- In the long term:
  - Better science education would allow improving competencies of citizens to judge scientific issues relevant to society
  - Citizen can better influence STI-policy if they are more competent
  - Strategic priority setting can be underpinned by informed citizens
  - Critical thinking becomes more widespread
  - Enhancement of knowledge democracy
  - Allows moving towards a more productive society and economy, and ultimately prosperity
  - Health benefits can be achieved, due to a more conscious approach to health and environment
  - A downside: this may lead to more effective and dangerous terrorists

### Relevance to societal challenges:

- Active and healthy ageing
- Smart cities
  - IT-based version of smart cities
  - Smart cities of smart people
- Water efficient Europe
  - Better water use and management
- Non-energy raw materials
  - Not particular labour-intensive
- Smart mobility
  - Better solutions
- Agricultural productivity and sustainability
- Other: security

### Relevance to policy areas?

("High" refers to highlighted policy areas on which the issue is likely to have a major impact; numbers refer to priority order in terms of impact)

- Infrastructure
  - STI infrastructure
- Social welfare
- Economy and employment (High)
- Education (High, 11)
  - Education and Lifelong Learning infrastructure (High, 4)
  - Linkages with STI
- Security
  - We may face a shortage of excellent security experts!
- Environment and ecosystems
- STI (High, 6)
  - Research on educational matters needed
  - Linkages with culture and with education
- Other: Culture and media (High, 8)
  - There are also important linkages between culture and science
- Other: Migration

### How well is policy prepared?

- Current policies for dealing with the disinterest in science of young people are much narrower than what is suggested here
- Currently, the focus is mainly on STI and education policies
- A tighter coupling with Lifelong Learning and culture is needed

## Rebalancing the greenhouse

### Relevance to policy-making:

- In the short term immediate and sustained efforts are needed
- In the long term
  - Development policy beyond 2013
  - But also relevant to several EU 27 Member States
  - CO2 reduction potential of this emerging issue of relevance to all Kyoto-related agreements and initiatives
  - A early effort to advance knowledge on this issue could – in the longer-term – foster the competitiveness of Europe (but this would be a kind of “picking winners” strategy)

### Relevance to societal challenges:

- Active and healthy ageing
  - Limited and indirect relevance only
- Smart cities
  - Limited and indirect relevance only
- Water efficient Europe (6)
  - Medium-scale relevance
  - Possibly giving rise to new tensions regarding water use
- Non-energy raw materials (3)
  - Medium-scale relevance
  - Could help increase the potential for producing renewable materials
- Smart mobility (1)
  - Limited and indirect relevance only
- Agricultural productivity and sustainability (22)
  - High relevance in many regards

### Relevance to policy areas:

(“High” refers to highlighted policy areas on which the issue is likely to have a major impact; numbers refer to priority order terms of impact)

- Infrastructure (High, 3)
- Social welfare (1)
- Economy and employment
  - Could be relevant for the creation of green jobs in the agriculture and the processing of agricultural products
- Education (1)
  - Media attention and public information
- Security (3)
- Environment and ecosystems (High, 4)
- STI (High, 6)
- Other: Energy and energy mix (High, 6)
- Other: Migration (High, 1)
- Other: Agriculture (High, 5)
- Other: International cooperation and development (High, 8)

### How well is policy prepared:

- Only occasional attention has been paid so far to this issue
- More political will is needed to tackle the issue

## New alliances in the world

### Relevance to policy-making:

Not discussed in the working group

### Relevance to societal challenges:

- Russian + Chinese alliance: gas goes to China instead of Europe can be scenario
- This implies:
  - Energy policy: invest in other sources for energy
  - Reduce energy consumption
  - Less travel
  - Chance for green economy: new partnerships, new enterprises, new technologies

### Relevance to policy areas:

- Influences the whole political order
  - Matter of perspective: Europe vs. non-European countries
- Economy most affected: open innovation
- New global governance
- Balance of power from European perspective is less affected than other regions
- Positive effects on Europe due to migration of skilled workers: innovation
- Chinese land grabbing in Africa: effect on Europe: supply situation, security, ecosystems, migration
- Distribute welfare more evenly in the world
- Trust building among blocks
- Policy measure: exchange programmes, promote international trade
- Promote cultural integration through multi-ethnic housing policy (e.g. Singapore)
- What is the responsibility of the citizens

### How well is policy prepared:

- Cultural diversity is more resilient to shocks

## Large technology / science failure

**Relevance to policy-making:**  
Not discussed in the working group

**Relevance to societal challenges:**  
Not discussed in the working group

**Relevance to policy areas:**

- All areas affected
- Privatization of grids adds to the likelihood

**How well is policy prepared:**

- Military has scenarios of preparedness

## Not handling the financial crisis

**Relevance to policy-making:**

- Relevance is very high on the short term

**Relevance to societal challenges:**

- Active & Healthy Ageing: 4 + Pensions
- Smart Cities: 1
- Water-efficient Europe: 3 + budget cuts
- Raw materials: 0
- Smart mobility: 1
- Agro sustainability: 1

**Relevance to policy areas:**

- Physical/virtual infrastructure: 4
- Social welfare: 4 (new food consumption patterns)
- Economy + employment: 5 (burden across society)
- Education: 1
- Environment: 1
- STI: 3

**How well is policy prepared:**

- Policy-makers are hardly prepared, despite all the discussions.

## Health innovation: nano-lab inside the body

**Relevance to policy-making:**

- Especially relevant on the long term

**Relevance to societal challenges:**

- Active & Healthy Ageing: 5
- Smart Cities: 1
- Water-efficient Europe: 1
- Raw materials: 1
- Smart mobility: 3 (elderly + disabled able to drive)
- Agro sustainability: 1

**Relevance to policy areas:**

- Physical/virtual infrastructure: 1
- Social welfare: 3
- Economy + employment: 2
- Education: 2

**How well is policy prepared:**  
Not discussed in the working group

## Drastic change in food consumption

### Relevance to policy-making:

#### Short-term:

- coming from threat of food crisis and life style changes
- policy actions: procurement, awareness campaign, standardization
- on local level maybe more successful than on EU-level
- Is there a problem? What is the justification for policy?

#### Long-term:

- Impact on logistics structure, household system and transformation in financial, economic capital system
- tension between producers and policy-makers: when votes are at stake: employment, industry growth and competitiveness
- established interest in food production system
- connection with climate change
- comes from behavioural change

### Relevance to societal challenges:

- Active & Healthy Ageing
- Smart Cities
- Water Efficient Europe
- Sustainable supply of non-energy raw materials
- Agricultural productivity & sustainability

### Relevance to policy areas:

- Wild card is needed to push forward
- Is relevant for almost every policy area
- Inter-ministrial working groups needed
- Evidence-based: what can we learn from the past
- Policies in the area of environment & ecosystem can be used proactive to create a certain change, to amplify the movement. In addition it is the main driver for justification to take EU policy actions
- Policies in the area of STI: creating evidence

### How well is policy prepared:

- National governments have the flexibility to respond
- Governance is needed
- National governments have the role of preparing, studying, analyzing: it will be more on the radar of the food / agriculture ministries than in other policy areas.
- Regional governments can implement measures
- Countries affected by food crises in the past are more experiences and will have emergency/contingency plans, learned from past experiences
- Emergency plans at level of suppliers

## Increasing self-medication

### Relevance to policy-making:

#### Short term:

- Cost reduction in general is the issue, or is it about shifting costs?
- Where do we put our priorities?
- Super bacteria: reasons why we avoid hospitals?: gradually
- Wild card in some counties, while weak signal in others
- Is an evolving issues but can be caused by financial/economic changes
- Redesign of the health care system
- Education needed for healthier lifestyle and prevention

### Relevance to societal challenges:

- Active and Healthy Ageing

### Relevance to policy areas:

- Social Welfare
- Economy & employment
- Education
- Security: face drugs impacts safety
- STI: if triggered by pandemic

### How well is policy prepared:

- Experiments going on, mainly at level of awareness campaigns, information provision
- Families are well prepared. They know what to do with medical problems. Important source of information and self care

### 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. Keywords in building resilient systems are diversity and system redundancy, with reserves, buffers and additional peak capacities, also for rare and unavailable resources (Presentation by Barrie Stevens from OECD at EFP workshop, 26 October 2011).

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, 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 gaps 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 fulfils 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 analysing emerging issues as much as possible and to apply participatory approaches.

The participants in the EFP workshop identified for the selected issues the main policy requirement and actions they consider as relevant for policy-makers (see next page).

Note: Policy requirements were not discussed for the issue 'drastic change in food consumption' due to lack of time during the workshop

**Lack of interest in science by young people:**

- More policies needed to ensure the alignment between different areas and interdisciplinary thinking in teaching and training
- More attention to cross-cultural respect
- Develop approach and tools to monitor, assess and evaluate progress, e.g. towards a knowledge democracy
- Special education should be reinforced for disabled

**Rebalancing the greenhouse:**

- The focus should be on the well-being on individuals rather than on the technical solution
- International agreements would have to be concluded to tackle this issues; with non-binding agreements being a first step
- The issue could benefit from a good evidence base and the use of quantitative methods for impact assessment, in spite of some uncertainties about technical realization and future options
- Pilot actions in pilot countries could be initiated to test the approach
- Due to the involvement of several policy areas, a cross-cutting policy approach covering several areas and levels of policy is needed. Possibly an option for a European innovation partnership

**New alliances in the world:**

- Develop good quality infrastructure and health system to absorb shocks
- Develop shock absorptive systems (e.g. micro power plants, independent units)

**Large technology / science failure:**

- Intelligence information services harmonized with clear responsibilities
- Individual level: awareness raising, migration?, prevention
- Raising awareness at organizational level (banks)
- Support formation of social networks: happiness
- Increase level of preparedness in all parts of society (individual, neighborhood)
- Exercise the worst case scenario (turn-off the power supply)

**Not handling the financial crisis:**

- Improve transparency of banks across holdings and debts structure
- Organise black economy tax collection
- Improve governance of banks
- Improve understanding of complex systems
- Economic instruments

**Health innovation / nano-lab inside the body:**

- Improve understanding of the opportunity / costs of not doing it
- Develop data and information for lay people to improve acceptance

**Increasing self-medication**

- Too expensive new treatments financed privately or public-private structures
- Black list of suppliers: Creating / increasing transparency, raising awareness
- Allocate health professionals to provide correct information via new channels of health care information for self care / self medication
- Find new structures / channels for consults and information provision
- Alter tax system to stimulate healthy food
- New technologies for communication: e-health / lab in the home
- Employers have responsibility to avoid harmful activities
- Pharmacies take over doctor's role
- Empower people to do self medication / self care or make it as difficult as possible?
- Insurance system: can offer products / services supporting + financing this
- Connection between health + physical working conditions
- Enforcement of laws?

## 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 Netherlands has a planning model for national security. In 2007, the Dutch Strategy National Security was developed, which formulates five ‘vital interests’ as well as a definition of national security. This national strategy is not a grand vision, but more a planning procedure. It combines foresight, risk assessment, capabilities planning and policy actions for national security. Based on strategic foresight and horizon scanning, thematic in-depth foresights are prepared and identified national risks are assessed and prioritised. The results of the foresight and risk assessment activities are used as input for the capabilities planning. The national risk assessment methodology results in a risk profile based on the assessment of the likelihood and the impact of defined risk scenarios. The likelihood is defined by classifying the probability of a hazard (5 classes from low to high) and a qualitative description of the danger in terms of if it is conceivable and if there are clear indications or not. The impact assessment uses 10 impact criteria with scores on each of these criteria (Presentation by Tim Sweijts from the Hague Centre for Strategic Studies (HCSS) at EFP workshop, 26 October 2011).

The Dutch National Risk Assessment Report (most recent version in 2010: Nationale Risicobeoordeling Bevindingenrapportage 2010)<sup>12</sup> is the result of the foresight and risk assessment process. Between 2008 and 2010, 39 scenarios over 7 themes were 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. According to Tim

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<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>

Sweijts from HCSS, the national risk assessment model kick-started interdepartmental collaboration and offers a transparent process, but it is questionable to what extent this model can cope with uncertainties. In addition, putting politically sensitive or unpopular risks on the agenda remains a challenge.

Also the UK has a national risk assessment system installed. In 2008, the UK government published the National Risk Register<sup>13</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 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>14</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 faraway locations. The OECD believes that more frequent global shocks will be very likely in the years ahead. Key drivers for these global shocks are the growing interdependencies within economic, social and environmental spheres; the increasing seamless interconnectedness; the increasing complexity of systems; and the increasing concentrations of assets and population (Presentation by Barrie Stevens from OECD at EFP workshop, 26 October 2011).

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

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<sup>13</sup> <http://www.cabinetoffice.gov.uk/resource-library/national-risk-register>

<sup>14</sup> Downloadable from : <http://www.oecd.org/dataoecd/7/55/48329024.pdf>

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 a 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 countries know horizon scanning projects, for example Denmark (Danish Horizon Scanning System), Japan (NISTEP exercise), and Singapore (Risk Assessment and Horizon Scanning system)<sup>15</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

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<sup>15</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

not broad and challenging enough; there can be organisational isolation of the EWS manager; the scenarios limit the scanning of new developments; there can be no agreement on what a trend of changes is; there can be 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.

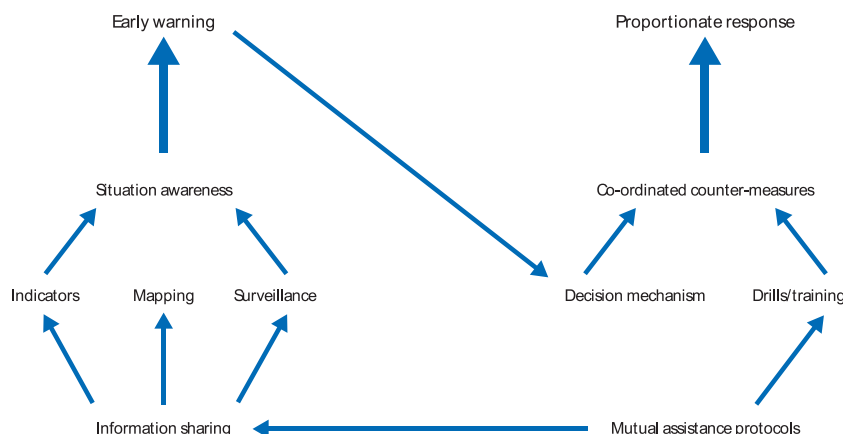
While Botterhuis et al (2010) suggest to use scenarios as some kind of lenses or filters to scan for weak signals and emerging issues and to structure them, Steinmueller (2003) advocates the use of wild cards in scenarios to estimate the susceptibility of a scenario to external disruptions, to compensate 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 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 builds 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 (figure 2-6).

Figure 2-6 Required capacities in early warning systems



Source: 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 exist. 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 be hard to 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).

At the EFP workshop, Tim Sweijs from HCSS presented other, more quantitative, approaches employed in Dutch foresight and risk assessment practices, which could be interesting approaches for more systemic early warning systems. 'Metafore' collects many views on future developments from many different sources and different language domains. The future views are systematically coded in a software programme in search for parameters (aspects that might be subject to change in the future) and drivers (main factors behind these possible changes). The results are used to search for dominant views but also trends, countertrends and missing elements. System Dynamic Modelling is used in the national risk assessment activities to explore multiple futures by focusing on feedback loops between drivers, to simulate a large set of scenarios and to look for 'scenario islands' and outliers in the scenario runs. Risk Dimension Analysis is employed to take into account the full risk spectrum, not to reach exhaustiveness, but to build a comprehensive portfolio of capabilities for coping with the risks. Tim Sweijs also points at StatPlanet, which visualises worldwide statistics for many indicators through interactive graphs and maps. StatPlanet helps quantifying qualitative assertions and visualising hypotheses and boundary conditions.

## 5. Conclusions and lessons from the workshop

This workshop paper shows that many projects and initiatives in the world aim at identifying and assessing weak signals and wild cards. Moreover, these projects and initiatives make clear that it is a rather difficult task to recognise these weak signals and wild cards and to really open our eyes. Many authors underline the notion that weak signals and wild cards should be collected from many different sources and perspectives and by many different experts and stakeholders. The projects and initiatives discussed in the workshop show that different approaches do exist, including very qualitative and very quantitative approaches, each with their advantages and pitfalls. Regardless the approach followed, the results will only be taken into account (and absorbed) by strategists and policy makers if the results are legitimate to them. As put forward by Teichler (2011), this legitimacy is created by using a rigorous, systematic and transparent methodology, one that fulfils the criteria of science. A lack of time and resources often limits the possibility of sound scientific approaches.

Participants in the EFP workshop acknowledge that systematic and transparent approaches are needed and that the foresight toolkit needs to be further developed. Also Tim Sweijs concluded in his presentation that we continuously need to rethink our approach towards mapping the future and to develop our toolkit. Nevertheless, some participants also warned against the appearance of 'scientificism'. We should avoid that we will predict things that cannot be predicted or that we develop 'evidence' that is non-existing. We should apply the qualitative and quantitative methods in a coherent way. Moreover, we need to develop better methods for linking the diverse types of information and taking into account the context of the information. Combining methods used in the security and defence domain with approaches more frequently used in the 'civil' domain could be beneficial in this respect.

Participants in the EFP workshop also concluded that we should focus on connecting the results of the forward looking activities to policy making. In the workshop, the participants tried to explore and discuss the requirements and options for policy makers in relation to the selected weak signals and wild cards. An important difficulty in this assessment was the broad set of weak signals and wild cards available in the workshop. Although participants represented different backgrounds, including foresight practitioners, STI policy experts, and policy makers, participants were not real experts in specific domains and found it rather difficult to assess the impact, likelihood, but also the policy requirements and options for specific weak signals and wild cards. Overall, the policy requirements and options formulated in the workshop remained rather general. This is not much different from other 'horizontal' initiatives to horizon scanning, early warning systems and the connection to policy. Once more, the workshop emphasised the need to involve a combination of thematic / domain experts, policy-makers and foresight practitioners in the process of identifying, analysing and assessing emerging issues as much as possible and to apply participatory approaches.

Despite the pleas for a better connection and translation between the results of forward looking activities and policy and to involve a broad audience, participants in the workshop also made clear that, because of the 'surprising' dimensions and high uncertainty of wild cards and weak signals ('unknown unknowns'), policy can never be fully prepared and fine-tuned towards these surprises. It is, however, very important that policy-makers focus on building capacity and capabilities, strengthening the resilience of the system, but most of all embrace and integrate the notion of the unknown unknowns in their policy-making.

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# Annex 1 – Workshop agenda

 <b>European Foresight Platform</b> supporting forward looking decision making <a href="http://www.foresight-platform.eu">www.foresight-platform.eu</a>	
<b>Workshop Agenda</b>	
<b>Meeting</b>	EFP European Policy Workshop
<b>Date</b>	October 26, 2011
<b>Place</b>	Neth-ER, Aarlenstraat 22 (Rue d'Arlon 22), Brussels
<b>Start / Close</b>	09:30-17:30

## ***Policy options for surprising and emerging futures in Europe***

### **Background**

Over the past few years we have witnessed a growing number of technological, economic, environmental, political, social and ethical surprising and emerging issues ('wild cards') with very high impacts in Europe and the world. The following three examples show that these surprising and emerging issues often have associated early warning signals (weak signals) that warn us about their potential occurrence. However, our blindness or reluctance to foresee radical changes in our lives rather often makes their manifestation look surprising.

#### *Global Economic Crisis*

- Wild card features: Industries and governments in Europe were caught by surprise. At the European Union level the crisis has created huge debt affecting national budgets leading to major cuts in social welfare, health and education, for example.
- Associated weak signals:
  - The Lehman Brothers bankruptcy in September 2008 was one of the many signals of the global financial crisis.
  - Housing bubble in the United States and some European Countries (e.g. Ireland and Spain).

#### *Fukushima Disaster*

- Wild card features: The 9.0 scale earthquake in Japan, followed by a powerful tsunami and the Fukushima disaster. These surprises obviously had an enormous impact in the Japanese society and economy. Also in Europe, several multinational companies have been affected due to major global supply chain disruptions and other market-related factors. But perhaps it is the nuclear sector itself that will be shaken the most. The Fukushima situation has already strengthened anti-nuclear movements (in Germany, for example) and has led to the creation of several government task forces aimed to scrutinise existing and future nuclear plans and investments.
- Associated weak signals:
  - Two years before the disaster the International Atomic Energy Agency (IAEA) sent warnings to Japanese authorities about security shortcomings in the Fukushima nuclear plant. Wikileaks showed a leaked cable explicitly mentioning that Fukushima was not able to withstand an earthquake of a magnitude higher than 7.
  - In 2008, other groups, such as the G-8 Nuclear Safety and Security Group had also raised serious concerns over safety issues in Japanese nuclear plants. Furthermore, some leaked cables show that in the last four decades guidance on how to protect nuclear plans from earthquakes had been updated three times.

### *Arab Spring*

- Wild card features: The 2011 socio-political changes in the Middle East and North Africa (MENA) have brought mixed outcomes to the region. On the positive side, there are hopes for more democratic and transparent MENA societies in the future. But these hopes are being challenged by the growing unrest, uncertainty and unstable conditions, which range from crisis of governance in some countries to armed conflicts in others. The impact of the MENA revolutions in Europe can be wide-ranging, including uncontrolled mass-migration, direct involvement in military actions, unstable energy supply, etc.
- Associated weak signals:
  - The role of social media (Twitter & Facebook), new ICT allowing real-time reporting of developments using , for example, Blackberry Messenger, etc.
  - The role of Wikileaks informing about major corruption networks in MENA governments

Worldwide, there are several initiatives that aim to identify, collect and interpret emerging issues and potential surprises that could have an impact of the economy and society. Also in Europe the EC launched a number *blue-sky research* initiatives aimed to identify issues that should not be left “out of the policy radar” because they could have an impact on the European economy and society and could be important in shaping the European Research Area. These foresight and forecasting projects include:

- INFU: Innovation Futures in Europe: A Foresight Exercise on Emerging Patterns of Innovation
- SESTI: Scanning for Emerging Science and Technology Issues
- FarHorizon: Use of foresight to align research with longer term policy needs in Europe
- SANDERA – The future impact of security and defence policies on the European Research Area
- IKNOW – Interconnecting knowledge for the early identification of issues, events and developments (e.g. wild cards and associated weak signals) shaping and shaking the future of science, technology and innovation in the European Research Area
- CIVISTI - Citizen Visions on Science, Technology and Innovation: 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).

While it is true that the role of foresight and forecasting is NOT to predict future surprises but to enhance anticipatory intelligence, the so-called blue-sky initiatives of the European Union have identified and analysed hundreds of potential surprising and emerging issues. These have been studied in terms of their relevance for ERA and their interconnection with several thematic areas addressed by the European Framework Programme for RTD, including: health; agriculture and biotechnology; ICT; nanotechnology; energy (including nuclear); environment; transport; social sciences and humanities; security and space. Similarly, these RTD projects have identified hundreds of early warning signals or weak signals (ambiguous observables and developments) and assessed them in terms of their significance and potential implications for Europe.

As a knowledge hub for foresight, the European Foresight Platform (EFP) brings together the information and knowledge base on foresight in Europe and internationally. As a result, EFP has an extensive overview of emerging issues and potential surprises identified in various foresight activities.

### **EFP workshop objectives**

The European Foresight Platform workshop will bring together the emerging issues and potential surprises identified in various foresight and forward looking activities. More particularly, the EFP workshop will focus on those issues and surprises that could shape the European Research Area (ERA).

This workshop aims to discuss and prioritise the most important emerging issues and surprises for Europe as well as to identify policy requirements and research questions to address these surprises. Moreover, the workshop will discuss in more detail how the European and national *early warning* monitoring and management systems look like and how we take into account the specific nature of the various member states (risk assessment culture and practices, levels of vulnerability and resilience to certain surprises).

The EFP workshop aims bringing together national and European stakeholders to support the development of proactive policy options for European governments intervention in selected priority issues.

The EFP policy workshop will have seven interconnected blocks on potential policy *IMPACTS* of researching surprising and emerging issues:

1. Introducing EFP and EU Blue Sky research on surprising and emerging issues
2. Mapping surprising and emerging issues from EU-funded research
3. Prioritising and discussing surprising and emerging issues
4. Assessing potential implications of surprising and emerging issues
5. Contextualising surprising and emerging issues into EU research and innovation policy
6. Transferring know-how from national actors mapping surprising and emerging issues
7. Supporting EU and national cooperation on surprising and emerging issues research

## Programme for the EFP workshop

**9:00 – 9:30 Registration and coffee**

### Block 1: Introducing EFP and EU Blue Sky research on surprising and emerging issues

<b>09:30</b>	Susanne Giesecke, AIT - Welcome and introduction to EFP and to the workshop: Agenda, desired outcomes, chairing, rapporteurs
<b>09 :35</b>	Tour de table - The participants' name, affiliation and relationships to the workshop issues
<b>09:45</b>	Introduction by Domenico Rossetti di Valdalbero, DG RTD
<b>09:50</b>	Annelieke van der Giessen, TNO and Rafael Popper, MIOIR – Presenting the background information and approach to the workshop

### Block 2: Mapping surprising and emerging issues from EU-funded research

<b>10:15</b>	<p>Presentation of 5 to 10 emerging issues and early warning signals identified by four Blue Sky projects (15 minutes each).</p> <ul style="list-style-type: none"> <li>○ INFU – Susanne Giesecke (AIT)</li> <li>○ SESTI – Vicente Carabias (IPTS)</li> <li>○ FarHorizon – Matthias Weber (AIT) / Victor van Rij (AWT)</li> <li>○ iKnow – Rafael Popper (UniMan / MIOIR)</li> </ul>
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### Block 3: Prioritizing and discussing identified surprising and emerging issues

<b>11:15</b>	<p>Working groups will discuss the list of emerging issues and early warning signals presented in block 2 and come to a first “prioritization” and discussion of these emerging issues and surprises.</p> <p>The first round of prioritisation and selection will be based on four dimensions:</p> <ul style="list-style-type: none"> <li>○ Plausibility</li> <li>○ Impact and reach</li> <li>○ Novelty of the emerging issues and early warning signals to policy makers</li> <li>○ Extent to which policy can influence the emerging issues.</li> </ul>
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**12:15: Working lunch**

### Block 4: Assessing potential implications of surprising and emerging issues

<b>13:00</b>	<p>The second round of prioritisation and selection will discuss in more detail the potential implications of surprising and emerging issues..</p> <ul style="list-style-type: none"> <li>○ Assessment of short-term (up to 10 years) and long-term (10+ years) priority for policymaking</li> <li>○ Assessment of relevance to societal challenges and more specific to the European Innovation Partnerships themes: Active and Healthy Ageing, Smart Cities, Water-Efficient Europe, Sustainable supply of non-energy raw materials for a Modern Society, Smart mobility for Europe's citizens and businesses, Agricultural productivity and sustainability</li> <li>○ Assessment of impacts on several policy areas:             <ul style="list-style-type: none"> <li>▪ Physical infrastructure and Virtual infrastructure</li> <li>▪ Social welfare</li> <li>▪ Economy &amp; employment</li> <li>▪ Education</li> <li>▪ Security</li> <li>▪ Environment &amp; ecosystems</li> <li>▪ Science, technology &amp; innovation (STI) systems</li> </ul> </li> <li>○ Assessment of the level of preparedness by policy makers</li> </ul>
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**Block 5: Contextualising surprising and emerging issues into EU research and innovation policy**

<b>14:00</b>	Identifying the policy requirements and policy actions needed to anticipate, manage and address the selected emerging issues Identifying where further research may be needed to explore the emerging issue
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**15:00: 5 minute feed-back presentations by rapporteurs of the working groups**

**15:20 Coffee break**

**Block 6: Transferring know-how from national actors mapping surprising and emerging issues**

<b>15:35</b>	<p>Presentations from Tim Sweijs, HCSS presenting the Dutch ‘early-warning’ system for risks and surprises and from Barrie Stevens, OECD on Future Global Shocks</p> <ul style="list-style-type: none"> <li>○ How do national risk/surprise management and early warning systems look like? What is the approach followed?</li> <li>○ How can national risk registers benefit from Pan-European surprise and early warning systems?</li> <li>○ What do Pan-European risks mean for the national policies?</li> <li>○ Can national early warning systems learn from other nation’s risks/surprises?</li> <li>○ How do governments address and manage the emerging and surprising issues</li> </ul>
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**Block 7: Supporting EU and national cooperation on emerging and surprising issues research**

<b>16:30</b>	<p>Brainstorming session on potential synergies, complementarities and ways forward:</p> <ul style="list-style-type: none"> <li>○ How could a (pan-) European early warning system for emerging issues and surprises look like?</li> <li>○ How could European surprise monitoring and management systems be used at the national level?</li> <li>○ How do we take into account the specific nature of the various member states (risk assessment culture and practices, levels of vulnerability and resilience to certain surprises)?</li> <li>○ How can national and European governments address and manage emerging and surprising issues</li> </ul>
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**17:15: Summary and concluding remarks**

**17:30: End of workshop**

## Annex 2 – Participants

Monika	Antal	EC, JRC
Jesus	Alquezar	EC, DG Research & Innovation
Vicente	Carabias-Barcelo	IPTS
Claudio	Chauke Nehme	Center for Strategic Studies and Management - CGEE
Jan Maarten	De Vet	Ecorys
Jim	Dratwa	EC, DG Research & Innovation
Philippe	Durance	CNAM
José Miguel	Fernández Güell	Universidad Politécnica de Madrid
Marie-Valentine	Florin	IRGC – International Risk Governance Council
Susanne	Giesecke	Austrian Institute of Technology
Blaz	Golob	Centre for eGovernance Development for South East Europe
Jennifer	Harper	Malta Council for Science and Technology (MCST)
Riitta	Kirjavainen	Prime Minister's Office Finland
Totti	Konnola	Impetu Solutions
Hank	Kune	EDUCORE
David	Mair	EC, JRC
Elisabetta	Marinelli	IPTS
Riel	Miller	Xperidox
Rafael	Popper	University of Manchester
Domenico	Rossetti di Valdalbero	EC, DG Research & Innovation
Roxana	Sandu	EC
Fabiana	Scapolo	EC
Andras	Siegler	EC, DG Research & Innovation
Karl-Heinz	Simon	University of Kassel
Jack	Smith	University of Ottawa
Vivienne	Soykova	Czech Technical University
Barrie	Stevens	OECD
Marc	Suters	Ernst & Young
Tim	Sweijs	The Hague Centre for Strategic Studies
Thomas	Teichler	University of Manchester
Annelieke	van der Giessen	TNO
Victor	van Rij	Advisory Council for Science and Technology Policy (AWT)
Matthias	Weber	Austrian Institute of Technology
Tomasz	Wliwinski	EC, DG Research & Innovation
Henk	Wolters	Deltares

## Annex 3 – Summary working groups

### Working group chaired by Matthias Weber

#### Screening and selecting wildcards

Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
Obesity turns into a global epidemic (also for health markets)	<ul style="list-style-type: none"> <li>- Already happening</li> <li>- Obesity is associated to stress</li> </ul>	<ul style="list-style-type: none"> <li>- On health, also mental health</li> <li>- On labour</li> <li>- On budgets (insurances, labour costs)</li> </ul>	<ul style="list-style-type: none"> <li>- Not really novel, but little action so far</li> <li>- Significant variation across countries in terms of sensitization</li> </ul>	<ul style="list-style-type: none"> <li>- If properly done, massive influence possible</li> <li>- Appropriate policy mix required</li> </ul>	0
Social unrest: immigrants are regarded as the scapegoats (the elderly as scapegoats were not considered further)	<ul style="list-style-type: none"> <li>- Immigrants are already in this situation in some countries</li> <li>- Social unrest noticeable</li> </ul>	<ul style="list-style-type: none"> <li>- Instability in pockets of society</li> <li>- Potential to grow</li> <li>- Negative impact on inward migration of "brains"</li> </ul>	<ul style="list-style-type: none"> <li>- No novel</li> <li>- Tends to be put under the carpet</li> <li>- Significant variation across countries</li> </ul>	<ul style="list-style-type: none"> <li>- Major role of migration policy</li> <li>- Policy needs to be developed gradually and over a longer time period</li> </ul>	6
Lack of interest in science by young people	<ul style="list-style-type: none"> <li>- Valid for some specific areas only</li> <li>- Depends on career perspectives</li> </ul>	<ul style="list-style-type: none"> <li>- High impact on innovation potential of society</li> </ul>	<ul style="list-style-type: none"> <li>- Not novel</li> </ul>	<ul style="list-style-type: none"> <li>- New educational models could make a difference</li> <li>- Major influence of LLL policies</li> <li>- Better training of teachers, high qualifications needed</li> <li>- Policy needs to be developed gradually and over a longer time period</li> </ul>	8
Migration of internet service to user-friendly and reliable pervasive ICT environments	<ul style="list-style-type: none"> <li>- Already existing, but likely to go further</li> </ul>	<ul style="list-style-type: none"> <li>- High positive impacts possible</li> <li>- But widening gap with user skills</li> </ul>	<ul style="list-style-type: none"> <li>- Growing interest in this issue, in particular as related to cyber-</li> </ul>	<ul style="list-style-type: none"> <li>- Standards and regulation required</li> </ul>	5



Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
		inhibits positive impacts	security		
Re-greening the earth: Rebalancing the greenhouse effects into prosperous (deserts, efficient photosynthetic production, water resources, artificial photosynthesis)	<ul style="list-style-type: none"> <li>- To a partial extent only; not as comprehensively as suggested by some proponents</li> </ul>	<ul style="list-style-type: none"> <li>- Very high in many regards</li> </ul>	<ul style="list-style-type: none"> <li>- Limited attention to the issue</li> <li>- One some first initiatives in research</li> </ul>	<ul style="list-style-type: none"> <li>- International policy agreements</li> <li>- Multiple policy areas: R&amp;D, agriculture, spatial planning, regulation</li> </ul>	8
Man-made ecological disasters (including terrorism)	<ul style="list-style-type: none"> <li>- Happening already, with Fukushima combining man-made and natural</li> <li>- This issues will definitively continue to be relevant</li> </ul>	<ul style="list-style-type: none"> <li>- All orders of magnitude possible</li> <li>- Potentially very high</li> </ul>	<ul style="list-style-type: none"> <li>- Not novel</li> <li>- No high priority</li> </ul>	<ul style="list-style-type: none"> <li>- Prevention</li> <li>- Monitoring and alerts</li> <li>- Anticipatory research on risk and counter-strategies</li> </ul>	1
Influencing embryonic and evolutionary cognitive development of humans	<ul style="list-style-type: none"> <li>- Uncertainty high, also scientifically with many doubts</li> </ul>	<ul style="list-style-type: none"> <li>- Ethical considerations come into play</li> </ul>	<ul style="list-style-type: none"> <li>- Rather recent development</li> <li>- Relatively novel on the policy agendas</li> </ul>	<ul style="list-style-type: none"> <li>- Very high influence of regulation</li> </ul>	6
Customer-centred contest and competition in innovation: new solutions compete for support in a context for customers	<ul style="list-style-type: none"> <li>- Already done in some areas</li> <li>- Can represents a win-win situation for both firms and customers, if customers cannot carry their ideas forward on their own.</li> </ul>	<ul style="list-style-type: none"> <li>- Enables provision of better products that are more geared towards customer needs</li> </ul>	<ul style="list-style-type: none"> <li>- Not an issue for government</li> </ul>	<ul style="list-style-type: none"> <li>- Not applicable</li> </ul>	0
Hybrid nuclear energy	-	-	-	-	-



Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
Innovation camps enabling interaction between a large number of participants	-	-	-	-	-

### Working group chaired by Susanne Giesecke

#### Screening and selecting wild cards

Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
Automatic learning through neuro-data transfer	<ul style="list-style-type: none"> <li>- We have to understand more about learning</li> <li>- In 2 years time: -3</li> <li>- In 100 years time: +3</li> <li>- Medium plausible: There are signal processing theories and tools to understand and interpret neuro signals. The question is how to transfer neuro signals to a machine</li> <li>- -3</li> <li>- -3</li> <li>- -2</li> <li>- -2</li> </ul>	<ul style="list-style-type: none"> <li>- +3</li> <li>- +5 Impacts society and economy</li> <li>- +3</li> <li>- +1</li> <li>- +3</li> <li>- +3</li> </ul>	<ul style="list-style-type: none"> <li>- +3</li> <li>- +3</li> <li>- +2</li> <li>- +2</li> <li>- +3</li> </ul>	<ul style="list-style-type: none"> <li>- +1</li> <li>- -2</li> <li>- +2</li> <li>- 0</li> <li>- +2</li> <li>- +1</li> </ul>	2
Large technology/science failure	<ul style="list-style-type: none"> <li>- +3</li> <li>- -2</li> <li>- +2</li> </ul>	<ul style="list-style-type: none"> <li>- +3</li> <li>- +3</li> <li>- +2</li> </ul>	<ul style="list-style-type: none"> <li>- -2</li> <li>- +1</li> <li>- +2</li> </ul>	<ul style="list-style-type: none"> <li>- +1</li> <li>- +3</li> <li>- 0</li> </ul>	8



Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
Long term black out of electrical system	<ul style="list-style-type: none"> <li>- +2</li> <li>- +1</li> <li>- +1</li> </ul>	<ul style="list-style-type: none"> <li>- +5</li> <li>- +3</li> <li>- +3</li> </ul>	<ul style="list-style-type: none"> <li>- -1</li> <li>- 0</li> <li>- 0</li> </ul>	<ul style="list-style-type: none"> <li>- +5</li> <li>- +2</li> <li>- 1</li> </ul>	
Information crisis caused by personalised information delivery	<ul style="list-style-type: none"> <li>- Authorisation regime?</li> </ul>	-	-	-	
Very cheap and abundant clean energy / cold fusion	<ul style="list-style-type: none"> <li>- Hard to assess because technology is complicated</li> <li>- Very low</li> </ul>	<ul style="list-style-type: none"> <li>- Huge impact</li> </ul>	<ul style="list-style-type: none"> <li>- huge</li> </ul>	<ul style="list-style-type: none"> <li>- Stimulate research but success is not guaranteed, low relevance, low possibility to influence</li> </ul>	
Reverse innovation: Western company uses cheap R&D and production in emerging regions for local innovation for domestic markets, later introduction on western home markets	<ul style="list-style-type: none"> <li>- Already happening</li> <li>- Medium plausible</li> <li>- Safety standards</li> <li>- Medicines on the internet</li> </ul>	<ul style="list-style-type: none"> <li>- High impact</li> </ul>	<ul style="list-style-type: none"> <li>- 0</li> </ul>	<ul style="list-style-type: none"> <li>- High</li> <li>- Market regulation and protectionism</li> </ul>	6
Society becomes hostile towards innovation	<ul style="list-style-type: none"> <li>- Globalisation</li> <li>- What about social innovation, low tech innovation?</li> <li>- Plausible in some parts of European society</li> <li>- Plausible if technological failure</li> <li>- Not plausible in Brazil</li> <li>- Low!</li> </ul>	<ul style="list-style-type: none"> <li>- High impact if applied to major parts of society</li> </ul>	<ul style="list-style-type: none"> <li>- 0</li> </ul>	<ul style="list-style-type: none"> <li>- Linked to the management of risks</li> </ul>	4
New alliances in the world	<ul style="list-style-type: none"> <li>- Bipolar &gt;&gt; multipolar world</li> <li>- Thematic alliances</li> </ul>	<ul style="list-style-type: none"> <li>- medium</li> </ul>	<ul style="list-style-type: none"> <li>- 0, some forms are new</li> </ul>	<ul style="list-style-type: none"> <li>- Geo-politics, very high, high also if governments block private alliances</li> </ul>	10



Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
	<ul style="list-style-type: none"> <li>- Different networks</li> <li>- Private networks/enterprises</li> </ul>				

### Working group chaired by Rafael Popper

#### Screening and selecting wild cards

Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
Gas from Trash (WI)	- 4	- 1	- 4	- 3 - Decentralisation of energy management	
Nano-lab inside your body (WI)  Very much connected to issue 'reprioritizing health research'	- 3	<ul style="list-style-type: none"> <li>- 5</li> <li>- Supporting ICT infra for info sharing</li> <li>- Privacy</li> <li>- Understandable data will allow individuals to pressure doctors/hospitals to take preventive action</li> <li>- Data from nano-lab will create the basis for in-deep medical research</li> </ul>	- 4	- 5	
EC scrap research support project (WE)	- 4	- 1	- 1	- 1	
Re-prioritising health research?	- 5	- 4	- 1	- 4	



Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
Prevention vs cure Luxury vs basic care Diversification in medication					
Artificial food (WI)  Connected to issue of risks from new technologies found out too late	- 3	- 1	- 1	- 1	
Risks from new technologies found out too late (DELETED)	-	-	-	-	
Administration rather than results a priority (WE)	- 4	- 4	- 1	- 3	
Not handling financial crisis (WE)	- 5 >> WI	- 5	- 1	- 5	
ICT enhanced learning systems (WE)	- 5 >> WI	- 5	- 1	- 5	

### Working group chaired by Elisabetta Marinelli / Annelieke van der Giessen

#### Screening and selecting wild cards

Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
Drastic changes in consumption: we all go vegetarian	- Climate change requires that we go vegy because of methane gas	- Effect on prices of land, agriculture, agribusiness, chemical industry	- Low novelty - Not new at all, already being discussed for 40	- Medium policy influence - Large role for policy if it is to happen	



Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
	<ul style="list-style-type: none"> <li>contribution to greenhouse</li> <li>- Consumption changes are likely and plausible</li> <li>- Drastic change in consumption is mildly plausible. Change in climate change awareness + increase of sharing systems, self sufficient systems, decrease of meat consumption</li> <li>- Unlikely as 'old' products will be pushed from the shelves, cosmetic innovation is more likely</li> <li>- Low plausibility</li> <li>- Not so probably as it will face huge resistance</li> </ul>	<ul style="list-style-type: none"> <li>- High impact</li> <li>- Strong impact on sustainability and consumption of raw materials</li> <li>- Strong impact, it gives momentum to further the environmental agenda</li> </ul>	<p>years since Rome</p>		
Neuro-enhancement Influencing + reading brains	<ul style="list-style-type: none"> <li>- Unlikely? Depends on breakthrough</li> <li>- Not very likely, privacy issues are too significant; communication of industry decreases</li> </ul>	<ul style="list-style-type: none"> <li>- Big impact on communication security / defence</li> </ul>	<ul style="list-style-type: none"> <li>- Policy will be lagging behind if it happens</li> </ul>	<ul style="list-style-type: none"> <li>- Privacy / ethical issues</li> </ul>	
Increasing self medication	<ul style="list-style-type: none"> <li>- Personalised medicine / health care</li> </ul>	<ul style="list-style-type: none"> <li>- International drug traffic increases</li> </ul>	<ul style="list-style-type: none"> <li>- Already happening</li> </ul>	<ul style="list-style-type: none"> <li>- High potential: regulation, information</li> </ul>	



Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
	<ul style="list-style-type: none"> <li>- Developing countries: more traditional medicine</li> <li>- Highly plausible due to access to information</li> <li>- Likely due to rising health costs, availability through internet, rise of alternative medicine</li> </ul>	<ul style="list-style-type: none"> <li>- Black market for drugs</li> <li>- Liability issues</li> <li>- Faster medication, wrong cure and side effects, super bacteria</li> <li>- Lowering health care costs?</li> </ul>			
Faster climate change	<ul style="list-style-type: none"> <li>- Highly plausible</li> <li>- Jump and qualitative change is plausible/likely</li> <li>- High/medium plausibility, very complex</li> </ul>	<ul style="list-style-type: none"> <li>- Very high impact</li> <li>- Melting of ice: flooding, weather extremes, agricultural production decreases, food prices rise, disaster management becomes routine</li> <li>- Very uncertain on where and how</li> <li>- Multiple effects: agriculture, health crises such as malaria</li> </ul>	<ul style="list-style-type: none"> <li>- Low novelty</li> <li>- Not new at all since Al Gore's movie</li> <li>- Low novelty, but high uncertainties</li> </ul>	<ul style="list-style-type: none"> <li>- Low policy influence</li> <li>- Requires a global governance</li> <li>- Unclear about what to do</li> <li>- Major role for policy in post-kyoto era</li> </ul>	
Long, deepening recession	<ul style="list-style-type: none"> <li>- Highly plausible</li> <li>- Plausible</li> </ul>	<ul style="list-style-type: none"> <li>- Very high impact</li> </ul>	<ul style="list-style-type: none"> <li>- Low novelty</li> <li>- Fear for recession is not new, fear for deep recession is perhaps new</li> </ul>	<ul style="list-style-type: none"> <li>- Potential policy influence</li> <li>- New framework for financial institutions</li> <li>- Limits to risky investments</li> <li>- Limits to speculation</li> <li>- Stronger fiscal ties within the EU to</li> </ul>	



Issue	Plausibility	Impact and Reach	Novelty to Policy	Influence of Policy	Vote
				have more discipline in finance	
Mental health in ageing society	<ul style="list-style-type: none"> <li>- High plausibility</li> <li>- Likely, lack of knowledge of degenerative diseases</li> </ul>	<ul style="list-style-type: none"> <li>- High impact</li> <li>- Racial aspect: immigrants are caretakers for western elderly</li> <li>- Change of family structure</li> <li>- Only a western problem</li> </ul>	<ul style="list-style-type: none"> <li>- Low novelty</li> </ul>	<ul style="list-style-type: none"> <li>- Low / medium policy influence</li> <li>- Investment in research</li> <li>- New employment rights for caretakers</li> </ul>	
No innovation: traditional values, growing mistrust of consumers in innovation	<ul style="list-style-type: none"> <li>- Low plausibility</li> </ul>	<ul style="list-style-type: none"> <li>- High impact if true</li> </ul>	<ul style="list-style-type: none"> <li>- High novelty</li> </ul>	<ul style="list-style-type: none"> <li>- Medium policy influence</li> </ul>	
Top secret innovation: artificial hype about brand, identify with the brand, story telling part of product innovation	<ul style="list-style-type: none"> <li>- Likely as industry wants to control whole value chain</li> <li>- Top secret in sense of nano breakthrough, quantum computing, artificial life: medium plausible, high impact</li> </ul>	<ul style="list-style-type: none"> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>-</li> </ul>	
Nuclear war causing immense crop losses + contamination + destroying soil structures	<ul style="list-style-type: none"> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>- Any global nuclear event has major impact</li> </ul>	<ul style="list-style-type: none"> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>-</li> </ul>	

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